IMPACTS OF A CONDITIONAL CASH TRANSFER SCHEME ON HEALTH IN COLOMBIA

by

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I, Ian Forde, confirm that the work presented in the thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

Conditional cash transfer schemes (CCTS) are increasingly popular interventions aiming to improve the welfare of the worst off: Families receive regular cash as long as they comply with behavioral conditions concerning uptake of preventive healthcare and schooling. Literature Review, however, finds that associated health impacts are often small or inconsistent and are occasionally adverse.

The aim of this thesis is to advance understanding of the impact of CCTS on health and on health equity. It does this by examining the effect of *Familias,* the Colombian scheme, on outcomes little discussed in the literature, namely rates of obesity in women and in children (an unintended outcome), and women's healthcare knowledge.

It sets findings within a conceptual framework that sees health as being co-produced between individuals and society. Co-production requires investment in individuals' human capital, material resources and creation of fairer socioeconomic environments, somewhat resembling the underpinning philosophy and structure of CCTS.

Multiple regression on a range of individual, household and community level covariates using an intention-to-treat protocol on prospectively collected data with matched controls finds that *Familias* is associated with increased odds of obesity in women (O.R.=1.41, 95% C.I. 1.09, 1.82; p=0.01) and odds of overweight or obesity in girls aged 2-7 at baseline (O.R.=2.13, 95% C.I. 1.23, 3.69; p<0.01). Furthermore, *Familias* fails to improve healthcare knowledge, a marker of human capital, in women despite being a core objective of the programme (logit coefficient= -0.20, 95% C.I. -0.41, 0.01; p=0.06).

Given these negative findings, a number of policy recommendations are made emphasising the importance of social determinants of health: balancing imposition of behavioural requirements with the realisation of rights to high-quality public services, considering the potential for universalising aspects of the schemes and exploring a greater role for the health sector in CCTS design, operation and evaluation.

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<u>PART I</u>

BACKGROUND TO THE THESIS

Chapter 1: Origins and rationale

This thesis examines the effects of conditional cash transfer schemes (CCTS) on a number of health outcomes and considers their potential to address health inequity. In particular, it asks whether taking a perspective that emphasises the importance of socioeconomic determinants of health (SDH) can advance understanding of CCTS' impact on health and offer original insights into their potential refinement. Current knowledge on CCTS as a whole and new empirical analyses from the Colombian CCTS are interpreted with a social determinants perspective in mind.

This research is worth doing for three reasons. First, vast numbers of individuals, households and communities die prematurely or fall ill unnecessarily. It is estimated, for example, that there would be around seven million fewer infant deaths each year if every country were to have the infant mortality rate seen in Iceland[1]. There are no innate biological reasons why Icelandic children die less often than children in other countries: Figure 1.1 shows the variation in children's mortality rates within and between countries. A clear association between rates of death and national and household wealth suggests ample scope to alleviate suffering if the right socioeconomic policies can be enacted; numerous other equally graphic examples of the importance of socioeconomic determinants exist. There are few who would argue with the inherent merit, if not urgency, of this aspiration.

Second, the health and welfare sectors responsible for the task remain unclear on the detail of which socioeconomic policies to enact, where and how. This is in marked contrast to the state of knowledge at the more biomedical end of the sectors' interest. There, there has been significant success at identifying and prioritising the most effective programmes of action. The Disease Control Priorities in Developing Countries project[2], for example, attempts to identify priority health interventions in low and middle income countries, drawing data from the WHO Choosing Interventions that are Cost Effective (CHOICE) project. The interventions identified are overwhelmingly biomedical. Considering how to improve childhood health for example, dietary fortification with zinc or vitamin A and measles vaccination emerged as the most cost-effective strategies applicable to all children[3]. Although some more structural strategies such as legislative changes in food production, traffic control and tobacco and alcohol policy are included, the editors recognise that healthcare interventions are over-represented.

The importance of addressing non-biomedical determinants is underlined by The Global Burden of Disease project, which estimated the incidence, duration and mortality of over 130 major causes of disease and disability and quantified the burden of disease attributable to 20 major risk factors[4]. These include poor diet, unsafe sex, unsafe sanitation and indoor smoke as well as many other risk factors which can only be addressed by socioeconomic intervention.

Figure 1.1: Under-5 mortality rate per 1000 live births by level of household wealth (source: Gwatkin et al, Socio-economic differences in health, WB 2007 reprinted from CSDH 2008[1])

Even if the right socioeconomic interventions were identified, the 'absorptive capacity' of less developed countries would still be an issue. This refers to the levels of inefficiency (and, occasionally, corruption) within recipient bureaucracies, low levels of healthcare workforce and workforce skills, lack of political will and the distortion of health systems caused by multiple 'vertical' donor programmes, that is, those that force the prioritization of isolated healthcare issues[5 6]. In contrast, there is compelling evidence that more holistic forms of healthcare are associated with better gains in population health. In Costa Rica, for example, strengthened primary care was estimated to be associated with reductions in child mortality of 13% and adult mortality of 4%, every 5 years between 1970 and 1985 independent of improvements in other health determinants[1].

CCTS have emerged in recent years as one socioeconomic policy that appears to overcome many of these shortcomings: they approach poverty and poor health holistically, are transparently implemented, have successfully gone to scale at national level and are supported by substantial political will. These increasingly popular interventions seek to promote uptake of public services that go under-used by certain sections of the community. Through this, they aim to improve the welfare of the worst off and break the intergenerational transmission of poverty. Detailed discussion of how CCTS operate and whether they achieve their aim is presented in Chapters 5 & 6. It will be shown that some important health and educational benefits are associated with CCTS, but concerns persist that these may be small, superficial or unsustained.

Finally, there are key health outcomes whose association with CCTS is under-researched. The new findings presented are the effects of the Colombian CCTS, *Familias en Acción,* on prevalence of obesity in women, the prevalence of obesity in children and on levels of maternal knowledge regarding the prevention and treatment of acute diarrhoeal illness in children (ADI). As well as being outcomes about which the CCTS literature says little, these outcomes are associated with a significant disease burden. Obesity accounts for an increasingly large burden of ill-health globally, a burden increasingly focussed on the poorest groups in society. Similarly, ADI is a prominent manifestation of global inequity in child health, and one that is easily remediable through simple household measures if the mother is aware of them. Furthermore, maternal knowledge is protective against abnormal nutritional outcomes so is worth examining alongside analyses on obesity.

As well as the research need outlined above, there are a number of personal reasons why this programme of research appealed, particularly given my background as a public health practitioner. First, despite their popularity and significant impact on health and health services, the health sector has thus far had little involvement in CCTS design, implementation or evaluation. Critically considering the schemes from a health perspective seemed an opportune challenge. Second, work undertaken with the Secretariat of the WHO Commission on Social Determinants of Health led to an interest in the interplay between individual behaviour change and action on the social determinants of health as contrasting or complementary means to overcome disadvantage. CCTS offer an empirical vehicle with which to explore this interplay, as explained in Chapter 5. Third, I was keen that my research be oriented toward policy (particularly policy that addresses health inequity), rather than theory or descriptive epidemiology. Finally, CCTS originated and are most widely implemented in Latin America, a region in which I have a long-standing interest.

The thesis aims to produce results and insights that are useful in refining the design and operation of conditional cash transfer schemes, in order to make them more effective interventions in the urgent task of reducing avoidable disparities in health.

Chapter 2: Conceptual Framework

The first chapter briefly set out the impetus behind the thesis, namely a concern for health equity, for the social determinants of health and for effective policy to improve health equity, and its central aim to advance understanding of the impact of CCTS on health and their potential role in improving health and reducing health inequity. This chapter looks at the issue of health equity and its determinants from a more theoretical perspective. It aims to provide a conceptual framework with which to understand the potential of CCTS to improve health equity and through which to interpret new quantitative findings from *Familias*.

Understanding the determinants of ill health and health inequity

Much discussion of the determinants of health inequity begins with Sir Douglas Black's report to the UK Department of Health and Social Security in 1980[7]. He showed that the death rate for men in social class V was twice that for men in social class I and suggested four possible explanations:

- measurement artefact, where both health and class are artificial constructs with little substantive relevance and where any association between them is of little causal significance;
- natural or social selection, where prior health determines one's social position, that is, innate physical frailty may cause an individual to drift to the bottom of the ladder of social and economic standing. As an extension to this idea, Wilkinson postulated that adult health and social position need not determine each other but may be co-determined by the accumulating influence of social factors earlier in life, such as levels of childhood disadvantage or education[8];
- behavioural or cultural factors, where unhealthy lifestyle choices such as heavy smoking cluster within the lower social classes, resulting from individually or culturally determined, but voluntary, lifestyle preferences;

- structural or materialist factors, where the lower social classes are unequally and involuntarily exposed to adverse environmental conditions which cause poor health. These may include psychosocial stressors and hazards, indeed any factor outside the individual's control.

Although chance, bias and confounding remain important considerations in any study, artefact has been discounted as an explanation of health differentials[9]. The existence of clear gradients of health disparity across occupational groups (unrelated to a poor/non-poor distinction) is particularly conclusive evidence against the artefact hypothesis[10-12].

The role of social selection or drift appears small. Loss of socioeconomic status due to ill-health rarely occurs, particularly among professionals, and tends to be limited to certain groups such as middle aged men[13]. Nevertheless even in this demographic group the evidence for the social selection mechanism is unconvincing, as neatly illustrated by comparing the effects of lung cancer and of chronic bronchitis on social position. A diagnosis of lung cancer typically leads to death within months – no drop in social position is observed for these men, as might be expected given the short time frame. Social position is equally stable, however, for men diagnosed with chronic bronchitis – despite the fact that these men survive for many years after diagnosis, ample time for social drift to occur, were it to be an important phenomenon[14]. There is also recent evidence that individuals transferring between social classes (up or down) may in fact reduce health inequalities by diluting the mean health of their destination class and pulling it toward the population mean[15].

Most debate, therefore, has centered on the relative importance of behavioural and structural factors. This is particularly true in policy terms, since policy makers are concerned with the question of how health inequalities can be tackled in practice. Black strongly advocated addressing material inequalities. A striking finding of his report, for example, was that 65% of the variation in deaths, permanent sickness and low birth weight in 678 wards in the North of England could be explained by indicators of material deprivation. The opposite view was expressed by a junior health minister visiting the same region after the report's publication. She was quoted as saying "I honestly don't think [poor health] has anything to do with poverty. The problem very often for many people is just ignorance…and failing to realize they do have some control over their lives."[16]

The rest of this chapter considers the debate over the relative importance of behavioural and structural determinants in more detail, particularly as regards an appropriate policy response to health inequity. It argues that approaches which prioritise action at the individual-behavioural level or action on the social determinants of health can in some cases complement each other. It suggests 'co-production' as a framework that integrates action on individual-behavioural and social determinants and which can be used as a conceptual framework in the rest of the thesis, both to understand the potential for CCTS as a policy tool and to interpret the quantitative findings from *Familias en Acción*.

The individual and the social approach

One way of understanding how health and ill-health arise is to focus on determinants of disease that are within or close to the individual. Such approaches prioritise action against biomedical agents (genes, infectious disease vectors and environmental toxins) and/or an individual's knowledge, beliefs and values (regarding future risks and benefits of particular decisions, for example).

The biomedical paradigm became dominant in the latter part of the nineteenth century, in line with a strong Victorian preference for the determinism of Newtonian physics and Cartesian dualism (the 'body as machine' metaphor). The rapid development of germ theory with the research of Pasteur, Lister and Koch in the 1860s and 1870s reinforced this, and twentieth century progress in genetics and immunology has continued to sustain the dominance of this paradigm.

Partly contrasting, but also complementing, this determinism has been a proliferation of interest in factors which determine an individual's actions. Several theories have been developed from the 1970's onwards, including the Health Belief Model[17], Theory of Reasoned Action[18] and Transtheoretical Model[19]. All focus on within-individual factors, such as perceptions of risks or benefits, readiness to change and self-efficacy. Environmental factors tend to be confined to the social sphere (especially other peoples' views), although newer ecological approaches have recognised the importance of the physical environment in shaping people's choices regarding, for example, physical exercise.

A criticism of both approaches is that they pay little attention to deeper situated determinants of disease and/or health behaviour, which may entirely account for an individual's disease burden if they cannot access clean water, or which may entirely constrain an individual's choices if they have never been taught to read, to give just two examples.

Indeed, awareness that an individual's physical, social and economic environment affects their health has been known for centuries. Villerme in 1840, for example, documented that managers, merchants and directors from Mulhouse could expect to live 10.6 years longer than factory workers from the same city[20]. Understanding the reasons behind such differences remained a relatively low priority for epidemiologists until the work of Leonard Syme and others in the 1970's[21 22]. Syme, the first sociologist to be employed by the US Public Health Service, introduced the concept of "control of destiny" – or the power to lead the life one wants – as the explanation behind social class gradients in health. As evidence around social patterning in health accumulated and the economic climate worsened during the recession of the 1980's, policy makers, particularly in Europe, increasingly began to take notice of the implications made by the new specialism of 'social epidemiology'[23]. The central theme of the WHO's "European Health for All" strategy in 1984 was reduction of social inequalities in health and several countries commissioned research to inform domestic policy.

One culmination of this interest was the decision of WHO Director-General Lee Jong-wook to launch a Commission on Social Determinants of Health (CSDH) in May 2005. The Commission sought to gather international evidence on models and practices that effectively address the social determinants of health. Its final high-level recommendations were that multilateral agencies, national and local governments, the private sector and academic and civil society should work together to:

- **improve the conditions of daily life,** through investment in the social, physical and cognitive development of children; urban and rural infrastructure and governance; environmental protection; and access to healthy work, social welfare and fairly financed health care;

- **tackle the inequitable distribution of power, money and resources**, by placing responsibility for health equity and action on social determinants at the highest level of government; reinforcing the state as the prime provider of basic services and health protection; enabling wider participation in decision making and particularly empowering women and other marginalised groups; and
- **continue to develop the knowledge base** by measuring the problem and evaluating action.

Equity of health outcomes and the elimination of avoidable inequalities in health status were the Commission's core objectives; another part of its remit was to build a global movement for action on health equity and social determinants that linked governments, international organizations, research institutions and civil society together. This captures well what is meant by a 'social determinants approach' – a central objective of health equity and action on a set of social and economic phenomena that are drivers of health outcomes and their avoidable stratification.

The Commission identified several sets of social and economic phenomena that give rise to health inequity. Most deeply situated are the socioeconomic and political contexts in which people live and work, including societal norms and values, macroeconomic, health and social policy, and the nature and quality of local governance. This social processes set in train by these contexts determine people's unequal experience of education, work, income, gender and race, which in turn influence more proximal determinants of health such as material wealth, behavioural choices or psychosocial stressors, as set out in Figure 2.1. Collectively, these factors determine people's vulnerability or resilience to health events[24].

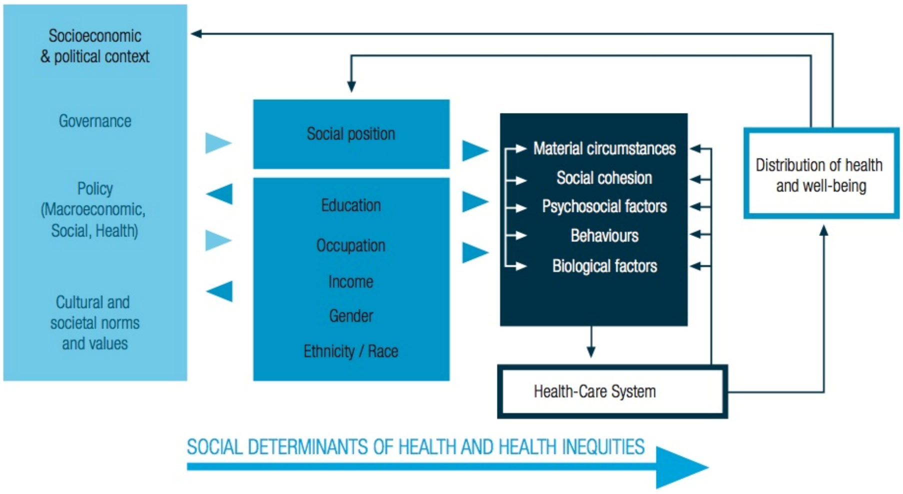


Figure 2.1: the conceptual framework used by the Commission on Social Determinants of Health

The distinguishing feature of a social determinants approach to health is the crafting of policies directed to reducing the adverse health impacts associated with deeply situated determinants of health inequity. Human rights frameworks are embraced as the appropriate legal mechanism with which to move towards this goal. Other priorities include addressing the gradient of poor health that exists across society, building social cohesion and increasing social participation[1].

Nevertheless, whilst endorsing the necessity of a programme of action to create physical, social and economic environments conducive to good health, it may that such a programme could, in some cases, be complemented by recognising and integrating an individual's potential to improve her own health, as explained below.

Towards an integrated policy response

Three arguments can be made why an approach to health equity which prioritises action on social determinants should, in some cases, also recognise the role of the individual. First, plausible determinants of health can be identified at the individual level, most evidently personal decisions to engage in healthy or unhealthy behaviour. Such decisions are an expression of individual autonomy and need to be accounted for. Second, it cannot be assumed that creation of a level playing field in social and economic terms will lead to individuals adopting healthy behaviours without further engagement from peers, experts and professionals; finally, the opportunity to influence policy depends in part upon identifying and exploiting political opportunity, as well as challenging orthodoxy when necessary. Each reason is discussed further below.

Causation

'Autonomy' is a person's capacity to determine their own behaviour or course of action in the context of a set of choices. 'Agency' is a closely related concept referring to the capacity to enact one's choice; in the case of health, it would refer to the capacity to influence and determine health outcomes. It is important to recognise individual autonomy and agency in an account of health equity for two reasons. First, the poor and socially excluded demand it. An expression of this comes from a member of the Australian Aboriginal community; even though highly marginalised, the speaker makes it clear that his community are more than victims of circumstance:

'…we can step up to the challenge and we all have that leadership potential and it's not about having to be some huge person ... so it's about, sort of like, stepping up to the mark.'[25]

Despite living with profound, structured prejudice and disadvantage[26 27], this individual recognises some degree of autonomy and agency is nevertheless preserved and appears necessary to exit disadvantage. He does not resign to fatalism.

Second, our understanding of how individual-level and social determinants combine to cause ill-health is incomplete. Social phenomena such as poverty and its consequences can significantly constrain individuals' ability to act healthily. Similarly, individual factors such as knowledge, values and biology also determine behaviour and outcomes. Nevertheless, attempts to quantify the relative explanatory power of one versus the other or to set-out whether social and individual-level determinants act in sequence or in parallel, intermittently or continuously, remain vigorously contested[28].

A dichotomisation between social and individual-level determinants is unlikely to aid understanding. Polarized frameworks are poor conceptions of the world and previously accepted dichotomies, whether gene/environment, quantum/relativity or political left/right, are being replaced with more sophisticated, integrated understandings. Regarding determinants of health, Krieger suggests that social and individual determinants act continuously and in parallel. She writes that an artificial division obscures "the intermingling of ecosystems, economics, politics, history and specific exposures and processes at every level, macro to micro, from societal to inside the body"[29]. Many other attempts have been made to capture and explain the same idea of multiple determinants acting simultaneously across different levels[28 30 31]. Two visual representations of these are given below.

Figure 2.2: One visualisation of the determinants of health, from Glass & McAtee 2006[32]

In their ‘axis of nested hierarchies’ model, Glass and McAtee suggest that causes of ill-health and causes of the causes can be visualised as a running stream, simultaneously influenced by individual and social factors at multiple levels. Their visualisation is enjoyably rich and worth quoting at length:

> “Time is represented by the flow of water across an irregular surface (horizontal axis), while biological and social organization is represented by a vertical axis reflecting nested biological and social hierarchies. The vertical axis begins in bedrock (genes), and rises through biological systems lying beneath the surface (underwater), progressing to the plane of the waterline where individual behavior occurs. Above the water’s surface is a landscape of ever larger structures that make up the social, built, and natural environments … Individuals are like buoyant objects floating in a network of tributaries, streams and rivers, each beginning a journey at different points and affected by differing topographical features … Illness states can be represented by pockets in the river bed into which a person might descend. The watershed might contain bumps, hills, or mountains that parallel barriers to adoption of health promoting behaviors. Areas of depression (valleys or canyons) represent opportunities or inducements that attract the flow of water. Depending on differential distribution of resources, some objects floating in the stream may be more able to scale obstacles against the force of gravity, while others may be destined to take the shortest, easiest course.”[32]

In contrast, Nurse, Campion and Sheehan offer something much more prosaic in their ‘dynamic model for well-being’ (Figure 2.3 below). Nurse et al. see well-being as dependent upon reducing risk factors (at social and individual level) and promoting protective factors (again at social and individual level), within the context of a healthy and supportive environment.

The point of presenting two (from many possible) alternative models of the determinants of health alongside the CSDH framework of Figure 2.1 is not to favour one or other particularly, but to emphasise the intertwining and simultaneity of individual-behavioural and social determinants of health.

Figure 2.3: an alternative visualisation of the determinants of health, from Nurse, Campion and Sheehan, 2006[33]

Convincingly separating the ‘causes of the causes’ from the ‘causes’ of poor health (to use the language of the Commission on Social Determinants of Health) appears difficult. The two are to some extent conjoined in effect, particularly where health behaviours are concerned. Hence, a policy response to health inequity should combine action on social determinants with recognition of individuals’ ability to influence his or her personal welfare.

Consequences

An argument similar to the analysis of causality above applies when considering consequences of action on social determinants. We cannot assume that healthy behaviours will follow as an inevitable consequence from the correction of social and economic inequalities. This is because individual behaviour depends on a range of other drivers, including an individual's perceptions, beliefs and motives, as noted earlier, which may not change or change unpredictably.

Resnicow and Page explored this idea using novel paradigms borrowed from the fields of chaos and complexity[34]. They note that although some behaviour change events may be understood in simple, linear models, most behaviour change occurs in a highly complex and non-linear manner. It may therefore be impossible to predict what balance of interventions across the individual (addressing knowledge and attitudes, for example) and the environment will tip behaviour change. They state: "the role of the health professional is to ensure the balls are kept spinning at various intervals, with varying air flow velocities".

Hence, even if social determinants were recognised as fundamental and first-order in terms of causality, it may still be incorrect to mount a policy response that proceeds across a sequence of determinants, from the structural to the individual. Instead, individuals need to be actively and continuously engaged to invest in their wellbeing from the start. The WHO Framework Convention on Tobacco Control[35] provides an exemplar of such an approach. The Framework asserts the importance of behaviour change such as smoking cessation programmes as well as structural issues such as tackling the illicit tobacco trade.

The political context

Finally, faced with the constraints of diminishing resources, rising costs and intensifying expectations, contemporary health and social care policy promotes individual autonomy as an increasingly explicit principle. A recent government publication setting out the direction of public services reform in the UK called *Working Together*[36] makes this clear, not least in its title, but also in content: “People do not expect public services to solve all their problems. They understand that parents have to parent, patients have to prevent health problems escalating, and everyone must play fairly by the rules.”

Whilst an argument to ignore political preferences and advocate purely on principle is often compelling, the evidence shows that it is important to be aware of the interests of politicians, officials and the public and exploit windows of political opportunity accordingly[37]. Although the social determinants of health agenda is active in a number of administrations globally, the stability of its presence on the political agenda can never be certain. Recent empirical work from the United States, for example, finds that despite increasing public awareness of the social determinants of health, there was no increase in public backing for policy action[38].

It may therefore be judicious to offer policy options that address the entwined influences of individual and structural health determinants to engage and, where necessary, challenge the broadest set of decision makers.

Co-production in health

The difficulty, or undesirability, of separating individual-level and social determinants, leads to the core problem of how appeals to an individual’s agency regarding his or her own welfare (even if partial) can be recognised and integrated into an approach to health equity that prioritises social determinants.

One solution is to see good health and welfare being the result of co-production. This is simply the idea that ‘‘responsibility for better health should be shared between society and the individual ... society’s efforts for health improvement should be dovetailed with individuals’ and families’ efforts’’[39]. Co-production derives from the social determinants approach to health and mirrors it in two key respects; first, in recognising that individual-level beliefs and behaviours are important in determining health outcomes; second, in recognising that such individual-level factors are strongly influenced by social determinants and social processes. Whilst the social determinants approach focuses action exclusively on the ‘causes of the causes’, however, the co-production approach states that in some cases policy makers can also appeal to an individual's agency and their responsibility to maintain and improve their health 'Responsibility' requires careful definition and is discussed more fully below.

The idea of co-production originated within the public sector. It was conceived as a means of reforming local public services, particularly councils, schools or hospitals that were failing, or rejuvenating services that were under resourced[40]. In essence, local governments began to twin their resources with the time, energy and experience of local individuals to develop local solutions to local problems and build stronger communities[41]. Here, the idea is transported to the health domain and is used to refer to the idea that individuals' and communities' health can be improved through their own choices and actions whilst improving and creating a more fair physical, social and economic environment around them, making it more conducive to good health.

It is important not to assume an individual's ability to co-produce, but to make adequate investment to enable her to do so. Investment must occur in three domains, as set out in Wolff and de Shalit's Disadvantage[42]. The first is investment in an individual's human capital. This refers to an individual's stock of knowledge and skills, lack of which severely constrains individuals' abilities to participate fully in society and may irretrievably consign them (and subsequent generations) to poverty and marginalization. Human capital can be built up through education and training, formally and informally, from professionals, peers or elders. The second is investment in material and financial resources. Both human capital and external resources need to be at a level which enables genuine autonomy, as previously defined. The third requirement is to work to change social structures to increase individuals' opportunity to overcome disadvantage, in other words, the "equitable distribution of power, money and resources" as argued by the social determinants approach.

These are the basic elements necessary to see responsibility for better health shared between society and the individual, as set out in Figure 2.4 below.

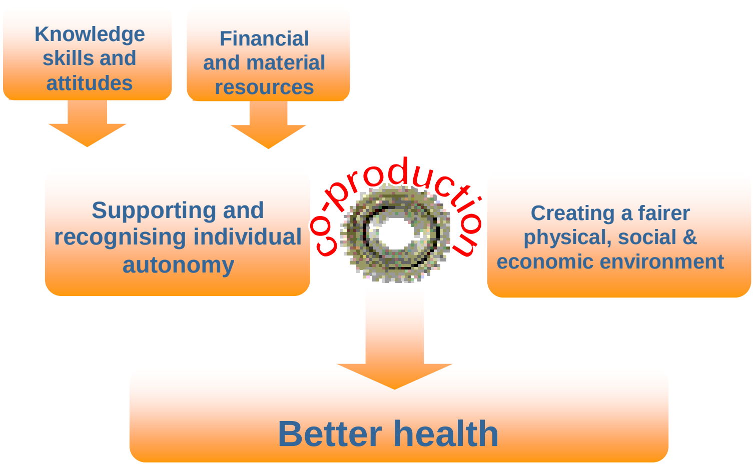


Figure 2.4: Co-production and health

Compared to the axis of nested hierarchies, dynamic model of well-being or other conceptual frameworks of the determinants of health, co-production has two advantages from a policy-making perspective. First, it is simple yet is able to capture the essence of the multiple and complex determinants conceived of in other frameworks. Second, it moves beyond mere recognition of agency, to expose responsibilities. In contrast to autonomy or agency, 'responsibility' refers to an obligation to act, in this case, in ways that can lead to better health

This is likely to be appealing to policy makers because it identifies which agents are obliged to act to solve the problem of poor health rather than merely describing how the problem arose. Co-production is usually taken to refer to a shared responsibility between the individual and wider society (or the State). It has greater flexibility than this, however, and can identify the potential for better health by calling upon the responsibilities shared between and across individuals, households, communities, and governments.

Particularly close attention must be given to how 'responsibility' is defined, since it is important that co-production stays true to the values embedded in a social determinants approach. Schmidt has considered the notion of 'responsibility' in some detail when applied to health[43] and makes clear that the term can have multiple implicit and explicit meanings, often used simultaneously. At a basic level, the term can be used either retrospectively or prospectively. In a backward-looking sense, ‘person X is responsible for health status Y’ may mean ‘X played a certain causal role in having brought about Y’. In a forward-looking sense, the same phrase may mean ‘X should work to achieve Y because no-one else practically can, or will, do so on her behalf’ (e.g. exercise more).

Blame is often imputed when responsibility is used retrospectively (‘X played a certain causal role in having brought about (adverse) health status Y and should be penalized as a result’) and may even, although more rarely, be invoked prospectively (‘X should work to achieve Y and will be penalized if she does not’). There is no reason, however, why such consequentialist approaches should not be overridden by the values embedded in a social determinants approach. Even in retrospective application, values of solidarity may preclude blame and penalization. Indeed, the primary notion driving co-production in health is to support, not blame, individuals[39].

Other conceptual issues also require refinement. First, there are some circumstances where the co-production approach appears inapplicable, principally situations of such extreme social injustice where it is irrelevant or inappropriate to talk about individual autonomy, agency or responsibility. Forced prostitution would be one example. It is self-evident that individuals cannot reasonably be responsible for healthy or unhealthy actions if their circumstances constrain them to a single behaviour or where they lack genuine opportunity to behave differently.

Even where an appeal to shared responsibility is appropriate, an outstanding difficulty remains in determining or weighing the relative responsibility of each agent. Individuals vary greatly in their capacity and interest to act (although co-production calls for investment in their human capital and material needs to maximise this where possible). Likewise governments and professionals fluctuate in the support they give to individuals and how much they expect individuals to do themselves. Further thought needs to be given as to whether there are any robust principles to guide fair balancing of responsibilities and investment between agents.

Schimdt identifies other considerations that can help decide whether an appeal to individual responsibility is appropriate[44]. These include the extent to which such an appeal in the health domain is commensurate with appeals made in other domains (such as saving adequate funds for retirement) and the extent to which it may compromise other parties (damaging the doctor-patient relationship, for example). Further major considerations are whether consensus exists around definitions of ‘responsible’ behaviour (is vegetarianism, for example?) and the conflict between appeals to ‘act responsibly’ and personal freedom to act as one chooses.

Co-production has been successfully applied to the creation of health and welfare in various policy initiatives across the world. Australia’s *Disabled Apprentice Wage Support Program* is a sophisticated example of the idea. The programme provides financial assistance to employers who employ apprentices with disabilities or those who become disabled during their apprenticeship. Assistance includes wage support payments, tutorials, interpreter or mentor services, leasing or purchasing essential equipment or modifying the workplace. A full suite of resources and service contacts for employers and employees underpins the program[45]. Similarly, Sweden’s *‘Passion for Life*’ policy provides older people with the tools for a healthy lifestyle and empowers them to continue to live fulfilled lives as they grow older[46].

Co-production seeks to tap into individuals’ potential, exploring and maximising this with others’ help as necessary. It may be that other advantages come from calling upon a degree of responsibility at the individual level. Identifying and supporting personal responsibility may build human capital. Overcoming notions of fatalism or resignation is particularly important in this regard. One might even assert that one of the major goals of action on the social determinants of health ought to be building and enabling individual responsibility for health or that a purely rights-based approach, which makes no mention of responsibility, may actually undermine social fabric and jeopardise the action on social determinants agenda. At this stage, however, both statements remain assertions which would benefit from further critique and enquiry.

Co-production need not just work at individual level, but can also be applied to communities as well[47] [48]. Whether applied between individuals, households, communities or any combination of these, certain conditions would have to be in place for it to work well. These have not been exhaustively discussed or debated, but are likely to include authentic respect between parties, shared objectives and shared understandings of cause and effect (agreeing that vaccination is safe rather than harmful, for example), shared understanding of mutual capabilities (including those yet to be realized) and a shared understanding of mutual duties. Concrete manifestations of this are increasingly common, as seen in the NHS Constitution, for example. The way that timely and accurate information can support co-production is also increasingly being seen, in Baltimore's *CitiStat*[49] or the United Kingdom's *police.uk*[50] platforms, for example. These are websites which allow residents to monitor and comment on the performance of local public services.

Successful co-production is difficult. It will require meaningful and sustained engagement from government and society at large. But some evidence shows that it may leads to better outcomes and be cost-effective[51]. Furthermore, individuals are keen to co-produce[52], something which public services have at times overlooked.

Co-production and conditional cash transfer schemes

Co-production is an approach which seeks to integrate a role for individual agency, even if partial, within a social determinants approach to better health. Although an appeal to individual responsibility is an explicit part of co-production, it does not downplay the importance of the social determinants. It recognizes that co-production cannot be assumed, but requires adequate investments. All the inputs, in fact, are socially determined, such as literacy, underscoring co-production's close alliance to the social determinants approach. The value of co-production lies in translating competing theories (often driven politically) into policy action which is likely to have a broad consensus.

Co-production is a particularly apt conceptual framework with which to examine the impacts of CCTS for several reasons. First, both co-production and CCTS aim towards the same objective, namely better health and better health equity. Second, CCTS embody shared responsibility, the key idea of co-production, as an explicit core objective. Of note, co-responsibility is a prominent concept in Colombian social welfare policy generally, and in the official narrative surrounding *Familias en Acción* in particular, as discussed in Chapter 7. Third, CCTS separately identify yet jointly address distinct elements of co-production as shown in Figure 2.4: investment in human capital (by incentivising uptake of health and education services for younger household members and attendance at seminars on health, nutrition and parenting for older household members); and amplification of external resources (through disbursement of nutritional supplements and cash transfers). The conceptual model and the policy part company, however, around the third element of co-production, namely creation of a fairer physical, social and economic environment. In many CCTS, structural conditions are assumed to be adequate and are left unaddressed, although may receive investment from other initiatives. Similarly, CCTS evaluations do not typically capture variables that reflect structural determinants or plausible markers.

This point of separation between the model of co-production and the intervention of CCTS is not necessarily disadvantageous. Later chapters will examine CCTS impact on child and adult overweight, an unintended and adverse outcome, and on maternal healthcare knowledge. If adverse programme effects are found, it may be the case that co-production can offer guidance on how CCTS could be reformulated to correct apparent policy failures. In this sense, the omission of CCTS to explicitly address the physical, social and economic environment may be particularly salient

Accordingly, co-production is used as the conceptual framework to explore CCTS impacts as described in the current literature and to explain findings from the new analyses presented in Chapters 10, 11 & 12. Chapter 13 gathers these findings together and reconsiders co-production's utility as the chosen conceptual framework for the thesis.

The aim of the thesis is to understand better the impact of CCTS on health. It is important to note that the thesis does not test the hypothesis that co-production is good for health; to do so convincingly would require testing many more associations in more settings and policy frameworks than are offered in this thesis. Nor does the thesis primarily test the adequacy of co-production as a conceptual model for understanding CCTS impacts, although this is discussed in Chapter 13 as mentioned above.

The co-production model carries risks and limitations, most notably the risk that blame and penalisation are too readily associated with the notion of responsibility, even if co-production tries to resist this. The social determinants approach can push back against this on two levels; first with the empirical insight that “features of the social and built environment [exist] above and before the individual (at the familial, community, organizational, and societal levels), constrain, limit, reward, and induce the behaviour of individuals”[32], second with its values-system based on solidarity and human rights.

Summary

Attempts to explain the origin of health inequalities, and craft appropriate corrective policies in response, have a long history. Artefact or social selection appear inadequate explanations. Instead, there has been increasing interest over recent decades in addressing the most deeply situated causes of health inequity, namely the socioeconomic and political contexts in which people live and work. Action on the social determinants of health does not, in some cases however, preclude an appeal to individuals’ responsibility to maintain and promote their health, as long as ‘responsibility’ is not defined punitively and adequate investment is made in an individual’s material resources and human capital to allow them to realise such responsibility, at the same time as creating fairer physical, social and economic environments. Such an approach, closely allied to the social determinants approach, has been called ‘co-production’ in health and will be used as the conceptual framework for the analyses of *Familias en Acción* presented in this thesis, given the number of shared objectives and constituent elements between co-production and CCTS.

Chapter 3: Structure and approach

The rest of the thesis consists of four parts. A literature review in Part II summarises current knowledge on CCTS operation and impacts on health. Part III describes the setting, operation and evaluation strategy of the Colombian CCTS, Familias, the empirical vehicle which will be used to generate new findings on the impact of Familias on health. Part IV presents these analyses and Part V concludes by synthesising the findings from Parts II and IV in relation to the concerns and conceptual framework established in Part I.

Visits to the field where Familias operates in August 2007 and March-June 2011 supported the research by providing context and detailed operational knowledge of the programme. An understanding of the broader context in which CCTS and other social welfare programmes operate was gained by a three-month sabbatical spent in the Information, Evidence and Research Cluster at WHO Headquarters in Geneva in Spring 2010, where I was able to interview several policy experts.

Supervision was provided jointly between UCL Epidemiology and Public Health (Professors M.G. Marmot and T. Chandola) and UCL Economics (Professor O. Attanasio). Funding was provided by a Medical Research Council Research Training Fellowship. No conflicts of interest followed from either of these arrangements.

The thesis analyses data in the public domain, in which all personal identifiers have been suppressed. As required by the funding body, ethical issues pertinent to the project were identified and discussed with the UCL Research Ethics Committee in April 2007. It was agreed that the research did not raise any particular ethical issues beyond those covered in UCL Guidelines for Responsible Practice in Research, which were followed throughout.

Conclusions to Part I

CCTS are increasingly popular social welfare interventions that seek to improve the welfare of the worst off and break the intergenerational transmission of poverty. The aim of this thesis is to ask whether a social determinants of health (SDH) critique of CCTS can offer new insights into their design, operation and evaluation. This will be achieved in two ways: by examining current knowledge and practice around CCTS from an SDH perspective and by contributing new findings on the impact of *Familias*, the Colombian CCTS, on maternal and child obesity and maternal healthcare knowledge and practice.

The explanatory conceptual framework to be used will be co-production, a model which sees simultaneous investment in human capital, material resources and changes to the physical, social and economic environment as the best means to overcome disadvantage. Particular attention will be paid to the impact of CCTS on health equity, on the interaction between CCTS impacts and certain social determinants of health and on the role of the health sector with respect to CCTS.

PART II

LITERATURE REVIEW

Chapter 4: Methodology of literature review

A scoping literature review on CCTS was undertaken in June 2007 and updated in April 2009 and July 2011. The objective was to understand how CCTS evolved and currently operate, gather evidence of their impact on health and the determinants of health, and identify areas where the literature currently says little.

A scoping literature review has been defined as a process which aims ‘to map rapidly the key concepts underpinning a research area and the main sources and types of evidence available, and can be undertaken as stand-alone projects in their own right, especially where an area is complex’[53]. Scoping reviews seek ‘to be as comprehensive as possible in identifying primary studies (published and unpublished) and reviews suitable for answering the central research question’ and aim to produce a critical, narrative account of a field of research[54]. They can be contrasted with systematic literature reviews, which typically have a tightly focussed research question (precisely specifying intervention, outcome and population), exclude many methodologies (such as qualitative studies or non-randomised quantitative studies) and aim to produce synthetic quantitative estimates or weighted comparative estimates of an intervention’s effect. Key markers of quality and rigour, however, apply equally to scoping and systematic reviews. A well-conducted scoping review is comprehensive, transparent and reproducible, with explicit study selection criteria and data extraction procedures[55].

A scoping review was felt appropriate for this thesis because the aim was to obtain a broad, critical overview of CCTS impact on health rather than estimate, in quantitative terms, a specific impact. All research methodologies, including qualitative work, were of interest. Furthermore in practical terms, a systematic review requires additional reviewers to duplicate and adjudicate appraisals, which was not possible given resource constraints.

A rigorous, transparent and reproducible methodology was used for the scoping review, following recommended guidelines[54 55]. Preliminary reading indicated that most CCTS literature was published within Economics and that a substantial body was also in the grey literature (commonly defined as any "information produced and distributed on all levels of government, academics, business and industry in electronic and print formats not controlled by commercial publishing i.e. where publishing is not the primary activity of the producing body"[56]). Consequently, a diverse and complex search strategy was required, developed with the assistance a Medical Librarian.

Three broad questions were developed to define the interests of the thesis and allow relevant material to be identified. These were:

- what is known about the historical context, objectives and mechanisms underlying CCTS?
- to what extent do CCTS lead to better health?

And, using the co-production model.

- to what extent do CCTS invest in material resources, build human and social capital and address structural determinants?

Several resources were searched:

bibliographic databases:	Econlit, Econpapers, WoS, IBSS, ZETOC, Geobase PubMed, CAB.
information gateways:	Intute, ELDIS, RFE, ERN/SSRN, Handbook of Latin America Studies, LILACS.
grey literature sources:	SIGLE.
government and national CCTS websites:	Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Honduras, Jamaica, Kenya, Mexico, Nicaragua, Pakistan, Paraguay, Peru, South Africa, Turkey.
NGO websites:	Institute for Fiscal Studies, World Bank (*including* Poverty Impact Evaluations Database), Inter-American Development Bank, World Health Organisation, World Food Programme (*especially* Food for Education *section*), UNESCO, London School of Economics.

Search terms were chosen to maximise sensitivity at the expense of specificity:

bibliographic databases, information gateways and grey literature sources and NGO websites:	conditional cash transfer* OR "conditional cash transfer*" *in all fields*
government and national CCTS websites:	full name OR commonly used acronym of national CCTS.

No limits were placed on publication date, population, study design or publication type; material in languages other than English or Spanish, however, was not retrieved. Reference lists of key articles were examined and authors were contacted to source additional material. Where interim reports and pilot studies were published, only final reports were extracted for review.

Appraisal Framework

Data extraction forms were created and documents appraised for quality and importance, using standard frameworks[57]. The data extraction forms are provided in Appendix A. An evidence grade[58]. was applied to each document:

Grade	**Evidence source**
I	Meta-analysis of RCTs, at least one RCT or at least one controlled study without randomisation
II	At least one other type of quasi-experimental study
III	Non-experimental descriptive studies, such as comparative studies, correlation studies and case-control studies
IV	Expert committee reports of opinions and/or clinical experience of respected authorities

Results

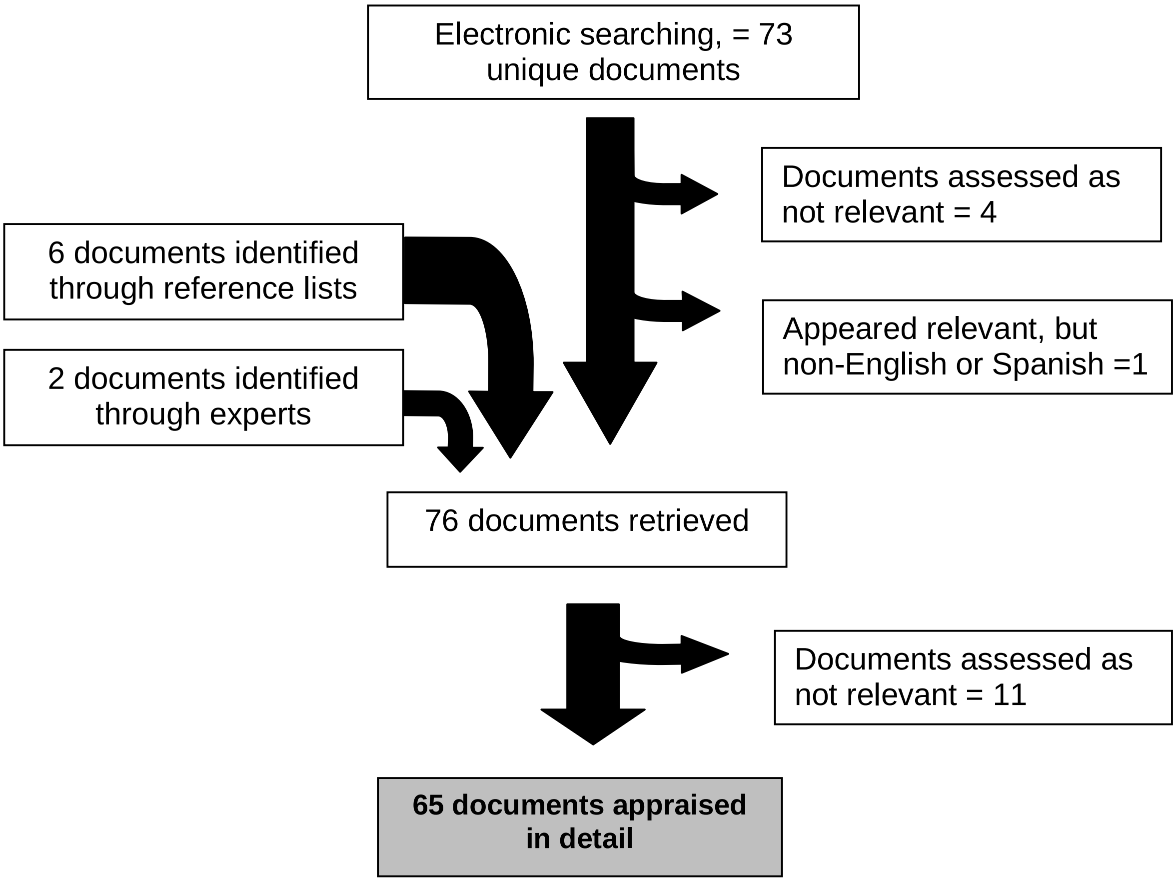


Figure 4.1: Results of the literature scoping review

Description of papers

65 documents were selected for in-depth analysis. 42 were programme evaluations and 23 were general overviews of the area (including 1 systematic review). 49 were sourced from the grey literature (including 2 websites and 1 workshop summary) and 16 from peer-reviewed journals.

A summary table is provided below.

Discussion

Although a scoping literature review is perhaps a less familiar approach than a systematic review, it is an increasingly recognised methodology for meeting particular research needs and was appropriate to meet the information needs of this thesis. Ultimately, of course, terms such as 'systematic / traditional / structured / scoping etc. literature review' are not precisely defined or ranked in terms of desirability, and one's approach to the literature should be tailored according to needs and available resources.

The critical point is that any approach taken should be rigorous, explicit and transparent. The scoping review presented here meets these criteria. An important weakness, however, is exclusion of non-English/non-Spanish material. This is particularly likely to affect inclusion of evidence from *Bolsa Familia*, Brazil's CCTS. Mitigating this weakness, however, English and Spanish cover nearly all of the relevant literature, as shown in the flow diagram above, including material from *Bolsa Familia.* Furthermore, inclusion of reviews and other secondary sources means that important findings reported in Portuguese (or other languages) is likely to have been captured.

Summary table of CCTS literature

1. What is known about the historical context, objectives and mechanisms underlying CCTS?

Source	Design and sample	Purpose and content	Conclusions	Evidence Grade
Fiszbein A, 2009[59] Grey literature	Non-systematic review (qualitative & quantitative)	Synthesis of all CCTS evidence	Supportive of CCTS and the strong evaluation culture that established, acknowledges CCTS limits and need for high-quality public sector.	**I**
Rawlings, 2003[60] Grey literature	Non-systematic review (qualitative & quantitative)	Overview of CCTS structure and objectives.	CCTS succeed in addressing many of the failures of traditional social assistance programmes.	**III**
Rawlings, 2005[61] Grey literature	Non-systematic review (qualitative & quantitative)	Overview of CCTS structure and objectives.	CCTS succeed in addressing many of the failures of traditional social assistance programmes (same as 18).	**III**
Rawlings, 2005[62] Peer reviewed	Non-systematic review	Overview of CCTS structure and objectives; includes comparative outcome data. (similar material to 18, 14)	CCTS create new ‘accountability relationships’ between the poor and public services.	**III**
Villatoro, 2005[63] Peer reviewed	Non-systematic review	Reviews the experience of Latin American countries with CCTS.	Work must also be done to change societal attitudes to poverty.	**III**
Adato, 2000[64] Grey literature	Qualitative study of *Progresa* (Mexico, 1997)	Discusses the scheme’s operational success	Evidence that health and educational services have improved as a result of the CCTS.	**III**

Handa, 2006[65] Peer reviewed	Non-systematic review	A review of CCTS designs; identifies risks and inconsistencies; includes comparative outcome data.	Criticises CCTS focus on children at expense of adults, demand side at expense of supply side.	**III**
Kakwani, 2005[66] Grey literature	Ex-ante evaluation (quantitative)	Considers how CCTS might operate in sub-Saharan Africa.	In Africa, CCTS may not be affordable; conditionality would be necessary to induce behaviour change; broad targeting may suffice.	**IV**
Chapman, 2006[67] Grey literature	Non-systematic review (qualitative)	Considers the role of social transfers to increase equitable uptake of education and health services.	CCTS are one of a several policy options; various contextual questions must be asked before deciding which to implement.	**IV**
Veras Soares, 2004[68] Grey literature	Non-systematic review (qualitative)	Considers possible short- and long-term effects of CCTS.	Advocates a shift of attention to the quality of public services to safeguard any long-term impacts.	**IV**
de Britto, 2005[69] Grey literature	Non-systematic review (qualitative)	A shorter, updated version of ref 92.	Cautions against seeing CCTS as a panacea.	**IV**
Nigenda, 2005[70] Grey literature	Non-systematic review (qualitative)	Reviews the lessons offered by Latin American CCTS for African countries.	African view of poverty differs - conditionality may be unnecessary; supply side will need strengthening; public funding unlikely in Africa.	**IV**
World Bank[71] Grey literature	Webpage	Descriptive global overview of CCTS currently operating.	n/a	**IV**
Schubert, 2006[72] Peer reviewed	Non-systematic review of various CCTS	Asks whether Latin American experiences of CCTS would be generalisable to Africa.	Good reasons for not being able to generalise CCTS effects beyond Latin American contexts.	**IV**
Glassman, 2006[73] Grey literature	Non-systematic review (qualitative) of various CCTS	Identifies and critically discusses the assumptions underlying CCTS and their evaluations.	Clear risks if assumptions are false or are inappropriately emphasised,	**IV**
de Britto, 2004[74] Grey literature	Non-systematic review (qualitative)	Policy review attempting to explain the burgeoning global popularity of CCTS	The appeal of CCTS lies in their ability to unite protection from deprivation and promotion of capabilities.	**IV**

Save the Children, 2009[75] Grey literature	Non-systematic review (qualitative & quantitative)	Explores the impact of cash transfers on child mortality and morbidity.	Regular, predictable household transfers of cash can accelerate reductions in child mortality.	**IV**
OECD, 2009[76] Grey literature	Non-systematic review (qualitative & quantitative)	Considers the role of social protection in promoting national economic growth which favours the poor.	Social protection interventions (including cash transfers) are affordable and should be used more often to promote pro-poor growth.	**IV**
Overseas Development Institute, 2005[77] Grey literature	Non-systematic review (qualitative & quantitative)	Considers the trade-off between cash transfers and other policy options for tackling poverty.	There are good reasons to prefer cash transfer schemes over supply-side interventions or in-kind transfers.	**IV**
UK Department for International Development, 2011[78] Grey literature	Non-systematic review (qualitative & quantitative)	A review of evidence to inform Departmental spending decisions.	There is convincing evidence which supports DFID's investment in country level cash transfer programmes.	**IV**

2. *To what extent do CCTS led to better health?*

Source	Intervention (country, start date)	Design and sample	Outcome measure(s)	Conclusions	Evidence Grade
Rivera, 2004[79] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised; 373 treatment and 277 control infants <1yr; follow-up 2yr later.	Rates of anaemia and growth retardation in young children.	CCTS associated with an extra 1.016cm/year in growth, but stunting remained prevalent.	I
Gertler, 2004[80] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1998 & '99 follow-up.	Rates of anaemia, growth retardation and recent illness in children aged less than 3.	Treatment children 25% less likely to be anaemic, 25% less likely to be ill; no impact on stunting.	I
Behrman, 2005[81] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1998 & '99 follow-up.	Growth rate in 12-36 month olds *who received supplement* (irrespective of randomisation allocation).	CCTS associated with an extra 1.016cm/year in growth, but stunting remained prevalent.	I
Gertler, 2001[82] Grey literature	*Progresa* (Mexico, 1997)	Randomised community based design; 2003 follow-up.	Days of difficulty performing daily tasks in the past four week; other similar measures.	No impact on adolescents; 18-50 yrs: 12 fewer days; >50 yrs: 20 fewer days.	I
Gertler, 2000[83] Grey literature	*Progresa* (Mexico, 1997)	Randomised community based design; 2003 follow-up.	Use of preventive healthcare.	Increased by 18%, including a shift toward earlier pre-natal care.	I
Fernald, 2008[84] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised community based design; 2003 follow-up.	Adult cardiovascular outcomes	Doubling of cumulative cash transfers associated with higher BMI ($p<0.0001$), and blood pressure ($p = 0.03$).	I
Gertler, 2004[80] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1998 & '99 follow-up.	Rates of acute diarroheal and respiratory illness in children aged less than 3.	Newborns 25% less likely ($p<0.05$) and 0-3yr olds 22% ($p<0.01$) less likely to be ill, especially the poorest.	I

Skoufias, 2005[85] Grey literature	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1999 follow-up.	Synthesis of all *Progresa* research to 2005. Rates of acute illness in older children.	12% lower incidence in children aged 3-6; no effect in older age groups.	**I**
Huerta, 2006[86] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 2001&2002 follow-up.	Recent self-reported morbidity in children aged under 5 in rural areas.	Programme associated with lower likelihood of diarrhoeal illness, but greater likelihood of respiratory illness.	**I**
Steclov, 2006[87] Grey literature	Non-systematic review (quantitative)	Various	Assesses the impact of CCTS programs on childbearing.	Honduran CCTS was pro-natalist by 2-4%: CCTS may have unintended effects on family size.	**I**
Morris, 2004[88] Peer reviewed	*Bolsa Alimentacao* pilot (Brazil, 2001)	Quasi-randomised; 1387 treatment children <7yrs and 502 matched controls; f/u 6 mnth later.	Child growth.	The pilot CCTS has a *negative* impact on child growth: 31g less weight gain per month of CCTS.	**I**
Cruz, 2006[89] Grey literature	*Oportunidades** (Mexico, 1997)	Randomised community based design; 10 year follow-up.	Adolescent and adult health knowledge and behaviours.	Improved knowledge of lifestyle risk factors including smoking, alcohol, sexual health and family planning; reduced smoking rates.	**I**
Lagarde, 2007[90] Peer reviewed	Systematic review	Various	Systematic review of CCTS health effects.	CCTS can increase use of preventive services and sometimes improve health status.	**I**
Maluccio, 2004[91] Grey literature	*Red de Protección* (Nicaragua, 2000)	Randomised; 320 treatment and 186 control communities; 2001&2002 follow-up.	Use of preventive healthcare.	Increase of 17.5% (p<0.05) progressive gradient was seen across poverty tertiles.	**I**
Morris, 2004[92] Peer reviewed	*PRAF* (Honduras, 2000)	Randomised; 70 municipalities; follow-up 2yrs later.	Uptake of preventive health interventions.	CCTS associated with increased child weighing, immunisations and post-natal care.	**I**

Attanasio, 2005[93] Grey literature	*Familias en Acción* (Colombia, 2002)	Cohort of 57 'treatment' communities with 65 matched 'controls'; follow-up 2003 and 2005.	Preventive healthcare visits.	Increases in 0-24 month olds (p<0.05) and 24-48 month olds (p<0.05), no impact in older children.	**II**
Fernald, 2008[94] Peer reviewed	*Oportunidades** (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; follow-up five years later.	Growth and development outcomes in children aged 24-68 months.	Doubling of cash transfers assoc'd with less stunting and overweight, and better cognitive/motor dvlp'ment.	**I**
Behrman, 2005[81] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1998 & '99 follow-up.	Growth rate in 12-36 month olds *who received supplement* (irrespective of randomisation allocation).	CCTS associated with an extra 1.016cm/year in growth, but stunting remained prevalent.	**I**
Attanasio, 2005[93] Grey literature	*Familias en Acción* (Colombia, 2002)	Cohort of 57 'treatment' communities with 65 matched 'controls'; follow-up 2003 and 2005.	School and healthcare attendance; self-reported morbidity.	<4yrs old: increased health care visits, decreased gastric illness; no effect for >4yrs or respiratory illness.	**II**
Levy, 2007[95] Grey literature	*PATH* (Jamaica, 2001)	Regression discontinuity: 2,500 just eligible & 2,500 just ineligible households compared; 2004 & '05 f/u.	School and healthcare attendance for the young and elderly; rates of acute illness in the young.	0-6 yrs: 38% increase in healthcare att'dnce; acute illness: no effect.	**II**
Attanasio, 2005[96] Grey literature	*Familias en Acción* (Colombia, 2002)	Cohort of 57 'treatment' communities with 65 matched 'controls'; follow-up 2003 and 2005.	Nutritional status in children.	<2yrs old: 6.9% decrease in chronic malnourishmnet; >2yrs old: no effect. Anaemia: no effect.	**II**
Bando, 2005[97] Grey literature	*Progresa* (Mexico, 1997)	Subgroup comparison between indigenous and non-indigenous groups; 2000 follow-up.	Health outcomes in children and adolescents.	No important differences in programme impact between groups.	**I**
Gillespie, 2004[98] Peer reviewed	*PRAF* (Honduras)	Editorial for ref 66.	Uptake of preventive health interventions.	Although CCTS are a 'dramatic break' from usual models, they should not be seen as a magic bullet	**IV**

* Mexico's *Progresa* was renamed *Oportunidades* in 2002.

3. To what extent do CCTS invest in material resources, build human and social capital and address structural determinants?

Source	Intervention (country, start date)	Design and sample	Outcome measure(s)	Conclusions	Evidence Grade
Skoufias, 2005[85] Grey literature	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1999 follow-up.	Synthesis of all *Progresa* research to 2005. Cognitive achievement in school leavers.	No measureable impact.	**I**
Macours, 2008[99] Grey literature	*Atención a Crisis*, (Nicaragua, 2005)	Randomised community based design; follow-up nine months after baseline data collection.	Cognitive ability in pre-school children and maternal parenting skills.	Improvement of 0.1-0.2 s.d. in cognitive ability; greater access to pen, paper, books and read to more often.	**I**
Paxson, 2007[100] Grey literature	*Bono de Desarollo Humano* (Ecuador, 2003)	Randomised community based design; 2005/6 follow-up.	Physical, cognitive, and socio-emotional development of children and parenting skills.	Improvement of 0.25 s.d. among the poorest quartile; of children; no improvement in parenting skills of mothers.	**I**
Handa, 2000[65] Grey literature	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1999 follow-up.	Community level effects: poverty, inequality, price inflation.	CCTS associated with positive impacts on poverty and inequality; no inflationary effect.	**I**
Ponce, 2008[101] Grey literature	*Bono de Desarollo Humano* (Ecuador, 2003)	Randomised community based design; 2005/6 follow-up. Regression discontinuity design.	Cognitive ability in school children.	No impact of the programme on children's cognitive test scores.	**I**
Hoddinott, 2000[102] Peer reviewed	*Progresa* (Mexico, 1997)	Randomised; 320 treatment and 186 control communities; 1999 follow-up.	Household consumption.	CCTS associated with 14.5% increased consumption, esp. fruits, veg. and animal products.	**I**

Attanasio, 2006[103] Grey literature	*Familias en Acción* (Colombia, 2002)	Cohort of 57 'treatment' communities with 65 matched 'controls'; follow-up 2003 and 2005.	Household consumption.	15% increase, mainly accounted for by food stuffs and children's clothing.	**II**
Attanasio, 2004[104] Grey literature	*Familias en Acción* (Colombia, 2002)	Baseline report; including some qualitative work.	Intra-household decision making, consumption, labour.	Women report having acquired a more prominent role and greater freedoms.	**III**
de Brauw, 2008[105] Grey literature	*Bono de Desarollo Humano* (Ecuador, 2003)	Randomised community based design; 2005/6 follow-up. Regression discontinuity design.	School enrolment and child labour.	Positive impact on enrolment (10%) and child labour (-17%). Perceived conditionality was important.	**I**
Schady, 2009[106] Grey literature	*Progresa* (Mexico, 1997)	Comparison of families who did and did not receive forms to monitor compliance with conditions.	School enrolment.	Children who did not receive form 21% less likely to continue to secondary school ($p<0.05$)	**I**
Behrman, 2006[107] Peer reviewed	*Progresa (Mexico, 1997)*	Randomised; 320 treatment and 186 control communities; 1998 & '99 follow-up.	Poverty measures, school enrolment, health.	Poverty headcount decreased by 10%, 2'ary school enrolment increased by 3-9%.	**I**
Behrman, 2005[108] Grey literature	*Oportunidades** (Mexico, 1997)	Randomised community based design; 2003 follow-up; participants aged 15-21	Educational and cognitive outcomes.	Programme associated with 0.2 more years of schooling, but no impact on cognitive ability.	**I**
Palma, 2005[109] Grey literature	*Chile Solidario* (Chile, 2002)	Approx. 128,000 participating families; no control cohort.	Compliance with conditions; levels of opt-out or drop-out.	Compliance with conditions high e.g. 96.9% for health conditions; 5.2% opt-out rate, 4.8% drop-out.	**III**

Chile Solidario website[110] Grey literature	*Chile Solidario* (Chile, 2002)	Approx. 128,000 participating families; no control cohort.	Effects on social exclusion.	43% participants report improved relationships within the family and neighbourhood.	**III**
Adato, 2000[111] Grey literature	*Progresa* (Mexico, 1997)	Qualitative study: as above + structured interviews with 16 doctors & 16 school directors in 2000.	Impact on community relations.	Targeting process seen as unfair and may adversely impact community relations.	**III**
Adato, 2000[112] Grey literature	*Progresa* (Mexico, 1997)	Qualitative study: surveys and focus groups with 230 women in 1999.	Impact on women's status and intra-household relationships.	Men less likely to be sole decision makers (regarding purchases and child care); increase in self-esteem.	**III**
Soares, 2007[113] Grey literature	Non-systematic review (quantitative)	Quantifies the redistributive impact of CCTS in Mexico, Brazil, Chile.	Gini coefficient	Between the mid-1990's and mid-2000's, CCTS accounted for 21% of inequality reduction in Brazil and Mexico and 15% in Chile.	**III**
Jones, 2007[114] Grey literature	*Juntos* (Peru, 2005)	Qualitative study: key informant interviews and focus group discussions in 2006.	Children's time use; intra-household and community dynamics.	Children spend more time in school; increased household security; risk of clientalism present.	**III**

Chapter 5: History, operation and evaluation of CCTS

This chapter uses results from the literature review to describe the history, operation and evaluation of CCTS. The seminal descriptive and theoretical texts in the field are summarised and critiqued. The chapter begins by defining the interventions that form the subject of the thesis.

Definition and historical context of CCTS

Cash transfers are regular, predictable amounts of money given to households and individuals by governmental or non-governmental agencies. Pensions, child benefit, disability benefit and regular household grants are the most common types of transfer and may be universally available or targeted towards households with fewest resources.

Conditional cash transfer schemes are those that require participants to comply with pre-specified behaviours such as ensuring children's attendance at school and health checkups and mothers' attendance at health and nutrition seminars. The conditions are usually specified in advance in the scheme's design. Failure to comply renders the household ineligible to receive further cash transfers, in theory at least. In practice, the monitoring and enforcement of conditionality is variably applied across different schemes and even across different regions within the same scheme[59].

The conditional cash transfer schemes discussed in this thesis must be contrasted against cash transfers made in emergency or disaster-relief settings, remittances sent home by family members living abroad or financial incentives offered to comply with discrete health behaviours such as treatment compliance or weight loss. Although there is no clear-cut separation between these health incentive schemes and the incentives offered by CCTS, the conditional cash transfers discussed in this thesis (sometimes referred to as '*Progresa*-type' cash transfers) form a recognisable group, distinguished by their historical context, stated objectives and constituent elements. These are discussed next.

Constituent elements

Each scheme defines three core elements: the size and frequency of the cash transfer, a set of conditions with which households must comply to receive the transfer and eligibility or targeting criteria which identify the households the scheme seeks to help.

Typical designs are set out below.

Cash Transfer	• Equal to 6-8% of target households' mean monthly income in Brazil, Honduras, Jamaica, Ecuador; about 20% in Mexico and Colombia; about 30% in Nicaragua. • Cash transfer about 75% greater for secondary school enrollment compared to primary in Mexico, Colombia and Jamaica; about 25% greater for girls compared boys in Mexico; 10% greater for boys compared to girls in Jamaica.
Conditions	**Health:** • Children 0-6 year old: regular attendance at health clinics for old for immunizations and developmental check-ups. • Pregnant and lactating mothers: regular attendance at health clinics and hospital based delivery rather than home birth. • Other adults: attendance at health and education

	seminars for mothers in most Latin American schemes; two health center visits per year for people with disabilities and the elderly in Jamaican scheme.
Conditions	**Education:** • Generally require 80%-85% school attendance for children of primary and secondary school age. **Enforcement:** • Most schemes monitor compliance at least quarterly, but penalties and sanctions are variably applied.
Targeting	• Health component: poor households with children age 0-5, pregnant and lactating women. • Education component: poor households with children age 6-17. • Population coverage is typically in the range of 2.8% (Jamaica) to 16% (Brazil), but reaches 40% in Ecuador.

Two schemes have departed slightly from the typical model are those from Chile and El Salvador.

Chile's CCTS *Juntos* approaches chronic poverty as a multidimensional problem and seeks to address a family's psycho-social as well as material needs. Programme counsellors support families over a two-year period to decide themselves how their quality of life can best be improved. Households are able to select their own sets of conditions from a list of about fifty. These include traditional co-responsibilities around participating in health, education and training, as well as innovative conditions such as participating in community groups, fair distribution of household chores, supporting family members in the penal system and receiving counselling around domestic violence prevention. As well as a cash incentive, participants gain preferential access to welfare programmes[109 110 114].

El Salvador's CCTS is distinctive in that in combines an emphasis on building social capital within the community alongside CCTS' traditional emphasis on co-responsibility and conditionality. *Red Solidaria* comprises three strands: a conditional cash transfer to mothers in poor households; investment in local health and education facilities with particular emphasis on connecting them to power, water and sanitation grids; and microcredits to support poor rural households to increase, diversify and sustain their productive capacity. Local communities are given the opportunity to determine their own infrastructure and development needs. Part of the conditionality is that households are required to come together at community level and improve the local physical environment, by organising litter pick-ups for example[115 116].

Appendix B gives more detailed policy content from a number of different CCTS.

All CCTS currently operating are reviewed in *Conditional Cash Transfers: Reducing Present and Future Poverty*[59], a recent World Bank's publication that gives a comprehensive account of ten years' research and experience with CCTS. The review describes the operational components of the schemes, gathers together evaluations of the schemes' impact, including significant amounts of unpublished material, and considers which aspects of the schemes could be developed operationally or would benefit from further research.

Early on, the book emphasises the strong evaluation culture that established itself around CCTS. This itself depends upon three key elements of systems excellence, extensive documentation and public transparency. A critical perspective, however, would note that relatively little of the CCTS evidence-base has been subjected to peer-review. Of the book's 300-odd references, less than half (113) come from peer-reviewed journals and almost a sixth (43) do not even exist in the grey literature, but are cited as unpublished manuscripts.

Although the World Bank, the Inter-American Development Bank and other regional development banks are strong advocates of CCTS and funded many schemes, the book is balanced in its appraisal. It acknowledges the limitations of CCTS, issuing a strong denial that CCTS should be seen as a policy solution for all poor households. Instead, they should be seen as part of a broader social protection system. CCTS have little to offer the elderly poor for example (it recommends pensions as the right instrument for this group) and are a poor solution to transient poverty shocks.

The book also acknowledges the complementarities needed to make CCTS function. Most notably, schemes require accessible and sufficiently high-quality health and education public sectors; the book states that "…there is some evidence that weaknesses in the supply of services are a limiting factor to the effectiveness of CCT programs" (page 187). It is also frank on the controversial question of conditionality, admitting that relatively little is known about the impact of different degrees of incorporating and enforcing conditionality through sanctions such as suspension of benefits.

As well as discussing schemes' impact across health and educational outcomes (summarized in this thesis in the following chapter, using primary sources), the book also identifies areas for further research. These include exploring potential synergies with other welfare initiatives (particularly those which improve the supply of health and educational services and which support parenting) and evaluating CCTS impacts in novel settings or for novel outcomes. In particular, further work is needed to identify which elements of the CCTS intervention are most determinant of associated outcomes. Whether the cash transfer, imposition of conditions, parenting workshops or nutritional supplements offered by some schemes are most instrumental in delivering CCTS impacts remains unclear. In addition, there are a number of household- and community-level mediators, discussed later in the chapter, which could be also instrumental; again, their relative importance is unknown.

The same point is made in a shorter review of CCTS published by Lagarde et al., the only systematic review of CCTS impacts to appear in a peer-reviewed publication. They search a wide range of electronic medical and social science databases seeking evidence on whether CCTS improve use of health services and improve health outcomes in low and middle-income countries. They appraise ten articles in detail (half of them stemming from the grey literature), covering six CCTS, and find consistent evidence that CCTS improve health service uptake but more variable evidence on whether health status is improved. In their discussion, the authors note that although CCTS improve health service use, “none of the included studies could investigate which barriers to access the programmes had been particularly successful to help overcome (eg, financial, cultural, etc)” (page 1908). Thus a critical question in how CCTS operate remains unanswered. This review is useful, but methodological concerns exist around the completeness of the search strategy (it is not clear whether authors hand-searched reference lists, made contact with experts or excluded non-English literature, for example) and absence quality appraisal the papers reviewed.

Historical background to CCTS

A shift away from the neo-liberal Washington consensus of the 1980s, which had been characterised by the dismantling of state services and replacement with segmented private services often with user-fees, occurred after the economic collapse of the late 1980's. Draibe and Riesco write of the emergence of a new development strategy, which repositioned the state as a leading actor and renewed a commitment to both the urban poor and rural peasants[117]. One consequence was that welfare models in the developing world began to resemble European types, that is, characterised by higher levels of social insurance, a concern for minimum standards and an emphasis on security, rather than social assistance as an option of last resort. This shift in emphasis coincided with a desire to foster human capital more directly and correct some of the institutional shortcomings typical of previous interactions with poor households such as poor targeting or a lack of coordination between government ministries[118].

This policy shift included experimentation with cash transfers. Until then, cash transfers had featured little in low and middle-income country policy. Governments and donors usually preferred supply-side interventions (addressing the quality and accessibility of schools, hospitals or other public services) or in-kind transfers of goods or food. This contrasted sharply with high-income countries, where universal child benefits, state pensions etc. were, and still are, the norm.

Several reasons for the unpopularity of welfare have been suggested. Foremost may have been a concern that cash transfers could have negative consequences, such as a reduction in paid employment or other productive activity. Allowing welfare recipients complete freedom in their spending may also have been seen as inefficient. If a policy's objective is to increase consumption of a particular good, such as preventive healthcare or nutritious food, then this may be less reliably achieved through cash transfers than through transfers of supplements or vouchers. Cash may be more difficult to target, since it is likely to have a greater appeal to the wealthy than in-kind transfers, and may be doubly regressive if it creates an inflationary drive on local markets. There may also be concerns around corruption and criminal diversion. Finally, there may simply have been an aversion to the notion that the poor could benefit from something as simple as receipt of regular cash, rather than more sophisticated aid dependent on the presence and active management of professional groups.

Equally, however, there exists a set of reasons why cash transfers should be preferred over in-kind transfers. Most evidently, cash allows the recipient autonomy to decide how best they can consume and invest, with the concomitant dignity that that implies. Cash is more easily distributed and collected than bulky goods, with evidence that it is no more prone to losses from corruption or street theft than commodity transfers[77]. Cash is also likely to stimulate local markets, rather than suppress them as might in-kind transfers, and have multiplier effects throughout the local economy.

The policy of trying *conditional* cash transfers arose more or less simultaneously, in response to the deep economic recessions of Latin America in the 1980's, intensified by the Mexican and Asian crises of 1995 and 1997. Municipalities in Brazil began experimenting with conditional welfare in 1995; *Progresa*, the first nationwide conditional CT, began in Mexico in 1997. The innovation of conditionality no doubt stems, at least in part, from the concerns attached to cash-based welfare described above. There are also positive theoretical reasons why conditionality might be desirable, discussed later. Nevertheless, some have suggested that conditions became imposed because of Latin American attitudes to poverty, namely that poverty is the outcome of individual failure rather than lack of opportunity. According to this view, conditions are needed because the poor behave irresponsibly and need close supervision[72].

De Britto[74] reviews the historical context of CCTS in an attempt to explain their burgeoning popularity and examines their design and operation, contrasting them with Social Investment Funds which had previously been the welfare policy of choice. She develops a useful framework for policy analysis more generally, which evaluates policy across five criteria: political feasibility, administrative operability, adequacy (or appropriateness to the problem needing to be solved), collateral effects and targeting.

Applying her framework, she notes that most of the literature is grey, making objective assessment difficult. Nevertheless, she is able to conclude with some certainty that the appeal of CCTS lies in their ability to unite the two basic, but contrasting, approaches to social welfare, namely protection from deprivation and promotion of capabilities. She writes: "[CCTS] combine the short term objectives of safety nets with the long term goals of building human capital and breaking the vicious intergenerational circle of poverty traps. As such, CCTS aim at responding to two interrelated problems" (page 5).

The use of conditionality to bridge short and long term poverty reduction explains, according to this analysis, CCTS appeal across the political spectrum, survival across changes in domestic political rule and rapid rise to international prominence. She describes CCTS as a true innovation with significant potential, but cautions that no single policy can ever be a panacea.

The paper is weakened, however, by failure to consider empirical data on whether CCTS actually meet their objectives. This is surprising since she describes the history and operation of two CCTS (Mexico's *Progresa* and Brazil's *Bolsa Escola*) in some detail. Her analytical framework, although grounded in others' theoretical work, also appears partial and overly technical. It omits public acceptability, equity or other widely recognised values, for example.

Rawlings[61] also attempts to identify reasons for CCTS' popularity. In a similar fashion to de Britto, she contrasts them with earlier social programmes which she criticises for weak poverty targeting, high administration costs, lack of integration across disparate projects with overlapping goals, fostering clientalism and giving little attention to long term structural poverty. She identifies six key innovations brought by CCTS, namely changing accountability relationships, addressing both current and future poverty, effectively targeting the poor, providing cash, fostering synergies in human development (noting, for example, “the ineffectiveness of certain human capital investments, such as education, without the provision of other basic inputs, such as adequate nutrition”, page 144) and, finally, strategic use of programme evaluation.

She goes on to consider some criticisms of CCTS, such as their bypassing, rather than challenge to, unresponsive local bureaucracies, overly strong centralization of CCTS (with no evidence that CCTS are in any way responsive to local concerns), a risk of tying poor people to low-quality or ineffective service providers and the fact that CCTS are not useful for communities with limited health or educational infrastructures, for specific vulnerable groups (such as people with disabilities, migrant workers or those displaced by violence) or for households without children or wealthier households suffering shocks such as job loss or natural disasters. She recognizes, however, that a comprehensive welfare system should provide other safety nets to cover these events.

She identifies the key question as whether CCTS will enable poor families to graduate from social assistance to economic independence. She also suggests future directions for CCTS policy development, including more thorough analysis of the tradeoff between supply and demand side resourcing and debate regarding alternative conditional requirements, such as engaging adults in income generating activities.

Glassman et al[73] take an original approach and identify the assumptions underlying CCTS, critically interrogating each of them. From this, they are able to articulate the risks and potential adverse effects of CCTS. Assumptions include notions that utilisation of health services is suboptimal amongst the poor, that poor women lack sufficient health knowledge to care for their children, that transfer of health knowledge will induce behaviour change, that imposing conditions is necessary and that health and education services will cope with the increased demands induced by CCTS. Consequent risks (if these assumptions are false or are inappropriately emphasised) are that schemes are unnecessary or inefficient, that low quality in health services is overlooked, that other determinants of health are neglected, that CCTS maintain dependence and foster clientalism or that CCTS damage intra-household relationships. The analysis moves on from the theoretical and the authors present some secondary empirical data to informally test their hypotheses. Although occasional support for their assertions is found, the predominant conclusion is that there is little evidence from which to draw. For example, regarding level of mothers' healthcare and childcare knowledge, they write "…direct measurement of health knowledge and attitudes has generally not been a component of the evaluations (or if included in questionnaires, has not been reported in evaluation reports or papers as in the case of Colombia) in spite of the inclusion of health education components in all programs" (page 16).

The authors are broadly critical of CCTS evaluations. They observe that evaluation designs were primarily concerned with detecting effects on poverty, inequality, consumption and school attendance. Consequently, "…in most cases, it seems that the health and nutrition objectives were essentially afterthoughts, thought to be "good" but not meriting more in-depth analysis" (page 22). They identify a number of relevant outcomes as yet unexplored in the literature, particularly around health-related behaviours, attitudes and household decision-making, and ask how these factors might contribute to or limit impacts on outcomes. As a specific example, they cite acute childhood diarrhea; thus far, just incidence data has been published, rather than household knowledge and practices around self-treatment.

The paper is weakened by the lack of a theoretical framework underlying their analysis of assumptions and risks. Likewise, they do not set out any strategy by which they searched for empirical data to interrogate their hypotheses. Thus, we cannot be sure of the validity of their conclusions. Nevertheless, it is a useful and insightful paper.

Alongside the World Bank review discussed earlier, several reviews have been published in recent years which bring together the evidence around cash transfers more generally, considering the impacts of non-conditional transfers (such as household grants, pensions, disability and child benefits) alongside conditional transfers, the focus of this thesis. A report published by Save the Children UK[75] concludes that regular, predictable household transfers of cash can play a critical role in accelerating reductions in child mortality, most immediately by increasing access to healthcare and reducing malnutrition. It identifies three key design features: the duration over which the transfer is received, the age of recipient (with a critically important window to influence long terms outcomes in infants aged under 2 years), and the size of transfer.

The Organisation for Economic Cooperation and Development[76] argue that well-functioning labour markets and social protection (which include cash transfer schemes) are two areas which have not received enough attention in thinking about economic growth that favours the poor. The paper argues that cash transfers are affordable, have a range of positive benefits and considers the various mechanisms through which cash transfers can help the poor escape poverty, discussed later in this Chapter. The report emphasises that a range of complementary interventions are needed alongside cash transfers, particularly those which address structural determinants of poverty such as access to labour markets.

The Overseas Development Institute considers the trade-off between cash transfers and other policy options for tackling poverty[77]. It concludes that cash transfers have traditionally had a marginal role in poverty reduction: supply side measures are generally preferred, and where transfers are instituted, they tend to be in-kind (such as food parcels). The paper argues that cash transfers may be more efficient to distribute, may be no more prone to loss and corruption than other transfers and, being a demand-side intervention, enable household and communities to lift themselves out of poverty through a range of unexploited mechanisms, discussed further below.

Finally, the UK's Department for International Development provides a comprehensive review of peer-reviewed, grey and unpublished material around cash transfer schemes of every type[78]. The document's primary function is to present evidence that supports Departmental spending; as such, it does not contain insights or analysis that cannot be found elsewhere, but it does conclude with a commitment to invest in 16 country programmes and advocate for expansion of cash transfer schemes in international fora such as the G20.

Objectives and Mechanisms underlying CCTS

The reviews offered by the World Bank, Lagarde, de Britto, Rawlings and Glassman provide a basis to discuss the objectives and mechanisms underlying CCTS. The schemes are complex interventions that aim to relieve immediate poverty at the same time as building human capital, thereby breaking the intergenerational transmission of poverty and contributing to upward social mobility for marginalised households.

On one level, immediate poverty relief appears straightforward and is embodied by the cash transfer. There are, however, potentially deeper and more sustained benefits related to better management of risk and vulnerability. The risk-averse attitude of the poor is well recognised. Because of a scarcity of resources, the poor rationally choose to minimise their exposure to environmental, economic and social risks, where possible. This frequently implies that they forego economically more profitable opportunities. Planting reliable, but low-yield, crops is an example. The OECD refers to this necessarily dysfunctional management of risk as a "major brake on human and economic development"[76]. Furthermore, the experience of economic shocks often forces impoverished households to make decisions that satisfy immediate survival needs at the expense of future income. Examples of such decisions include the sale of land and livestock, or the withdrawal of children from school; these may permanently and irreversibly weaken the household's ability to prosper. Cash transfers can relax some of the constraints households face around managing risk and enable them to manage response to shocks more effectively.

The notion of building human capital is equally complex and relies on several levers. First, the imposition of conditions encourages households to invest in children’s early education and healthcare. If services are good, the expectation is that healthier, better educated children will be more able to participate fully in society and enjoy upward social mobility. This also requires, however, sufficient and fair employment and adequate social protection during periods of illness, unemployment or retirement. Second, transfers can promote positive social norms. Aligning the behaviours of the poor to broader social norms around preventive healthcare and schooling for example, is likely to build social cohesion; in particular, poor families may feel a greater sense of citizenship[76 87]. It is also known that transfers made to women increase their status and self-esteem as shown by shifts in decision-making power within the household[112]. Extra income is also more likely to be spent on children's schooling and nutritious food, than if transferred to men[59]. Indeed, supporting gender equality is an explicit aim of most CCTS.

The imposition of conditionality is believed to transform the relationship between families and services in fundamental ways. Conditionality tackles the demand-side limits to effective welfare. Previously, the bulk of social policy fuelled the supply side, improving schools and clinics, for example. Services, however, still went underused by the poorest who most needed them because multiple barriers, such as the costs of travel or lost employment, deter use even where services are 'free'. In addition, incomplete information or uncertainty prevent families from investing in health and education. Setting conditions transforms the cash transfer into an incentive that stimulates demand for welfare services, overcoming some of these barriers.

Furthermore, the expectation of a partnership between government and families is created, an expectation that would have been less visible through supply side financing alone. Such partnerships stimulate co-responsibility for development across government and community, a critical element in securing health equity and the central notion underlying co-production, the conceptual framework used in the thesis and described in Chapter 2. Visible co-responsibility is thought to explain the appeal of CCTS across the political spectrum and their survival in Mexico and Colombia despite regime changes. Co-responsibility operates at other levels too. CCTS engage with poverty as a complex, multidimensional problem - this is reflected in their structure, which requires joint input from health, education and welfare ministries. Obvious synergies, such as good nutrition and schooling, are brought into focus and more complex goals such as gender equality also benefit from cross-government action.

Rawlings considers the question of changing "accountability relationships" in detail[60]. By this she means that CCTS create new working relationships between the poor and service providers, between the poor and government. These relationships set out mutual obligations and entitlements; consequently, she is the first in the literature to explicitly introduce the notion of co-responsibility: "CCTS … allow national governments to forge a direct relationship with poor families, seeking to foster co-responsibility by requiring families to assume responsibility for schooling, health care and the appropriate use of the cash grants" (page 33). The concept, though, is more or less stated as a 'given' and no further critical discussion follows.

Conditionality remains of the most contentious issues relating to cash transfer schemes. Opponents deploy a range of moral and empirical arguments against the imposition of behavioural requirements. Morally, they claim that conditional welfare is deplorable if that welfare is essential to a family's livelihood. Opponents note that conditions are typically drawn up by well-paid professionals with little understanding of the reality of poverty and can be demeaning, stigmatising or irrelevant as a result[119]. Some have suggested that conditions, most commonly applied to CTs in Latin America, are only necessary because of particular attitudes to poverty in the region, discussed earlier. Indeed, conditionality may be little more than 'a way of ensuring middle-class support for the poverty budget'[65]. If so, 'demand' generated by conditional CTs is not demand in any real sense. Families do not express their preferences but adopt behaviours dictated by Ministries, perpetuating clientalism and entrenching attitudes to poverty. One author writes of the risk of "infantilizing" participants[111].

Empirically, opponents point to the fact that the cost-effectiveness of conditionality is unclear[72 73] and that conditions are variably enforced. Few families are expelled from conditional CTs, which underlines conditions' superficial and unnecessary nature. Most importantly, there is a solid and extensive body of evidence that non-conditional transfers (such as household grants, pensions, child or disability benefits) are associated with a range of positive outcomes and do not negatively impact on recipients' willingness to participate in the labour market[75 76 78 120]. Social marketing campaigns on good ways to use transfers (investing in children's education for example) and making transfers to women are thought to be key to the success of non-conditional transfers.

Although such evidence is useful, it does not bring us closer to answering the critical question of whether conditionality has a separately identifiable *additional* effect (positive or negative) or cost, relative to non-conditional transfers. This is only answerable with a head-to-head comparison of a conditional and non-conditional scheme, identical in other respects including accompanying social marketing and female beneficiaries.

Inferences relevant to the question have been drawn from data simulations and from observation, exploiting unintended discontinuities in programme implementation. Six such studies are available. Simulation on Mexican data (which predicted observed outcomes well when compared alongside), found that a pure income transfer programme, paying close to the maximum transfer available under *Progresa*, was associated with an increase in schooling of only about 20% of the conditioned-programme, at greatly increased cost[121]. Simulation on Brazilian data found that parental choices around children's schooling and labour under a non-conditional transfer scheme were almost unchanged from those where the scheme did not exist[122]. Similarly, simulation on data for fifteen sub-Saharan African states concluded that a cash transfer without conditionality would not lead to any substantial increase in school attendance[66], although this must be contrasted with observational evidence from South Africa's pension scheme presented earlier.

Observational data from Mexico exploits the fact that some *Progresa* beneficiaries did not receive the forms needed to monitor their children's attendance at school and were consequently unable to describe the scheme's conditions. Children from these households were 21% less likely to continue to secondary school (p<0.01). Moreover, the difference was larger for illiterate households, suggesting that the absence of conditions has the potential to worsen inequity[105]. In Ecuador, the *BDH* programme as finally implemented did not explicitly make transfers conditional, but conditionality had been the initial intention and public information was disseminated to that effect. As a result, some households believed that they were required to "ensure that children attend school". School enrolment in such households increased by 7-13% (p<0.001) in contrast to households believing the transfers to be non-conditional, where no significant difference was found[106]. Finally, in Cambodia the CESSP scheme offered cash transfers to the entire household, made conditional only on school enrolment of children in lower secondary school. School enrolment improved for children in this age group, but not for their siblings indictating that the income effect was nil if non-conditional[123].

Finally, evidence from a randomised head-to-head trial of conditional and unconditional transfers is available from Zomba, Malawi[124]. Transfers made to adolescent girls conditioned on regular school attendance were effective at preventing drop out (equivalent to ten extra days' schooling per year, $p<0.05$), whereas unconditioned transfers had no discernable effect compared to controls. Conditioned transfers were *less* effective, however, at preventing teenage pregnancy and marriage. The authors demonstrated that this was because a large enough number of girls (11% over one year) failed to comply with programme conditions and, lacking any income support, became more prone to marriage or pregnancy. In contrast, girls receiving unconditional transfers were able to avoid teenage marriage or pregnancy, whether or not they attended school.

Several possible policy conclusions follow, i) that the size of the conditioned incentive should be increased, to maximise school attendance; ii) that the incentive should become conditioned upon additional target behaviours, namely delaying marriage or pregnancy; iii) that conditionality is inappropriate in this setting, for these outcomes, and should be abandoned; or iv) that simultaneous but distinct policy objectives should be met by simultaneous but distinct policy instruments: an unconditional cash transfer to prevent teenage marriage offered alongside a conditional cash transfer to improve school attendance and educational attainment.

Most of the evidence around the relative benefits of conditionality pertains to school enrolment, with little evidence (other than that from Zomba) on health outcomes. A number of other evidence gaps remain, including whether more intensive social marketing could replicate the effect of conditions, as well as a thorough understanding of whether and how conditionality is actually applied in the field. Anecdotal evidence suggests that conditions are variably enforced both across and within schemes; in some it is reported that beneficiaries continue to receive programme benefits even when they do not comply with programme conditions [personal communication]. Likewise, the nature of any 'penalities' enforced is variable. In some schemes, non-compliers are ejected, in others they offered additional support[125]. Clearly, these issues complicate quantification of a separately identifiable effect of conditionality.

Perhaps the most important evidence gap centres on what participants themselves feel about conditionality. Anxieties about detrimental effects of conditionality are exclusively expressed by (typically Northern) academics, as remote from the experience of real poverty as the policy designers they criticise. Very little work has been done to gather the views of conditional CT beneficiaries. *Progresa* is one of the few conditional CTs to have published qualitative research. Although not exempt from methodological criticism (such as failure to specify how focus groups were recruited), beneficiaries there reported that the scheme was well-liked[107].

Less information is available on how conditionality affects programme costs, in line with the relative lack of information on scheme cost-effectiveness, noted earlier. Estimates of programme cost ascribable to conditionality range from 2% to 24% of total programme administrative costs[126]. Total administrative costs for conditional CTs, relative to overall budget, are similar to other welfare schemes[59]. In a separate paper Alvarez et al. provide empirical evidence that conditionality improves targeting efficiency by screening-out the relatively wealthy, who find the conditionality requirements overly burdensome and leave the programme. In contrast, the extreme poor have low dropout rates. There are two important exceptions to this, however - indigenous households are more likely to dropout (perhaps because of linguistic difficulties in complying with conditions), as are very poor households living in wealthier communities. The authors suggest that conditionality can be usefully included in programme design as a means to improve efficiency, but only if properly realised through close monitoring and if special attention paid to groups likely to dropout, with clear re-entry mechanisms provided[127]. In Zomba, transfers were found to be more cost-effective if made conditional: to achieve the same school enrolment gain from $5/month offered conditionally, an unconditional offer of $10/month was required, a budget increase much larger than the additional administrative cost of implementing conditionality[124].

Another long running debate concerns the net benefit of targeting an intervention so that only certain groups (typically the poor or otherwise marginalised) receive it. Proponents use an efficiency argument: targeting is necessary so that those most in need benefit most, with leakage to less needy groups reduced. Those who are less inclined toward targeting deploy a number of counter-arguments: the information needed to target may be lacking or prohibitively expensive to obtain; focussed initiatives detract attention from securing welfare gains for all, rich and poor; targeting is unnecessary since universal benefits can still favour the poor in relative terms; and universalism contributes to other objectives such as nation building[128].

Two features stand out in the way CCTS are targeted. First, is the considerable effort made to ensure that transfers go to families most in need and are not captured by the better-off[107 129-131]. Schemes often use the geographical distribution of poverty as a first index and then household levels of wealth (measured either directly or via proxies, such as houses' construction material) for a second tier of targeting. In some schemes, communities are given the opportunity to scrutinize published lists of selected households as a final step in the targeting process, though it is not clear whether this ever leads to modification of participant lists. Second, is the attempt to challenge gender inequity. This takes several forms, the most important being designation of the female head of household as recipient for cash transfers in virtually every scheme. Female status and decision-making power is further enhanced by creating health and nutrition seminars primarily for mothers. Some schemes allow women also elect a peer to liaise with officials and facilitate smooth running of the programme[91 112] and larger cash transfers may also be paid for girls' school attendance compared to boys', offsetting the lower value attached to female education within some disadvantaged communities[70].

Another possible point of contention is that despite the fact that health gain is an explicit objective of all CCTS, intellectual and operational 'ownership' of the schemes has thus far been dominated by Economists. It appears that the Public Health community has failed to engage substantively with the opportunities and issues raised by CCTS. For example, in the World Bank's comprehensive review of ten years' global experience of the schemes with over 400 references, no more than 15 came from public health, medical or nutritional institutions and journals[59]. Several reasons may lay behind this. First, health practitioners may view CCTS as primarily a tool for poverty reduction, thus peripheral to their expertise and core concern and better left to other agencies. This is likely to be linked to the continued dominance of the biomedical model of health and disease in Public Health practice. Second, some nervousness may have been felt around involvement in schemes that advocated conditionality and in most cases carried heavy political branding. Practitioners may have felt uncertainty around the ethical implications of conditionality and the ethical and practical implications of political sponsoring. Finally, there may simply have been distaste at the notion of distributing cash to the poor, rather than something more under the control of planners and bureaucrats[77].

One of the objectives of this thesis is to attempt to resolve some of these issues by providing a critique of CCTS design and operation from a social determinants of health perspective. These issues will be returned to in Part V.

CCTS and co-production

The thesis earlier introduced the idea of co-production as a model for securing better health and welfare outcomes. Co-production is a good model with which to explore CCTS for two reasons. First, CCTS embody shared responsibility as their core objective; second, CCTS distinguish, and act differently upon, the three basic elements of co-production identified earlier: investment in human capital, amplification of external resources and change in social structures.

Regarding shared responsibility, this features explicitly in the standard narrative through which CCTS are presented and discussed, as identified in the quote from Rawlings above. Likewise, the authors of the Peruvian *Juntos* evaluation write that CCTS are essentially about “balancing rights and responsibilities”[61].

Regarding the basic elements of co-production, CCTS address investment in human capital by incentivising uptake of health and education services (for younger household members) and attendance at seminars on health, nutrition and parenting (for older household members). They address amplification of external resource through disbursement of cash transfers and nutritional supplements. Structural conditions such as health and education services are usually assumed adequate and held constant, although in some schemes these services receive additional investment. It will be shown later, however, that it remains unknown what effect, if any, this additional investment has. In no scheme, however, does there appear to be explicit investment in, or co-ordination with other efforts to improve, wider structural conditions such as opportunities for fair employment.

Thus, if CCTS are viewed using the co-production model, it can be seen that that CCTS mainly seek to address the human capital and material resources elements, by intervening in selected individual and household level determinants. They do not address structural opportunities, with the notable exception of attempting to address gender inequality (by making cash transfers payable to the female head of household and offering a greater financial incentive for girls' secondary school attendance compared to boys). Generally, however, CCTS assume that structural determinants are adequate or are adequately addressed by other interventions.

A model showing how co-production and CCTS mirror each other is set out in Figure 5.1 below. This takes the key components and objectives of CCTS and maps them onto the elements of co-production as earlier set out in Figure 2.4.

It will be shown in the next chapter that significant uncertainty remains whether CCTS achieve gains in human capital and 'final' outcomes such as objective measures of health or cognitive test scores. If they fail to do so, then the co-production model suggests that such limited welfare gains would arise because CCTS do not invest sufficiently in structural determinants, invest insufficiently in human capital, insufficiently in material transfers or some combination of the above.

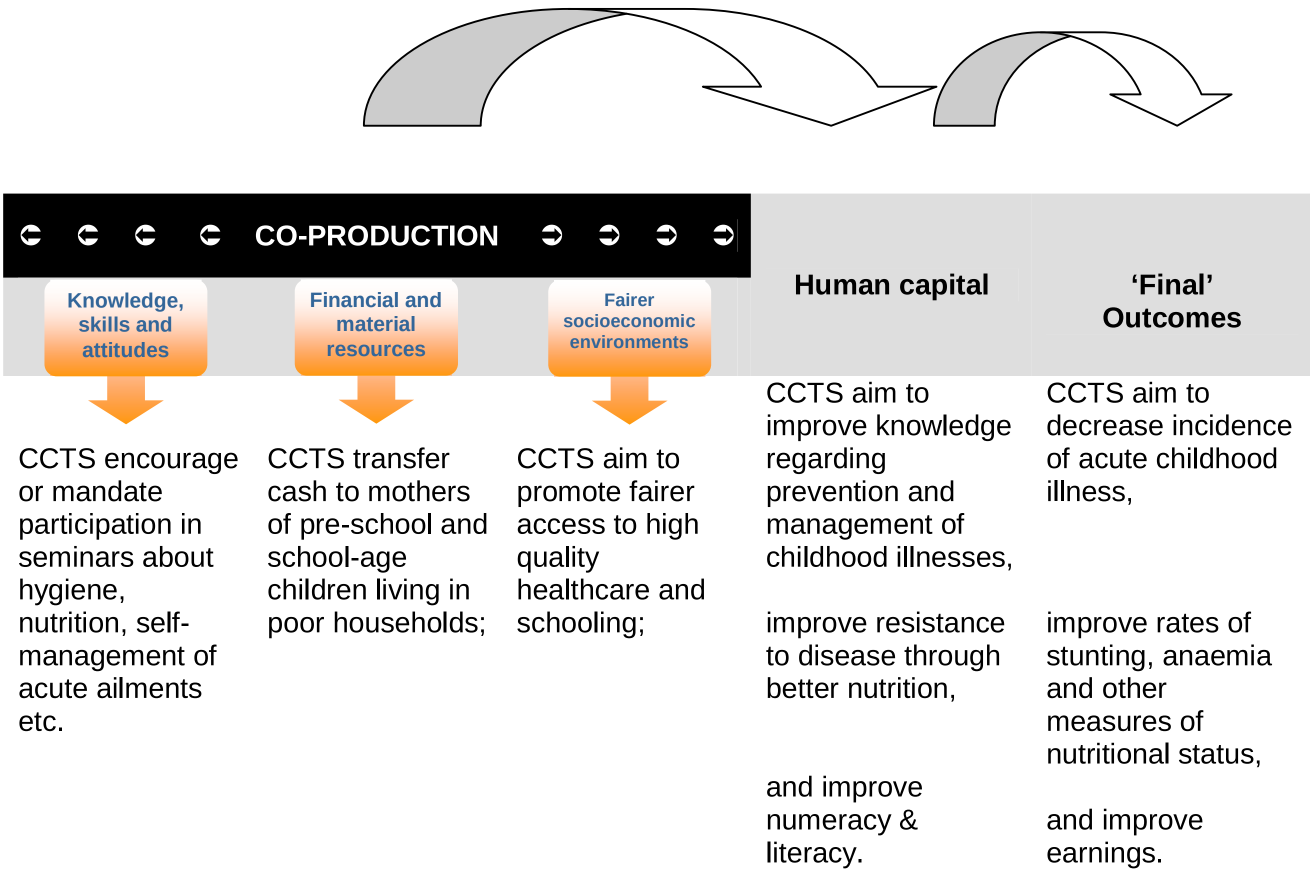


Figure 5.1: the relationship between co-production and CCTS

In summary, conditional cash transfer schemes are increasingly popular welfare policies which offer poor households regular, predictable amounts of money as long as they comply with pre-specified behaviours, mainly around uptake of preventive healthcare and schooling for the family's children.

They are complex interventions whose core objectives are to relieve immediate poverty and improve upward social mobility and equity. There are several mechanisms through which they might achieve these aims, including enabling recipients to better manage risk, contributing to economic growth, building social cohesion and supporting human capital development through greater use of health and education services. Nevertheless, some elements remain controversial, such as the imposition of conditionality, targeting and the role of the health sector in scheme design, operation and evaluation.

Within the co-production framework it can be seen that CCTS explicitly attempt investment in human capital and material resources, but investment in structural conditions is not a standard component. It remains unclear which elements are most important in achieving CCTS objectives and the health sector appears relatively uninvolved in scheme design, operation and evaluation.

The next chapter examines the evidence on whether CCTS achieve their aims, paying particular attention to health outcomes and health systems, using the co-production framework to organise its findings.

Chapter 6: Health Impacts associated with CCTS

This chapter summarises the current state of knowledge regarding the health impacts of CCTS. The primary question for this scoping review is

- to what extent to which CCTS lead to better health?

Subsequent questions are informed by the co-production model:

- to what extent do CCTS impact on households' material resources, on human and social capital and on structural determinants?

Methods of the main CCTS evaluations

Most CCTS included rigorous impact evaluations, which set them apart from many previous policy initiatives which often had weak or non-existent evaluation components. The *Progresa* evaluation, undertaken by an external agency and using a randomised methodology, large sample size and repeat measurements, set an early high standard although, inevitably, not all evaluations were able to replicate this approach.

The methods and limitations of the major CCTS evaluations are as follows:

Mexico's *Progresa*[79-81 89 132] provides the largest source of evidence. The evaluation randomised half of participant communities to receive the programme in 1998 and others a year later. Detailed surveys of approximately 80,000 individuals in 14,500 households were conducted at baseline and thereafter six-monthly for two years; attrition rates were around 5% and similar in treatment and control groups. Most analyses used intention-to-treat protocols. The method used to randomise is not stated in any of the publications, however, and appears to have broken down within clusters; for example, workers preferentially allocated supplement to the most malnourished looking children. Consequently, when programme effect was analysed assuming random allocation, no effect, or even a negative effect, was seen for some outcomes. Another concern centres on the lack of baseline data on haemoglobin and socioeconomic position for the estimations on stunting and anaemia; the study authors report that these parameters were measured in a 'randomly selected' sub-sample but give no details of how the sample was identified, nor how sample size was calculated.

Progresa is one of the few evaluations to include qualitative work[64 111 112]. Its validity is challenged, though, by an absence of information explaining how focus group participants were selected. The possibility that focus group participants may have felt compelled to give a good account of the programme is only briefly considered as a footnote; ethical issues are not discussed at all.

Nicaragua's *Red de Protección Social (RPS)*[91] also implemented a cluster RCT. Regions, stratified by deprivation scores, were randomised by drawing coloured balls from a bag. Treatment areas began the programme immediately, and control areas after a two-year lag. Despite randomisation, the evaluation used 'double-difference' estimations of programme effect (explained further in Chapter 9).

Accurate measurement of exposure, such as the extent of infants' iron supplementation, was poor and it is unclear whether outcomes such as immunisation were systematically observed or subjectively reported. Leakage across programme areas was noted (efforts to deliver vaccine in treatment areas also had positive effects in control areas). Non-random drop-out (12%) was observed, but sensitivity analysis indicated that attrition bias was not driving the results.

Honduras' *Programa de Asignación Familiar (PRAF)*[92] also implemented a cluster RCT; 70 municipalities were randomised to four groups - CCTS alone, supply-side initiatives alone (comprising quality improvement in health centres and schools and training of lay nutrition advisors), both or neither. Attrition was less than 5% at two-year follow-up. The programme was not, however, implemented according to protocol. It proved 'logistically impossible' to achieve more than introductory training for the nutritional advisors because no legal mechanism could be found to distribute resources from central government to community teams. Hence, the supply-side only arm had to be abandoned.

Colombia's *Familias en Acción*[93 96 104 133] non-randomly assigned 57 communities to start the programme in 2002; an additional 65 communities were matched as controls. In the evaluations published by the Institute of Fiscal Studies, propensity score matching (whereby the probability of being designated 'treatment' or 'control' is determined on the basis of a number of observable characteristics and included as a control variable) was used to adjust for non-random assignation. Households were surveyed at baseline and again in late 2003 and late 2005. This evaluation is discussed in more detail in later chapters.

Evaluation of Jamaica's *Programme of Advancement Through Health and Education (PATH)*[95] was non-randomised and compared 2,500 participants with 2,500 non-participants. The sample was restricted to individuals as close to the eligibility threshold as possible, i.e. just-eligible or just-ineligible, in order to make the groups as comparable as possible. This technique is known as a 'regression discontinuity' analysis.

Ecuador's *Bono de Desarollo Humano (BDH)* scheme[101 106] was randomised. Unlike other CCTS, *BDH* did not make transfers conditional. For a brief period, however, national publicity explicitly talked about school enrolment, preventive healthcare and other activities being a condition of enrollment in the programme. The evaluation asked whether households believed that conditions were enforced which offers an opportunity to examine the effect of apparent conditionality.

Do CCTS lead to better health?

Mortality in adults and children

There have been few estimations of long-run outcomes such as mortality. Analysis of routine national statistics from Mexico, however, suggests an 11% reduction in maternal mortality and 2% reduction in infant mortality in communities participating in *Progresa*[134] after ten years. India's *Janani Suraksha Yojana* programme is a CCTS which incentivises women to give birth in a health facility. It is not strictly a *Progresa*-type CCTS, in that it incentivises a single, discrete behaviour without wider objectives of improving human capital and promoting social mobility. Nevertheless, in a non-randomised study using data from routinely collected household surveys, the programme was associated with reductions in mortality of 4·1 (95% CI 2·5, 5·7) perinatal deaths per 1000 pregnancies and 2·4 (95% CI 0·7, 4·1) neonatal deaths per 1000 live births[135].

Acute illnesses in adults and children

Infants participating in *Progresa* were less likely than controls to suffer from acute respiratory or diarrhoeal illness in the month prior to interview: newborns were 25.3% ($p<0.05$) less likely and 0-3 year olds 22.3% ($p<0.01$) less likely[80]. Subgroup analysis found that benefit was restricted to the poorest tertile for diarrhoeal disease[86]. 3-5 year old children had a 12% lower incidence of illness[85]. No effect was seen for those aged 6-17, which the authors concluded was unsurprising since this is generally a healthy group. Effects were not seen until the child had been receiving benefits for at least twelve months. Secondary analyses by another author found an increased rate of respiratory illness in 'treatment' children after two years[86]. This self-reported morbidity may reflect greater awareness of symptoms.

Effects are also seen in adults, even though the intervention's focus was on children. Participants aged 18-50 showed 19% fewer days of difficulty due to illness and a 7.5% increase in the distance they were able to walk without fatigue (no p-values given). No effect was seen for those aged 6-17, which the authors concluded was 'not surprising since this is generally a healthy group to start with'[83].

In Colombia's *Familias* scheme, significant decreases in the incidence of recent diarrhoeal illness were reported in under two year olds (27% less likely to report illness in the month prior to interview, $p<0.05$) and in two to four year olds (16% less likely, $p<0.05$), although no significant effect was seen for older children or for respiratory illnesses in any age group[93]. No effect was seen in Jamaica's *PATH* scheme[95]. These outcomes were not reported from CCTS evaluations in Honduras or Ecuador.

Again, although not strictly a Progresa-type CCTS, Tanzania's RESPECT study randomised men and women aged 18-30 to receive $20 every four months if they remained clear of sexually transmitted infections. Preliminary results recently announced report a positive impact[136].

Childhood Growth and Anaemia

The *Progresa* evaluation reported improved mean height-for-age at 2-year follow up, equivalent to an extra 1.02 cm/year in growth (or an additional one sixth mean growth per year) in 12-36 month olds[83]. These findings were not robust if an intention-to-treat analysis was used. Furthermore, the programme did not fully correct height deficiencies and stunting remained prevalent. Nevertheless, Behrman and Hoddinot estimate that 1cm extra growth potentially translates into a 2.9% increase in adult earnings[137].

In Nicaragua, rates of stunting (height-for-age) fell in both treatment and control groups, but by 5.3% more in treatment communities (the 'double-difference'; $p<0.1\%$). There was no significant difference seen for wasting (weight-for-height) but weight-for-age scores (indicative of chronic malnutrition) had a double-difference of 6.0% in favour of the programme ($p<0.05$)[91].

There was only a small effect seen in Colombia in under 24-month olds, namely a 6.9% decreased probability of being chronically malnourished as indicated by height-for-age score; no effect was seen in children older than two years[96]. Improvements in growth were not replicated by evaluations in Honduras[92], or in the unconditional transfer scheme in Ecuador[100].

The *Progresa* reported a significant improvement in mean haemoglobin level (11.12 vs. 10.75g/dL, $p=0.01$) and rates of anaemia (44.3% vs. 54.9%, $p=0.03$) after one year. At second follow-up, by which time 'control' communities had received the intervention for a year, differences between the groups were no longer apparent. Prevalence of anaemia in the treatment group remained high, as for stunting.

No impact on rates of anaemia was seen in Nicaragua's programme for children aged 6-60 months, where prevalence was approximately 33% in both treatment and control groups[91]. No impact was seen in the Colombian scheme. Neither scheme offers food or nutritional supplements, in contrast to the Mexican scheme, which may explain the absence of effect.

Adverse effects

Some CCTS have been associated with unintended adverse effects. In a Brazilian pilot scheme, each additional month of exposure was associated with *reduced* weight gain in beneficiary children compared to non-participating children (of 31g/month, $p<0.001$)[88]. Although this study is weakened by lack of baseline data, short follow-up, significant amounts of missing data (10-20%) and systematic differences between participating and non-participating women, the authors concluded that the difference observed may have been due to mothers viewing the cash transfers as conditional on their children remaining underweight, since their experience from an earlier programme had been that benefits stopped as children's health improved. Although this effect may have disappeared with longer follow-up (perhaps as mothers realised they were mistaken), this nevertheless underlines the importance of clear communication about the purpose and operation of conditionality.

The scheme in Honduras was associated with an increase in birth rate of between 2 and 4% ($0.001<p<0.053$, depending on model used). This may be because the scheme allowed childless households to enrol if they subsequently had a child, in contrast to schemes elsewhere with fixed eligibility[87]. This pro-natalist effect may not necessarily imply an adverse outcome (it could, for example, simply reflect households deciding to start their family earlier). Nevertheless an increase in fertility amongst poor, rural women is a serious unintended consequence if real and stresses the importance of careful programme design.

Fernald et al. use data from Mexico's *Progesa* scheme and examine how cardiovascular outcomes varied amongst adult beneficiaries. They find that a doubling of cumulative cash transfers was associated with increased BMI ($0.83 kg/m^2$, $p<0.0001$)

and diastolic blood pressure (1.19mmHg, p=0.03)[84]. Although the study examines the effect of cash transfers in isolation (and so may be relevant to non-conditional transfers), extreme caution is needed in interpreting their findings since the differences in household composition and behaviour that determine the amount of cash accumulated (whether in a conditional or non-conditional scheme) are likely to distribute non-randomly across households and be endogenous to the outcomes examined.

In summary, some CCTS are associated with improvements in rates of acute illness, childhood growth and anaemia, but these are not seen consistently across all schemes. Most of the positive impacts are reported by Mexico's *Progresa,* but even here some benefits are lost if an intention-to-treat analysis is used. Furthermore, some CCTS have been associated with unanticipated adverse health effects such as a doubling of the birth rate in Honduras.

Do CCTS impact on households' material resources?

Poverty measures

The global review published by the World Bank found that, with few exceptions, CCTS are strongly progressive[138]. For example, irrespective of the measure used, *Progresa* had a significant impact on reducing poverty in its first two years of operation: headcount declined by 17%, poverty gap by 36% and severity of poverty by 46%[85]; furthermore, the scheme's poorest infants consumed the most nutritional supplement and gained the most height (if an indigenous head of household or being in receipt of another social assistance programme are taken as proxies for poverty)[79]. The finding is not borne out, however, by work by Bando[97] who found equal programme impacts in indigenous and non-indigenous households. Furthermore, there was no significant association for many other indicators of poverty.

Coady, reviewing several CCTS, concluded that 81% benefits go to the poorest 40% families[139]. Soares estimated the impact of CCTS on the Gini coefficients of Mexico, Brazil and Chile[113] and found that all three programmes are well targeted to the poorest individuals and that, on average, about 60% of CCTS resources flow to poorest 20% of the population. Jamaica's *PATH* programme provides an example of a more detailed analysis: the programme reaches 20% of the poor, half the intended target. 59% of beneficiaries are poor and 27% extremely poor. 6% of beneficiaries however fall into the top two wealth quintiles[95].

Although CCTS exert some redistributive effect, it is worth noting that they only comprise a small proportion of public welfare spending, compared to sickness benefit or public pensions. Furthermore, wealth equity is, of course, mostly determined by income from private markets and significant redistribution will not be driven by CCTS.

Household consumption

In Mexico, *Progresa* was associated with 11% greater median food expenditure in treatment households; dietary quality as well as quantity increased and most additional expenditure went on fruits, vegetables and animal products[102]. Median caloric acquisition was about 8% higher overall. Similarly, in Colombia *Familias* was associated with a 15% increase in household consumption, mainly accounted for by food, children's clothing and footwear. Alcohol and tobacco consumption remained constant[133].

In Nicaragua, a drop in coffee prices was experienced during the operation of *Red de Proteccion Social*. Control communities exhibited a sharp decline in their household consumption; however no change was seen for treatment communities implying a protective effect of the programme[91]. Treatment households altered their consumption patterns to spend more on meat, fruit and vegetables and less on grains, potatoes and bread ($p<0.01$).

Do CCTS impact on human and social capital?

Educational attainment

All CCTS are associated with increases in school enrolment, particularly for secondary education. In Mexico, primary school enrolment was already over 90% and *Progresa* had little impact in this age group. Secondary school enrolment, however, was worse (67% for girls and 73% for boys) and larger increases were seen in this age group (of approximately 8% and 5% respectively). The programme was more successful at keeping children in school, than encouraging those who had left to return[85]. Likewise, in Colombia no impact was seen for 8 – 11 year olds, among whom 90% already attended school. In older children, however, *Familias* was associated with a 10.1% increase in attendance in rural areas and 5.1% increase in non-rural areas. Rurally though, absenteeism remained prevalent with only 56% of this age group attending school[93].

A substantially larger benefit was seen in Nicaragua with an increase in secondary school enrolment to over 90% (double-difference 17.7%, $p<0.01$) and concomitant decrease in child labour for 7-13 year olds[91].

Caution should be exercised in interpreting enrolment or attendance rates, since they do not necessarily reflect educational attainment. There was no improvement in standardised attainment test scores in Mexico[134] or Ecuador[101]. Other countries have not reported this outcome.

School enrolment shows particularly strong progressive distribution patterns. Ecuador's *Bono de Desarollo Humano* programme exerted most effect among the poorest households[106]. In Nicaragua, gains in primary school enrolment were 28.4% for extremely poor pupils, 15% for poor and 9.8% for non-poor, with a similar distribution in grade-completion[132].

Early childhood development

A few studies have examined the effects of CCTS on parenting skills and early childhood development. The Ecuadorean programme was associated with a small improvement of around 0.25 standard deviations in cognitive development among the poorest quartile of children. No effect was found on parenting skills, however, when using the HOME scale which measures maternal punitiveness and lack of warmth[100]. In Nicaragua children in CCTS households were more likely to have access to pen, paper and books, and parents were found to spend more time reading to them[99]. Small cognitive improvements of 0.1 to 0.2 standard deviations were associated with the scheme, equivalent to ~1.5 months' of catch-up in the cohort's children who were delayed 28 months on average – a statistically significant but clinically very small gain.

Early *Progresa* evaluations found no measurable impact on children's cognitive ability, despite increases in school enrolment[85]. Later evaluations suggested that the cash transfer was associated with a small improvement in cognition; however this was an assessment of the cash-effect within participants, rather than comparison with non-participants[94].

Social capital and gender

There is little evidence on the impact of CCTS on social capital, that is, networks of co-operation and mutually supportive relationships[140]. The little evidence that exists presents an unclear picture. A quantitative study in Colombia found evidence of a positive impact on social capital[141] as measured by levels of trust, co-operation and communication between community members in surveys in 2005, however focus groups in Mexico noted an increase in community tensions as a result of perceived unfairness in who was excluded from CCTS participation[111].

Surveys asking about intra-household decision making in Mexico found that the majority of decisions on purchases, child care and schooling were jointly taken by the male and female heads of household. The extra income given to women through *Progresa* made husbands less likely to be sole decision makers, including deciding how to use the cash transfer[112]. The authors also undertook focus groups with beneficiary women. They reported an increase in self-esteem, through leaving the house more often (usually for *Progresa* activities), having more opportunities to speak to other women about problems, being more comfortable speaking out in groups and being better educated through educational workshops. The authors noted that some aspects of intra-household tension were probably not captured by the focus groups, such as domestic violence and alcohol abuse.

A similar picture emerges from Colombia. Decisions regarding schooling and child health care are shared jointly by mother and father, but the baseline report found that spending decisions, particularly regarding food, were typically the prerogative of the father[104]. Focus groups expressed the view that women had acquired a more prominent role and had greater freedoms to provide for their children as a result of the programme and that it had not generated significant conflicts within the household.

An interesting preliminary result from the *Malawian Schooling, Income and HIV Risk* study was recently presented at the XVIII International AIDS Conference which may relate to female empowerment. Women aged 13-22 who received cash transfers had a 60% lower HIV prevalence compared to controls (1.2% vs. 3.0%, p<0.05). This study authors think this may have been due to a reduction in transactional sex[136].

Health knowledge and behaviour

There is little published evidence on how CCTS affect this important element of human capital. Mexico's *Progresa* is the only evaluation to have looked at this outcome, but two relevant reports yield an inconsistent picture. The more detailed, dated 2004[142], reports that rurally, participating women had adequate knowledge of contraceptive methods more often than unexposed controls (80.8 vs. 76.9%, p<0.05), but that no difference was seen in urban areas, which the authors ascribe to the multiplicity of information sources in urban settings beyond that provided by the programme. This report also notes a beneficial programme impact for adolescents' alcohol intake. Negative effects, however, are reported for adolescent smoking where rates were higher in 1998 enrollees (26.8%) versus 2000 enrollees (19.4%, p<0.05) or nonexposed controls (24.0%, non-significant). Likewise, consumption of alcohol and tobacco amongst participating adults did not differ from unexposed controls.

Another official document dated 2006, however, reports that participants showed improved knowledge of lifestyle risk factors including smoking, alcohol, sexual health and family planning and reduced smoking rates[89].

Observing increased consumption of ‘healthy’ goods, such as fruit and vegetables, and unchanged consumption of ‘unhealthy’ goods, such as tobacco and alcohol, may also imply good health knowledge. This does not, however, necessarily represent better knowledge as a result of CCTS participation; it may simply reflect improved economic capital against a background of unchanged understanding.

In summary, CCTS appear weak at investing in the human and social capital element of co-production. Improved school attendance does not appear to translate into improved educational attainment, impacts on early childhood cognitive development are very small and effects on social capital are unclear. Very little is known about health knowledge, which is surprising since workshop attendance is a mandatory or encouraged part of most CCTS.

Do CCTS impact on structural determinants?

Discussion of CCTS impacts on structural determinants in this section is restricted to their effect on health systems. There is in fact little literature concerning CCTS impacts on other structural determinants other than that already summarised around poverty and household spending, educational attainment, social capital and gender.

Given that CCTS include health gain as an explicit objective and that CCTS universally mandate increased healthcare utilization as one of their conditions, it is unsurprising that these schemes incur substantial impacts on health systems.

The *Progresa* evaluation found that use of preventive healthcare increased by 18%, including earlier pre-natal care[83]. Households reported a 53% increase in visits to public clinics with no decrease in visits to private clinics, suggesting beneficiaries were not transferring from private to public providers. A negative impact, however, was seen for 0-2 year olds, for whom total clinic visits (public and private) fell by 25% compared to non-beneficiaries; hospital stays also fell by more than half and visits to private doctors by a third. Large reductions in hospitalization were also seen for adults aged over 18. Health care utilization, however, is a poor measure of health care need and these results may be consistent with a positive health impact of *Progresa*.

In Nicaragua, preventive clinic visits increased by 17.5% ($p<0.05$) and a strongly progressive gradient was seen across poverty tertiles ($p<0.05$)[91]. In Honduras, *PRAF* was associated with a large increase in antenatal care and child immunisation and growth-monitoring (of 15-20%, $p<0.01$)[92]. In Colombia, *Familias* was associated with significant increases in preventive health care visits for 0-24 month olds (of 22%, $p<0.05$) and 24-48 month olds (of 46%, $p<0.05$); no significant impact was seen in older children[93]. The Jamaican *PATH* programme evaluation found a significant increase in clinic visits for children (from 0.73 to 1.01 visits per six months, $p<0.001$), which was associated with better vaccination rates and receipt of health advice. No effects were seen for the elderly, but this group had high attendance rates already[95].

Aside from increases in service use, expected given schemes' conditionality, little else is known about CCTS ' impact on other health system elements such as workforce, financial flows or provision of other services, and it is unclear whether increased service use would impact positively or negatively on health systems. This is concerning because prior to implementation, planners of CCTS had recognised that health and education services (the 'supply-side') needed to be of adequate quality and accessibility if conditions were to have any validity or force[118 143]. Similarly, planners in African countries recognised that local service infrastructures were often too inadequate to justifiably impose conditions, either because services were inaccessible to the majority of the poor or too weak bear the strain of additional demand[72]. This is one of the reasons why conditional schemes have not been used in Africa.

Despite this, evaluations generally give no description of the safety, quality or accessibility of services before or after the implementation of CCTS. An exception is an isolated report of services struggling to cope with increased demand and the quality of care deteriorating at some sites in Peru after introduction of *Juntos* in 2005[144]. Other insights are available from focus-groups undertaken with beneficiaries and professionals involved in Mexico's *Progresa*[64]. There, 75% of beneficiaries felt that health services had improved since inception of the programme, including the manner and disposition of healthcare professionals and time spent in consultations. Remote communities reported more frequent and longer contact with visiting healthcare workers. Doctors reported that the programme had brought about additional training, although no increase in staff numbers. Some caution is needed with this study since it is not clear how focus group participants were recruited. It is also worth noting that *Progesa* (since renamed *Oportunidades*) has developed a system of 'sentinel points' which hold public services to account by taking user views on their quality and publishing them online.

The lack of information on service quality is a clear deficiency if one wants to give a complete account of the extent to which CCTS contribute to better health and welfare. It is particularly problematic in the case of CCTS, because their central rationale is that services go under used by those who most need them, even when freely accessible and of decent quality, for a variety of reasons which a conditional incentive can help resolve. Whether or not this is really the case, however, is difficult to determine. Furthermore, the question of whether it is more appropriate to wait for adequate service infrastructure before considering conditionality, or whether the introduction of conditional schemes can be used to drive the development of service infrastructure, as appears to have happened in Mexico, is left unresolved.

In summary, the impact of CCTS on health systems, particularly access, is likely to be substantial, but suffers from a lack of scrutiny and research. International health sector expertise should be centrally placed to offer technical assistance on this issue, describing, understanding and anticipating health system impacts setting by setting and ensuring that the safety, quality and accessibility of health care services are maintained despite, or indeed because of, the presence of a CCTS.

Conclusions to Part II

CCTS are increasingly popular social welfare interventions that seek to improve the welfare of the worst off and break the intergenerational transmission of poverty. They do this by transferring regular sums of cash to the poorest families in society, as long as the household complies with certain conditions, such as regular attendance at preventive healthcare checkups and school for younger household members and attendance at seminars on health, nutrition and parenting for older household members.

Review of the literature shows that the evidence base is disproportionately drawn from one scheme, *Progresa* in Mexico. Nevertheless, a synthesis of all the available evaluations finds that CCTS have had some positive impacts particularly around improving uptake of preventive healthcare and schooling. Impacts on more 'final' health or educational outcomes are much more modest. Reductions in incidence of acute childhood illnesses, for example, are not seen in all schemes and improvements in longer-term parameters such as childhood growth and anaemia are small and, again, not consistently seen. In addition, there have been some unintended effects, such as worsened cardiovascular outcomes in adults, and some important outcomes, such as healthcare knowledge, have received very little attention in the literature, despite workshops and seminars being an important element of the schemes and improved human capital a key objective.

It also appears that the health sector have been relatively uninvolved in the design and operation of CCTS to date. This is surprising given the significant health and health service impacts associated with CCTS, and given that all of the unintended adverse outcomes are within the health domain.

Within the co-production framework it can be seen that CCTS explicitly attempt investment in human capital and material resources, but investment in structural conditions is not a standard component. If CCTS effects are indeed 'weak' in achieving final outcomes as suggested above, this could arise because the schemes insufficiently invest in material resources, human capital, structural conditions or some combination of these three. Indeed, the conclusion of recent core texts, such as the World Bank CCTS review, is that it remains unclear which elements of the CCTS intervention are most important in achieving their objectives and avoiding adverse outcomes - some issues such as conditionality and targeting remain controversial. Further analysis on more final health outcomes and, where possible determinants of health, is also necessary.

This thesis aims to contribute to meeting this need. To do this, the thesis takes the Colombian CCTS *Familas en Acción* and asks: what is the effect of *Familias* on important but hitherto unexamined health outcomes? What is its effect on health knowledge, an important determinant of 'final' outcomes? What policy implications follow and could a critique of CCTS from a social determinants point of view offer ways to modify and improve the schemes?

The following chapters present quantitative analyses which aim to begin answering these questions. Chapters 7, 8 & 9 set out the social and political context for Colombia's *Familias* scheme, and describe in detail the scheme's operation and evaluation. Chapters 10, 11 & 12 go on to test three hypotheses, setting out the rationale for and relevance of each hypothesis in the relevant chapter:

[1] participation in *Familias* is associated with increasing body mass index in women;

[2] participation in *Familias* is associated with an increased body mass index for age (BMIZ) in children;

[3] participation in *Familias* is associated with an improvement in women's knowledge and practice around the management and prevention of acute childhood diarrhoea.

PART III

METHODS OF FAMILIAS EN ACCION

Chapter 7: Colombia – the setting for Familias

This chapter aims to set the context for the policy evaluation that follows by briefly addressing three questions: what kind of country is Colombia, demographically, economically and in public health terms? What is the history and current state of welfare policy in Colombia and where does *Familias en Acción* fit in? And finally, how well does the co-production model reflect current policy in Colombia?

Demography, health and healthcare in Colombia

With a population of over 45 million people, Colombia has the 29th largest population in the world and the second largest in South America. The population (30% of whom are under 15 years old) is ethnically diverse and comprises native Indians, Spanish colonists, Africans brought as slaves and twentieth-century immigrants from Europe and the Middle East.

Colombia is one of the most urbanized countries in Latin America. 71% of the population lives in urban areas and thirty cities have populations of 100,000 or more. It is the fourth largest economy in Latin America with a GDP per capita of $7,968 (82nd in the world). In common with much of Latin America, wealth and income in Colombia are unevenly distributed (Gini coefficient was 0.587 in 2009)[145]. Official figures indicate that about 46% of Colombians lived below the poverty line and some 17% in extreme poverty[146]. Unemployment stands at 12% and adult illiteracy at 7.6% (15.4% rurally; 2003 figures). Colombia has one of the world's largest populations of internally displaced persons, at around 4.5 million people (2010)[147].

Life expectancy in Colombia is 72.3 years (2005) and infant mortality 15.5 per 1000 live births (2008). Although the rate compares favourably with neighbouring countries such as Ecuador (18.1), Perú (21.0) and Venezuela (16.1), it masks wide social disparities which range from 14 for mothers with university education to 43 for uneducated mothers[148].

Amongst adults, the principal causes of death are ischaemic heart disease, chronic respiratory disease, diabetes and cancer. Historically, violence has been the most frequent cause amongst adolescent and adult males although since 2001–2 Colombia has halved its homicide rate, previously one of the world's highest at more than 60 per 100,000 inhabitants[149].

Amongst children, the leading causes of death are acute diarrhoeal and respiratory infections. Prevalence of chronic child malnutrition ranges from 3.3% in the wealthiest households, to 19.8% in the poorest households[148].

In 2005 Colombia was reported to have 1.1 physicians per 1,000 people, compared with a Latin American average of 1.5. Per capita expenditure on health care was US$150, equivalent to 5.8% of GDP compared to 7.5% in Chile, 5.7% in Ecuador, 4.5% in Perú and 5.4% in Venezuela. Health standards in Colombia have improved greatly since the 1980s[150], particularly as a result of reforms in 1993 which expanded coverage from 21% to 66% in 2005.

In recent years, however, healthcare has become precarious. Faced with financial crisis in the health sector, the Colombian Government declared a state of emergency in 2009. Health sector deficit had been rising unsustainably for many years, largely because high rates of informal sector employment meant that fewer people joined employment-based contributory health insurance schemes than expected, remaining in the publicly-funded sector[151]. Additionally, recent auditing by the Presidential Office estimates several billion pesos to have been illegally diverted from public funds, roughly equal to the deficit[152]. The constitutional court, however, reasoned that the crisis was foreseeable and declared the state of emergency unconstitutional. The same judgment enshrined healthcare as a legally enforceable right, and set a deadline of one year by which universal access to a basic package of care had to be guaranteed.

Social welfare policy in Colombia

The following summary draws from a review published by the UN Development Programme[153].

At start of the twentieth century, most social assistance in Colombia was provided by the charitable sector for lack of any other infrastructure. With repeated economic crises and persistent poverty, such charitable endeavours became embedded as important elements of social welfare. State-backed national welfare began in the 1930's under President Lopez Pumarejo. The primary policy objective was to protect workers' salaries and promote stable employment and, being limited to those in formal employment, disadvantaged sectors of society saw little benefit.

In the latter half of the century, national economic planning sought to boost productivity by building infrastructure, clarifying land titles and developing mining, construction and manufacturing. The economic crises of the 1980s made it clear that this programme did not benefit Colombian society equally. In response, the 1983-1986 national development plan sought to distribute growth more evenly, being sub-titled *"Change with equity*". A concern for equity continued despite the neoliberal reforms of the late 1980's and early 1990s: alongside increasing private provision of health and education services, coupled with greater competition between providers, came renewed effort to target social welfare toward the most deprived. Commitment was demonstrated by developing national indicators that measured basic unmet needs and numbers living below the poverty line during Barco's presidency (1986-1990).

Nevertheless, rates of poverty increased during the early 1990s as a result of global economic shocks. Although ensuing policy correctly addressed poverty as a multidimensional problem, attempts to increase school enrolment and promote uptake of other services met with limited success. For example, secondary school coverage increased only from 46.0 to 48.4%, far short of the 70% target set for 1995. Poor co-ordination and leadership at the Ministry level was thought to explain these disappointing impacts. The government's response, in the second half of the 1990s, was to increase social spending, alongside attempts to improve service quality and expand opportunities for training and employment.

Anti-poverty programmes became personally associated with the President's Office during the Samper Pizano administration (1994-1998), a noteworthy feature that persists today. The move was as much a practical attempt at better co-ordination as a political strategy. Under an umbrella entitled the *Social Solidarity Network*, initiatives included creation of rural and urban employment opportunities for unskilled labourers; integrated health and nutrition programmes for mothers and infants (including supplements and vouchers); specific support for households headed by single women, adolescents and young people (particularly those with an aptitude for the arts or sport), elderly people, indigenous groups and homeless people; and investment to improve the physical environment and infrastructure in poor communities. Again, however, these initiatives did not meet expectations, only reaching an estimated 30% of intended beneficiaries. Worse, in a national survey in 1997, 90% of poor rural families said they had no knowledge of, and had not received any benefits from, any of these programmes. Suggested reasons behind this failure included weak administrative capability and illegal diversion of funds. Several large state institutions and programmes were subsequently investigated for corruption.

The latter half of the 1990's saw an unanticipated slowing of GDP to almost nonexistent growth and consequent rises in unemployment, reaching 19.7% in 2000. The low price of coffee on the world market added to Colombia's problems, as did extensive regional earthquakes and worsening internal conflict. Numbers living in poverty increased from 19.7 million in 1997 to 22.7 million in 1999.

As part of the national reconstruction plan, President Pastrana Arango tried to limit the impact of the recession on Colombia's most vulnerable communities by consolidating Pizano's *Social Solidarity Network* into three main programmes: *Empleo en Acción, Jóvenes en Acción* and *Familias en Acción.* The Uribe adminstration (2002-2010) continued with these programmes and launched a *Social Reactivation Plan*, massively expanding each of them to cover poor families across the country. For example, *Familias en Acción*, which had covered around 150,000 families in 2002, expanded 20-fold to enroll almost 3 million households. The total number of anti-poverty initiative beneficiaries currently stands at just over 12 million, in a country of around 46 million. The plan succeeded in reducing rates of poverty, although in 2008 an estimated 71% Colombians were still either living in poverty (defined as those individuals without sufficient income to cover basic goods and services beyond nutritional needs) or had incomes just above the poverty line; furthermore, land-ownership had become more concentrated during Uribe's term, reaching a Gini-coefficient of 0.875 in the same year.

Nevertheless, Uribe enjoyed a 75% approval near end of his term. As well as welfare expansion, he sought to promote social cohesion, dramatically reducing rates of violence and criminality (Figure 7.1). New initiatives were directed toward the needs of displaced persons, making reparation to victims of violence and reintegrating paramilitaries into civil life. Between 2000 and 2007, Colombia's Human Development Index (a composite measure of life expectancy, literacy, education and standards of living, especially child welfare, reported by the UN) rose from 0.772 to 0.807, admitting Colombia to the group of countries with "high" levels of human development[145]. Despite the global economic crisis of recent years, Colombia has experienced fast economic growth and been branded one of the CIVETS (Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa) – a group characterised by dynamic economies, foreign investment and young, growing populations.

Santos has continued with the centre-right approach of his predecessor, stating his core philosophy as "the market wherever possible and the state wherever necessary". Alongside this, a concern for social mobility and equality features prominently. Discussing Colombia's Millennium Development goals at a UN speech, he said there was "nothing more important" and reducing poverty and achieving equity as "our challenge, our dream, our obsession"[154].

Santos' national development plan is subtitled *Prosperidad para todos (Prosperity for all)* and makes a link between economic growth and social mobility, stating that "economic growth is not an end in itself but a means to achieve a society with wellbeing and equality of opportunity for everyone"[155]. The plan identifies four challenges, namely increasing the effectiveness of social spending, both in terms of coverage and quality of interventions; improving targeting so that the most poor and most vulnerable benefit most; building a coherent system of social protection to create human capital and reduce poor households' vulnerability; and promoting social inclusion such that "every Colombian has access to the fundamental tools to allow them to realise their individual destiny, independent of gender, ethnicity, social position, sexual orientation or birthplace." The plan aims to promote better engagement of the poorest households with an integrated set of services, so that they increase income sustainably and exit definitively from poverty. *Familias en Acción* is highlighted as one of the key programmes to achieve this.

Co-responsibility in Colombian welfare policy

The notion that responsibility for better health and welfare should be shared between society and the individual, the key idea of co-production, became prominent in Pizano's *Social Solidarity Network.* The *Network* recognised poor families as active agents in their exit from poverty and, whilst offering them investment and support, placed them under an obligation to act in ways that were expected to lead to better health and welfare.

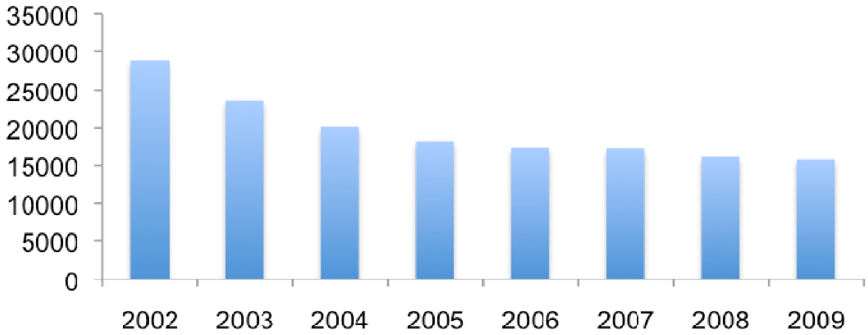
The benefits and obligations required of participants in *Familias en Acción* are described in detail in the next chapter. *Jovenes en Acción,* another initiative dating from 2001, offered unemployed urban youths aged 18-30 (with priority given to Afro-Colombians and internally displaced people) a daily allowance of 5000 pesos (US$ 2.60) and preferential access to business start-up funds, as long as they completed 300-700 hours of apprenticeship in a field of their choosing and an additional 60 hours of training in life skills around themes such as employability and civic participation. *Empleo en Acción* set out a similar conditional offer for the poor and unemployed in older age groups.

The co-responsibility approach pioneered by these schemes continues to be prominent in contemporary Colombian welfare policy, appearing fundamental in the current administration's national development plan: *"Beneficiary families are considered active subjects with responsibilities to the rest of society".* As if to underline the theme, one of the brochures accompanying the plan quotes a female participant as saying *"Co-*

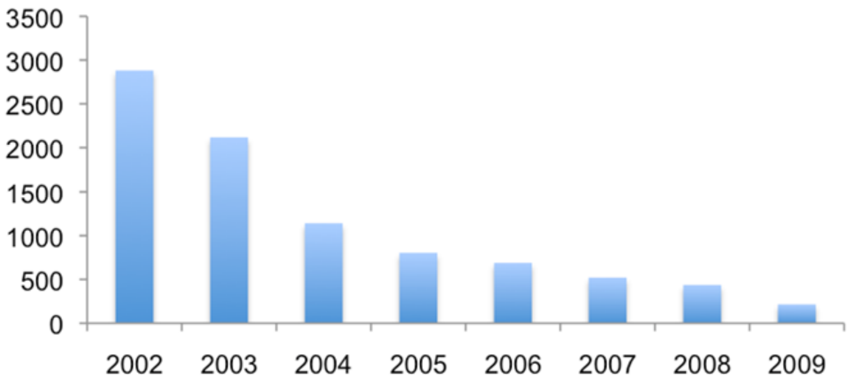
responsibility benefits mothers, in that they learn to be better mothers; I believe that is the essence, to learn to be responsible. To be a mother is to learn to be responsible from the moment a child is born."

Prosperidad para todos brings together all welfare schemes under a single umbrella strategy called *Red Juntos,* which requires families to meet 44 achievements including national registration of births and disabilities, engaging in work, training and education programmes, taking up the offer of health and nutrition services and having a bank account. This is meant to *"support families to construct a new perspective on life which permits them to be active agents in their own development"* and lead to *"families commit[ting] themselves to overcoming their situation".*[155]

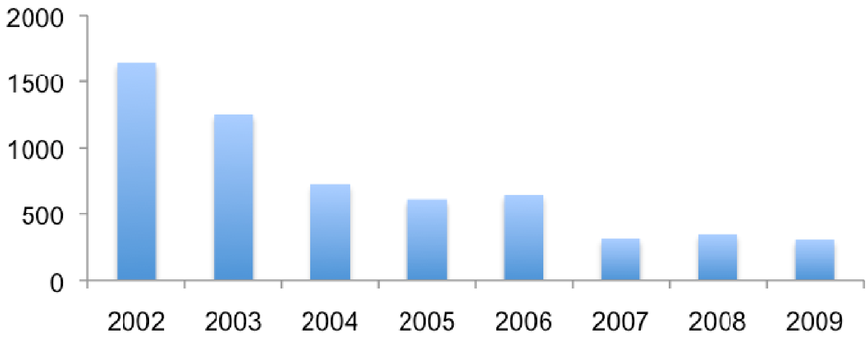
The prominence of the notion in recent Colombian welfare policy that responsibility for better health and welfare should be shared between society and the individual is clear therefore. Chapter 2 explored the caveats which should be placed around co-production, for it to be a reasonable approach to overcoming disadvantage. The purpose of this chapter is to show that the co-production model seems to reflect current Colombian welfare policy well, implying that it is an apt conceptual framework with which to evaluate *Familias en Acción.*



Homicides, 45% reduction



Kidnappings, 93% reduction



Terrorist attacks, 81% reduction

Figure 7.1: reductions in levels of violent crime in Colombia, 2002-2008[149]

Chapter 8: Operation of Familias en Acción

Operation of the programme

Familias began in 2002. It operates the following conditions and transfers: 'educational' conditions apply to families with children aged 7 to 17 and offer 14000 pesos (US$6) per month per primary school child and 28000 pesos (US$12) per month per secondary school child, conditional on 85% school attendance rate; 'nutritional' (health) conditions, apply to families with children aged 0 to 6 and offer 46500 pesos (US$20) per month per family, conditional on complying with children's immunisations and health check-ups and mothers' attendance at health, nutrition and parenting seminars. By late 2004 some 412,000 families were enrolled and approximately US$183,250,000 had been transferred[96].

To enrol in *Familias,* families have to meet two sets of qualifying criteria: first, they must live in a non-urban municipality with sufficient infrastructure to implement the programme; second, they must be sufficiently poor and have school age children. Details of each of these criteria is set out next.

Colombia comprises 1,060 municipalities, 622 of which met all of the following four criteria: (i) less than 100,000 inhabitants and not a departmental capital; (ii) sufficient education and health infrastructure to enable participants to comply with the programme's conditions; (iii) a bank to enable cash transfers to programme participants and (iv) administrative office with up-to-date census, welfare and service infrastructure data. All 622 implemented *Familias* and are henceforth termed 'treatment' municipalities. It is important to note, then, that 'treatment' was defined at municipality level and was not randomly allocated.

Treatment municipalities included a range of population densities and infrastructure, from dispersed rural communities to medium-sized towns. Second stage targeting then identified eligible households within qualifying municipalities, using an indicator of household deprivation called SISBEN. SISBEN score is determined using the first principal component of a number of variables related to poverty and has been used to target all previous national welfare programmes and utility pricing. SISBEN-1 households (accounting for more or less the lowest quintile of household income distribution) were eligible for *Familias* if they included children aged under-17.

Evaluation of the programme: sampling strategy

Rigorous evaluation of the impact of *Familias* was a requirement of the agencies funding the programme, hence an evaluation strategy was incorporated its inception. Prospective data were collected on a sample of treatment and control households using specifically designed survey instruments and it is this purposefully collected data that is analysed in this thesis. Surveyed households were chosen to be representative of the participant population as possible, as explained next.

As noted above, treatment was defined at municipality level and was not randomly allocated. Given that determination of individual household exposure involved a second layer of eligibility criteria, four possible types of household result:

		Municipality (determined on basis of sufficient infrastructure)	
		Eligible	Ineligible
Household (determined on basis of poverty and having children under 17)	Eligible	**A**	**B**
	Ineligible	**C**	**D**

Cell A represents treatment households, that is, those families sufficiently poor and with children aged under 17 that live in non-urban municipalities with sufficient infrastructure to be capable of delivering the programme. Cells B, C and D represent households who did not receive the programme. Households in cell B are eligible for *Familias* (that is, are sufficiently poor with children under 17) but in municipalities that did not receive the programme because they are large towns with >100,000 inhabitants or lack infrastructure capable of delivering the programme.

Three possible comparisons could be made to evaluate the programme, A vs. B, A vs. C or A vs. D. Group D can be discounted as a comparison group, since households in this cell are different to those in cell A both on municipality-level and household-level criteria: they are likely to be so different to treatment households as to make a bad choice of comparison group. In essence, the choice between cells B and C relates to whether households in group A are more similar to those in group B or in group C.

Choosing group B as the comparison group is reasonable because *Familias* is an intervention whose mechanisms operate at, and whose outcomes are measured at, household level. It makes sense therefore, for the comparison group to be as similar as possible to the treatment group at this level. This rules out group C, who are substantively different from group A by virtue of being wealthier (SISBEN 2 and above) and/or without children aged under 17.

Nevertheless, the problem remains that differences between groups A and B persist at municipality level. This was dealt with in various ways. First, control municipalities were sought that were as similar as possible to treatment communities. Matching was performed within 25 strata based on region, health/education infrastructure, population, land area and quality of life index. Post-hoc analysis showed that most control municipalities had been ineligible for *Familias* because of absence of a bank and municipality offices. As a result, control municipalities are slightly poorer than treatment areas.

Second, statistical methods were used to control for differences likely to exist between groups A and B. As explained in the next chapter, these comprised inclusion of a wide range of co-variates, including some at area-level, in regression models and isolating a co-efficient that identifies the effect of municipality.

Having defined treatment and comparison households, the evaluation sample was constructed to be as representative of all participating households as follows: 57 treatment municipalities were randomly selected and matched with 65 control municipalities, drawn evenly across the strata described above. Approximately 100 eligible households were randomly sampled from each treatment and control municipality, generating an analytic sample of 11,428 households.

Finally, with respect to cell A, "intention-to-treat" (ITT) analyses are made. This means that households are analysed according to the treatment/control status of their municipality at baseline, whether or not they took up the offer of *Familias* or whether they changed status between baseline and follow-up. It is known that only around 86.5% of qualifiying households took up the offer of *Familias* and that a small number changed status between baseline and follow-up[103]. To participate in *Familias*, families would have had to withdraw from a welfare scheme called *Hogares Comunitarios* that provided subsidized child care and food for pre-school children. This may explain 15% non-participation rate. The intention-to-treat analysis leads to a more conservative estimate (self-evidently by about 15%) of programme effect if either of these situations occurs. Nevertheless, it is preferred because it evaluates the programme under 'real-world' conditions, rather than ideal conditions (with 100% adherence and no cross over), and so is arguably of more interest to policy makers and funders.

In summary, the evaluation of *Familias* comprises a prospective cohort study using an intention-to-treat analysis. In the analyses which follow, regression is performed upon treatment/control allocation status of the municipality, not of the household.

This is set out schematically in Figure 8.1 below.

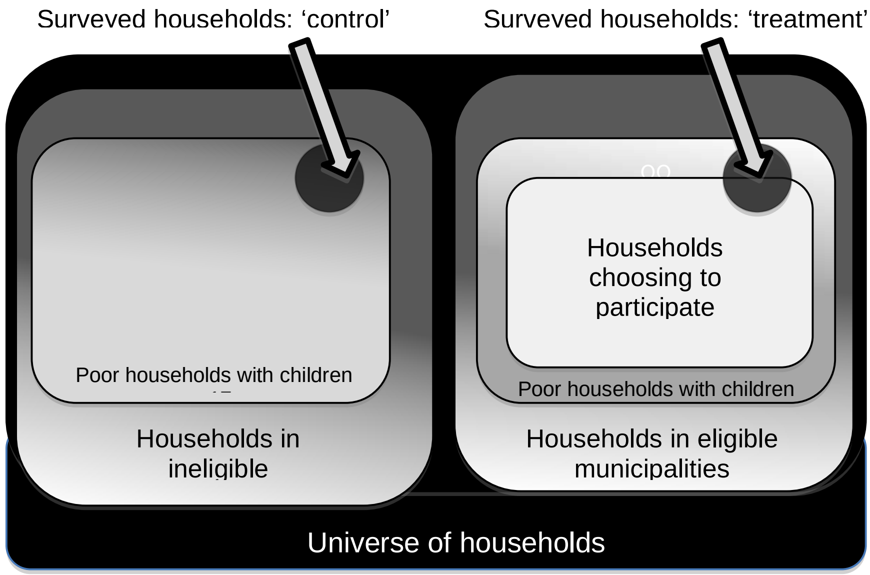


Figure 8.1: schematic representation of evaluation sample

Data collection and quality assurance

Detailed surveys in treatment and control households covered outcomes of interest as well as a wide range of possible relevant co-variates. Each survey lasted 3-4 hours and comprised the following modules:

Módulo 1: **Vivienda y hogar**	Household characteristics, such as construction material, utilities, services and income.
Módulo 2: **Participación**	Extent of participation in *Familias* and other social welfare programmes.
Módulo 3: **Gastos**	Household spending and consumption of goods.
Módulo 4: **Mujer**	Reproductive history, attendance at health and parenting workshops, participation in community activities, knowledge of the management of acute diarroheal illness in children.
Módulo 5: **Niños de 0 a 6**	Carer-reported health (including recent acute diarrhoeal or respiratory illness) and use of healthcare services, measures of height, weight and haemoglobin.
Módulo 6: **Personas de 7 y más**	Level of education, self-reported health and use of healthcare services, time allocation to labour, recreation and other activities.

Local area surveys were also undertaken on health and education infrastructure, local wages and food prices.

The survey tool changed slightly across phases, for example, questions around breast-feeding were not asked at phase 3 and parity (the number of times the woman had given birth) was not asked at phase 1.

Measures to ensure reliability of the data included extensive questionnaire piloting and fieldworker training, standardized methods (e.g. Pan-American Health Organisation manual on anthropometrics) direct observation of ~10% of surveys by quality controllers and repeat measures on a subset of participants.

Of note, this thesis uses the raw survey data as its start point, merging and appending between levels and across phases and generating derived variables of interest as necessary. In two cases, pre-prepared data files inherited from the Insitute of Fiscal Studies (London) were used, namely a file containing derived height-for-age, weight-for-age and height-for-weight Z-scores for children at each phase and a file summarizing household spending on goods and on food at each phase.

It is important to note that a significant problem arose with baseline data collection. Political pressure to get the programme underway meant that *Familias* started operating in some municipalities before baseline data collection had been completed. These municipalities are henceforth referred to as TBB (treatment before baseline) municipalities, contrasting with TAB municipalities (treatment after baseline).

TBB municipalities comprise 31 of the 57 treatment municipalities selected for data collection. *Familias* was underway by the end of 2001 in these areas, that is, about six months before baseline data collection. Unfortunately, the baseline data show numerous differences between TBB and TAB communities, in other words, the phenomenon of becoming a TBB vs. TAB municipality was not random.

There are various statistical methods that can be used to deal with the problem of TBB communities. One option is to drop them from the analyses, another is to create a dummy variable that reflects operation of the programme independent of time and of the treatment/control status of the municipality. This latter method is explained in more detail in the next chapter.

Follow-up and attrition

Three surveys took place between mid-2002 and early 2006, covering both treatment and control households.

Phase 1: Baseline, June – Oct 2002	11502 households	-
Phase 2: 1st follow-up, July – Nov 2003	10800 households	**6% loss**
Phase 3: 2nd follow-up, Jan - March 2006	9566 households	**17% loss**

The same households were resurveyed for each phase. Measures to minimize attrition included widely publicised support for *Familias* from civic leaders (including President Uribe) and *Familias* participants, regular contact with participants and efforts to trace households that had changed location – each was asked to nominate at least two relatives/friends to contact should they have moved. Furthermore, a website and participant newsletters and other publications sought to maintain contact with participants.

Funding

In 2001, a partnership between the Institute of Fiscal Studies (London, a research institute), Econometria (Bogotá, a research institute) and SEI (Bogotá, a company specialising in the design and collection of social surveys) was commissioned by the Colombian Government to evaluate *Familias*, after open tendering.

The data is now in the public domain.

Discussion

In summary, the evaluation of *Familias* uses an intention-to-treat analysis on panel data prospectively collected over three time points in around ten thousand households.

Strengths of the evaluation include its prospective nature, large scale and relatively modest loss to follow-up. A wide range of data is collected, covering several phenomena including socio-economic, anthropometric and clinical variables. Furthermore, extensive quality control mechanisms were implemented, including independently commissioned data collection and analysis.

The primary weakness of the evaluation is its non-randomised nature. Although various statistical techniques can be used to strengthen the rigour of the conclusions drawn from cohort studies, the evidence derived from observational data can never be considered as strong as that derived from a experimental design. An additional weakness is the non-blinded nature of the evaluation. Clearly, it would not have been possible to blind participants to their treatment/control status. Likewise, it would have been difficult to blind survey teams collecting outcome data to the status of the household they were visiting. This may have led to systematic differences in the way outcomes were reported or recorded between exposure groups, which could bias statistical associations in either direction.

Randomisation was, naturally, the preferred option of those commissioned to design and run the evaluation. It was disallowed, however, by those running the programme on behalf of the Government. This, and the phenomenon of TBB communities, point to the close political interest taken in *Familias*. This could be considered another weakness in its evaluation; alternatively, however, this interest was moderated by independent reporting of findings. Political interest probably upgrades the relevance and impact of the evaluation and is probably an unavoidable (and not necessarily unwelcome) feature of any evaluation of a large scale publicly funded intervention.

One might also argue that absence of a qualitative component is a weakness; this theme is taken up in Chapter 14.

Chapter 9: Statistical methods

A variety of statistical methods have been used to evaluate *Familias;* this chapter describes the approach developed for this thesis.

For each of the three outcomes (women's BMI, children's BMIZ and women's healthcare knowledge), statistical analysis consisted of six discrete steps:

- determination of the analytic sample;
- determination of the outcome of interest;
- determination of co-variates, determination of exposure;
- estimation of programme effect;
- supplementary estimations in sub-groups of interest.

Details of each step is given next.

Determination of the analytic sample

Inclusion and exclusion criteria for the analytic sample were determined *a priori*, in general, on purely biological grounds. It is appropriate, for example, to exclude pregnant and breast-feeding women from analyses on body mass index. The preference was to apply few, if any exclusion criteria in order to make full use of the data available, reduce the chances of Type II (false negative) errors through having an underpowered sample size and maximise the generalisabilty of findings.

Participants lost to follow-up were censored. For each analysis, a participant flow-chart quantifying sample attrition is provided. Also provided is a table quantifying differences in exposure type, outcome of interest and co-variates at baseline according to attrition. This forms the basis for discussion of possible bias in the estimations of programme effect through non-random drop-out.

Determination of the outcome of interest

Variables representing the outcomes of interest were identified within survey modules, or constructed *de novo* from survey items (for example, body mass index). Similarly, clinically relevant categories were constructed from survey items as appropriate (for example, 'obese' or 'overweight').

The face-validity of the outcomes chosen, that is their credibility and utility in the eyes of other researchers and practitioners, was ensured by basing them on internationally established norms (for example, construction of a score for women's' knowledge of the management of acute diarrhoeal illness in children was based on published guidance from the World Health Organisation).

The distribution of outcome variables was examined. Some extreme observations were apparent (for example, a woman with a recorded height of 40.3cm). Such outliers present a dilemma: if they are data entry errors then they should be dropped, otherwise they may adversely affect the conclusions drawn. If data entry error is not certain, however, then outliers may represent data-points of particular interest. Dropping them would be an error, since analyses may become biased.

In this thesis, the preference has been to minimise data censoring as far as possible. Censoring was only applied where observations were completely implausible (for example, the woman with a recorded height of 40.3cm was dropped, whereas a woman with a recorded parity of 22 births was not). If censoring appeared necessary, a conservative, objectively determined *a priori* rule was created and applied equally across all groups at all phases. In every case, this rule was that observations below the 1% and above the 99% centile be censored. The rule was chosen to maximise data retention whilst cleaning the data of obviously erroneous entries in a non-biased, systematic fashion.

A preliminary estimate of programme impact can be made by directly observing outcomes of interest in exposed and unexposed groups, at baseline and follow-up. For each analysis, simple 2x2 tables showing these values are provided. These form the basis for the double-difference analytic method described later in this chapter.

Determination of co-variates

As described in the preceding chapter, exposure to *Familias* was not random between municipalities, making identification and inclusion of potential confounders in the statistical model particularly important. Other variables, which could act as markers of the mechanisms that mediate between exposure to *Familias* and eventual health outcomes (such as household spending on food in the case of obesity analyses), were also considered as co-variates.

Possible confounders or mediators of the hypothesized relationships at the individual, household and municipality levels were identified from the literature and verified with experts who had conducted previous studies using *Familias* data. With two exceptions, all were measured at baseline. The exceptions were:

- travel time to medical centre, included as a continuously distributed marker of rurality. This was not measured at baseline but recorded at first follow-up survey;
- maternal parity. This was not measured at baseline but recorded at second follow-up survey.

The distribution of each co-variate was examined to look for implausible values. Censoring was not deemed necessary for any. Where co-variates were missing, reasons for missingness were explored, multiple imputation used to replace missing values where appropriate and the size and direction of likely bias introduced by missingness discussed in each chapter.

Continuous distributions were transformed to approximate a normal distribution where appropriate to do so and some categorical variables were re-categorised, as described below.

At the individual level, *woman's age* was treated as a continuous variable; a dichotomous variable *woman's community participation* was created if the woman had participated in any local sport, civil, religious, political or commercial activity in the past six months. An ordered categorical variable for *woman's completed formal education* was created as follows – 1: primary education incomplete; 2: primary education complete; 3: secondary education complete; 4: higher education.

At the household level, *household wealth* was measured by surveying households' consumption of a wide range of items over the past week to a year, depending on the nature of the item. Consumption is well validated as a robust measure of household wealth, being more resistant to temporary fluctuations in welfare than enquiring about recent income itself and less subject to reporting bias[104]. *Household wealth* was treated as a continuous variable and log transformed. *Household size* and *persons per room* and *travel time to medical centre* were treated as continuous variables. An ordered categorical variable for *completed formal head-of-household education* was created in the same way as woman's education. A dichotomous variable '*urban location'* was created to identify households living in or near the main municipal centre of each municipality. As stated in the previous chapter, all eligible municipalities were smaller than 100,000 inhabitants; '*urban location'* is a relative term, therefore, that usually refers the centre of local administration in the municipality. These locations will usually have at least 3,000 inhabitants and various public facilities such as a town hall, a school and a health centre, in contrast to the more remote parts of the municipality.

At the municipality level, *population, number of families eligible for Familias, quality of life score, ratio of doctors to population, ratio of nurses to population* and *average household wealth* were treated as continuous variables; all were log transformed. *Average travel time to medical centre* and *proportion of households with piped water* were treated as continuous variables. Population was taken from 2000 census figures. Quality of life score was taken from a 1997 survey which asked a standard set of questions, well established in Colombia, about household size, crowding, construction, amenities and educational levels[104].

The possibility of non-linear relationships between co-variates and the outcome of interest was explored using Box-Tidewell regression prior to each analysis. Variables were transformed as necessary to improve the fit of the model.

Within each analysis, co-variates were added in as vectors in sequentially nested models as follows:

Model A: programme exposure only
Model B: model A + individual level co-variates
Model C: model B + household level co-variates
Model D: model C + municipality level co-variates

The particular co-variates included in each analysis vary depending on the outcome of interest; specific details are given chapter by chapter. For each analysis, a table showing the distribution of baseline co-variates by exposure group is provided.

Determination of exposure

As described in the preceding chapter, estimation of the effect of exposure to *Familias* is complicated by two issues: first, the non-randomised nature of the evaluation; second, the fact that *Familias* started in some municipalities before baseline data-collection ('TBB municipalities'). As a result, some time must be spent explaining how variables representing programme exposure were created and handled.

Analysis of observational data most commonly deals with the first issue, non-randomisation, by building multi-variate models that take account of baseline differences in co-variates between exposure groups. If the outcome of interest is also thought to differ between exposure groups at baseline, then this is included as an additional right-hand side regressor.

This approach, henceforth referred to as 'ordinary' regression, may be represented in the case of *Familias* as follows:

$$Y_{i,\,T1} = \beta_0 + \beta_1 Y_{i,\,T0} + \beta_2 Mun_i + \beta_3 X_i + \varepsilon_i \qquad [1]$$

where

$Y_{i,\,T1}$	=	outcome of interest for individual *i* at follow-up
$Y_{i,\,T0}$	=	outcome of interest for individual *i* at baseline
Mun_i	=	1 if an intervention municipality, 0 if not
X_i	=	all (observed) co-variates
ε_i	=	error term

The co-efficient β_2 on Mun_i is read as the estimate of the effect of the programme on the outcome of interest at follow-up, adjusted for baseline differences in the outcome of interest and/or co-variates. An important assumption of this method is that all determinant baseline differences not observed in X_i will be captured in $Y_{i,\,T1}$ to yield an unbiased estimate of β_2. Furthermore, it is assumed that the coefficient β_2 is synonymous with the effect of treatment, that is, the coefficient is entirely explained by exposure / non-exposure to the programme.

In the case of *Familias,* it is known that this is not the case - there are differences between municipalities beyond exposure/non-exposure to *Familias* (recall that control municipalities differed from treatment municipalities in lacking sufficient infrastructure to deliver the programme or through being larger than 100,000 inhabitants). In this case, the assumption that β_2 is synonymous with the effect of the programme must be relaxed. Instead of [1], a regression model that identifies the effect of the programme independent of municipality-level differences is sought. This is achievable through the 'double-difference' specification[1], explained next.

The first step in this approach is to recognise that, in ordinary regression, specification [1], the constituent data is arranged as follows:

[1] The seminal treatment of this technique is given in Meyer, Bruce, "Natural and Quasi-Natural Experiments in Economics," Journal of Business and Economic Statistics, v. 13 (1995): 151-162. A thorough-going appraisal of its limitations, as discussed later in this Chapter, can be found in Bertrand, M.; Duflo, E.; Mullainathan, S. "How Much Should We Trust Differences-in-Differences Estimates?" The Quarterly Journal of Economics, v. 119, n. 1, p. 249-275, February 2004.

i (id)	**$Y_{i, T0}$** (outcome at baseline)	**$Y_{i, T1}$** (outcome at follow-up)	**Mun_i** (0=control, 1=intervention)	**X_i** (co-variates)
1	C_0	C_1	0	X_1
2	I_0	I_1	1	X_2

Data in this format is commonly referred to as being 'wide'.

The same information, without any loss or addition of data, can be re-arranged thus:

i (id)	**Y_i** (outcome)	**Time** (0=baseline, 1=follow-up)	**Mun_i** (0=control, 1=intervention)	**$Intervention_{i,T}$** (0=not operating; 1=operating)	**X_i** (co-variates)
1	C_0	0	0	0	X_1
1	C_1	1	0	0	X_1
2	I_0	0	1	0	X_2
2	I_1	1	1	1	X_2

Data in this format is commonly referred to as being 'long'.

Data in long format allows separate coefficients to be identified for time, municipality and intervention as shown in the following regression model:

$$Y_i = \beta_0 + \beta_1 Time + \beta_2 Mun_i + \beta_3 Intervention_{i,T} + \beta_4 X_i + \varepsilon \qquad [2]$$

Here, the co-efficient of interest is β_3 - the effect of the intervention when operating. Of note, β_3 in [2] should be of a similar value to β_2 in [1], although by being independent of area and time, it should be more precise – that is, its standard error should be smaller.

An alternative way of visualising this specification plots the various outcomes graphically:

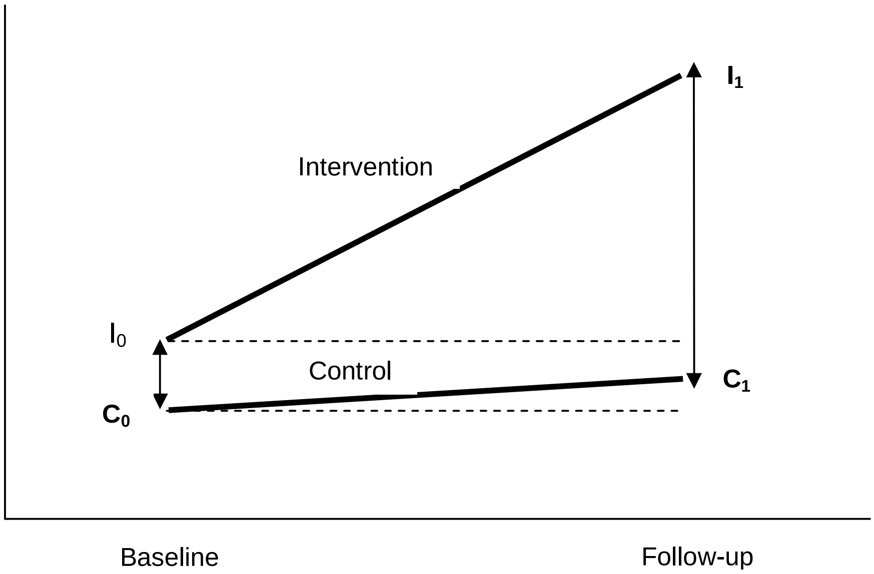


Figure 9.1: graphical representation of the double-difference specification

The graphical arrangement of data in Figure 9.1 makes clear how the term 'double-difference' comes to be applied to this regression model. First, the model allows for the outcome of interest to differ between intervention and control areas at baseline. Second, the model allows for the outcome to change over time in control areas (that is, a secular trend). Baseline differences in the outcome (I_0 - C_0), are subtracted from the difference after the programme has been implemented (I_1 - C_1). This identifies the net effect of the programme independent of any baseline difference and secular trend, as shown in the table below:

	Control	Intervention	**Difference across groups**
Baseline	C_0	I_0	I_0 - C_0
Follow-up	C_1	I_1	I_1 - C_1
Difference over time	$C_1 – C_0$	$I_1 – I_0$	**Double-difference** **(I_1 - C_1) – (I_0 - C_0)**

This graphical representation can be related to the specification in [2] as follows: ignoring the co-variates and error term for simplicity,

- the difference I_1 - C_1 is captured by $(\beta_0+\beta_1+\beta_2+\beta_3) – (\beta_0+\beta_1)$ $\mathbf{= \beta_2+\beta_3}$**;**
- the difference I_0 - C_0 is captured by $(\beta_0+\beta_2) – (\beta_0)$ $\mathbf{= \beta_2}$**;**
- the double-difference is therefore captured by $(\beta_2+\beta_3) – (\beta_2)$ $\mathbf{= \beta_3}$**,**

Hence it can be seen that $\boldsymbol{\beta_3}$ is the co-efficient associated with operation of the programme as explained earlier.

Creating a dummy variable that equals 1 when *Familias* is operating, independent of time or municipality, gives the double-difference specification a robust means with which to handle TBB areas. This is shown in the data set below (with I_0 / I_1 replaced by 'TAB' and 'TBB' as occurred in *Familias):*

i (id)	**Y** (outcome)	**Time** (0=baseline, 1=follow-up)	**Area** $_i$ (0=control, 1=TAB; 2=TBB)	**Intervention** (0=not operating; 1=operating)	**X** $_i$ (co-variates)
1	C_0	0	0	0	X_1
1	C_1	1	0	0	X_1
2	TAB_0	0	1	0	X_2
2	TAB_1	1	1	1	X_2
3	TBB_1	0	2	1	X_3
3	TBB_1	1	2	1	X_3

The same approach can be used to handle data from different time points, by creating additional levels of the time variable. The effect of the intervention can still be read off independently of time and area, or can be estimated at different time points by using the time variable to filter the data entering the model. This is shown in the data set below:

i (id)	**Y** (outcome)	**Time** (0=baseline, 1=1st f/u; 2=2nd f/u)	**Area** $_i$ (0=control, 1=TAB; 2=TBB)	**Intervention** (0=not operating; 1=operating)	**X** $_i$ (co-variates)
1	C_0	0	0	0	X_1
1	C_1	1	0	0	X_1
1	C_2	2	0	0	X_1
2	TAB_0	0	1	0	X_2
2	TAB_1	1	1	1	X_2
2	TAB_2	2	1	1	X_2
3	TBB_1	0	2	1	X_3
3	TBB_1	1	2	1	X_3
3	TBB_2	2	2	1	X_3

Hence, the double-difference method has the advantage of obtaining a relatively precise estimate of programme effect whilst offering a flexible means of dealing with data from several time points and the problem of TBB communities.

The main assumptions with the method are two-fold: first, that any secular trend is not substantially different between exposed and unexposed communities; second, that co-variate values do not change over time. This is important because only baseline values are entered into the model; they are regressed against outcomes for baseline as well as every other time point.

Regarding the first assumption, prior work by the IFS shows that the ‘common trends’ assumption holds[96]. This was verified by examining historical data on the trends of key co-variates immediately prior to inception of *Familias.* Regarding the second assumption, all co-variates selected in subsequent analyses have been chosen, as far as possible, to be fixed. In some cases this was not possible, but the co-variate seemed essential to include (e.g. sibling number, in the analyses on child overweight and obesity). In other cases, the co-variate was not constant, but would have changed equally over all participants, thus netting out any bias (e.g. participant age).

Estimation of programme effect

The impact of *Familias* was assessed in the same way for each outcome, by applying the statistical models described above in a regular sequence as follows:

a) ordinary regression with TBB areas dropped;
b) double-difference regression with TBB areas dropped;
c) double-difference regression with TBB areas included;
d) exploration of interaction effects between programme exposure and markers of health inequity.

Other than outcome variable, the only differences between analyses were choice of co-variates, as discussed above, and choice of regression model. This depended on the nature of the outcome variable: *linear regression* was used for continuously distributed outcomes, *logistic regression* for dichotomous outcomes and *ordered logit regression* for polychotomous and logically ordered outcomes.

The utility of each statistical model is discussed in turn.

a) Ordinary regression with TBB areas dropped

Although not the preferred statistical model, examination of output from ordinary regression is critical. In particular, it is necessary to verify that the distribution of residuals (error terms) is random, since non-random distribution implies mis-specification of the model. Plots showing the distribution of residuals for each analysis are provided where appropriate.

Ordinary regression also offers other opportunities to assess mis-specification, including various goodness-of-fit tests and tests to exclude significant co-linearity between co-variates.

In linear regression, the *F-statistic* tests whether the model predicts the outcome better than the empty (intercept-only) model. The R^2 *value* estimates the proportion of the variability in outcome that is explained by the model. The likelihood ratio test (*LR test*) compares the predictive power of two nested models, with and without a key variable of interest (for example, exposure to *Familias*). Results from each of these are discussed where appropriate in the analyses which follow.

Collinearity refers to a high degree of correlation between two right-hand side variables in a model. If present, it can lead to inappropriately large standard errors of the affected variables, although will not bias the point estimates themselves. Collinearity can by assessed by estimating the *variance inflation factor (VIF)* for each variable in the model. This is equal to $(tolerance)^{-1}$ for a particular variable, where *tolerance* is simply 1 minus the R^2 that results from the regression of the other variables on that variable. Where collinearity is present, tolerance is low and the VIF becomes large. In general, a VIF less than 10 is acceptable. VIFs are discussed as appropriate in the analyses which follow.

In logistic regression, the *Wald* χ^2 statistic performs a similar function to the F-statistic in linear regression, by comparing the predictive power of the specified model with an empty (intercept-only) model. Various pseudo-R^2 values can also be estimated. Additional information is yielded by the *link test*; this uses the linear predicted value (*hat*) and its square to rebuild the model. The variable *hat* should be a statistically significant predictor, since it derives from the model (this will be the case unless the model is completely mis-specified); *hat-squared*, however, should not have any predictive power except by chance. A statistically significant *hat-squared* suggests mis-specification, such as omission of relevant variables or an incorrect link function. Again, results from each of these are discussed where appropriate in the analyses which follow.

Finally, ordinary regression is also useful in that it provides a preliminary estimate of programme effect. As discussed earlier, this is may be relatively imprecise compared to double-difference estimators (that is, with a larger standard error and wider confidence intervals) but the point-estimate yielded should be similar.

In summary, the output from ordinary regression was examined as a preliminary step to verify that the selected outcome variable, exposure variable and co-variates constitute a correctly specified model with reasonable explanatory power. If reassurance on these points is obtained, it is reasonable to restructure the data into a 'long' format and continue with double-difference estimations.

b) Double-difference regression with TBB areas dropped

A more precise estimate of programme effect than that offered by ordinary regression can be obtained from double-difference regressions, which also allow for greater flexibility in the model as explained earlier. In the first instance, TBB areas were dropped to simplify the model and keep it intuitively close to the ordinary regressions presented earlier. It is expected that the point estimates obtained from the two methods would be similar, with the double-difference method yielding smaller standard errors.

Vectors of co-variates at individual, household and municipality level were added in sequentially nested models (A-D) as described earlier. To account for the hierarchial nature of the data and the possibility of non-independence of observations, robust standard errors are estimated, clustered at municipality level (a coarser, more conservative choice than within-household or within-participant clustering).

For each analysis, a table showing the regression output (co-efficient, 95% confidence interval, p-value) for models A-D is provided.

c) Double-difference regression with TBB areas included

Information from TBB areas can be recovered by creating a dummy variable that reflects programme exposure, irrespective of time-point or municipality-type, as explained earlier.

It is not possible to predict in advance how inclusion of TBB areas will affect the estimate of programme effect. Inclusion might yield a smaller estimate if most or all of the programme's impact occurs quickly, before baseline data collection. In this case, the outcome variable would be similar at all time points, implying no effect of the programme. Rates of vaccine preventable illness following vaccination might be an example, since the participant would gain the full effect of the programme (switching from non-immune to immune) very quickly.

Alternatively, if the effect of the programme is sustained and cumulative, inclusion of TBB areas might yield a larger estimate of effect. This is because values of the outcome variable associated with programme operation will be higher than if pre-exposure had not occurred. Participant weight following regular cash transfers might be an example, since the additional calorie consumption that may result from additional income is likely to be sustained and cumulative.

Nevertheless, analyses with TBB areas recovered are performed, to fully explore the data-set. Furthermore, that the point estimates obtained with and without TBB areas are likely to be broadly similar, since pre-exposure was limited to around six months.

As previously, vectors of co-variates are added in sequentially and robust standard errors are estimated. For each analysis, a table showing the regression output (co-efficient, 95% confidence interval, p-value) for models A-D is provided.

d) Interaction effects with markers of health inequity

Finally, given the particular interest in this thesis on the impact of CCTS on health equity, the possibility of differential programme impacts was explored by examining interaction terms between *Familias* and certain markers of socio-economic position. These included maternal literacy, level of education, household wealth and urban/rural location. As previously, a double-difference approach, in the fully adjusted model (model D) with robust standard errors, with and without TBB areas included) was used.

For each analysis, a table showing the co-efficient on these interaction terms (with 95% confidence interval and p-value) is provided.

Supplementary estimations

In each chapter, various supplementary estimations are undertaken which add further detail to findings from the principal analysis. For example, in the chapter on children's nutritional outcomes, the phenomenon of nutritional 'double-burden' (that is, co-existence of under- and over-nutrition in the same individual or household) is explored, and in the chapter on maternal knowledge, the relationship between mothers' knowledge score and the frequency and severity of diarrhoeal illness in the sub-set of children who were ill with diarrhoea immediately prior to the survey visit was explored.

Discussion

In summary, the statistical approach chosen builds analyses in a logical and consistent manner; starting with the simple observation of crude outcomes in exposed and unexposed areas, at baseline and follow-up, in a 2x2 table before building to double-difference analyses of multivariate models. Conservative estimates were sought, by using an intention-to-treat analyses and employing robust standard errors, clustered coarsely at municipality-level. The approach aims to be rigorous, limiting censoring and exclusion criteria except on *a priori* biological grounds and verifying model specification before proceeding to more complex analyses.

It should be noted that a variety of other statistical techniques have been used in evaluation of *Familias,* such as propensity score matching and instrumental variables analysis. Each has particular advantages, limitations and necessary assumptions. The double-difference model was chosen because it offers flexibility whilst remaining intuitively close to the data and not requiring many assumptions. The assumptions have been checked as plausible in this data set.

Nevertheless, this nor any statistical approach cannot fully correct for the non-randomised nature of the data and caution will be necessary in any inferences drawn. Additionally, it is impossible to control for any bias introduced due to the non-blinded nature of the evaluation.

Note: all analyses were run using Stata-11 (Special Edition). In all tables of results, the following convention is used to highlight significant associations:

*	Significant at the 5% level
**	Significant at the 1% level
***	Significant at the 0.1% level

PART IV

NEW RESULTS FROM FAMILIAS EN ACCION

Chapter 10: Nutritional Outcomes in Women

Relationship between this chapter and broader thesis

The central concern of thesis is to explore the health impacts of CCTS, using the conceptual model of co-production as a means to improve health and health equity. Co-production calls for simultaneous investment in individuals' human capital and material resources whilst addressing inequities in the social and structural determinants of health. It is a particularly apt model with which to examine the impact of CCTS, since these schemes offer simultaneous investment in the human capital and material resources of poor households.

Two reasons for exploring the association between CCTS and adult nutritional outcomes are apparent. First, abnormal adult nutritional status is universally recognised as a cause of disadvantage, whether under- or over-weight. Furthermore, there is evidence that the burden of overweight is increasingly affecting disadvantaged groups and may worsen health inequity (the evidence for both these assertions is set out in a later section). Thus abnormal nutritional status is an interesting outcome to examine in its own right.

Second, the drivers of abnormal nutritional status are highly complex. Multiple, densely interrelated levers operate across several levels from the deeply social to highly individual. An indication of this complexity is given in Figure 10.1 below which attempts to map the drivers of obesity; the detail is not important, just the visible complexity.

CCTS seek to address disadvantage through action on a limited set of these levers, exclusively found at the individual and household level. The impact of CCTS on nutritional status may therefore shed some light on the question of the relative importance of action on individual and social level determinants in overcoming disadvantage.

Figure 10.1: Foresight's systems map of the causes of individual obesity[156]

The adult nutritional outcomes that will be studied in this chapter are the body mass index and prevalence of overweight and obesity in women participating in the *Familias* evaluation. The specific hypothesis to be tested is that **participation in *Familias* is associated with increased body mass index in women**. The context and reasoning leading to this hypothesis is set out next.

The epidemiology of adult nutritional status globally and in Colombia

Adult adiposity (that is, fatness) and distribution of adiposity can be measured using several techniques, including waist-hip ratio, skin fold thickness or bioimpedance. Body mass index (BMI) is another such measure and has been shown to be well correlated with direct measures of adiposity and associated clinical outcomes[157]. BMI is calculated and categorised as follows:

BMI = weight / (height)^2	Underweight:	BMI <18.5 kg/m^2
	Ideal:	BMI 20 to <25 kg/m^2
	Overweight:	BMI 25 to <30 kg/m^2
	Obese:	BMI ≥30 kg/m^2

The ease with which BMI can be calculated makes it the most widely used measure of adiposity both clinically and in large population surveys.

The marked increase global BMI during recent decades is a well-recognised public health phenomenon. The most recent international data report that BMI has increased by 0.4kg/m^2 per decade for men and 0.5kg/m^2 for women, worldwide since 1980. In 2008, one in three adults was overweight and one in nine obese[158]. Another collation of national survey data predicted that global prevalence of overweight would be 38% by 2030 and obesity prevalence 20%, if recent secular trends were to continue[159]. The issue, at times referred to as an 'obesity epidemic' has become a public health priority worldwide, as signalled by the adoption of the Global Strategy on Diet, Physical Activity, and Health at the World Health Assembly in 2004.

Several reasons underlie the epidemic, principally a decrease in individuals' energy expenditure that results from modern environments purposefully designed to reduce exertion, falling food prices and a change in diet towards highly refined and energy dense foods[160]. Improved life expectancy may also play a role. The Baltimore ageing study showed that 75 year old men expend 1200 kcal less energy per day compared to 25 year olds. Unless dietary intake is commensurately reduced, increasing BMI is unavoidable[157]. Finally, the 'thrifty gene' hypothesis suggests that a genotype that was historically advantageous in man's earliest history is now 'compromised' by an environment relatively unaffected by food scarcity, and predisposes to adverse weight gain[161].

The phenomenon within developing countries is particularly marked. Although overweight and obesity is more common in established market economies than in developing countries (35.2 vs. 19.6% for overweight and 20.3 vs. 6.7% for obesity[159]; more detailed figures for Colombia are given later), there is a larger absolute number of individuals affected in developing countries and trends are expected to increase most rapidly in these regions of the world (with expected increases of over 200% in some cases)[159]. By 2025, it is estimated that three quarters of the obese population worldwide will be in non-industrialized countries[162]. Although the same factors of population ageing, increased calorie intake and decreased energy expenditure are at play, additional factors exacerbate the problem in this setting[163]. The first has been termed the 'nutrition transition' and refers to changes in eating habits secondary to shifts in the economic and social environment. Cheaper vegetable oil and fat prices mean that individuals in developing countries now eat much higher levels of fat and sugar (the so-called 'Western diet')[164 165] and the classic relationship between incomes and fat intake has now become uncoupled[166]. Second, 'food insecurity', that is where individuals define themselves as not having enough to eat, has been reported to lead to behaviours and/or altered metabolism that are –paradoxically- linked to increasing obesity[167]. Third, population growth will lead to higher absolute numbers of affected individuals in these regions.

Additionally, the association between short stature in adults (resulting from childhood malnutrition and stunting) and adult obesity has recently received attention. In one study from Brazil, the co-existence of adult short stature (those individuals in the lowest quartile of height distribution) and *over*weight or obesity was more prevalent than the co-existence of adult short stature and *under*weight at 30% and 16% respectively, despite the fact that adults in this very poor region were consuming only 66% of the recommended daily calorie intake adjusted for height[168]. The reasons underlying the association between adult short stature and obesity, particularly prominent in females, remain unclear. The 'thrifty phenotype' hypothesis, also referred to as the Barker hypothesis, is likely to play a role. This suggests that nutritional deprivation occurs at an early age, especially in the prenatal stage and/or during the first three years of life, leads the individual to undergo metabolic adaptations that result in greater susceptibility to obesity in adult life[169].

The persistent problem of adult under-nutrition (BMI <18.5 kg/m^2) should not be over-looked. Women are known to be disproportionately affected, owing to their high nutritional requirements for pregnancy and lactation, gender inequalities in poverty and gender discrimination in food allocation. Rates of adult female under-nutrition up to 40% have been reported in some populations[170].

The burden of disease associated with abnormal BMI

Obesity has recently been shown to decrease life expectancy by 7 years at the age of 40 years[157]. The risks of several major causes of mortality, such as diabetes, hypertension and dyslipidaemia all increase from a BMI of 21kg/m^2 such that, globally, 44% of diabetes burden and 23% of ischaemic heart disease burden are attributable to overweight and obesity. Overweight and obesity are also associated with 7–41% of certain cancers, particularly breast, colon and prostate and with osteoarthritis, a major cause of disability. In total, overweight and obesity is thought to be directly responsible for 5% of global deaths. Furthermore, other common causes such as high blood pressure (13%), high blood glucose (6%) and physical inactivity (6%) are significantly determined by excessive BMI[171].

The psychological and social consequences of obesity are also significant. In some settings, obese individuals have been shown to be less acceptable marriage partners, be offered fewer job promotions and earn less[172]. In the US, obese women are 37% more likely to be diagnosed with major depression[157].

Excess mortality is also associated being underweight. Several population surveys find statistically significant relative mortality risks of 2-3 for adults with BMI <18.5 kg/m^2 compared to adults with BMI 18.5 to <25 kg/m^2, which persist after adjusting for age, smoking and longstanding illness[173-175]. The reasons for this are unclear, but may relate to undiagnosed, sub-clinical illness.

Socioeconomic differentials

At all ages and throughout the world, women are generally found to have a higher mean BMI and higher rates of obesity than men, for biological reasons[157].

The association between socio-economic position (SEP) and overweight and obesity is complex. Until the late 1980's, obesity was linked with low SEP in high income countries and with high SEP in low income countries. In other words, obesity played no part in worse health outcomes associated with lower SEP in developing countries. This picture has now changed. Data from 1992-2000 across 37 countries indicates that whilst lower SEP still confers strong protection against obesity in the poorest societies (GNP less than US$745 per capita), low SEP has become *positively* associated with obesity in upper-middle income developing economies, starting at a GNP of about US$2500 per capita[164 176].

Several reasons for this shift in obesity toward those of lower SEP groups are possible. First, it is likely that at a certain level of national wealth lack of food (or high energy expenditure) becomes uncommon, even among poorer sections of the community. Second, individuals of lower SEP have been found to have lower levels of health-related knowledge[177]. They are also likely to experience greater difficulty in accessing low energy-density foods (which are often more expensive), less leisure-time, and fewer opportunities for recreational exercise. Given that they are less able to exercise choice, they can find themselves more at the mercy of the obesogenic environment[176]. Finally, the association between short stature and adult obesity described earlier can accelerate the shift of obesity toward disadvantaged groups.

Colombia

A collation of community and national surveys between 1986 and 2007[158] shows a rising BMI trend in both men and women:

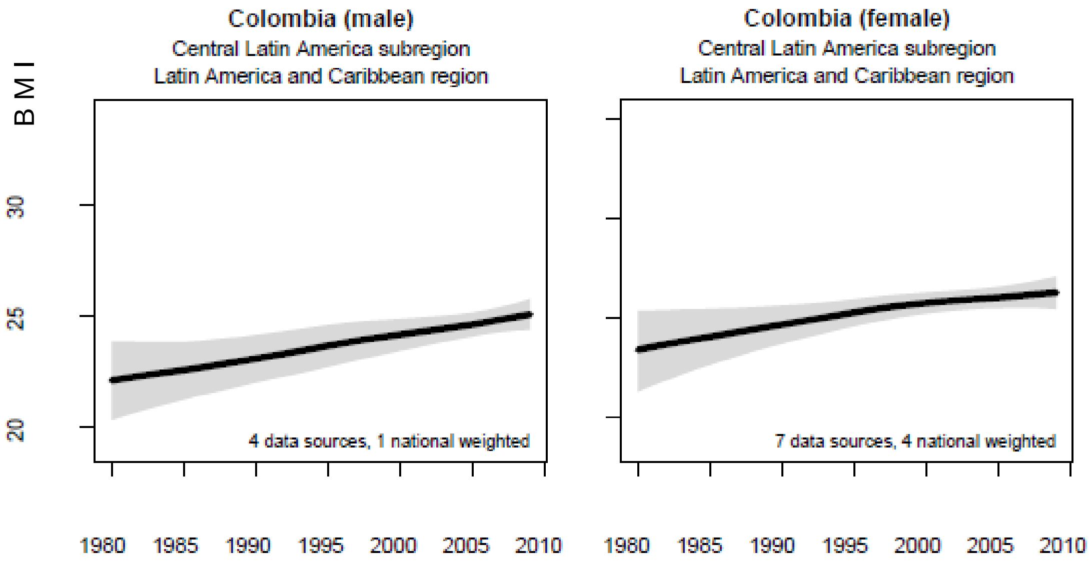


Figure 10.2: trends in adult BMI in Colombia, 1980 to date

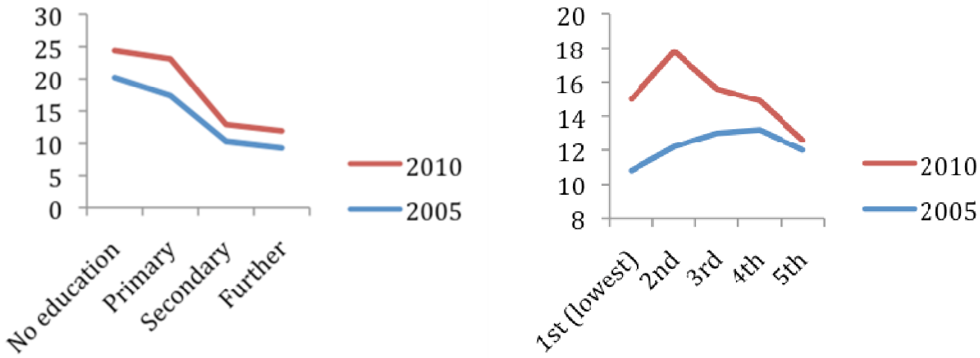
The most recent national data come from the 2010 Demographic and Health Survey (DHS)[178]. This nationwide sample included 43,723 Colombian women aged 15 to 49, 31.1% of whom were overweight and 15.2% obese, falling between the rates described earlier in established market economies and developing countries.

Socio-economic differentials in rates of overweight and obesity in the DHS sample are shown in the table below. Patterns are more clearly evident for obesity than for overweight, obesity being markedly more common in women with no formal education and apparently more common in less wealthy and in rural women.

	Overweight (%)	Obesity (%)
Educational Level		
Incomplete primary education	33.4	24.4
Complete primary education	37.0	23.1
Complete secondary education	28.8	12.9
Further education	30.1	11.0
Wealth Quintile		
1 (least wealthy)	28.9	15.0
2	31.0	17.8
3	30.3	15.6
4	31.2	14.9
5	33.7	12.6
Zone		
Urban	31.0	14.9
Rural	31.3	16.3

Table 10.1: Socioeconomic differences in prevalence of overweight and obesity in women aged 15-49, Colombia 2010[178].

Comparison of 2005 and 2010 obesity rates by socioeconomic position in these women is shown in Figures 10.3 and 10.4 below. Of particular interest is the large increase in obesity prevalence observed in women of the lowest wealth quintile between 2005 and 2010, compared to a small increase in the wealthiest women. This may be an early sign of the reversal of the socioeconomic gradient as discussed earlier.



level of education wealth quintile

Figures 10.3 and 10.4: obesity prevalence in Colombian women aged 15-49, by socioeconomic position

In the 2010 survey, 4.8% of women of childbearing age had a BMI <18.5kg/m^2, most commonly at lowest levels of wealth. 3.5% were of short stature, defined as less than 1.45m. Short stature was more common amongst older women, those without formal education (11.5%), at lowest levels of wealth and living rurally. Stature is likely to be driven by genetic background to some extent, and was noted to be tallest in Afro-Colombian women and shortest in indigenous Amerindian women.

The clinical burden associated with adult overweight and obesity is disproportionately high in Latin America, as shown in the graph below, such that obesity is the second most important risk factor for mortality and disease in most parts of the continent[179]. This may relate to a racial tendency toward abdominal obesity, which is known to be associated with excess cardiovascular risk, compared to other distributions of excess adiposity[157].

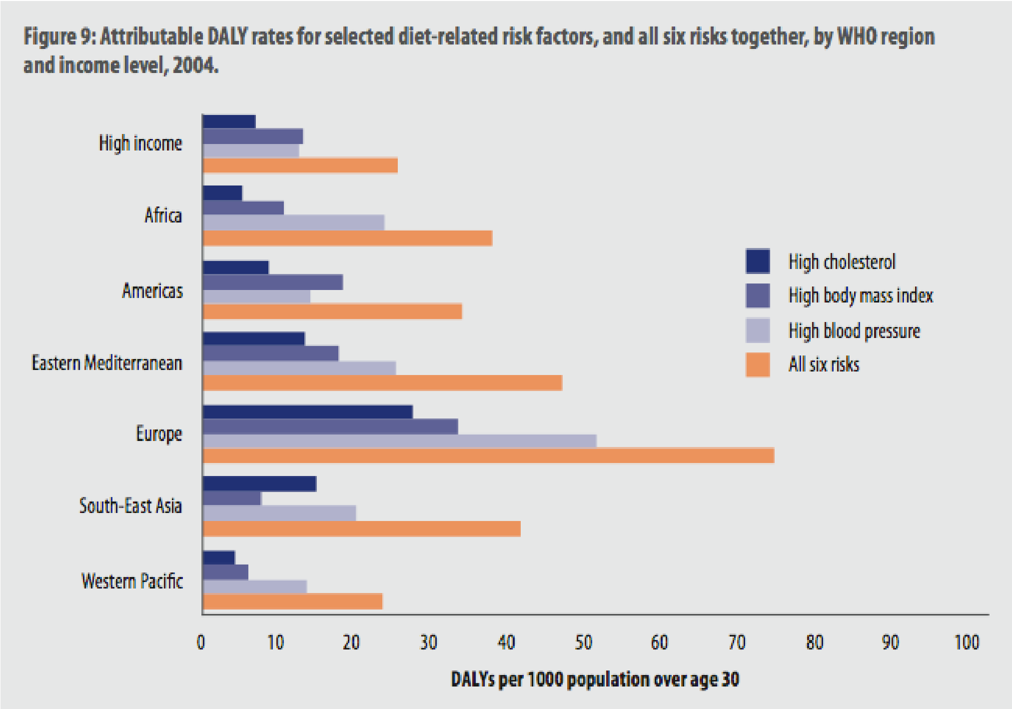


Figure 10.5: the burden of disease caused by high BMI and associated risks[171]

In summary, obesity is one of the most important public health problems of current times. Women are affected more often, particularly women of low SEP and of short stature. Furthermore, the associated clinical burden is greater in Latin American women, indicating the likelihood with which obesity may widen health inequalities, whether within countries or globally. Together, these reasons make a compelling rationale for exploring the impact of *Familias* on adult female overweight and obesity, hitherto unexamined outcomes.

Adult nutritional outcomes and CCTS

CCTS target cash transfers to women living in the most socio-economically deprived households, that is, households where rates of under-nutrition are highest and which are simultaneously most vulnerable to the obesity epidemic described earlier.

In particular, *Familias* offers beneficiaries a ‘nutrition transfer’ worth 40,000 pesos (around US$15) per month if they have children aged 0 to 5 and additional payments of 14,000 pesos (around US$5.5) for each child regularly attending primary school and of 28,000 pesos (around US$11) for each child regularly attending secondary school.

Work already published by IFS[103] examines the impact of the programme on household spending. Using retrospective questions referring to spending in the previous week, the evaluation finds that food accounts for a large fraction of total spending, particularly in rural areas (74% total household spend). At baseline, in terms of value, the largest share of food spending comprised meat, chicken, fish, milk and eggs and other foods classed as ‘proteins’.

Operation of *Familias* was associated with a 15% increase in total household spending (19.5% rurally, 9.3% urban), with food spending commensurately increased. These figures are comparable to those reported from other CCTS, which range from 11 to 19%. Table 10.2 details the significant increases household spend on proteins, cereals, fats and oils observed in association with the programme, with no change in the spend on sugar and sweets.

	Baseline spend in previous week (pesos)	Total food share (%)	Households reporting zero consumption (%)	Increase in spend associated with *Familias* (pesos)	
				urban	rural
Proteins (meat, chicken, milk etc)	111,201	37.7	1.1	21,831**	21,717**
Cereals (mainly rice)	52,717	18.5	3.1	5,009*	9,095**
Fruit and vegetables	32,203	10.9	3.4	1,399	4,249
Potatoes, yucca and other tubers	26,401	9.5	6.5	2,939	4,133
Sugar and sweets	23,093	8.3	6.3	1,235	647
Fats and oils	12,810	4.6	11.5	1,888*	3,139*
Pulses	9,324	3.2	28.0	314	2,008

Table 10.2: The impact of Familias on food consumption (*p<0.05; **p<0.01)[103]

Although this, at first sight, appears to be a beneficial and desired outcome, the question arises whether increases in household spend may lead to over-nutrition. The issue has not been examined in the context of any CCTS, with one exception. Fernald et al[84] attempt to isolate the effect of cash in Mexico's *Progresa* CCTS by analysing the effect of the cumulative amount of cash transferred to households over six years. They find that, in adults aged 18-65, a doubling of cumulative cash transferred was associated with higher BMI ($\beta=0.83$, $p<0.0001$) and higher odds of being overweight or obese (odds ratios 1.41 to 1.57, $p<0.0001$ to 0.03), after adjustment for a wide range of covariates, including household composition at baseline.

There are, however, significant problems with interpreting this as an effect of *programme operation* because cumulative cash transferred depends on factors that need not be random but instead reflect individual behaviour[180]. For example, households with more children in school receive more cash. This could well reflect earlier choices made by households, relating to long term household circumstances and the educational attainment and child rearing skills of parents. There have as yet been no studies of the effect of *operation* of a CCTS on adult weight.

Methods

Chapters 8 and 9 described the setting, intervention, selection of participants and controls, survey methodology, use of the double-difference technique and the selection and statistical handing of co-variates at the individual, household and community level to estimate the effect size associated with the intervention. Additional detail will be presented here to the extent that it is relevant to the estimation of the effect of *Familias* on adult female weight.

Intervention

As described earlier, *Familias* offers participants a regular monthly cash transfer whose size is dependent on household composition. Prior work by the IFS has demonstrated that the average transfer is equivalent to about 20% of regular monthly household income.

Analytic Sample

The analytic sample is restricted to women aged 18 or older who were fully observed (with respect to outcome, explanatory variables and co-variates) at baseline. Pregnant women at either study phase were excluded from the analysis, as were breast-feeding women at baseline. Breast-feeding was not recorded in the follow-up survey.

Women underweight at baseline (BMI<18.5kg/m^2) were excluded from the main analysis and analysed separately.

Separate analyses were also undertaken for women of short stature. Although there is no clear consensus in the literature as to how adult short stature should be defined, the definition used in these analyses was that used in the 2005 Colombian DHS to define short stature in adult females, i.e. height below 145cm.

Outcome measures

A key hypothesis behind *Familias* was that the programme would reduce rates of child malnutrition. As part of the strategy to evaluate this impact, the heights and weights of all biological mothers of surveyed children was observed. It is this incidental data that are analysed in this chapter. Height and weight were recorded by 18 trained fieldworkers using a protocol based on the Pan-American Health Organisation Manual on Anthropometrics[214], with standardised measuring boards (Shorr Productions, Olney, Maryland USA) and electronic scales (Seca 770, Vogel & Halke, Hamburg, Germany).

Since some measurements appeared to have been mis-recorded (e.g. height <40cm or >190cm), observations were trimmed at the 1% and 99% centiles at each phase.

BMI was calculated for each woman using the formula given earlier. BMI was retained as a continuous variable; additionally, a number of dichotomous variables were created based on standard cut-offs:

Overweight :	$25 \leq$ BMI $<30\text{kg/m}^2$
Obese :	BMI $\geq 30\text{kg/m}^2$
Overweight or obese :	BMI $\geq 25\text{kg/m}^2$

Normality was checked visually, inspecting box-plots and probability-probability plot (P-P plot or percent plot) generated within Stata. The P-P plot compares an empirical cumulative distribution of a variable with a specific theoretical cumulative distribution (in this case, the standard normal distribution).

Confounding and mediating variables

Possible confounders or mediators of the hypothesized relationships at the individual, household and community levels were identified from the literature and verified with experts who had conducted previous studies of similar outcomes. Identification and statistical handling of co-variates was conducted as described in the Chapter 8.

For this study, an additional co-variate was included: at baseline, women were asked how many live births they had had in their lifetime. Women's response was included in analyses as a continuous variable at the individual level. This question (nor any similar question regarding parity) was not asked at either follow-up survey.

Statistical techniques

A double-difference methodology was employed, as earlier described, to account for unobserved differences at baseline and trends over time. Similarly, the issue of TAB / TBB households was handled by creating a dummy variable equal to 1 when the programme was operating and equal to 0 when not, as explained in earlier chapters.

BMI was treated as a continuously distributed outcome. Having verified a normal distribution, ordinary least squares regression used to estimate the impact of the programme. The impact on odds of overweight or obesity and odds of obesity were estimated using logistic regression.

In each case, a stepwise analytic approach was taken that first estimated the unadjusted effect of the programme before adding in vectors of individual, household and community level variables in sequentially nested models on identical samples. Robust standard errors are reported, clustered at municipality level.

Model A	Area, time, programme operation
Model B	**as Model A,** *plus addition of individual-level co-variates:* age education literacy travel time to medical centre reported community participation

number of live births

Model C	**as Model B,** *plus addition of household-level co-variates:* head-of-household education head-of-household literacy household size persons per room log household wealth presence of piped water to household urban location
Model D	**as Model C,** *plus addition of community-level co-variates:* log municipality population eligible families in municipality eligible families in urbanized municipality quality of life index ratio of doctors to population ratio of nurses to population average household weath average travel time to medical centre average presence of household piped water

Table 10.3 Explanatory variables included in sequentially nested models

Missing outcome observations were not replaced but deleted list-wise from the sample.

Given the thesis' emphasis on health equity, interactions between markers of social position (woman's age, literacy, level of completed education, household wealth and urban location) and programme operation were explored.

Differences in baseline co-variates by programme exposure, and in baseline co-variates between the analytic sample and women lost to follow-up, were explored using t-test (for differences in means for continuously distributed variables) or chi-squared test (for categorical variables).

Results

Descriptive statistics of baseline sample

3309 women fulfilled the inclusion criteria at baseline, 1271 from control communities, 1028 from TBB and 1010 from TAB communities. Mean age was 33.2 years (95% CI 32.9, 33.4) and mean BMI was 25.3kg/m^2 (95% CI 25.1, 25.5).

BMI was normally distributed in all exposure groups, as shown in Figure 10.6. (women with BMI<18kg/m^2 are censored, as explained earlier) There were no significant differences in baseline height, weight or BMI between women from different exposure groups.

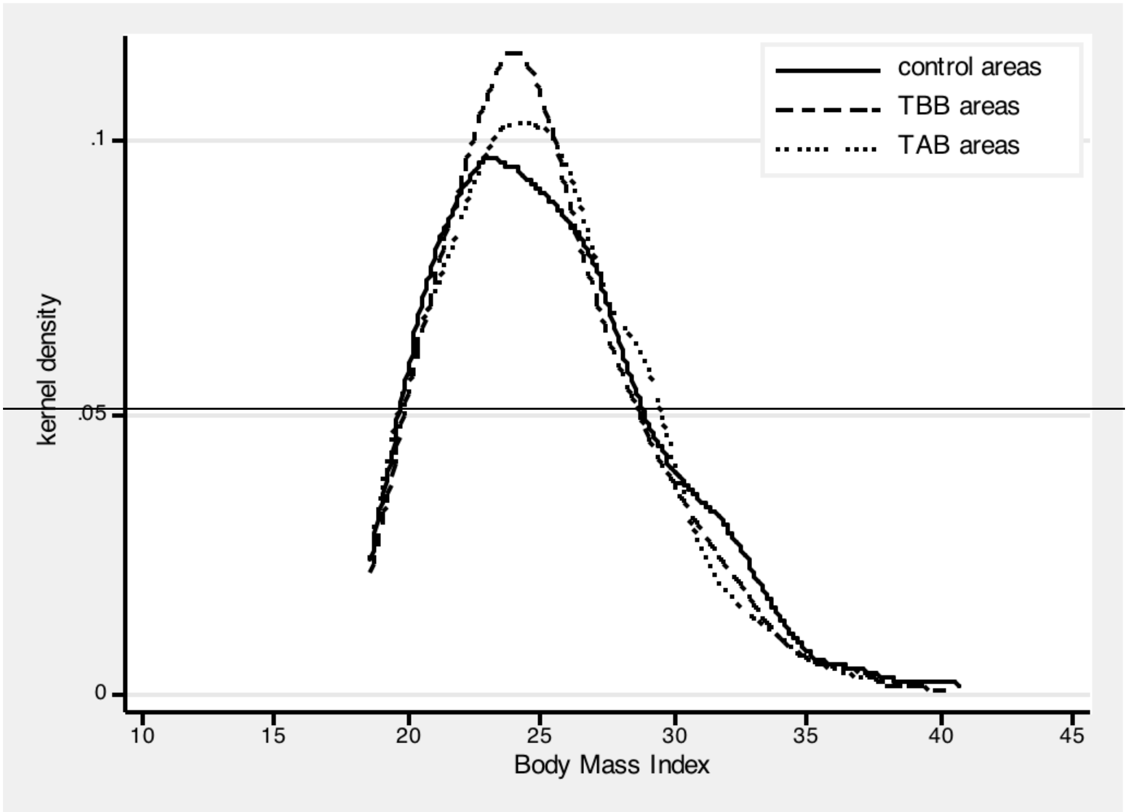


Figure 10.6: distribution of BMI in women meeting inclusion criteria at baseline

There were, however, several differences in baseline co-variates between women from different exposure groups, significant at the 0.01 level or less. These are shown in Table 10.12. Most differences occurred at household and municipality level, for example, TAB-women were slightly wealthier than control women (12.80 vs. 12.75 log pesos, p=0.05) and reported shorter travel times to medical centres (32.9 vs. 37.8 min, p=0.03) and a greater likelihood of household piped water (68.2% vs. 62.9%, p=0.03); TBB women were less likely to be urbanised (40.9% vs. 51.4%, p<0.001) and reported less crowded households (3.0 vs. 3.2 persons per room, p=0.02) with a lower likelihood of piped water (53.4% vs. 62.9%, p<0.001).

Loss to follow-up

2289 (69.2% of baseline sample) women had repeat measurements taken and fulfilled inclusion criteria at follow-up, 902 from control communities, 723 from TBB and 668 from TAB communities (χ^2=6.63, p=0.03). A flow-diagram of participants is given in Figure 10.7.

	CONTROL	**TBB**	**TAB**
baseline sample	**1271**	**1028**	**1010**
	▼	▼	▼
lost to follow-up	-325	-268	-310
	▼	▼	▼
ineligible	-44	-37	-32
	▼	▼	▼
sample at phase 3	**902** (71.0%)	**723** (70.3%)	**668** (66.1%)
			χ^2=6.63, p=0.03

Figure 10.7: flow-diagram of participants

The characteristics of women lost to follow-up are given in Table 10.13. Compared to women who comprised the final analytic sample, these women were less literate (77.2% vs. 85.0%, t=-5.49, p<0.001) with lower formal educational attainment (χ^2=10.85, p=0.01), reported greater parity (5.1 vs. 4.6 live births, t=5.69, p<0.001), came from households with a less literate head of household (75.0% vs. 81.2%, t= -4.08, p<0.001) at a greater distance from medical services (43.3 vs. 36.1 minutes average travel time, t=4.10, p<0.001). They came from municipalities with a greater average travel time to medical services (39.6 vs. 36.8 minutes, t=3.66, p=0.003) and on average fewer households with piped water (60.9% vs 63.0%, t=-2.62, p=0.01). BMI at baseline did not differ between those lost to follow-up and those retained (25.2 vs 24.9 kg/m^2, t=1.10, p=0.27).

Preliminary analyses

BMI increased with time across all exposure groups as shown in Figure 10.8.

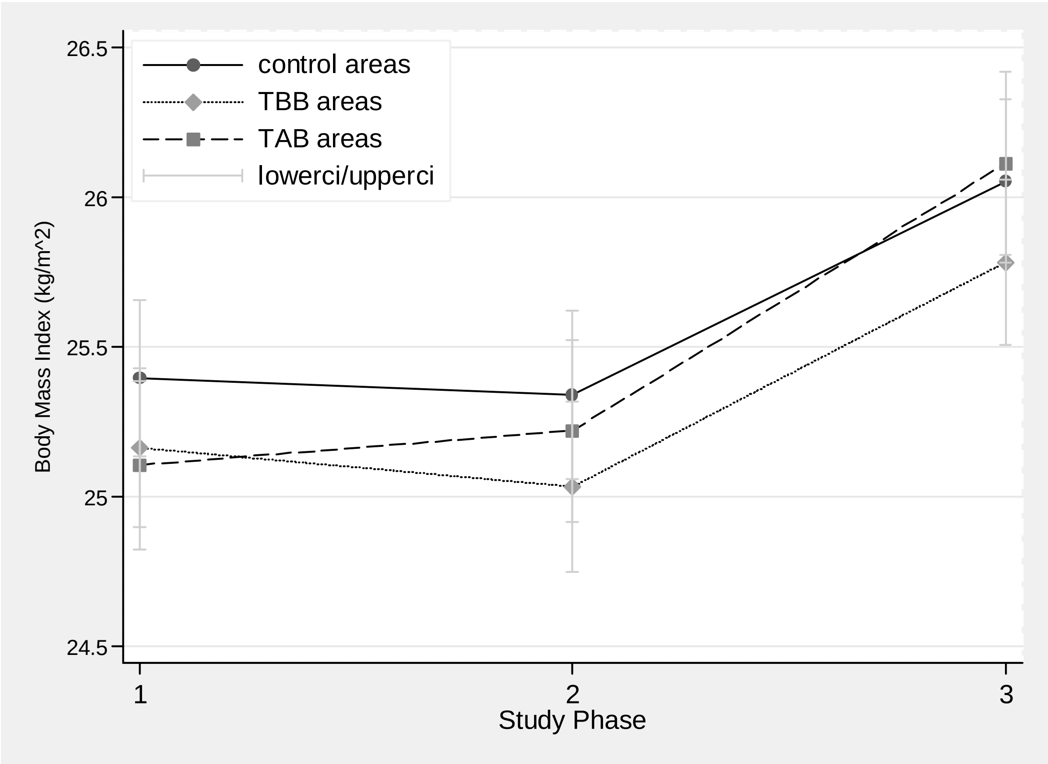


Figure 10.8: trends in women's BMI across study phases

Double-difference tables can be constructed to give a preliminary indication of the impact of the programme. The following tables show crude unadjusted outcomes for women from control and TAB areas, at baseline and second follow-up. For simplicity, women from TBB areas are not included (although are included in subsequent multivariate analyses). Direct observation of crude outcomes suggests that BMI and rates of overweight and obesity increased in all areas over time, but that BMI and rates of obesity increased more rapidly in treatment areas than in control areas (Tables 10.4 – 10.6).

	Control	Treatment	*Diff. across groups*
Baseline (phase 1)	25.40 (25.13, 25.66)	25.11 (24.83, 25.39)	-0.29
Follow-up (phase 3)	26.05 (25.78, 26.33)	26.11 (25.81, 26.42)	0.06
Difference over time	0.66	1.01	**0.35**

Table 10.4: crude mean BMI (95% CI, kg/m^2) and double-difference

	Control	Treatment	*Diff. across groups*
Baseline (phase 1)	34.8 (31.8, 37.8)	36.5 (32.9, 40.1)	1.65
Follow-up (phase 3)	38.2 (35.2, 41.3)	39.3 (35.6, 42.9)	1.03
Difference over time	3.4	2.8	**-0.6**

Table 10.5: crude prevalence (%) of overweight or obese (95% CI) and double-difference

	Control	Treatment	*Diff. across groups*
Baseline (phase 1)	14.4 (12.2, 16.6)	10.5 (8.2, 12.8)	-3.9
Follow-up (phase 3)	17.1 (14.8, 19.5)	17.1 (14.3, 19.9)	-0.0
Difference over time	2.7	6.6	**3.9**

Table 10.6: crude prevalence (%) of obesity (95% CI) and double-difference

As in previous analyses, estimation of the fully adjusted effect of *Familias* begins with ordinary multivariate regression, to verify adequate specification of the statistical model. A fully adjusted ordinary least squares linear regression of the effect of the programme on phase 3 BMI (having dropped TBB areas) yields the following diagnostic output:

F-statistic	447.38 ($p<0.0001$)
R^2	82.6%

Table 10.7: regression diagnostics from ordinary least squares linear regression

The highly significant p-value on the F-statistic indicates that the model predicts phase 3 BMI significantly better than then empty (intercept-only) model. This is confirmed by a very high R^2 >80%. Examination of residuals from this model demonstrates that they are normally distributed with zero mean, as expected (Figure 10.6).

Inspection of observations with a high residual did not reveal any obvious data entry errors, consequently no further observations were dropped from the model. Box-Tidewell regression did not suggest any non-linear relationships between predictors and the outcome of interest; furthermore, inspection of variance inflation factors did not demonstrate any co-linearity between the regressors. Finally, a likelihood ratio test comparing the fully-adjusted model with and without the dummy variable representing exposure to *Familias* found that the model performed significantly better with the dummy variable included (χ^2=4.64, p=0.03).

In summary, the model appears correctly specified and has strong predictive power. Reassurance on this point means that it is reasonable to restructure the data into a 'long' format and continue with double-difference estimations.

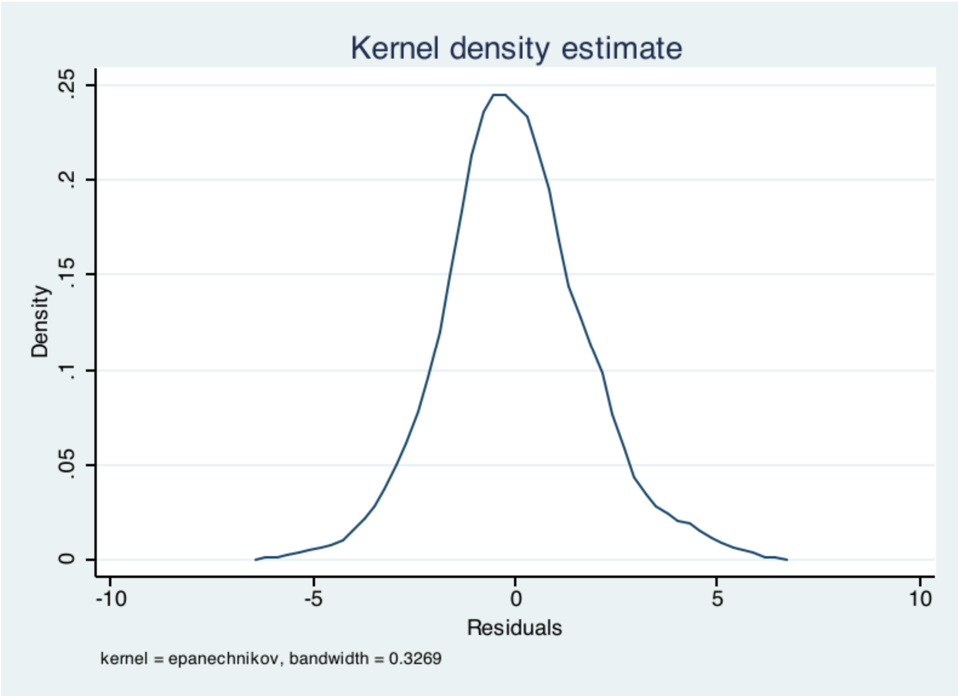


Figure 10.9: distribution of residuals from ordinary least squares regression of phase 3 BMI on phase 1 BMI, programme exposure and other co-variates.

Before proceeding with double-difference estimations, however, it is worth looking at the regression co-efficients yielded by ordinary regression. In the fully-adjusted ordinary least squares model (with TBB areas dropped), exposure to *Familias* was associated with an increased BMI, although the co-efficient falls just outside the 5% threshold for significance. Baseline BMI is strongly determinant, as shown in Table 10.8 below.

	Co-efficient		S.E.	p-value
Exposure to *Familias*	0.22		0.12	0.07
Baseline BMI	0.97	***	0.01	<0.001

Table 10.8: Determinants of BMI at phase 3 (ordinary linear regression, fully-adjusted model with TBB areas dropped)

Double-difference analyses

Table 10.14 shows estimates of the effect of the programme and other co-variates on BMI at phase 3, with TBB areas dropped. Consistent with preliminary analyses, the operation of the programme has a weak effect on BMI just outside the 0.05 significance level (β=0.25, 95% CI -0.02, 0.52, p=0.07 in Model A). Inclusion of TBB areas, however, finds a statistically significant association (β=0.31, 95% CI 0.07, 0.55, p=0.01 in Model A, as shown in Table 10.15). Increasing time was positively associated with BMI (β=0.76; 95%CI 0.61, 0.90; p<0.001) and living in a TBB area negatively associated (β=-0.64; 95%CI -1.14, -0.14; p=0.01).

Addition of co-variates did not attenuate the relationship between programme exposure and BMI. In Model D, women's age (β=0.07; 95%CI 0.04, 0.10; p<0.001) and household wealth (β=0.79; 95%CI 0.43, 1.14; p<0.001) were also strongly positively associated with BMI, and parity negatively associated (β=-0.12; 95%CI -0.22, -0.02; p=0.02).

Logistic regression with odds of overweight or obesity (BMI≥25) as the outcome variable did not demonstrate a statistically significant relationship with operation of *Familias* (O.R.=1.15; 95%CI 0.97,1.36; p=0.11, in model A, with TBB areas dropped; Table 10.16). Addition of co-variates demonstrated strong positive relationships with increasing time (O.R.=1.36; 95%CI 1.19, 1.51; p<0.001), age (O.R.=1.03; 95%CI 1.01, 1.04; p<0.01) and household wealth (O.R.=1.47; 95%CI 1.22, 1.77; p<0.001). Inclusion of TBB areas yielded very similar results (Table 10.17).

Logistic regression with odds of obesity (BMI≥30) as the outcome variable did, however, find a statistically significant relationship with operation of *Familias* (O.R.=1.41 95%CI 1.09, 1.82; p=0.01, in model A, with TBB areas dropped; Table 10.18). This relationship was robust to the addition of co-variates, and strong positive relationships were also seen with time (O.R.=1.27; 95%CI 1.11, 1.46; p<0.001) and age (O.R.=1.03; 95%CI 1.00, 1.05; p=0.02). Living in a TAB area was associated with lower odds of obesity (O.R.=0.60; 95%CI 0.43, 0.83; p<0.01). Inclusion of TBB areas yielded very similar results (Table 10.19).

Interactions

To explore the health equity impact of the programme, interactions between operation of *Familias* and certain markers of socio-economic position were explored for all three outcomes (BMI, odds of overweight or obesity and odds of obesity), with and without TBB areas. None were found to be significant.

For brevity, Table 10.9 below just shows interaction co-efficients for odds of obesity, with TBB areas dropped, in the fully adjusted model (Model D).

Interaction	Co-efficient	S.E.	p-value
Familias * woman's age	0.99	0.68	0.50
Familias * woman's literacy	0.95	0.37	0.91
Familias * woman's completed formal education	1.11	0.59	0.56
Familias * household wealth	1.26	0.94	0.35
Familias * urban location	0.78	0.92	0.36

Table 10.9: Interaction between operation of *Familias* and markers of socio-economic position on odds of obesity, TBB areas dropped

Supplementary analyses

1. Inclusion of BMI at phase 2 (first follow-up)

To explore the timeline underlying the association between programme exposure and BMI gain, all three outcomes (BMI, odds of overweight or obesity and odds of obesity) at phase 2 (just over a year after programme implementation) were included in the regressions. Dummy variables that reflected operation of the programme were created for models that contained just phase 1 and 2 data or phase 1, 2 and 3 data, with and without TBB areas (four specifications in total, each run with vectors of co-variates sequentially added as models A-D, with robust standard errors).

Operation of the programme was not found to be associated with phase 2 outcomes in any model, although woman's age and household wealth were found to be determinant in some models. For brevity, Table 10.10 below just shows co-efficients associated with programme exposure, age and household wealth, with TBB areas dropped, in the fully adjusted model (Model D).

	Co-efficient / Odds Ratio		S.E.	p-value
Linear regression on BMI				
Exposure to *Familias*	0.07		0.33	0.82
Age	0.07	***	0.02	<0.001
Household wealth	0.86	***	0.18	<0.001
Logistic regression on odds of overweight or obesity				
Exposure to *Familias*	1.08		0.16	0.58
Age	1.02	**	0.01	0.001
Household wealth	1.55	***	0.13	<0.001
Logistic regression on odds of obesity				
Exposure to *Familias*	1.19		0.27	0.44
Age	1.02		0.13	0.09
Household wealth	1.28		0.22	0.14

Table 10.10: Effect of programme and other co-variates on phase 2 outcomes

2. Inclusion of household food consumption at phase 3 (second follow-up)

To explore mechanisms underlying the association between programme exposure and BMI gain, household reported spending on food at second follow-up was added as a co-variate (in the fully-adjusted OLS regression of programme exposure on BMI, with TBB areas dropped).

Inclusion of this additional co-variate (shown as *food* in Table 10.11 below) attenuated the co-efficient on *Familias* by 23%; *food* itself was a significant predictor at the 5% level and improved the overall predictive power of the model as shown by a significant likelihood ratio test.

Model	**Co-efficient**		**S.E.**	**Attenuation of co-efficient**
Model D				
Programme exposure	0.215		0.12	-
Model D^{food}				
Programme exposure	0.165		0.12	23%
food	0.226	*	0.09	-
LR test comparing Model D^{food} nested in Model D: χ^2**=7.11, p=0.007**				

Table 10.11: effect of household reported spending on food at second follow-up as an additional co-variate.

3. Women underweight at baseline

89 women had BMI <18.5kg/m^2 at baseline. Operation of the programme was associated with a similarly sized, although non-significant, BMI increase in this group as in non-underweight women (β= 0.21; 95%CI -0.34, 0.77; p=0.78, in model A with TBB areas included). Increasing time and age were both significantly positively associated with BMI gain, consistent with findings in other women.

4. Women of short stature

127 women were of short-stature (height <145cm) at baseline. Operation of the programme was not associated with any change in BMI in this group (β=0.14; 95%CI -0.62, 0.91; p=0.71, in model A with TBB areas included). Increasing time was significantly positively associated with BMI gain, consistent with findings in women of greater stature.

No association between operation of the programme and odds of obesity or overweight was found in this sub-group.

Discussion

Main result

The study finds that participation in *Familias* is associated with a significant increase in adult female BMI, after controlling for several individual, household and community level co-variates and secular time trends. Increasing age and household wealth are also consistently positively associated in the full data-set (TBB areas included). The programme effect is evident a year after programme implementation.

Although the BMI increase associated with programme participation is small (with coefficients of around 0.2 to 0.3 kg/m^2 in fully adjusted models), it is nevertheless associated with significantly increased odds of obesity.

No programme effect is seen in women underweight or of low stature at baseline.

Interpretation

This effect is likely to have arisen because of increased calorie consumption in households exposed to *Familias.* Prior work by the IFS demonstrated, as already discussed, a 15% increase in households' spending on food as a result of the programme. A significant positive association with household wealth and attenuation of the co-efficient associated with *Familias* by household food-consumption support this possibility.

Attenuation is not complete, so other possibilities must also be sought, such as decreased energy expenditure. Data on activity patterns are more scarce compared to dietary trends, but Popkin describes rapid and profound changes toward more sedentary lifestyles in the Latin American region and elsewhere[165]. Moreover, a recent survey of Chilean adults revealed that only 8.8% performed 30 minutes of regular physical activity three times a week and that sedentary behaviour increased as formal education declined[181]. The income supplements offered by *Familias* may allow women to substitute leisure time for labour, including purchase of labour saving devices. Incomplete attenuation may also be explained by a non-linear relation between food consumption at the household level and at the level of the individual woman.

The roles of chance and confounding have been reduced as much as possible. Nevertheless, it is possible that the findings are confounded by alternative explanations. For example, it is known that *Familias* municipalities were slightly wealthier and had better infrastructure than control municipalities. One can envisage many mechanisms that would lead to a steeper upward BMI trend in these wealthier communities independent of the programme: expansion of motorised public transport, new cinemas or other forms of sedentary recreation, proliferation of fast-food outlets selling calorie-dense foods and so on. Bias is less likely to have occurred, since exposure and outcome were objectively determined using standardised instruments.

Lack of a programme effect in women underweight or of low stature is probably due to small sample size with insufficient power to detect a significant difference.

Relation to other studies

With the exception of the Fernald study discussed in this Chapter's introduction, there have been no other studies of the effect of a cash transfer programme on adult nutritional status. The Fernald study uses a similar follow-up time (approximately five years), but measures programme exposure as cumulative cash transferred rather than the dichotomous variable used in this analysis. Nevertheless, their estimate on BMI impact is similar in magnitude: a doubling of cumulative cash transfers was associated with higher BMI of 0.83kg/m^2 (95% CI 0.46, 1.20; p<0.0001) in their study population.

Strengths and weaknesses of the study

The study benefits from a prior hypothesis deriving from earlier findings within the same cohort (namely a positive association between participation in *Familias* and household consumption, including food consumption). The study's main result is plausible and consistent with this earlier finding. Additionally, the analysis benefits from a single hypothesis exploring essentially one outcome, thus avoiding the risk of false positive findings that may arise with multiple comparisons. Although several outcomes were defined in the course of the analysis (BMI, overweight, obesity, overweight or obesity), all are simple monotonic transformation of BMI.

The study is also strengthened by having repeated measurements on a large sample, with follow-up rates of just under 70%. Attrition was slightly greater in treatment communities. This is likely to bias findings in the same direction as the intention-to-treat analysis, i.e. toward a more conservative estimate of programme effect. Furthermore, attrition was greater in rural areas and may represent a phenomenon of rural displacement. This is known to be a feature of Colombian society, still struggling with internal conflict concentrated in rural zones. Given that urbanicity is not determinant of BMI in this sample, this is unlikely to have biased the results. Nevertheless, baseline BMI (the main determinant of the outcome of interest) was not significantly different between women lost to follow-up and those retained in the analytic sample, so attrition is unlikely to have biased the results.

The primary weakness, as in the preceding chapter, relates to the non-randomised nature of the evaluation. Several differences in baseline co-variates are apparent by exposure type. These are adjusted for in multi-variate analyses. Furthermore, the double-difference specification estimates separate coefficients for each area-type, which capture unobserved differences at this level. Nevertheless, the possibility of residual confounding remains which can lead to a falsely inflated estimate of programme effect.

An additional weakness relates to the absence of data on breastfeeding at follow-up. Inclusion of breastfeeding (in other words, recently pregnant) women would be expected to right-shift the distribution of BMI. Any effect on coefficient estimation, however, is unlikely to be important since the numbers of breastfeeding women are small and likely to be similar in treatment and control groups: at follow-up 2.0% women reported current pregnancy, roughly distributed evenly between exposure groups ($\chi 2=5.5$, $p=0.06$).

Policy implications

The prevention of nutrition-related chronic diseases (including over nutrition) is now a public health priority worldwide, as indicated by the World Health Assembly's adoption, in 2004, of the WHO Global Strategy on Diet, Physical Activity, and Health. The finding of an adverse outcome associated with an increasingly popular and widely replicated welfare initiative is therefore important.

Although the absolute increase in individual BMI associated with operation of the programme is small, health risks are known to increase from a BMI of 21kg/m^2. The clinical significance of even this small gain is underlined by demonstrating increased prevalence of adult female obesity associated with the programme. Related to this, the study provides a good illustration of a concept originally advanced by Rose in 1985, which specifies that small changes in clinical parameters at the individual level can translate to large public health impacts at the population level[182]. This is because even small shifts in a distribution curve will push large numbers of individuals across clinically important thresholds, as illustrated earlier in Table 10.6.

Such public health impacts are important from a health equity perspective. Obesity is already recognised, particularly among women, as a driver of already high health inequities generated by nutritional deficiencies, infectious diseases, and maternal and perinatal conditions[176]. It appears that targeted cash transfer programmes have the potential to exacerbate the problem. Clearly, this should not constitute an argument to keep poor households impoverished. Instead, policy makers and researchers need to pay closer attention to the complex determinants of obesity and disadvantage and attempt to ensure that discrete interventions to tackle one problem do not inadvertently worsen the other.

Although the drivers of obesity are relatively well described, prevention and reversal of obesity trends remains poorly understood and a major public health challenge. A recent systematic review of prevention strategies identified 24 studies covering 44 interventions and found that intensive counselling by both a doctor and dietician was the most cost-effective strategy with mass media campaigns as the least cost-effective[183]. It is already known that the "transitional" diets of poor communities are typically energy dense but micronutrient poor, particularly when supported by welfare programmes such as food subsidies or cash transfers[170].

The implication is that programmes such as *Familias* need to be accompanied by effective individual or household-level counselling on how to optimise the health benefits, and avoid the potential adverse effects, of greater material and food security. Changes in the physical, economic, and socio-cultural environment that make healthier choices concerning diet and physical activity behaviours feasible for all social classes are also necessary[176]. Given that a subsequent chapter in this thesis will show that *Familias* appears to be ineffective in transferring knowledge to women, despite high reported rates of seminar attendance, this is likely to represent a real challenge for policy makers.

It may be that incentives to avoid unhealthy weight gain could be incorporated into *Familias* and other CCTS. This might comprise additional conditions that require, for example, regular adult weighing and feedback, similar to the child-weighing conditions already in place. Further research would be necessary to measure the effectiveness and acceptability of such policy developments.

Relation to conceptual model in the wider thesis

This study demonstrates that cash transfers can be associated with higher rates of adult over-nutrition, an important driver of ill health and health inequity. This is an important association in its own right.

The study also sheds light on the relative importance of action on individual or social determinants of health. The findings illustrate that in some cases, actions on specific drivers of disadvantage (here, cash transfers at the individual and household level) which are known to be associated with a wide range of beneficial outcomes can nevertheless have adverse effects on other outcomes. This is particularly true of health outcomes with complex determinants such as obesity or parenting behaviour. Parallel investments are necessary at the same level or at other levels.

The finding of an adverse effect on such an important risk factor for ill-health is also a particularly strong argument for greater involvement from the health sector in the design, operation and evaluation of cash transfer schemes.

	Control			TBB					TAB				
							diff. cf. Control					diff. cf. Control	
	Mean	95% CI		**Mean**	95% CI		t / χ^2	p	**Mean**	95% CI		t / χ^2	p
Individual level co-variates													
Age (yr)	**33.1**	32.7	33.6	**33.6**	33.1	34.1	-1.37	0.17	**33.1**	32.6	33.6	0.07	0.95
1ary education incomplete	**59.5**	56.2	62.8	**60.4**	56.8	64.0			**60.0**	56.2	63.8		
1ary education complete	**34.0**	30.8	37.1	**34.4**	30.9	38.0	χ^2= 1.33	0.72	**33.0**	29.3	36.7	χ^2= 1.53	0.68
2ary education complete	**5.2**	3.7	6.7	**4.0**	2.5	5.4			**6.2**	4.3	8.1		
Further education	**1.3**	0.5	2.0	**1.1**	0.4	1.9			**0.8**	0.1	1.5		
Literate	**84.0**	81.5	86.4	**86.0**	83.5	88.6	-1.13	0.26	**86.0**	83.3	88.7	-1.08	0.28
Travel time to medical centre (min)	**37.8**	34.6	41.0	**37.5**	34.6	40.4	0.13	0.89	**32.9**	30.0	35.8	2.11	0.03
Community participation	**17.4**	14.9	19.9	**24.7**	21.5	27.9	-3.54	<0.01	**31.0**	27.4	34.6	-6.25	<0.001
Number of live births	**4.6**	4.5	4.8	**4.5**	4.3	4.6	1.32	0.19	**4.7**	4.5	4.8	-0.19	0.85
Household level co-variates													
Head of h'hold 1ary education incomplete	**63.7**	60.4	66.9	**59.3**	55.7	63.0			**62.7**	58.9	66.4		
Head of h'hold 1ary education complete	**30.5**	27.3	33.5	**36.8**	33.2	40.4	χ^2= 11.42	0.01	**29.9**	26.3	33.4	χ^2= 1.41	0.70
Head of h'hold 2ary education complete	**5.2**	3.7	6.7	**2.9**	1.6	4.1			**6.5**	4.5	8.4		
Head of h'hold further education	**0.7**	0.1	1.2	**1.0**	0.3	1.7			**0.9**	0.2	1.7		
Literacy of head of household	**78.4**	75.7	81.2	**85.7**	83.1	88.3	-3.73	<0.01	**80.6**	77.5	83.7	-1.04	0.30
Household size (persons)	**6.1**	6.0	6.3	**6.1**	5.9	6.2	0.91	0.36	**6.3**	6.1	6.4	-0.92	0.36
Persons per room	**3.2**	3.1	3.4	**3.0**	2.9	3.2	2.42	0.02	**2.7**	2.6	2.8	6.06	<0.001
Log household wealth (pesos)	**12.75**	12.71	12.79	**12.96**	12.93	13	-7.73	<0.001	**12.80**	12.76	12.85	-1.93	0.05
Piped water to household	**62.9**	59.6	66.1	**53.4**	49.7	57.1	3.82	<0.001	**68.2**	64.6	71.2	-2.14	0.03
Urban location	**51.4**	48.1	54. 8	**40.9**	37.3	44.6	4.2	<0.001	**42.7**	38.8	46.5	3.37	<0.001
Municipality level co-variates													
Log municipality population	**9.81**	9.75	9.87	**10.22**	10.16	10.27	-10.11	<0.001	**9.84**	9.78	9.9	-0.76	0.45
Eligible families in municipality	**6.28**	6.2	6.35	**7.19**	7.13	7.26	-17.67	<0.001	**6.79**	6.73	6.86	-9.75	<0.001
Eligible families in urbanized municipality	**3.63**	3.58	3.69	**3.30**	3.24	3.36	7.85	<0.001	**3.53**	3.47	3.6	2.34	0.02
Quality of life index	**54.6**	53.9	55.3	**53.9**	53.3	54.6	1.34	0.18	**53.3**	52.6	54.1	2.35	0.02
Ratio of doctors to population in municipality	**-1.18**	-1.21	-1.15	**-1.42**	-1.46	-1.38	10.42	<0.001	**-1.35**	-1.38	-1.31	7.21	<0.001
Ratio of nurses to population in municipality	**-0.48**	-0.52	-0.45	**-0.77**	-0.84	-0.71	7.72	<0.001	**-0.59**	-0.65	-0.53	3.12	<0.01
Av. municipality household wealth	**12.91**	12.9	12.92	**12.99**	12.98	13	-9.23	<0.001	**12.94**	12.92	12.95	-2.55	0.01
Av. municipality travel time to medical centre	**37.6**	36.1	39.1	**39.0**	37.7	40.3	-1.36	0.17	**34.2**	33.1	35.2	3.38	<0.001
Av. municipality piped water to household	**66.2**	64.7	67.8	**54.8**	53.4	56.2	10.61	<0.001	**67.3**	65.8	68.7	-0.95	0.34

Table 10.12: Characteristics of analytic sample at baseline (figures are percentages unless otherwise indicated)

	Analytic Sample			Lost to follow-up				
	Mean	95% CI		Mean	95% CI		t / χ^2	p
Individual level co-variates								
BMI at baseline	**24.9**	24.8	25.1	**25.2**	24.7	25.6	1.104	0.27
Age (yr)	**33.3**	33.0	33.5	**33.0**	32.4	33.6	-0.88	0.38
1ary education incomplete	**59.8**	57.8	61.8	**65.6**	62.7	68.5		
1ary education complete	**34.1**	32.1	36.0	**29.6**	26.8	32.4		
2ary education complete	**5.1**	4.2	6.0	**4.2**	3.0	5.4	χ^2=10.85	0.01
Further education	**1.1**	0.6	1.5	**0.6**	0.1	1.1		
Literate	**85.0**	83.5	86.4	**77.2**	74.6	79.7	-5.494	<0.001
Travel time to medical centre (min)	**36.1**	34.4	38.0	**43.3**	40.0	46.6	4.101	<0.001
Community participation	**23.5**	21.7	25.2	**24.9**	22.2	27.6	0.898	0.37
Number of live births	**4.6**	4.5	4.7	**5.1**	4.9	5.3	5.688	<0.001
Household level co-variates								
Head of h'hold 1ary education incomplete	**62.0**	60.0	63.9	**70.9**	68.1	73.7		
Head of h'old 1ary education complete	**32.5**	30.5	34.4	**25.1**	22.4	27.8		
Head of h'old 2ary education complete	**4.8**	3.9	5.6	**3.3**	2.2	4.4	χ^2=24.88	<0.001
Head of h'old further education	**0.8**	0.4	1.2	**0.7**	0.2	1.2		
Literacy of head of household	**81.2**	79.6	82.8	**75.0**	72.3	77.7	-4.083	<0.001
Household size (persons)	**6.1**	6.1	6.2	**6.3**	6.1	6.4	1.431	0.15
Persons per room	**3.0**	2.9	3.1	**3.0**	2.9	3.1	0.355	0.72
Log household wealth (pesos)	**12.82**	12.80	12.85	**12.81**	12.78	12.85	-0.52	0.60
Piped water to household	**61.4**	59.4	63.4	**57.9**	54.9	61.0	-1.892	0.06
Urban location	**46.0**	43.9	48.0	**44.8**	41.7	47.9	-0.616	0.53
Municipality level co-variates								
Log municipality population	**9.94**	9.92	9.98	**9.93**	9.88	9.98	-0.575	0.57
Eligible families in municipality	**6.71**	6.67	6.76	**6.76**	6.69	6.82	1.042	0.30
Eligible families in urbanized municipality	**3.51**	3.48	3.54	**3.51**	3.46	3.56	0.055	0.96
Quality of life index	**54.1**	53.7	54.5	**53.6**	53.0	54.2	-1.228	0.22
Ratio of doctors to population in municipality	**-1.30**	-1.32	-1.28	**-1.28**	-1.31	-1.25	1.311	0.19
Ratio of nurses to population in municipality	**-0.61**	-0.64	-0.58	**-0.55**	-0.60	-0.50	2.134	0.03
Av. municipality household wealth	**12.94**	12.93	12.95	**12.94**	12.93	12.95	0.039	0.97
Av. municipality travel time to medical centre	**36.8**	36.1	37.6	**39.6**	38.2	40.9	3.66	<0.01
Av. municipality piped water to household	**63.0**	62.1	63.9	**60.9**	59.5	62.2	-2.624	<0.01

Table 10.13: Characteristics of women lost to follow-up (figures are percentages unless otherwise indicated)

	Model A				Model B				Model C				Model D			
	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value
TAB area effect	**-0.27**		0.23	0.24	**-0.27**		0.23	0.24	**-0.35**		0.24	0.14	**-0.44**		0.25	0.08
Time effect	**0.81**	***	0.09	<0.001	**0.82**	***	0.09	<0.001	**0.82**	***	0.09	<0.001	**0.82**	***	0.09	<0.001
Programme effect	**0.25**		0.13	0.07	**0.25**		0.14	0.07	**0.25**		0.14	0.07	**0.25**		0.14	0.07
Individual level co-variates																
Age					**0.07**	***	0.02	<0.001	**0.07**	***	0.02	<0.001	**0.07**	***	0.02	<0.001
1ary education complete					**-0.32**		0.24	0.19	**-0.34**		0.25	0.18	**-0.33**		0.25	0.20
2ary education complete					**0.04**		0.42	0.93	**-0.13**		0.47	0.78	**-0.01**		0.46	0.98
Further education					**0.79**		0.75	0.30	**0.54**		0.84	0.52	**0.78**		0.74	0.29
Literate					**-0.09**		0.38	0.81	**-0.18**		0.39	0.65	**-0.22**		0.39	0.58
Travel time to medical centre					**-0.00**		0.00	0.48	**-0.00**		0.00	0.46	**-0.00**		0.00	0.52
Community participation					**-0.03**		0.26	0.90	**-0.06**		0.26	0.83	**-0.10**		0.27	0.72
Number of live births					**-0.10**	*	0.05	0.04	**-0.11**		0.06	0.08	**-0.11**		0.06	0.08
Household level co-variates																
Head of household 1ary education complete									**-0.23**		0.26	0.38	**-0.18**		0.26	0.49
Head of household 2ary education complete									**0.03**		0.49	0.95	**0.13**		0.51	0.80
Head of household further education									**-1.70**	*	0.83	0.04	**-1.63**	*	0.80	0.04
Literacy of head of household									**-0.03**		0.26	0.92	**-0.07**		0.27	0.81
Household size									**-0.02**		0.07	0.77	**-0.00**		0.07	0.98
Persons per room									**-0.04**		0.08	0.66	**-0.04**		0.08	0.64
Log household wealth									**0.74**	***	0.21	<0.001	**0.80**	***	0.21	<0.001
Piped water to household									**0.07**		0.23	0.77	**0.07**		0.26	0.80
Urban location									**-0.27**		0.26	0.30	**-0.21**		0.29	0.46
Municipality level co-variates																
Log municipality population													**-0.26**		0.19	0.16
Eligible families in municipality													**0.14**		0.15	0.36
Eligible families in urbanized municipality													**-0.07**		0.19	0.73
Quality of life index													**0.02**		0.02	0.16
Ratio of doctors to population in municipality													**-0.47**		0.25	0.07
Ratio of nurses to population in municipality													**0.04**		0.21	0.83
Av. municipality household wealth													**-0.67**		0.57	0.25
Av. municipality travel time to medic'l centre													**0.00**		0.01	0.74
Av. municipality piped water to household													**-0.00**		0.01	0.79

Table 10.14: Determinants of body mass index (TBB areas excluded)

	Model A				Model B				Model C				Model D			
	Co-efficient		**S.E.**	**p-value**	**Co-efficient**		**S.E.**	**p-value**	**Co-efficient**		**S.E.**	**p-value**	**Co-efficient**		**S.E.**	**p-value**
TBB area effect	**-0.64**	*	0.25	0.01	**-0.69**	**	0.25	0.01	**-0.86**	***	0.25	<0.001	**-0.86**	**	0.29	<0.001
TAB area effect	**-0.30**		0.23	0.20	**-0.29**		0.24	0.22	**-0.33**		0.24	0.17	**-0.37**		0.24	0.13
Time effect	**0.76**	***	0.07	<0.001	**0.76**	***	0.07	<0.001	**0.76**	***	0.07	<0.001	**0.76**	***	0.07	<0.001
Programme effect	**0.31**	*	0.12	0.01	**0.31**	*	0.12	0.01	**0.31**	*	0.12	0.01	**0.31**	*	0.12	0.01
Individual level co-variates																
Age					**0.08**	***	0.01	<0.001	**0.07**	***	0.01	<0.001	**0.07**	***	0.01	<0.001
1ary education complete					**-0.08**		0.19	0.68	**-0.17**		0.21	0.41	**-0.16**		0.21	0.44
2ary education complete					**-0.17**		0.36	0.63	**-0.50**		0.39	0.20	**-0.41**		0.39	0.29
Further education					**0.68**		0.82	0.41	**0.37**		0.86	0.67	**0.55**		0.83	0.51
Literate					**-0.15**		0.30	0.63	**-0.22**		0.30	0.47	**-0.26**		0.30	0.38
Travel time to medical centre					**-0.00**		0.00	0.23	**-0.00**		0.00	0.25	**-0.00**		0.00	0.18
Community participation					**-0.12**		0.20	0.54	**-0.17**		0.20	0.39	**-0.19**		0.21	0.35
Number of live births					**-0.12**	**	0.04	<0.01	**-0.11**	*	0.05	0.03	**-0.12**	*	0.05	0.02
Household level co-variates																
Head of household 1ary education complete									**0.04**		0.23	0.86	**0.08**		0.23	0.72
Head of household 2ary education complete									**0.29**		0.43	0.51	**0.33**		0.44	0.45
Head of household further education									**-0.61**		0.91	0.50	**-0.62**		0.91	0.50
Literacy of head of household									**-0.09**		0.23	0.69	**-0.10**		0.23	0.68
Household size									**-0.05**		0.06	0.39	**-0.03**		0.06	0.58
Persons per room									**-0.02**		0.06	0.80	**-0.02**		0.06	0.76
Log household wealth									**0.77**	***	0.17	<0.001	**0.79**	***	0.18	<0.001
Piped water to household									**-0.08**		0.18	0.67	**-0.08**		0.19	0.68
Urban location									**-0.06**		0.20	0.78	**-0.00**		0.23	1.00
Municipality level co-variates																
Log municipality population													**-0.29**		0.17	0.09
Eligible families in municipality													**0.10**		0.13	0.43
Eligible families in urbanized municipality													**0.08**		0.16	0.61
Quality of life index													**0.01**		0.01	0.46
Ratio of doctors to population in municipality													**-0.39**		0.20	0.05
Ratio of nurses to population in municipality													**0.11**		0.13	0.39
Av. municipality household wealth													**-0.55**		0.52	0.29
Av. municipality travel time to medical centre													**0.01**		0.01	0.36
Av. municipality piped water to household													**-0.00**		0.00	0.64

Table 10.15: Determinants of body mass index (TBB areas included)

	Model A				Model B				Model C				Model D			
	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value
TAB area effect	**0.96**		0.11	0.69	**0.96**		0.11	0.76	**0.93**		0.11	0.54	**0.91**		0.11	0.42
Time effect	**1.33**	***	0.08	<0.001	**1.34**	***	0.08	<0.001	**1.34**	***	0.08	<0.001	**1.36**	***	0.08	<0.001
Programme effect	**1.15**		0.10	0.11	**1.15**		0.10	0.12	**1.15**		0.10	0.11	**1.15**		0.10	0.12
Individual level co-variates																
Age					**1.03**	***	0.01	<0.001	**1.03**	***	0.01	<0.001	**1.03**	**	0.01	<0.01
1ary education complete					**0.86**		0.10	0.17	**0.87**		0.10	0.20	**0.86**		0.10	0.21
2ary education complete					**1.04**		0.24	0.86	**0.99**		0.22	0.96	**1.03**		0.24	0.88
Further education					**3.29**		2.03	0.05	**3.09**		2.15	0.10	**3.46**		2.34	0.07
Literate					**0.94**		0.16	0.72	**0.88**		0.15	0.46	**0.86**		0.15	0.38
Travel time to medical centre					**1.00**		0.00	0.80	**1.00**		0.00	0.76	**0.99**		0.00	0.69
Community participation					**0.96**		0.13	0.73	**0.95**		0.12	0.68	**0.94**		0.13	0.63
Number of live births					**0.96**	*	0.02	0.03	**0.97**		0.03	0.25	**0.97**		0.03	0.24
Household level co-variates																
Head of household 1ary education complete									**0.83**		0.10	0.10	**0.85**		0.10	0.16
Head of household 2ary education complete									**0.92**		0.20	0.69	**0.95**		0.22	0.84
Head of household further education									**0.46**		0.25	0.15	**0.47**		0.25	0.15
Literacy of head of household									**1.08**		0.11	0.42	**1.07**		0.11	0.53
Household size									**0.96**		0.03	0.16	**0.97**		0.03	0.28
Persons per room									**0.99**		0.03	0.70	**0.98**		0.03	0.63
Log household wealth									**1.43**	***	0.14	<0.001	**1.47**	***	0.14	<0.001
Piped water to household									**1.06**		0.12	0.58	**1.04**		0.13	0.76
Urban location									**0.88**		0.10	0.26	**0.91**		0.12	0.49
Municipality level co-variates																
Log municipality population													**0.86**		0.08	0.09
Eligible families in municipality													**1.07**		0.08	0.37
Eligible families in urbanized municipality													**0.99**		0.09	0.91
Quality of life index													**1.00**		0.01	0.28
Ratio of doctors to population in municipality													**0.85**		0.11	0.21
Ratio of nurses to population in municipality													**1.04**		0.10	0.71
Av. municipality household wealth													**0.74**		0.23	0.33
Av. municipality travel time to medical centre													**1.00**		0.00	0.41
Av. municipality piped water to household													**1.00**		0.00	0.95

Table 10.16: Determinants of overweight or obesity (TBB areas excluded)

	Model A				Model B				Model C				Model D			
	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value
TBB area effect	**0.80**		0.10	0.09	**0.79**		0.11	0.08	**0.73**	*	0.10	0.02	**0.77**		0.12	0.09
TAB area effect	**0.98**		0.11	0.83	**0.99**		0.12	0.93	**0.97**		0.12	0.83	**0.97**		0.12	0.83
Time effect	**1.39**	***	0.06	<0.001	**1.40**	***	0.07	<0.001	**1.40**	***	0.07	<0.001	**1.40**	***	0.07	<0.001
Programme effect	**1.10**		0.09	0.23	**1.10**		0.09	0.24	**1.10**		0.09	0.23	**1.10**		0.09	0.24
Individual level co-variates																
Age					**1.03**	***	0.01	<0.001	**1.03**	***	0.01	<0.001	**1.03**	***	0.01	<0.001
1ary education complete					**0.97**		0.09	0.75	**0.95**		0.09	0.61	**0.95**		0.10	0.59
2ary education complete					**0.91**		0.17	0.61	**0.79**		0.15	0.22	**0.82**		0.16	0.29
Further education					**2.26**		1.00	0.07	**2.03**		1.06	0.18	**2.21**		1.15	0.13
Literate					**0.96**		0.12	0.73	**0.90**		0.12	0.44	**0.88**		0.12	0.34
Travel time to medical centre					**0.99**		0.00	0.54	**1.00**		0.00	0.74	**0.99**		0.00	0.37
Community participation					**0.93**		0.09	0.45	**0.91**		0.09	0.34	**0.90**		0.10	0.32
Number of live births					**0.95**	**	0.02	0.01	**0.97**		0.02	0.16	**0.97**		0.02	0.12
Household level co-variates																
Head of household 1ary education complete									**0.91**		0.09	0.33	**0.93**		0.09	0.45
Head of household 2ary education complete									**1.03**		0.20	0.87	**1.05**		0.21	0.80
Head of household further education									**0.68**		0.34	0.45	**0.67**		0.34	0.43
Literacy of head of household									**1.06**		0.10	0.50	**1.07**		0.10	0.50
Household size									**0.95**		0.02	0.05	**0.96**		0.02	0.10
Persons per room									**1.00**		0.03	0.94	**0.99**		0.03	0.97
Log household wealth									**1.44**	***	0.12	<0.001	**1.46**	***	0.12	<0.001
Piped water to household									**1.04**		0.09	0.65	**1.02**		0.10	0.84
Urban location									**0.99**		0.10	0.96	**1.02**		0.11	0.82
Municipality level co-variates																
Log municipality population													**0.85**	*	0.07	0.05
Eligible families in municipality													**1.05**		0.07	0.44
Eligible families in urbanized municipality													**1.09**		0.08	0.21
Quality of life index													**1.00**		0.01	0.71
Ratio of doctors to population in municipality													**0.86**		0.08	0.11
Ratio of nurses to population in municipality													**1.09**		0.07	0.18
Av. municipality household wealth													**0.77**		0.22	0.36
Av. municipality travel time to medical centre													**1.00**		0.00	0.07
Average municipality piped water to household													**1.00**		0.00	0.93

Table 10.17: Determinants of overweight or obesity (TBB areas included)

	Model A				Model B				Model C				Model D			
	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value
TAB area effect	**0.64**	**	0.10	<0.01	**0.62**	**	0.10	<0.01	**0.63**	**	0.11	0.01	**0.60**	**	0.10	<0.01
Time effect	**1.27**	***	0.09	<0.001	**1.2**	***	0.09	<0.001	**1.27**	***	0.09	<0.001	**1.27**	***	0.09	<0.001
Programme effect	**1.41**	**	0.18	0.01	**1.411**	**	0.18	0.01	**1.41**	**	0.19	0.01	**1.41**	**	0.19	0.01
Individual level co-variates																
Age					**1.03**	**	0.01	0.01	**1.03**	*	0.01	0.01	**1.03**	*	0.01	0.02
1ary education complete					**0.99**		0.18	1.00	**0.94**		0.17	0.73	**0.94**		0.18	0.75
2ary education complete					**0.78**		0.27	0.48	**0.64**		0.22	0.19	**0.68**		0.23	0.26
Further education					**0.67**		0.43	0.54	**0.58**		0.40	0.43	**0.66**		0.44	0.53
Literate					**0.87**		0.20	0.59	**0.91**		0.21	0.67	**0.90**		0.20	0.63
Travel time to medical centre					**0.99**		0.00	0.18	**0.99**		0.00	0.53	**0.99**		0.00	0.64
Community participation					**1.07**		0.15	0.63	**1.08**		0.16	0.59	**1.04**		0.16	0.79
Number of live births					**0.98**		0.03	0.58	**0.98**		0.04	0.69	**0.98**		0.04	0.64
Household level co-variates																
Head of household 1ary education complete									**1.01**		0.16	0.97	**0.99**		0.16	0.98
Head of household 2ary education complete									**1.27**		0.35	0.39	**1.27**		0.38	0.41
Head of household further education									**0.28**		0.29	0.23	**0.29**		0.31	0.24
Literacy of head of household									**0.93**		0.15	0.64	**0.90**		0.15	0.54
Household size									**0.99**		0.04	0.90	**1.01**		0.04	0.90
Persons per room									**0.99**		0.05	0.78	**0.99**		0.05	0.81
Log household wealth									**1.18**		0.17	0.24	**1.15**		0.18	0.36
Piped water to household									**1.04**		0.16	0.78	**1.15**		0.20	0.42
Urban location									**1.27**		0.21	0.15	**1.21**		0.23	0.30
Municipality level co-variates																
Log municipality population													**0.94**		0.07	0.40
Eligible families in municipality													**1.07**		0.09	0.40
Eligible families in urbanized municipality													**0.98**		0.10	0.82
Quality of life index													**1.02**	*	0.01	0.05
Ratio of doctors to population in municipality													**0.78**		0.11	0.09
Ratio of nurses to population in municipality													**0.96**		0.11	0.69
Av. municipality household wealth													**1.15**		0.42	0.71
Av. municipality travel time to medical centre													**1.00**		0.01	0.82
Av. municipality piped water to household													**0.99**		0.00	0.25

Table 10.18: Determinants of obesity (TBB areas excluded)

	Model A				Model B				Model C				Model D			
	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value
TBB area effect	**0.57**	**	0.11	<0.01	**0.56**	**	0.10	<0.01	**0.54**	**	0.10	<0.01	**0.47**	***	0.10	<0.001
TAB area effect	**0.65**	**	0.10	0.01	**0.65**	**	0.10	0.01	**0.67**	*	0.11	0.02	**0.63**	**	0.10	0.01
Time effect	**1.33**	***	0.07	<0.001	**1.33**	***	0.07	<0.001	**1.34**	***	0.07	<0.001	**1.34**	***	0.07	<0.001
Programme effect	**1.34**	*	0.16	0.02	**1.34**	*	0.16	0.02	**1.35**	*	0.17	0.02	**1.35**	*	0.17	0.02
Individual level co-variates																
Age					**1.03**	**	0.01	<0.01	**1.03**	**	0.01	<0.01	**1.03**	**	0.01	<0.01
1ary education complete					**1.02**		0.15	0.92	**0.91**		0.14	0.54	**0.92**		0.15	0.60
2ary education complete					**0.71**		0.22	0.27	**0.55**	*	0.16	0.04	**0.57**		0.17	0.06
Further education					**0.73**		0.43	0.60	**0.61**		0.36	0.41	**0.67**		0.40	0.51
Literate					**0.84**		0.15	0.34	**0.86**		0.16	0.41	**0.86**		0.16	0.39
Travel time to medical centre					**0.99**	*	0.00	0.05	**0.99**		0.00	0.18	**0.99**		0.00	0.23
Community participation					**0.96**		0.12	0.71	**0.96**		0.12	0.72	**0.93**		0.12	0.60
Number of live births					**0.96**		0.03	0.21	**0.97**		0.04	0.48	**0.97**		0.04	0.43
Household level co-variates																
Head of household 1ary education complete									**1.19**		0.18	0.26	**1.19**		0.19	0.27
Head of household 2ary education complete									**1.38**		0.36	0.21	**1.35**		0.36	0.26
Head of household further education									**0.64**		0.49	0.56	**0.65**		0.50	0.57
Literacy of head of household									**0.89**		0.13	0.44	**0.88**		0.13	0.42
Household size									**0.99**		0.04	0.76	**0.99**		0.04	0.96
Persons per room									**0.98**		0.04	0.60	**0.98**		0.04	0.59
Log household wealth									**1.22**		0.15	0.10	**1.00**		0.16	0.18
Piped water to household									**0.83**		0.11	0.16	**0.90**		0.13	0.48
Urban location									**1.39**	*	0.19	0.02	**1.36**	*	0.21	0.05
Municipality level co-variates																
Log municipality population													**0.91**		0.06	0.19
Eligible families in municipality													**1.10**		0.09	0.23
Eligible families in urbanized municipality													**0.97**		0.10	0.73
Quality of life index													**1.01**		0.01	0.17
Ratio of doctors to population in municipality													**0.87**		0.12	0.32
Ratio of nurses to population in municipality													**0.93**		0.07	0.32
Av. municipality household wealth													**0.99**		0.35	0.99
Av. municipality travel time to medical centre													**1.00**		0.00	0.66
Average municipality piped water to household													**0.99**		0.00	0.23

Table 10.19: Determinants of obesity (TBB areas included)

Chapter 11: Nutritional Outcomes in Children

Relationship between this chapter and broader thesis

The previous chapter demonstrated that *Familias* has an adverse effect on rates of obesity in participating women, an important driver of ill-health and health inequity, particularly in low-income countries. This chapter examines the impact of *Familias* on rates of overweight and obesity in children. Examining nutritional outcomes in children is a natural progression of work presented in the previous chapter. There are, however, several additional reasons why examining childhood outcomes is particularly compelling. First, demonstration of an adverse impact in children may be more concerning than in adults because adverse health outcomes embedded in early years imply a greater number of healthy life years lost. Second, children are much less able to exert autonomy over health behaviours. They are more at the mercy of their physical and socioeconomic environment, including policy instruments introduced into the household. Third, *Familias* - an example of one such policy instrument - was specifically designed to improve life chances during children's early years.

It is particularly important, therefore, to study whether the negative health outcome observed in women also occurs in children. A recent study of 5 to 12 year olds in Bogota reported that over-nutrition has now become a bigger problem in these children than under-nutrition[184], which adds contextual weight to the necessity to study the impact of *Familias* on rates of overweight and obesity in this group.

The hypothesis tested is that **participation in *Familias* is associated with an increased body mass index for age (BMIZ) in children.**

The thesis will not examine the impact of *Familias* on measures of childhood under-nutrition since these are outcomes already explored by the Institute of Fiscal Studies, as discussed in Chapter 6 and restated later in this chapter.

The epidemiology of child nutritional status globally and in Colombia

Measuring childhood nutritional status

Assessment of nutritional status in children is more complicated than in adults due to the dynamic progression of their height and weight over time - any metric requires adjustment for age and gender if it is to be used to make comparisons within the same child over time or across children. Several such metrics exist. Historically, preferred measures in epidemiological surveys have been gender specific height-for-age, weight-for-age and weight-for-height. BMI for age has now supplanted these measures as the preferred metric to determine overweight or obesity[185] [186] although height- and weight-for-age are still used to identify under-nourishment.

Two difficulties arise in using and interpreting these – indeed, any – measures of childhood nutritional status. The first pertains to specifying what normal growth is, the second to defining deviations from normal growth that are clinically relevant (that is, associated with current or future ill-health). In recent years two major, although contrasting, approaches have emerged to settle these difficulties and currently dominate the field.

The International Obesity Task Force (IOTF), a research and advocacy body linked to The International Association for the Study of Obesity, specified normal growth by collating the height and weight of approximately 100,000 males and 100,000 females from birth to 25 years of age surveyed in Brazil, Great Britain, Hong Kong, the Netherlands, Singapore, and the United States in various studies between 1963 and 1993. *Abnormal* growth was defined by using commonly accepted definitions of abnormal nutritional status in adults, that is, BMI thresholds of 25 and 30 kg/m^2. Growth curves meeting these points at 18 years of age were identified by backward-extrapolation and used to define ‘overweight’ and ‘obese’ for each sex at younger ages[187]. This attempt to define childhood overweight and obesity by deploying clinical thresholds used in adults is probably advantageous in that it avoids deploying arbitrary z-scores, but the authors admit that extrapolation backward from 30kg/m^2 was “fairly imprecise” and, furthermore, that the relatively Western and wealthy reference populations tracked may not adequately represent other groups of children[188].

In contrast, the World Health Organisation’s Multicentre Growth Reference Study (MGRS) collected primary growth data from approximately 8,500 children in Brazil, Ghana, India, Norway, Oman and the USA from birth to 5 years of age, between 1997 and 2003[189]. The study attempted a normative description how children *should* grow by applying stringent inclusion criteria: no known health or environmental constraints to growth, mothers willing to follow MGRS feeding recommendations on exclusive or predominant breastfeeding, no maternal smoking before and after delivery, single term birth, and absence of significant morbidity. Exclusion of environmental constraints meant that low socio-economic status was the most common reason for ineligibility. Abnormal growth was defined by reference *within* the population: for children aged 0-5, those with a BMI >1SD above the population mean (for their age/gender) were described as being ‘at risk of overweight’, those >2SD as ‘overweight’, and those >3SD as ‘obese’.

Several comparisons between the two systems have been published using pre-existing data sets. In general, IOTF curves imply high rates of childhood overweight and obesity whereas MGRS curves generate more conservative estimates of prevalence[185].

There is still uncertainty regarding which normative standards to use and a lack of agreement regarding how to define child overweight and obesity. It is important to note, however, that such debate is extraneous to the research presented in this thesis. For before/after impact evaluations of programmes such as *Familias*, it is only important that outcomes are defined consistently, even if arbitrarily. Clearly, though, the interpretation and generalisability of results to other populations will nonetheless be assisted by using clinically meaningful outcomes. In this thesis, WHO-MGRS growth trajectories and thresholds will be used, since they yield the more conservative estimates of clinical burden.

Other validated methods of nutritional assessment in children for use in epidemiological surveys exist[190]. As mentioned earlier, weight and height for age are still most commonly used to identify *under*-nourished individuals, rather than BMIZ, by converting their measurements to standard deviations from the mean of age and sex specific reference populations (z-scores):

- height-for-age is considered a useful indicator of **chronic** under-nutrition; a z-score of less than -2 (HAZ < -2) defines a ‘stunted’ child;
- weight-for-height is considered a useful indicator of **acute** under-nutrition; a z-score of less than -2 (WHZ < -2) defines a ‘wasted’ child;
- weight-for-age is considered a useful indicator of **composite** (acute on chronic) under-nutrition; a z-score of less than -2 (WAZ < -2) defines an ‘underweight’ child.

The prevalence of childhood over-nutrition

The global epidemic of obesity, whose impact on adults was described in the previous chapter, is increasingly affecting children. Wang, in a review of the literature published between 1980 and 2005 covering more than 60 countries[191], reports that childhood obesity increased in all children (including those of pre-school age) in almost all countries for which data are available, including lower income countries. Large variations existed between countries, with the most dramatic increases observed in industrial countries where rates have doubled or tripled since the 1970’s.

This picture is corroborated by the IOTF who estimate that the prevalence of overweight or obesity in children of pre-school age in developing countries is 3.3%. In older children prevalence shows marked regional variation around the global average of 10%: rates are <10% in Africa and Asia compared to >20% in the Americas & Europe and are increasing by 0.5-1% per year. In Chile, for example, childhood overweight and obesity (based on the IOTF reference) rose dramatically from 12% to 26% in 6-year old boys and from 14% to 27% in 6-year old girls between 1987 and 2000[188]. In Mexico, rates of overweight or obese (based on US

Centers for Disease Control curves) were greater than 20% among children from low-income households; being male, having a younger or overweight mother and greater household wealth were all associated with a greater risk[192].

The drivers of the epidemic are fundamentally no different to those described in adults: a more sedentary lifestyle (typified in children by an increase in television viewing and video-games at the expense of physically active play) and dietary shifts. Adair examined trends in children's diets in Russia, USA, China and Philippines between 1977 and 2003 and found increased snacking, food away from home and consumption of calorie-dense fast food across these settings[193].

Socio-economic differentials

Understanding the relationship between SEP and adult obesity is complicated by the fact that causality in either direction is plausible. In contrast, children's SEP is unlikely to be determined by their nutritional status enabling, at least in theory, more robust inferences to be drawn from an association. Despite this, the inter-related effects of age, sex, puberty, ethnicity and SEP on the dynamic process of growth obscure the isolation and quantification of specific socioeconomic determinants of childhood obesity[190].

The broad social pattern might nevertheless be expected to mirror that seen in adults with very poor countries showing low levels of childhood obesity (concentrated in urban areas and wealthier households), relatively better off developing countries showing greater levels of obesity and a more equal socioeconomic distribution, and industrialized countries having the highest levels of obesity, concentrated among the children of poorer and less educated households[194]. This is indeed borne out by observation. Wang's review finds that in middle-income countries, children in better-off and urban households are more likely to be at risk of obesity compared to children in poorer or rural households and that, as economies develop, childhood obesity is most prevalent in households of lowest SEP and specific racial or ethnic groups[191 195].

Possible reasons for the association between low SEP and obesity were set out in the previous chapter, namely that individuals of lower SEP tend to buy energy-dense foods (either because of lower levels of health-related knowledge or because high energy-density foods are less expensive or more available), have less leisure-time, fewer opportunities for recreational exercise and can find themselves more at the mercy of the obesogenic environment given that they are less able to exercise choice[176].

Two additional determinants of childhood obesity require particular mention, the first being maternal education. This is known to be protective against obesity in women themselves and strongly determinant of childhood nutritional outcomes, whether under- or overweight[170]. In Brazil, for example, Guimaraes reports that a low level of maternal education is much more important than family income as a risk factor for childhood malnutrition[196]. Similarly, Martorell finds that maternal education is a stronger determinant of childhood obesity than gross national product in 71 nutritional surveys across 50 developing countries, using data from 1986 onward[194]. The direction of effect is variable depending on national context, as for SEP, with some countries showing a positive association between maternal education and childhood obesity and other countries a protective effect[164].

Second, the first few years of life are critically determinant. Children whose growth in terms of length or height is restricted through early malnutrition may respond to better nutrition in later years by increasing their weight but not – proportionately - their height. This results in increased risk of obesity and below average height[191]. Based on these findings, some have suggested that supplementary feeding programmes in developing countries can themselves contribute to rising obesity trends[197].

In summary, the burden of obesity is increasingly falling upon children at the most deprived end of the socioeconomic spectrum, as for adults. Several drivers underlie this including early life linear growth retardation, maternal obesity and maternal education.

The burden of disease associated with childhood over-nutrition

Some physical consequences of childhood overweight may be manifest in childhood, such slipped femoral epiphyses (the growth-plate at the top of the thigh bone) or diabetes. Additionally, some pathologies may be in process, but not yet clinically manifest, such as elevated blood pressure, insulin resistance and dyslipidaemia[198]. Few, if any, direct consequences are seen in very young infants, although Shibli reports that obese infants aged under 2 were admitted to hospital more often than their normal weight peers, in Haifa, Israel, particularly for breathing problems and delayed gross motor skills[199].

Physical manifestations are, however, relatively rare. More important are the psycho-social consequences of childhood overweight and the tracking of childhood overweight into adult obesity. The IOTF write that "although childhood obesity is far more common [nowadays], the social reaction to an obese child does not appear to have softened"[188]. Obese children are known to suffer stigma and discrimination from their peers, reporting fewer friends, lower participation in social and sports activities and lower self-esteem[194 200]. It should be noted that this is not seen in all cultural settings.

The other significance of childhood obesity lies in its direct correlation with adult obesity. Serdula in a review of the literature published between 1970 and 1992[201] found that the risk of adult obesity was 3.9-6.5 times greater in obese than in non-obese school children, with children of greater BMI being at greater risk. The association at younger ages is weaker: Whitaker reports that that childhood obesity was not a significant predictor of adult obesity at 1-2 years of age after adjustment for parental obesity but did become a significant predictor at 3-5 years of age, rising to an odds ratio of 17.5 (95% CI 7.7 to 39.5) for obesity present at 15 to 17 years of age. Parental obesity was identified as an additional predictor of adult obesity, more than doubling the risk among both obese and non-obese children[202] .

Given the lack of clinical significance in terms of either current or future disease burden, debate exists whether there is any merit in identifying infants under 2 years of age as ‘overweight’ or ‘obese’. IOTF growth curves do not extend below this age, whereas MGRS curves begin at birth.

The phenomenon of ‘double-burden’

In the preceding chapter, the observation that stunted women have a greater risk of obesity was discussed. A similar ‘double-burden’ phenomenon affects children and can adopt two forms. First, as with adults, a child can be simultaneously stunted and overweight. Additionally, however, intra-household double-burden can occur where an undernourished child lives with an overweight adult. The former case will be discussed first.

Simultaneous child stunting and overweight:

Duran, using figures from WHO databases, reports that the prevalence of simultaneous child stunting and overweight (defined as WAZ or WHZ > 2 s.d. on US Centers for Disease Control curves) averaged 13.7% in Latin America and 4.3% in the Caribbean in 2000[203]. Most variation between countries was due to differences in the prevalence of stunting; all had similar rates of childhood overweight. Fernald, in a study of 7,555 low-income Mexican children aged 2-6 reported rates of 5% in non-indigenous households and 10% in indigenous households (defining overweight as BMI for age >85% centile on US Centers for Disease Control curves). The phenomenon was positively associated with lower household wealth, lower maternal age and education, shorter maternal height and larger household size[192].

The mechanism, as mentioned earlier, is thought to be related to early malnutrition, whereby children whose initial linear growth is restricted respond to better nutrition in later years by a disproportionate increase in their weight relative to height[191]. As another marker of the ‘nutrition transition’, simultaneous child stunting and overweight is likely to become increasingly apparent and concentrated in groups at the most deprived end of the socioeconomic spectrum, since these are the children that suffer restricted growth in life[204].

Simultaneous household under- and over-nutrition:

Households where under- and over-nutrition co-exist are common in the developing world. Doak examines the prevalence and associations of double-burden, defined as co-existence of underweight (BMI<18.5kg/m^2) and overweight (BMI>25kg/m^2) individuals in the same household irrespective of age or relationship, using survey data between 1988 and 1996 from Brazil, China, Indonesia, the Kyrgyz Republic, Russia, Vietnam and the USA. Between 22 and 66% of households are found to be double-burden and are more likely to live in urban environments. The relationship with SEP varied by national context (with double-burden households being more wealthy than 'underweight only' households in some countries and poorer than 'overweight only' households in others)[205].

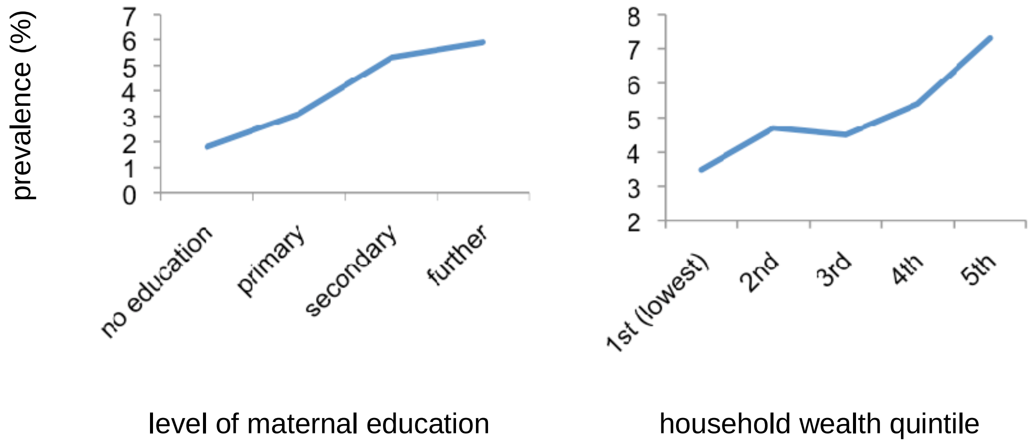
The most prevalent and 'classic' combination of simultaneous household under- and over-nutrition, however, is that of an underweight child and overweight non-elderly adult[206]. Garrett defines the phenomenon as the co-existence of a stunted child (HAZ< -2) and overweight mother (BMI>25kg/m^2) in the same household. Using DHS data from 1991-1998, he reports that Latin America shows the highest rates (from 2.0 to 13.4% and most prevalent in urban environments) followed by Africa, then Asia (where rates did not exceed 5%)[207]. Barquera, examining Mexican data from 1999 finds that double-burden, defined as co-existence of a stunted child (HAZ< -2) and a mother displaying central adiposity (waist-hip ratio>0.85), had a general prevalence of 6.2%, although is more prevalent amongst rural (14.5%) and indigenous (23.9%) households[208].

The mechanism(s) underlying the phenomenon are far from clear. Two broad potential explanations are put forward, one physiological and one behavioural. The former states maternal obesity and child stunting do not have opposite causes but are responses to the same insults at different stages of the lifecycle[170]. Specifically, inadequate nutrition in early life causes stunting as well as expression of the thrifty genotype, which promotes central obesity in later years. Barquera's finding of a linear association between rates of child stunting and maternal obesity may support this hypothesis[208]. A closely related possibility is that caloric availability is adequate throughout life but that micronutrients are consistently deficient, causing stunting in childhood and thereby later adult adiposity[207].

A more behavioural explanation, not incompatible with the physiological model, states that infants and adults experience the nutrition transition differently. Adults may increase their food share more than children, either because adults have greater control over the distribution of household resources or because children are more able to adjust their intake to energy expenditure. Adults may swap to more calorie-dense foods relative to children, or may reduce their energy expenditure more than children. This is particularly likely because most labour saving technologies relate to adult activities and because adult recreation (for example, watching television) tends to be more sedentary than children's[206 207].

Colombia

Analysis of data from Colombia's 2010 Demographics and Health Survey[178] found that rates of overweight (defined as WHZ score > 2 s.d.) amongst children aged less than 5 years were 5.3% in boys and 4.2% in girls. Disaggregation by socioeconomic position shows that the nutrition transition described earlier has not yet occurred in this population and overweight remains more common in more privileged Colombian children (Figures 11.1 and 11.2 below).



Figures 11.1 and 11.2: prevalence of overweight in Colombian children aged less than 5, by socioeconomic position.

A study of 3,075 children aged 5-12 years old in Bogotá in 2006 (an older and more urban population than covered by *Familias)*, estimated prevalence of overweight to be 11.1% and obesity 1.8% (using IOTF curves). Significant associations with higher socioeconomic status, maternal obesity, a snacking dietary pattern and frequent junk-food were reported[184].

The prevalence of obesity (defined as WHZ score > 2 s.d.) is reported to have dropped from 4.6% to 2.6% in pre-school children in Colombia, between 1986 and 1995[200]. This is thought to be due to better nutrition and improvements in linear growth in the first two years of life, which is protective against obesity.

The phenomenon of intra-household double-burden, defined as the co-existence of a stunted child (HAZ< -2) and overweight mother (BMI>25kg/m^2) in the same household, was reported to be 5.0% in Colombia's 1995 Demographics and Health Survey[209].

Child nutritional outcomes and CCTS

A core objective common to all CCTS is to improve the nutritional status of children living in poor households. Under-nutrition is common amongst the target children; in Colombia, for example, 2005 Demographic and Health Survey data reveal that the rate of chronic under-nutrition (defined as HAZ score <-2 s.d.) is 21.5% amongst 5-9 year old children living in the poorest quintile of households[210]. Such under-nutrition is known to contribute to the persistent and intergenerational nature of poverty: stunted individuals have worse health outcomes, learn less at school and earn less over their lifetimes compared to non-stunted peers[211 212].

The impact of CCTS on childhood nutritional outcomes is generally disappointing. The *Progresa* evaluation found an improvement in HAZ scores at 2-year follow up for 12-36 month olds, equivalent to an extra 1.0cm per year (or an additional one sixth mean growth per year)[79 80]. The programme did not fully correct height deficiencies, however, and stunting remained prevalent. Furthermore, findings were not robust if an intention-to-treat analysis was used.

In Nicaragua, no significant impact of the *Red de Proteccion Social* CCTS was seen on rates of stunting or wasting; WAZ scores, however, showed a double-difference of 6.0% in favour of the programme ($p<0.05$)[91]. No improvements in child growth were associated with the CCTS implemented in Honduras[92], Brazil[88] or Ecuador[213].

In Colombia, *Familias* was associated with a 6.9% lower probability of stunting amongst infants aged under 24 months ($p<0.05$). No effect was seen in older children[96].

Methods

Chapters 8 and 9 described the setting, intervention, selection of participants and controls, survey methodology, use of the double-difference technique and the selection and statistical handing of co-variates at the individual, household and community level to estimate the effect size associated with the intervention.

Additional detail will be presented here to the extent that it is relevant to the estimation of the effect of *Familias* on children's nutritional status.

Intervention

As described earlier, *Familias* offers participants a regular monthly cash transfer whose size is dependent on household composition. Prior work by the IFS has demonstrated that the average transfer is equivalent to about 20% of regular monthly household income.

Analytic Sample

The study protocol dictated that children aged under seven years should have their height and weight recorded at baseline and followed-up in subsequent surveys. The analytic sample is restricted to children who were fully observed (with respect to outcome, explanatory variables and co-variates) at baseline. In five cases, children's age was recorded as >84 months at baseline; these children were excluded.

Children aged less than 24 month were excluded from the analysis. This is because, as noted earlier, it is uncertain whether diagnosing excessive adiposity in children aged less than two has any clinical value or prognostic significance. No other exclusion criteria were applied.

Outcome measures

Child age, gender, height and weight were recorded by 18 trained fieldworkers using a protocol based on the Pan-American Health Organisation Manual on Anthropometrics[214], with standardised measuring boards (Shorr Productions, Olney, Maryland USA) and electronic scales (Seca 770, Vogel & Halke, Hamburg, Germany). Height/length in children aged under two years was measured lying and measured standing in older children.

In the preceding chapter, it was noted that some measurements on women were biologically implausible requiring that the dataset be trimmed at the 1% and 99% centiles. Implausible measurements are less obvious in children, given the natural variation in growth trajectories. Furthermore, inspection of children's data did not reveal obviously implausible measurements, hence all measurements were included in the analyses without data trimming.

BMI was calculated for each child as weight/(height)^2. BMI varies markedly across childhood (see Figure 11.3), hence it is important that it is adjusted for age and gender (unlike in adults). BMI-for-age Z-scores were obtained using publicly available software from the WHO-MGRS study[215]. Additionally, dichotomous variables for 'obese' and 'overweight or obese' were created using age and sex specific BMI thresholds (using WHO-MGRS thresholds, see Appendix C). As noted earlier, although there is on-going discussion regarding the clinical significance of particular BMI thresholds in children, the key criterion in a within-population comparison is that consistent criteria are used.

Figure 11.3: Centile-trajectory of BMI for age in boys[216]

Additional dichotomous variables were created to identify 'double-burden' households. As noted earlier, various phenotypes of the double-burden paradox exist. The *Familias* dataset only contains nutritional outcomes on children and mothers, thus limiting the phenotypes that can be identified. Fortunately, these are the phenotypes most commonly discussed in the literature. In this thesis, they are defined as follows:

"In-child double burden" *(simultaneous child stunting and overweight)*	child HAZ < -2 *and* child BMI above threshold for 'overweight'
"Intra-household double burden" *(simultaneous child stunting and maternal overweight or obesity)*	child HAZ < -2 *and* maternal BMI >25

Child HAZ scores were taken from a data file previously created by IFS (for their evaluation of the impact of *Familias* on rates of child stunting). As mentioned earlier in the chapter, HAZ scores remain the preferred metric to identify chronic childhood under-nutrition and have not been supplanted by BMI for age.

Confounding and mediating variables

Possible confounders or mediators of the hypothesized relationships at the individual, household and community levels were identified from the literature and verified with experts who had conducted previous studies of similar outcomes. Identification and statistical handling of co-variates was conducted as described in the previous analysis on women's BMI.

For this study, additional individual level co-variates were included. At the individual level, the child's age, gender, number of siblings and current or past participation in *Hogares Comunitarios (HC)* were included. *HC* is a welfare programme, established in 1986, targeted towards the same children as *Familias*. Participating children attend nurseries where they receive a lunch and two snacks each working day. Previous work by IFS had shown that *HC* is little used by children aged under 24 months, but is popular among older children. Furthermore, a child who has spent all his life in a *Hogar* is one standard deviation (or more than 2 cm) taller than a child who has not attended[93]. In municipalities where both *HC* and *Familias* are operating, parents have to choose between the two. Although children cannot simultaneously participate in both programmes, it is nevertheless important to include exposure to *HC* as a co-variate because, in treatment areas, any association between *Familias* and weight gain may be entirely explained by previous exposure to *HC.* Inclusion also allows a closer estimate of the marginal effect of participation in *Familias*, independent of prior exposure to other nutrition programmes or, in the case of control communities, current exposure.

At household level, the mother's baseline BMI was included given its close association with child BMI[184].

Statistical techniques

A double-difference methodology was employed, as earlier described, to account for unobserved differences at baseline and trends over time and obtain a more precise estimate of programme effect independent of area. Similarly, the issue of TAB / TBB households was handled by creating a dummy variable equal to 1 when the programme was operating and equal to 0 when not, as explained in earlier chapters.

Programme impact on BMIZ was estimated using linear regression and impact on rates of childhood obesity and overweight or obese using logistic regression. Robust standard errors are reported, clustered municipality level.

In each case, a stepwise analytic approach was taken that first estimated the unadjusted effect of the programme before adding in vectors of individual, household and community level variables in sequentially nested models on identical samples.

Model A Area, time, programme operation

Model B **as Model A,** *plus addition of individual-level co-variates:*

- age
- gender (unless gender-specific analyses)
- number of siblings
- participation in *Hogares Comunitarios*

Model C **as Model B,** *plus addition of household-level co-variates:*

- maternal age
- maternal education
- maternal literacy
- travel time to medical centre
- head-of-household education
- head-of-household literacy
- household size
- persons per room
- log household wealth
- presence of piped water to household
- urban location

Model D	**as Model C,** *plus addition of community-level co-variates:*	
		log municipality population eligible families in municipality eligible families in urbanized municipality quality of life index ratio of doctors to population ratio of nurses to population average household wealth average travel time to medical centre average presence of household piped water

Table 11.1: Explanatory variables included in sequentially nested models

Missing outcome observations were deleted list-wise from the sample.

Given the thesis' emphasis on health equity, interactions between markers of social position (mother's literacy and level of completed education, head of household literacy and level of completed education, household wealth and urban location) and programme operation were explored.

Differences in baseline co-variates by programme exposure, and in baseline co-variates between the analytic sample and women lost to follow-up, were explored using t-test (for differences in means for continuously distributed variables) or chi-squared test (for categorical variables).

Results

Descriptive statistics of baseline sample

4835 children fulfilled the inclusion criteria at baseline, 1868 from control areas, 1489 from TBB areas and 1468 from TAB areas. 51.0% were boys and mean age was 56.0 months (95% CI 55.5, 56.5).

BMIZ was normally distributed in all exposure groups, as shown in Figure 11.4.

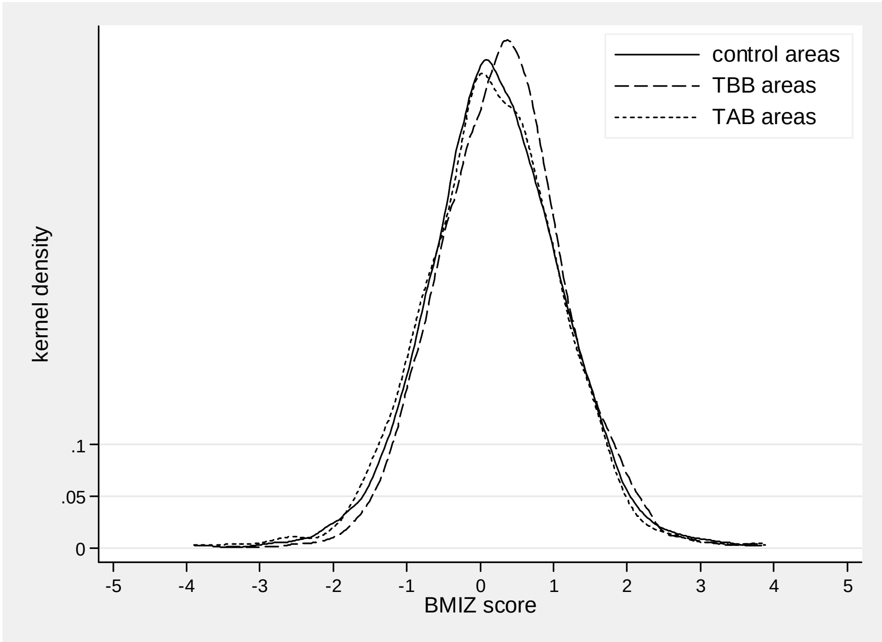


Figure 11.4: distribution of BMIZ in children meeting inclusion criteria at baseline

There were no significant differences in baseline BMIZ between children from control and TAB areas, however BMIZ in children from TBB areas was significantly greater (0.30 vs. 0.20 in control and vs. 0.16 in TAB municipalities, p<0.01), as shown in Table 11.18. There were also several differences in baseline co-variates between children from different exposure groups. For example, compared to children from control areas, children from TBB areas were less likely to be beneficiaries of the *Hogares Comunitarios* programme (34.8% vs. 56.4%, p<0.001), had mothers with slightly lower baseline BMI (24.7 vs. 25.1 kg/m^2, p<0.01) and came from less crowded households (3.2 vs. 3.4 persons per room, p<0.01). Children from TAB areas also came from less crowded households compared to controls (2.9 vs. 3.4 persons per room, p<0.001), with a greater likelihood of piped water (66.8% vs. 61.5%, p<0.01) and shorter travel times to medical services (34.6 vs. 37.4 min, p=0.01).

Missing data

Maternal BMI was missing in 12.7% and replaced by multiple imputation, generating 5 imputations from a model containing treatment/control status, age, parity, educational attainment, household wealth and ruruality. After replacement all other co-variates were completely observed, except in 242 (5%) children who were deleted list-wise. Incomplete observation was not significantly associated with treatment/control status (χ^2=0.71, p=0.40) or with other likely predictors of follow-up nutritional status including baseline BMIZ, age, gender, maternal BMI, household size or wealth (all p>0.09).

3.3 Baseline characteristics of the analytic sample

Loss to follow-up

3840 children (79.6% of baseline sample) had repeat measurements taken at follow-up, 1456 from control communities, 1229 from TBB and 1155 from TAB communities (χ^2=11.8, p=0.003). A flow diagram of participants is given in Figure 11.5.

	CONTROL	TBB	TAB
baseline sample	**1868**	**1489**	**1468**
	▼	▼	▼
lost to follow-up	-412	-260	-313
	▼	▼	▼
sample at 2nd follow-up	**1456** (77.9%)	**1229** (82.5%)	**1155** (78.7%)

χ^2=11.8, p=0.003

Figure 11.5: Flow diagram of participants

The characteristics of children lost to follow-up are given in Table 11.19. Compared to those who comprised the final analytic sample, children lost to follow-up are older (67.0 vs. 53.2 months, p<0.001) and have more siblings (5.2 vs. 5.0, p=0.01). They come from households with less literate (78.8% vs. 82.9%, p<0.01) and less educated mothers (χ^2=12.6, p=0.006) and less literate heads of household (76.4% vs. 79.8%, p=0.02). These households are also larger (6.6 vs. 6.4 persons, p=0.02), further from health services (48.5 vs. 37.3 min travel time, p<0.001), are less likely to have piped water (53.5% vs. 59.5%, p<0.01) and less likely to be urban (38.7% vs. 44.8%, p<0.01).

Preliminary analyses

BMIZ appeared to decrease over time across all exposure groups as shown in Figure 11.6.

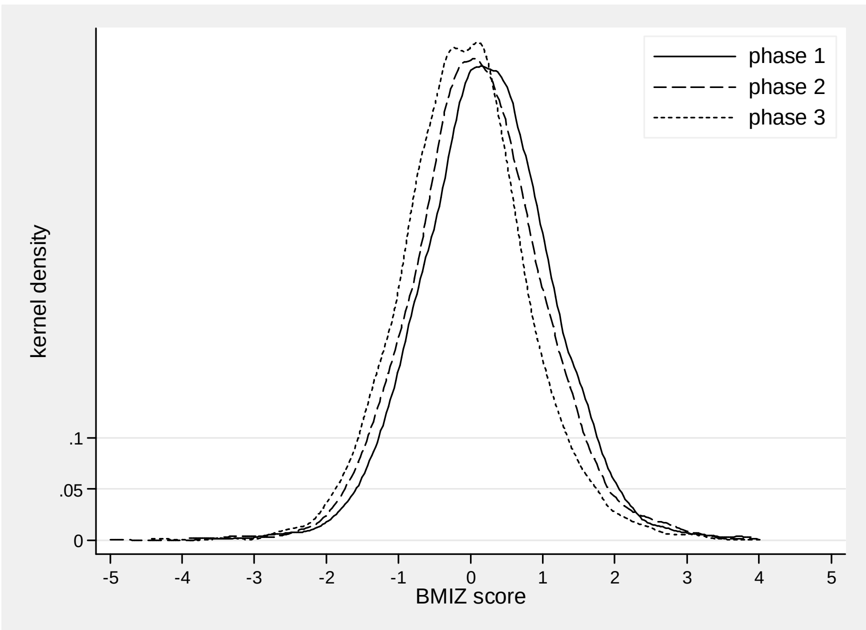


Figure 11.6: Trends in children's BMIZ across study phases

Abnormally high levels of BMIZ, however, as indicated by prevalence of overweight and obesity increased across all exposure groups, as shown in Figure 11.7.

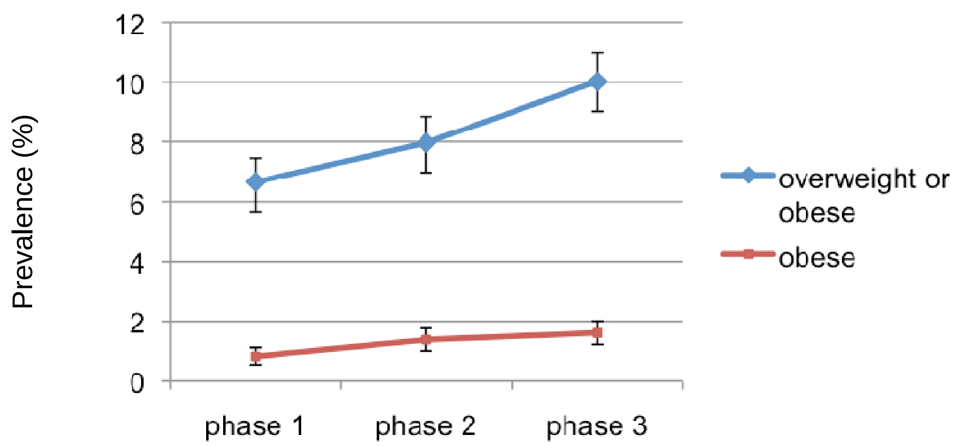


Figure 11.7: Trends in prevalence of overweight and obesity across study phases (genders combined**)**

Figures 11.6 and 11.7 appear contradictory. The co-existence, however, of an positive obesity trend against the background of a negative mean BMIZ trend is explained by closer inspection of the distributions in Figure 11.6: a slight negative skew at phase 1 transforms into a positive skew at phase 3, as shown in Table 11.2 below.

	Phase 1	Phase 2	Phase 3
mean BMIZ	0.235	0.108	-0.091
standard deviation	0.877	0.990	0.869
skewness	**-0.108**	**0.123**	**0.079**
kurtosis	3.223	3.728	3.844

Table 11.2: summary statistics of BMIZ distributions at phases 1, 2 and 3

Double-difference tables as earlier described can be constructed to give a preliminary indication of the impact of the programme. The following tables show crude unadjusted outcomes for children from control and TAB areas, at baseline and second follow-up. For simplicity, children from TBB areas are not included (although are included in subsequent multivariate analyses). Direct observation of crude outcomes suggests that BMIZ decreased over time in all areas, but less so in treatment municipalities.

	Control	Treatment	*Diff. across groups*
Baseline	0.25 (0.20, 0.29)	0.20 (0.14, 0.26)	- 0.05
Follow-up	-0.12 (-0.17, -0.08)	-0.03 (-0.08, 0.02)	0.09
Difference over time	-0.37	-0.23	**0.14**

Table 11.3: Crude BMIZ (95% CI) and double-difference (genders combined)

Rates of overweight and obesity increased in all areas over time, but that rates of overweight increased more rapidly in treatment areas than in control areas (Tables 11.3 and 11.4).

	Control	Treatment	*Diff. across groups*
Baseline	0.9 (0.5, 1.2)	0.9 (0.5, 1.3)	0.0
Follow-up	1.5 (0.9, 2.0)	1.4 (0.9, 2.0)	- 0.1
Difference over time	0.6	0.5	**- 0.1**

Table 11.4: crude prevalence (%) of obesity (95% CI) and double-difference (genders combined)

	Control	Treatment	*Diff. across groups*
Baseline	6.5 (5.6, 7.4)	6.1 (5.1 ,7.2)	- 0.4
Follow-up	8.7 (7.5, 9.9)	9.9 (8.4, 11.3)	1.2
Difference over time	2.2	3.8	**1.6**

Table 11.5: crude prevalence (%) of overweight or obese (95% CI) and double-difference (genders combined)

As in previous analyses, estimation of the fully adjusted effect of *Familias* begins with ordinary multivariate regression, to verify adequate specification of the statistical model. A fully adjusted ordinary least squares linear regression of the effect of the programme on phase 3 BMIZ (having dropped TBB areas) yields the following diagnostic output:

F-statistic	86.74, p<0.001
R^2	50.2%

Table 11.6: regression diagnostics from ordinary least squares linear regression

The highly significant p-value on the F-statistic indicates that the model predicts phase 3 BMIZ significantly better than then empty (intercept-only) model. This is confirmed by a satisfactory R^2 of 50%. Examination of residuals from this model demonstrates that they are normally distributed with zero mean, as expected (Figure 11.8).

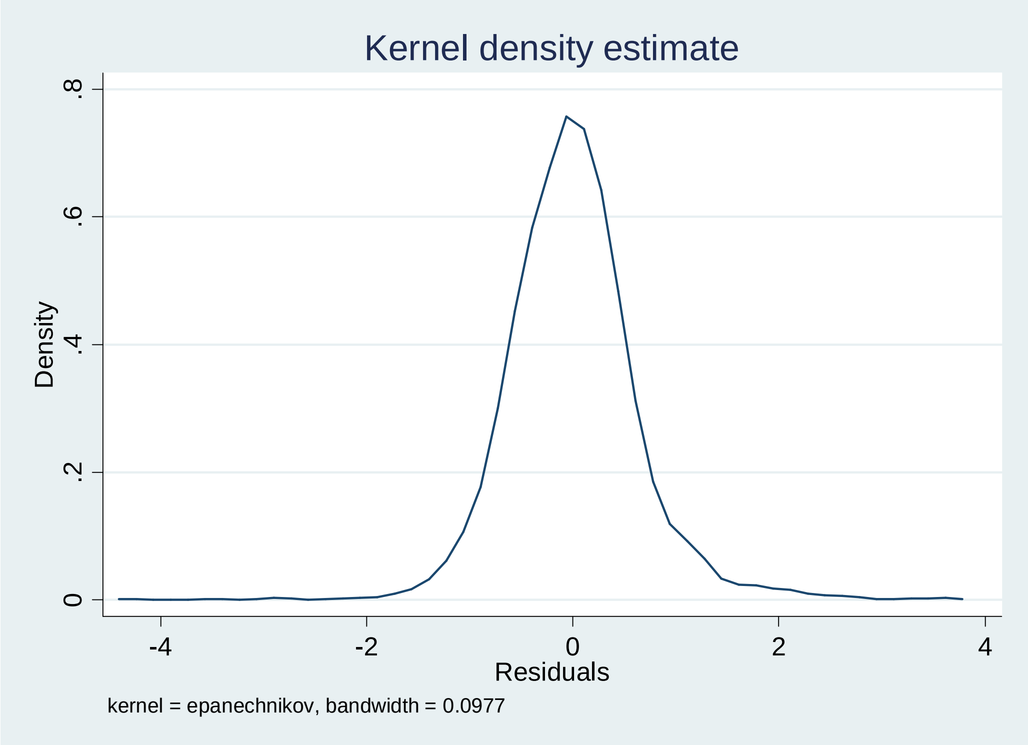


Figure 11.8: Distribution of residuals from ordinary least squares regression of phase 3 BMIZ on phase 1 BMIZ, programme exposure and other co-variates

A fully adjusted logistic regression model of the effect of the programme on the odds of childhood overweight or obesity (TBB areas dropped, genders combined) gives the following diagnostic output:

1	Wald-χ^2	442.08 ($p<0.0001$)
	McFadden's pseudo-R^2	20.2%
	McKelvey & Zaivona's pseudo-R^2	27.5%
	Significance of co-efficient on hat	<0.0001
Link test:	Significance of co-efficient on hat-squared	0.952

Table 11.7: regression diagnostics from ordinary logistic regression

The highly significant p-value on the Wald-χ^2 indicates that the specified model predicts the data better than an empty (intercept-only) model. Overall explanatory power is low to reasonable, as suggested by the pseudo-R^2 of 20-30%. Further reassurance is provided by the link test, where the linear predicted value (*hat*) is highly significant in its ability to predict the observed outcomes. *Hat-squared* is a non-significant predictor, as expected.

Inspection of observations with a high residual did not reveal any obvious data entry errors, consequently no further observations were dropped from the model.

Box-Tidewell regression did not suggest that the model was significantly improved by the inclusion of any non-linear co-variates; furthermore, inspection of variance inflation factors did not demonstrate any co-linearity between the regressors.

In summary, the model has reasonable predictive power and appears correctly specified. Reassurance on this point means that it is reasonable to restructure the data into a 'long' format and continue with double-difference estimations.

Before proceeding with double-difference estimations, however, it is worth looking at the regression co-efficients yielded by ordinary regression. In the fully-adjusted linear regression model (with TBB areas dropped), exposure to *Familias* was associated with significantly increased BMIZ (β=0.08, 95% CI 0.00, 0.17, p=0.05). Other variables also found to be determinant are shown in Table 11.8 below. Child's gender was not determinant (β=0.00, 95% CI -0.04, 0.04, p=0.99) and results are presented for boys and girls combined.

	Boys and girls combined			
	coefficient		S.E.	p-val
Exposure to *Familias*	0.08	*	0.04	0.05
Baseline BMIZ	0.60	***	0.03	<0.001
Age	0.003	**	0.00	0.01
Attendance at *Hogares*	-0.14	***	0.03	<0.001
Number of siblings	-0.03	***	0.01	<0.001
Mother's BMI	0.03	***	0.00	<0.001

Table 11.8: Determinants of BMIZ at phase 3 (ordinary linear regression, fully-adjusted model with TBB areas dropped)

Exposure to the programme was also associated with significantly increased odds of overweight or obesity in girls (O.R=1.78; 95% CI 1.06, 2.99, p=0.03), though not in boys (O.R=0.91; 95% CI 0.57, 1.41, p=0.68). Other variables also found to be determinant are shown in Table 11.9 below.

	Boys				Girls			
	O.R.		S.E.	p-val	O.R.		S.E.	p-val
Exposure to *Familias*	0.91		0.20	0.67	1.78	*	0.47	0.03
Overweight at baseline	19.34	***	5.80	<0.001	24.35	***	10.72	<0.001
Age	0.98	***	0.01	<0.001	0.99		0.01	0.19
Attendance at *Hogares*	0.69		0.16	0.10	0.41	***	0.09	<0.001
Number of siblings	0.97		0.05	0.63	0.78	***	0.05	<0.001
Mother's age	1.03		0.02	0.08	1.07	***	0.02	<0.001
Mother's BMI	1.11	***	0.02	<0.001	1.12	***	0.03	<0.001

Table 11.9: Determinants of overweight or obesity at phase 3 (ordinary logistic regression, fully-adjusted model with TBB areas dropped)

Double-difference analyses

Tables 11.21 -11.24 show estimates of the effect of the programme and other co-variates on BMIZ. In girls, operation of the programme does not appear significantly associated with BMIZ if TBB areas are dropped (β=0.12, 95% CI -0.01, 0.26, p=0.07 in Model A as shown in Table 11.21). Inclusion of TBB areas, however, finds a statistically significant association (β=0.14, 95% CI 0.01, 0.26, p=0.03 in Model A, Table 11.22); this association was robust to the inclusion of co-variates. Increasing time (β=-0.35, 95% CI -0.40, -0.29, p<0.001) was negatively associated as was age (β=-0.01, 95% CI -0.001, -0.005, p<0.001) and participation in *Hogares Comunitarios* (β=-0.13, 95% CI -0.19, -0.01, p=0.03). Maternal BMI was positively associated (β=0.05, 95% CI 0.04, 0.06, p<0.001). A positive gradient was seen across levels of maternal education, increasing to a coefficient of 0.64 (95% CI 0.11, 1.17, p=0.02) for women with the highest educational attainment, as shown in Table 11.22.

In boys, operation of the programme is significantly associated with BMIZ even if TBB areas are dropped (β=0.16, 95% CI 0.03, 0.28, p=0.01 in Model A, Table 11.23); the association becomes stronger if TBB areas are included (β=0.18, 95% CI 0.08, 0.29, p=0.001 in Model A, Table 11.24). This association persists into Model D and a similar pattern of explanatory co-variates to that in girls is seen. There is, however, no association with maternal educational attainment.

In girls, operation of the programme is associated with greater odds of being overweight or obese with TBB areas excluded in model A (O.R=2.13, 95% CI 1.23, 3.69, p<0.01) as shown in Table 11.25; this association is robust to the inclusion of co-variates. Inclusion of additional co-variates in Models B-D shows that increasing numbers of siblings is associated with lower odds (O.R.=0.89, 95% CI 0.78, 0.99; p=0.04) and increasing maternal BMI with higher odds (O.R.= 1.12, 95% CI 1.08, 1.17; p<0.001) of the outcome. Very similar co-efficients are obtained if TBB areas are included in the model (Table 11.26).

No association between odds of being overweight or obese and operation of the programme is seen in boys with TBB areas excluded (O.R=0.81, 95% CI 0.49, 1.14, p=0.28 in the unadjusted model, Table 11.27), although increasing time (O.R.=2.05, 95% CI 1.47, 2.87, p<0.001) and maternal BMI (O.R.=1.12, 95% CI 1.08, 1.16; p<0.001) are found to be positively associated, as in girls. Similar co-efficients are obtained if TBB areas are included in the model (see Table 11.28).

No association is seen between operation of the programme and odds of obesity in either girls or boys, whether or not TBB areas are included (Tables 11.29 – 11.32). Maternal BMI is, however, positively associated (p<0.001 in both genders).

Interactions

To explore the health equity impact of the programme, interactions between operation of *Familias* and certain markers of socio-economic position were explored, with and without TBB areas, on BMIZ and on rates of overweight and obesity, in boys and girls separately. None were found to be significant.

For brevity, Table 11.10 below just shows interaction co-efficients on BMIZ, with TBB areas dropped, in the fully adjusted model (Model D), chosen because of the earlier finding of a gradient across levels of maternal education in girls.

Interaction	Co-efficient	S.E.	p-value
Familias * head of household's literacy	-0.03	0.09	0.71
Familias * mother's literacy	-0.08	0.11	0.46
Familias * mother's educational attainment	-0.14	0.08	0.07
Familias * head of household's educational attain't	0.02	0.07	0.74
Familias * household wealth	0.01	0.07	0.86
Familias * urban location	-0.08	0.09	0.41

Table 11.10: Interaction between operation of *Familias* and markers of socio-economic position on odds of overweight or obesity in girls, TBB areas dropped

Supplementary analyses

1. In-child double burden

90 children were stunted and overweight at baseline (prevalence 1.9%; 95%CI 1.5, 2.2%). Operation of the programme was associated with increased odds of this outcome (O.R.=3.46; 95%CI 1.75, 6.86; p<0.001, in model A with TBB areas included, boys and girls combined). This association was robust to the inclusion of co-variates, and other co-variates were also found to be determinant as shown in Table 11.11 below.

	Odds ratio		**S.E.**	**p-value**
Exposure to *Familias*	3.56	***	1.28	<0.001
Male gender	1.97	**	0.51	<0.01
Time	0.38	**	0.11	<0.01
Maternal BMI	1.09	***	0.03	<0.001

Table 11.11: Odds of in-child double burden (double-difference logistic regression, fully-adjusted model with TBB areas included, boys and girls combined)

Similar results were obtained if TBB areas were excluded.

2. Intra-household double burden

488 stunted children came from households with an overweight or obese mother at baseline (prevalence 10.1%; 95%CI 9.3, 11.0%). Operation of the programme was not associated with any increased odds of this outcome (O.R.=1.16; 95%CI 0.82, 1.63; p=0.39, in model A with TBB areas included, boys and girls combined). Increasing maternal age and educational attainment were found to be protective against this outcome, as shown in Table 11.12 below.

	Odds ratio		S.E.	p-value
Exposure to *Familias*	1.20		0.22	0.33
Maternal age	0.97	**	0.01	0.001
Maternal primary education completed	0.70	*	0.11	0.03
Maternal secondary education completed	0.46	*	0.17	0.03
Maternal further education	0.27		0.31	0.25

Table 11.12: Odds of intra-household double burden (double-difference logistic regression, fully-adjusted model with TBB areas included, boys and girls combined)

Similar results were obtained if TBB areas were excluded.

3. Inclusion of outcomes at phase 2

To explore the timeline underlying the association between programme exposure and changes in prevalence of overweight and obesity, outcomes at phase 2 (July – November 2003) were included in the regressions. Dummy variables that reflected operation of the programme were created for models that contained just phase 1 and 2 data or phase 1, 2 and 3 data, with and without TBB areas (four specifications in total, each run with vectors of co-variates sequentially added as models A-D, with robust standard errors).

Operation of the programme was not found to be associated with BMIZ at phase 2 in either boys or girls, with or without TBB areas. Maternal BMI was significantly associated, as was maternal educational level in girls if TBB areas were included. These results are shown in Table 11.13 below.

	Coefficient		S.E.	p-value
BMIZ in girls				
Exposure to *Familias*	0.16		0.09	0.08
Maternal BMI	0.05	***	0.01	<0.001
Maternal completed 1ary education	0.08		0.05	0.09
Maternal completed 2ary education	0.20	*	0.09	0.02
Maternal further education	0.65	**	0.23	0.01
BMIZ in boys				
Exposure to *Familias*	0.17		0.11	0.13
Maternal BMI	0.04	***	0.01	<0.001
Maternal completed 1ary education	0.03		0.05	0.57
Maternal completed 2ary education	-0.03		0.11	0.79
Maternal further education	-0.02		0.18	0.92

Table 11.13: Effect of programme and other covariates on phase 2 BMIZ

Operation of the programme was found to be associated with odds of overweight or obesity in girls at phase 2 (O.R.=2.87, 95% CI 1.07, 7.73; p=0.04); mother's BMI was also found to be determinant (O.R.=1.10, 95% CI 1.04, 1.15; p<0.001). There was no association with obesity at phase 2 or for either outcome in boys at phase 2.

For brevity, Table 11.14 below just shows co-efficients associated with programme exposure, age and household wealth, with TBB areas dropped, in the fully adjusted model (Model D). Regressions with TBB areas included gave similar results.

	Odds Ratio		S.E.	p-value
Overweight or obesity in girls				
Exposure to *Familias*	2.87	*	1.45	0.04
Maternal BMI	1.10	***	0.03	<0.001
Overweight or obesity in boys				
Exposure to *Familias*	1.41		0.57	0.86
Maternal BMI	1.11	***	0.02	<0.001
Obesity in girls				
Exposure to *Familias*	4.7		5.7	0.20
Maternal BMI	1.14	*	0.07	0.03
Obesity in boys				
Exposure to *Familias*	5.26		6.07	0.15
Maternal BMI	1.10	**	0.04	<0.01

Table 11.14: Effect of programme and maternal BMI on phase 2 overweight and obesity

4. Inclusion of household food consumption at phase 3

To explore mechanisms underlying the association between programme exposure and changes in prevalence of overweight and obesity, household reported spending on food at second follow-up was added as a co-variate.

In the ordinary linear regression of programme exposure on BMIZ (fully adjusted, with TBB areas dropped, genders combined), this additional co-variate (shown as *food* in Table 11.15 below) was not a significant predictor in the model (β=0.04, 95% CI -0.02, 0.19=0, p=0.19). It attenuated the co-efficient on *Familias* by 10.3% but a likelihood ratio test showed that the model was not improved by its inclusion (χ^2=2.76, p=0.10).

Model	Coefficient		S.E.	Attenuation of co-efficient
Model D				
Programme exposure	0.084	*	0.04	-
Model D^{food}				
Programme exposure	0.076		0.04	10.3%
food	0.038		0.03	-

Table 11.15: effect on BMIZ of household reported spending on food at second follow-up as an additional co-variate.

In the ordinary logistic regression of programme exposure on odds of overweight or obesity in girls (fully adjusted, with TBB areas dropped), inclusion of this additional co-variate (shown as *food* in Table 11.16 below) did not attenuate the co-efficient on *Familias*; nor was *food* itself was a significant predictor in the model.

Model	Odds Ratio		S.E.	Attenuation of co-efficient
Model D				
Programme exposure	1.34	*	0.17	-
Model D^{food}				
Programme exposure	1.34	*	0.18	0%
food	0.97		0.20	-

Table 11.16: effect on odds of overweight or obesity in girls of household reported spending on food at second follow-up as an additional co-variate.

5. Analyses using IOTF definitions of childhood overweight and obesity

As discussed in the introductory paragraphs, the description of normal childhood growth and definition of excessive weight gain has not yet reached consensus, with various normative curves and thresholds of abnormality in use. It is interesting, therefore, to re-run the analyses a using different set of curves and thresholds. Vidmar and colleagues offer a Stata programme which categorises children according to IOTF definitions of overweight or obese (but does not provide a continuous BMIZ score)[217].

Re-analysis using IOTF definitions yields very similar results to those already presented: the programme is associated with increased odds of overweight or obesity in girls but not in boys, and not for obesity in either sex. The odds-ratios below are derived from fully-adjusted double-difference analyses with robust standard errors.

	Odds Ratio		S.E.	p-value
Overweight or obesity in girls				
TBB areas dropped	1.86	*	0.60	0.05
TBB areas included	1.78	*	0.47	0.03
Overweight or obesity in boys				
TBB areas dropped	1.21		0.34	0.49
TBB areas included	1.43		0.33	0.11
Obesity in girls				
TBB areas dropped	0.87		0.64	0.85
TBB areas included	0.72		0.53	0.66
Obesity in boys				
TBB areas dropped	1.81		1.34	0.43
TBB areas included	2.05		1.10	0.18

Table 11.17: Effect of programme on IOTF-defined childhood nutritional outcomes.

Discussion

Main result

This study finds that operation of *Familias* is significantly associated with increasing BMIZ in children aged 2 to 7 and, amongst girls, a significant increase in the odds of overweight or obesity. Odds were increased by phase 2 of the programme evaluation, that is, within about a year of *Familias* being in operation.

The programme is also associated with significantly increased odds of in-child double burden (simultaneous stunting and overweight). No association is seen with odds of obesity, with odds of intra-household double burden or with odds of any adverse nutritional outcome in boys. No heterogeneity of effect is observed with respect to markers of social determinants of health such as maternal literacy.

As discussed in Chapter 9, intention-to-treat analysis means that the real impact of Familias on odds of childhood overweight could be around 15% higher than estimated.

Interpretation

This effect is likely to have arisen because of increased calorie consumption in children exposed to *Familias.* Prior work by the IFS demonstrated, as already discussed, a 15% increase in households' food consumption as a result of the programme. Decreased energy expenditure is another possibility; the shift toward more sedentary lifestyles in the Latin American has already been mentioned[165]. The substitution of labour for schooling, as incentivised by CCTS, may contribute to this phenomenon. It should be noted, however, that school attendance in the cohort studied is over 90%[103], so any such substitution is unlikely to play a large role.

As in the preceding analysis, it is possible that the findings are confounded by alternative explanations. The same mechanisms, such as increased use of motorised transport in treatment areas, would apply.

In the analysis on obesity in women, household spending on food at phase 3 was found to partly explain the impact of *Familias*. This is not the case in this study, where inclusion of the variable does not attenuate the impact of *Familias* on BMIZ gain in children. Various explanations are possible. First, it may be that household spending on food is a poor measure of children's consumption - specifically, that children's food consumption increases by a disproportionately large amount for a given increase in household food spending. This seems plausible given that

Familias grants and parenting seminars are directed toward mothers, who are known to preferentially direct resources to children. Second, household spending may be poorly related to dietary quality, and children's diets switch to more energy dense foods. Consistent with this hypothesis, Monteiro reports that food trends in Brazil demonstrate an increase in sugar consumption (that is, cheap calories) over recent decades[218]. Finally, it may be that children's calorie consumption remains unchanged but their energy expenditure drops, although this seems less likely as discussed above.

The programme was associated with increasing BMIZ in both genders, but abnormal increases, as indicated by prevalence of overweight or obesity, were only seen in girls. There is evidence that energy expenditure in girls is less than that of boys of the same age[219]. Hence girls will be more disposed to weight gain when exposed to additional calories. Girls may also consume a greater share of household food relative to boys. Evidence supporting this assertion is seen in the cohort at baseline, when stunting was significantly less common in girls (23.3% (95%CI 21.6, 25.0%) vs. 26.3% in boys (95%CI 24.6, 28.1%)). This may suggest that girls preferentially receive food in the households studied. Additionally, female metabolism is known to predispose to fat deposition relative to males[157]. In reality, a complex interplay of factors is likely to be relevant. It should also be noted that the null finding in boys may be a false negative statistical artefact: sample attrition is greater amongst older children and increasing age is associated with greater odds of overweight in the sample of boys, but not girls.

The study does not find an association between operation of *Familias* and rates of childhood obesity. This contrasts with the findings of the study on women. WHO MGRS curves and thresholds, however, are known to yield very conservative estimates of the prevalence of childhood obesity relative to other standards[185], requiring a 5 year old to be at least 3 standard deviations above the mean before being classified as obese, for example. It may be, therefore, that the sample was insufficiently powered to detect an effect using WHO MGRS thresholds and/or that an association with obesity may become apparent with longer follow-up. Alternatively, the BMI-promoting effect of *Familias* may never be sufficiently large to cause obesity in children or may always be sufficiently moderated by factors such as increased exercise capacity.

The programme is also associated with increased odds of simultaneous child stunting and overweight. As discussed in the introductory paragraphs, stunting is determined in the first few years of life and is difficult to correct thereafter. It is unsurprising, therefore, that exposure to a welfare programme after the age of two causes disproportionate weight gain relative to height gain.

Relation to other studies

Comparison of the rates of childhood overweight and obesity observed in the *Familias* cohort with other studies are complicated by differences in the metrics and thresholds used to define the problem, as discussed in the introductory paragraphs. Nevertheless, rates reported here are broadly similar to those found in the IOTF survey[188] and Bogota 2006 survey[184].

The negative trend in BMIZ over time (Figure 11.6) is perhaps surprising, given the global trend of increasing overweight and obesity. Re-analysis of the cohort using different normative growth reference curves yields the same picture (Figure 11.9d below). A negative Colombian trend in childhood overweight has, however, already been reported elsewhere[200]. At first sight, the implication is that children are gaining more height relative to weight. This seems borne out by inspection of HAZ and WAZ trends in the cohort, using a variety of alternative reference curves. In Figures 11.9a and 11.9b below, children appear to be correcting height deficiencies more rapidly than weight deficiencies. Although contrary to the general consensus (underpinned by the Barker hypothesis) that height deficiencies are difficult to correct in later childhood, this phenomenon may occur if the quality and micronutrient-density of the Colombian diet is improving, relative to caloric intake.

figure 11.9a: Cohort trend in mean HAZ

figure 11.9b: Cohort trend in mean WAZ

figure 11.9c: Cohort trend in mean WHZ

figure 11.9d: Cohort trend in mean BMIZ

Figure 11.9: anthropometric trends in the *Familias* cohort using various alternative growth curves
- Colombian local reference
- WHO 2007: WHO-Multicentre Growth Reference Study[189]
- CDC 2000: US Centres for Disease Control[220]
- BGR 1990: British Growth Reference Study[221]

Artefact is another possible explanation. Use of growth reference curves that pre-date the cohort, however, may explain the finding. Although WHO-MGRS was published in 2007, its uses measurements taken 1997-2003; more recent cohorts (i.e. *Familias* children) typically have a foreshortened growth curve as explained by Tim Cole:

“The shape of the BMI curve is relevant - BMI rises steeply in first year, peaks at about 8 months and then falls again until age 3-5 years (the age depending on the population), and then it rises for the second time (adiposity rebound). If two populations are being compared (e.g. a recent group versus an older growth reference), the age at adiposity rebound is typically earlier in the more recent group. This means that the BMI curve is foreshortened - the age scale is effectively shrunk - and this has another effect too: it means that mean BMI between the early peak and the adiposity rebound is lower in the more recent group, simply because this section of the BMI curve has been moved to the left.” (personal communiation, 20/01/11).

In the age-range of the *Familias* cohort, therefore, it may appear that children are in a negative BMI trend relative to the reference cohort, as shown below:

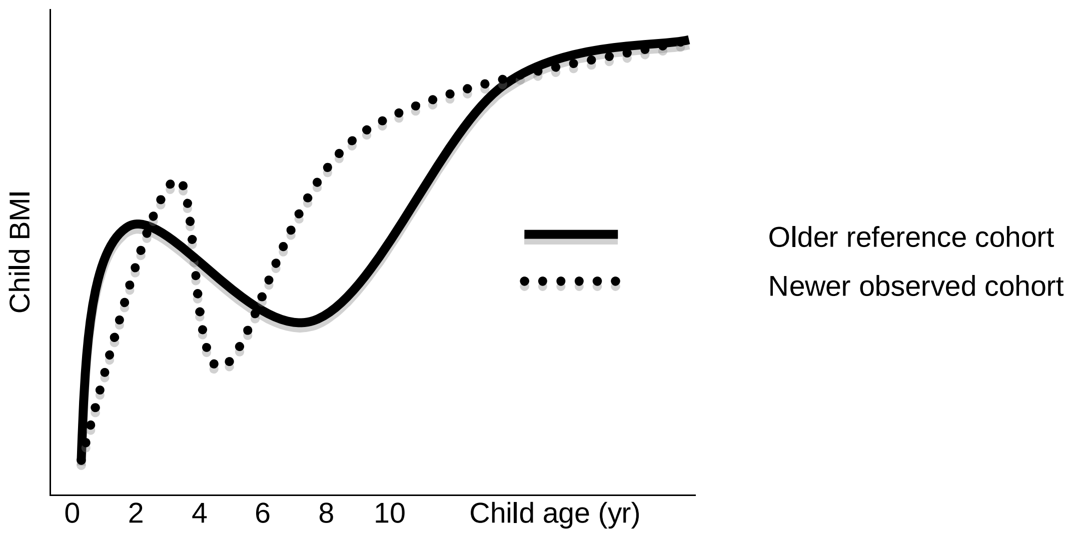


Figure 11.10: the foreshortening effect of comparing a newer cohort of children with an older reference cohort

Differential sample attrition would not account for the finding because children retained in the sample had higher mean BMIZ than children lost to follow-up (Table 11.20).

Finally, it may be that the trend is real and statistically significant, but nevertheless small in absolute terms and clinically unimportant (Elaine Borghi, WHO, personal communication). Even this were the case, it makes the adverse programme effect given the context of a negative secular trend perhaps more alarming.

Rates of in-child double burden (1.9% at baseline) are, however, lower than those observed in other cohorts. Fernald's study of impoverished Mexican children with a mean age of 4.0 years in 2003, for example, reports rates of 5-10%[192]. Differences in definition play a role: Fernald's study classified overweight as BMI-for-age above the 85% centile, just beyond the first standard deviation – a relatively non-conservative definition. Additionally, rates of stunting were significantly greater in the Mexican population, a third of whom were indigenous Indians, at up to 42.7%, in comparison to 24.9% in the *Familias* sample.

The adverse impact of *Familias* on rates of children's BMI concurs with the impact anticipated by Uauy, when discussing welfare programmes targeted by household wealth rather than nutritional indicators[197]. Not all studies have shown this effect however. For example, Fernald analysing data from *Progresa* CCTS in Mexico finds that BMI-for-age in eight to ten year old children was unchanged by an additional 18 months exposure to the programme in infancy[222]. In that study, however, all children had participated in *Progresa* for at least eight years, that is, no comparison was made with unexposed children. Additionally, boys and girls were pooled together. Both of these factors may have lead to a null finding in the Mexican data.

The finding of a positive association between mother's educational level and BMIZ in girls has been reported by Martorell, using Latin American data[164]. Maternal education is also protective against intra-household double-burden in this cohort. Overall, educated mothers appear to have better nourished children, which is a finding that has been consistently reported elsewhere[176 223].

Strengths and weaknesses of the study

The study benefits from a prior hypothesis deriving from earlier findings within the same cohort, namely positive associations between participation in *Familias*, food consumption and rates of obesity in women. The study's main result is plausible and consistent with these earlier findings. Additionally, the study had a large sample size of almost 4000 children with follow-up rates after three to four years of just under 80%. Information on a wide range of co-variates is available including, critically, exposure to other welfare programmes such as *Hogares Comunitarios*. A conservative statistical approach was used that analysed according to intention-to-treat and accounted for the non-independence of repeat observations by widening the standard errors of estimates.

As previously discussed, a primary weakness of the data is its non-randomized nature. Many differences between exposure groups are apparent at baseline which may cause biased and/or confounded associations, leading to either false positive or negative associations. A rigorous statistical approach was used in effort to obtain accurate estimates of association, which both adjusted for baseline differences through multivariate regression and accounted for additional unobserved municipality-level differences through a double-difference analysis.

Of particular note are the differences in BMIZ between exposure groups at baseline, where TBB children were observed to have significantly higher mean BMIZ. This may reflect non-random allocation of the programme and/or the fact that children in TBB areas were pre-exposed to the programme by about six months. Differences in the outcome of interest at baseline by exposure-type are a violation of the conditional independence assumption underlying most estimation methods. For this reason, it may be judicious to ignore TBB completely. Nevertheless, even with TBB areas dropped, an association between programme exposure and adverse BMIZ is seen. Furthermore, the double-difference approach adequately deals with the problem by accounting for baseline differences in its estimation method.

Although follow-up rates were good, greater sample attrition occurred in control communities. Reduction of sample size in the untreated group may lead to a false positive finding of treatment effect (a Type I error), but the absolute difference between attrition rates was small (no more than 4.6%). Loss to follow-up was also uneven with respect to co-variates. Sample attrition was greater in rural areas and may represent a phenomenon of rural displacement, as in the preceding chapter. Of note, children lost to follow-up were significantly older than those retained in the analytic sample (5.0 vs. 3.7 years, $p<0.001$). This may be because older children were less likely to be at home at the time of the survey interview. In most analyses, age was not significantly associated with odds of overweight or obesity, so this differential loss to follow-up is unlikely to have biased the results. In boys, however, increasing age is associated with a slightly increased risk of overweight or obesity in double-difference analyses (O.R. 1.01 for each additional month of age, $p<0.05$). Preferential drop-out of older children, therefore, is likely to lead to an under-estimate of programme effect.

Children lost to follow-up had smaller BMIZ than those retained in the sample, consistently across all exposure groups (Table 11.18 below). This bias may lead to an under-estimation of the adverse programme effect because attrition was greatest in control municipalities. Mean BMIZ at follow-up would therefore be inflated more in control municipalities than elsewhere.

	Lost to follow-up	Retained
All	0.06	0.26
Control (22.1% lost to f/u)	0.05	0.25
TBB (17.5% lost to f/u)	0.16	0.33
TAB (21.3% lost to f/u)	0.01	0.21

Table 11.18: mean baseline BMIZ by follow-up status and exposure type

This exploration of the effect of *Familias* on childhood nutritional outcomes generated many regressions: in boys and girls separately, with and without TBB areas and on BMI-derived outcomes as well as double burden outcomes, in-child and intra-household. False positive errors can arise when multiple comparisons are made. Associations between *Familias* and the adverse outcomes demonstrated are all significant at the 0.01 level or less, however, and are remain statistically significant after Bonferroni correction for multiple testing.

Policy implications

Familias is observed to worsen a key health outcome in participating children. Even though increased risk obesity was not observed and the effect appears limited to girls, this does not indicate lack of a serious public health problem. Indeed, the increased odds for overweight or obesity in girls is quite large (odds ratio 2.13) and, in the context of year on year increases in childhood overweight, is likely to represent a significant challenge to population health. If this negative impact is not addressed, there is the potential that it will reduce or reverse the health gains achieved through other aspects of *Familias*, particularly over the longer term. The appearance of an adverse health outcome at such an early age may lead to a significant reduction in years of healthy life. In this respect, it is perhaps more alarming than the adverse outcome observed in participating women.

This focus of the adverse outcome on girls is particularly unfortunate since females generally occupy disadvantaged social positions and CCTS were designed to improve the welfare of women and girls in particular. Furthermore, these findings must also be placed in the context of *Familias'* disappointing impact on childhood under-nutrition. The IFS had previously demonstrated that *Familias* did not improve indices of malnourishment in children over 2 (in common with several other CCTS evaluations). Thus, the adverse outcomes demonstrated in this study, restricted to non-malnourished children, are not compensated by beneficial outcomes in malnourished peers.

All sources agree that prevention is the most important approach in dealing with the problem of childhood overweight and obesity. There are as yet no effective interventions to treat childhood obesity, particularly across large numbers[188]. Furthermore, given that most people develop eating and activity patterns in childhood, successful avoidance of childhood obesity is critical to avoiding adult obesity[194 200]. These points raise difficult questions for an intervention which has been shown to worsen the problem. It is critical that *Familias* and other CCTS do not stimulate or embed adverse dietary and activity patterns in beneficiary children.

Policy implications for CCTS can be considered along three lines: redefinition of programme objectives, restructuring the policy in terms of target group, incentives and conditions and to consideration of supporting interventions to prevent abnormal weight gain. Each will be considered in turn.

First, nutritional objectives do not feature prominently in the current design and operation of CCTS. The main outcomes of interest to policy makers and funders centre on attendance at health and education facilities. Where attention is paid to clinical outcomes, the focus is on reducing rates of malnourishment. Thus far, none of the schemes have a stated objective to avoid excess weight gain. This should now change in the light of this and the preceding chapter. Careful refinement is necessary to protect the positive impacts achieved in the youngest beneficiaries. Specifically, objectives should be defined by participant's age: in the first few years of life the objective should be, as now, to improve linear growth and avoid stunting. Thereafter, however, objectives should shift to maintaining adequate nutrition whilst preventing excessive weight gain[224].

These objectives could partly be supported by reconsidering the targeting and incentive structure of CCTS. Currently, targeting occurs at household level and is based on socioeconomic measures such as wealth. This is appropriate where the focus of the programme is to improve socioeconomic outcomes. If, however, unanticipated effects emerge in other dimensions there is a case to consider which groups are most at risk of harm and revise targeting and eligibility criteria accordingly. Various revisions are appropriate given the findings of this study. One would be to restrict the programme to children under two. This is reasonable because good growth during these years and the avoidance of stunting is known to be protective against future overweight or obesity. Furthermore, *Familias* and several other CCTS have been shown to be effective in this age group. Another revision would be to restrict eligibility of older children to those demonstrably under-nourished. This may best be identified using WAZ, WHZ or BMI-for-age scores, since stunting (defined by HAZ) is likely to be irreversible above the age of three and to predispose to excess weight gain[224]. Uauy additionally suggests that the level of intervention should be adjusted for activity level[197], but this is likely to be difficult to measure in practice. There is also scope to consider whether additional conditions that may help avoid excessive weight gain are appropriate (a requirement to participate in sports or recreation, for example) and whether the cash transfer could be supplemented or partly replaced with vouchers for healthy food or exercise.

Refined objectives could also be met by closely integrating CCTS with supporting interventions to prevent abnormal weight gain. Improving health knowledge about optimal household nutrition is likely to be critical. Penny, for example, has shown that education alone can reduce stunting in areas where access to food is not a problem, in the absence of CCTS-type incentives or subsidies[225]. Parents and professionals need better information on normal childhood growth, the adverse consequences of excess weight and how excess weight gain can be avoided. Information on dietary quality is key, particularly the interplay between micronutrients and calories. De Lisle has shown that transitional diets are typically energy dense but micronutrient poor[170]. This is corroborated by the Pan-American Health Organisation who have demonstrated that low income families tend to buy energy-dense foods as their income improves[226]. Misconceptions that lead parents and professionals to focus on dietary quantity, not quality, and imbalances between micronutrients and calories may thus exacerbate the problem of over-nutrition. Giving parents more detailed feedback on children's growth, particularly if excessive, has also been shown to be effective in some settings[227] and may also be appropriate in CCTS settings.

Whatever educational interventions are chosen, it is likely that they will need to be specialised, intensive and tailored to the family. Several other legal, economic and environmental levers can also be identified at the community and national levels, as set out in Foresight's systems map of the determinants of obesity shown in Figure 10.1. A simple example would be enabling better access to safe play and recreation facilities. Such structural determinants have a particularly important role with regards to children, given that children have little ability to influence their environment or exert their own dietary and activity choices. The complexity of the problem is brought out by Lobstein[188] who writes that “no single aspect of this web of policies and processes can be addressed without having a potential impact on other areas, and the interests in these areas may be competing … the goal is not to find a single programme that works, as this is unlikely to be found, but to stimulate regional, national and local initiatives that are suitable for their context” (page 67).

The challenge of eliminating malnutrition in poor households whilst avoiding excessive weight gain is undoubtedly formidable. Yet examples of successful approaches exist in the region. Stein reports that Guatemala achieved nutritional gains (a reduction in stunting) whilst avoiding BMI increases in children less than six living rurally, between 1968 and 2007[228]. The country underwent a rapid nutritional transition over this time, including electrification with increase in television viewing and other sedentary activity. The authors suggest that a substantial increase in maternal schooling over the same period, with associated improvements in breastfeeding rates and dietary quality, as well as better sanitation and immunization could explain their findings. Another example is *‘’Vida Chile’’* which promotes healthy diets, physical activity, tobacco control and psychosocial health for all ages through schools, workplaces, and communities. It is partly credited with securing stabilized or decreasing obesity figures in the country[229].

Given the complexity of the health problem identified and the range of possible policy responses, there is a strong argument for greater engagement from the health sector in the design and operation of CCTS. Health sector involvement is relevant at the broadest, most strategic level as consideration is given to refining CCTS objectives, structure and design down to the micro-level of programme delivery to individual households, with the tailored communication of health knowledge described earlier.

Relation to conceptual model in the wider thesis

As in women, this study demonstrates that cash transfers can be associated with higher rates of childhood over-nutrition and implies that in some cases, actions on specific drivers of disadvantage (here, cash transfers at the individual and household level) can have adverse effects on other outcomes. Parallel investments are necessary at the same level or at other levels. Maternal education is likely to be important: significant associations with girls' BMIZ and intra-household double-burden are found in the *Familias* cohort, and maternal education is consistently reported as determinant of childhood nutritional outcomes in the wider literature.

Given the complexity of drivers behind overweight and obesity, and their importance as a risk factor for ill-health, there is a strong argument for greater involvement from the health sector in the design, operation and evaluation of cash transfer schemes.

	Control			TBB					TAB				
							diff. cf. Control					diff. cf. Control	
	Mean	95% CI		**Mean**	95% CI		t / χ^2	p	**Mean**	95% CI		t / χ^2	p
Individual level co-variates													
BMIZ	**0.20**	0.16	0.24	**0.30**	0.25	0.34	-2.95	<0.01	**0.16**	0.11	0.22	1.13	0.26
Gender (% boys)	**50.2**	47.6	52.8	**47.1**	44.3	49.9	1.6	0.11	**48.1**	45.3	51.0	1.05	0.29
Age (months)	**53.2**	52.4	54.0	**53.4**	52.5	54.3	-0.38	0.70	**52.9**	52.0	53.7	0.54	0.59
Number of siblings	**5.0**	4.9	5.1	**4.9**	4.7	5.0	1.49	0.14	**5.1**	5.0	5.3	-1.02	0.31
Hogares Communitarios beneficiary	**56.4**	53.8	58.9	**34.8**	32.2	37.5	11.4	<0.001	**41.5**	38.6	44.3	7.65	<0.001
Household level co-variates													
Mother's age (years)	**32.1**	31.8	32.5	**32.4**	32.0	32.8	-0.93	0.35	**32.3**	31.9	32.7	-0.78	0.43
Mother's BMI	**25.1**	24.9	25.3	**24.7**	24.4	24.9	2.72	0.01	**24.6**	24.3	24.8	3.18	<0.01
Mother's literacy	**82.4**	80.4	84.3	**84.0**	81.9	86.0	-1.12	0.26	**82.4**	80.2	84.6	-0.05	0.96
Mother's 1ary education incomplete	**60.0**	57.5	62.5	**62.7**	60.0	65.4			**63.6**	60.8	66.3		
Mother's 1ary education complete	**33.9**	31.4	36.3	**32.9**	30.3	35.5	χ^2=4.71	0.19	**31.0**	28.3	33.6	χ^2=6.49	0.09
Mother's 2ary education complete	**5.2**	4.0	6.3	**3.7**	2.6	4.7			**5.1**	3.9	6.4		
Mother's further education	**1.0**	0.5	1.5	**0.7**	0.3	1.2			**0.3**	0.0	0.7		
Mother's community participation	**18.7**	16.7	20.7	**23.8**	21.5	26.2	-3.27	<0.01	**28.9**	26.3	31.5	-6.2	<0.001
Head of household literacy	**78.2**	76.1	80.4	**82.9**	80.8	85.0	-3.05	<0.01	**78.6**	76.3	81.0	-0.24	0.81
Head of h'hold 1ary education incomplete	**62.8**	60.3	65.3	**64.8**	62.1	67.4			**67.6**	64.9	70.3		
Head of h'old 1ary education complete	**32.3**	29.9	34.7	**32.1**	29.4	34.7	χ^2=7.40	0.06	**27.1**	24.5	29.7	χ^2=8.27	0.04
Head of h'old 2ary education complete	**4.3**	3.3	5.4	**2.4**	1.6	3.3			**4.7**	3.5	5.9		
Head of h'old further education	**0.6**	0.2	1.0	**0.7**	0.3	1.2			**0.6**	0.2	1.1		
Travel time to medical centre (min)	**37.4**	35.0	39.8	**39.6**	37.2	42.0	-1.23	0.22	**34.6**	32.4	36.8	1.66	0.01
Household size (persons)	**6.4**	6.3	6.5	**6.3**	6.1	6.4	1.31	0.19	**6.5**	6.4	6.6	-1.49	0.14
Persons per room	**3.4**	3.3	3.5	**3.2**	3.1	3.3	2.96	<0.01	**2.9**	2.8	3.0	6.76	<0.001
Log household wealth (pesos)	**12.77**	12.74	12.8	**12.92**	12.89	12.95	-6.77	<0.001	**12.75**	12.71	12.78	0.99	0.32
Piped water to household	**61.5**	59.0	64.0	**51.7**	48.9	54.5	5.2	<0.001	**66.8**	64.0	69.5	-2.76	0.01
Urban location	**51.7**	49.1	54.3	**39.1**	36.4	41.9	6.6	<0.001	**42.0**	39.1	44.8	4.96	<0.001
Municipality level co-variates													
Log municipality population	**9.79**	9.75	9.83	**10.21**	10.17	10.25	-14.43	<0.001	**9.86**	9.82	9.91	-2.48	0.01
Eligible families in municipality	**6.32**	6.27	6.38	**7.19**	7.14	7.24	-22.1	<0.001	**6.8**	6.75	6.85	-12.11	<0.001
Eligible families in urbanized municipality	**3.67**	3.63	3.71	**3.3**	3.26	3.35	11.67	<0.001	**3.57**	3.53	3.62	3.01	<0.01
Quality of life index	**54.2**	53.6	54.7	**54.1**	53.6	54.6	0.25	0.80	**53.7**	53.1	54.2	1.26	0.21
Ratio of doctors to population in municipality	**-1.18**	-1.21	-1.16	**-1.43**	-1.46	-1.41	14.06	<0.001	**-1.33**	-1.36	-1.3	8.16	<0.001
Ratio of nurses to population in municipality	**-0.49**	-0.52	-0.46	**-0.73**	-0.78	-0.68	8.42	<0.001	**-0.6**	-0.64	-0.55	3.95	<0.001
Av. municipality household wealth	**12.92**	12.91	12.93	**12.99**	12.98	13	-10.08	<0.001	**12.93**	12.92	12.94	-0.57	0.57
Av. municipality travel time to medical centre	**38.4**	37.1	39.6	**39.4**	38.4	40.3	-1.24	0.22	**34.1**	33.3	34.8	5.32	<0.001
Av. municipality piped water to household	**65.5**	64.3	66.7	**55.0**	53.9	56.1	12.6	<0.001	**67.6**	66.6	68.7	-2.52	0.01

Table 11.19: Characteristics of analytic sample at baseline (figures are percentages unless otherwise indicated)

	Analytic Sample			Lost to follow-up				
	Mean	95% CI		Mean	95% CI		t / χ^2	p
Individual level co-variates								
BMIZ	**0.26**	0.23	0.29	**0.06**	0.01	0.12	-5.84	<0.001
Gender (% boys)	**48.6**	47.0	50.2	**50.8**	47.6	53.9	1.21	0.22
Age (months)	**53.2**	52.7	53.7	**67.0**	66.0	68.0	24.66	<0.001
Hogares Comunitarios beneficiary	**45.0**	43.4	46.6	**46.4**	43.3	49.5	0.79	0.43
Number of siblings	**5.0**	4.9	5.1	**5.2**	5.1	5.4	2.51	0.01
Household level co-variates								
Mother's age (years)	**32.3**	32.0	32.5	**32.5**	32.1	33.0	1.03	0.30
Mother's BMI	**24.8**	24.7	24.9	**24.8**	24.6	25.1	0.36	0.72
Mother's literacy	**82.9**	81.7	84.1	**78.8**	76.2	81.3	-3.00	<0.01
Mother's 1ary education incomplete	**61.9**	60.4	63.5	**67.5**	64.6	70.4		
Mother's 1ary education complete	**32.7**	31.2	34.2	**27.2**	24.4	30.0	χ^2=12.58	0.006
Mother's 2ary education complete	**4.7**	4.0	5.3	**4.3**	3.0	5.5		
Mother's further education	**0.7**	0.4	1.0	**0.1**	0.4	1.6		
Mother's community participation	**23.4**	22.1	24.8	**24.9**	22.2	27.6	0.96	0.34
Head of household literacy	**79.8**	78.6	81.1	**76.4**	73.8	79.1	-2.34	0.02
Head of h'hold 1ary education incomplete	**64.9**	63.4	66.3	**69.4**	66.6	72.3		
Head of h'hold 1ary education complete	**30.7**	29.2	32.1	**26.9**	24.1	29.7	χ^2=7.42	0.06
Head of h'hold 2ary education complete	**3.8**	3.2	4.4	**3.1**	2.1	4.2		
Head of h'hold further education	**0.7**	0.4	0.9	**0.5**	0.1	1.0		
Travel time to medical centre (min)	**37.3**	35.9	38.6	**48.5**	44.9	52.2	6.77	<0.001
Household size (persons)	**6.4**	6.3	6.4	**6.6**	6.4	6.7	2.32	0.02
Persons per room	**3.2**	3.1	3.2	**3.2**	3.1	3.3	0.85	0.40
Log household wealth (pesos)	**12.81**	12.79	12.83	**12.80**	12.8	12.8	-0.32	0.75
Piped water to household	**59.9**	58.4	61.5	**53.5**	50.4	56.6	-3.67	<0.01
Urban location	**44.8**	43.2	46.3	**38.7**	35.6	41.7	-3.44	<0.01
Municipality level co-variates								
Log municipality population	**9.94**	9.92	9.97	**9.91**	9.86	9.96	-1.32	0.19
Eligible families in municipality	**6.74**	6.71	6.78	**6.69**	6.63	6.76	-1.46	0.15
Eligible families in urbanized municipality	**3.52**	3.50	3.55	**3.41**	3.36	3.46	-3.84	<0.01
Quality of life index	**54.0**	53.7	54.3	**53.1**	52.4	53.7	-2.74	<0.01
Ratio of doctors to population in municipality	**-1.31**	-1.32	-1.29	**-1.27**	-1.30	-1.24	2.31	0.02
Ratio of nurses to population in municipality	**-0.60**	-0.63	-0.58	**-0.55**	-0.60	-0.50	1.82	0.07
Av. municipality household wealth	**12.95**	12.94	12.95	**12.94**	12.93	12.95	-1.26	0.21
Av. municipality travel time to medical centre	**37.4**	36.8	38.0	**41.4**	40.0	42.8	5.57	<0.001
Av. municipality piped water to household	**62.8**	62.1	63.4	**58.8**	57.5	60.2	-5.17	<0.001

Table 11.20: Characteristics of children lost to follow-up (figures are percentages unless otherwise indicated)

	Model A				Model B				Model C				Model D			
	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value
TAB area effect	0.01		0.08	0.90	-0.02		0.08	0.80	-0.04		0.06	0.59	-0.06		0.06	0.37
Time effect	-0.33	***	0.04	<0.001	-0.33	***	0.04	<0.001	-0.33	***	0.04	<0.001	-0.33	***	0.04	<0.001
Programme effect	0.12		0.07	0.07	0.12		0.07	0.07	0.12		0.07	0.07	0.12		0.07	0.07
<u>Individual level co-variates</u>																
Age					-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001
Hogares Communitarios beneficiary					-0.18	**	0.06	<0.01	-0.17	**	0.05	<0.01	-0.15	**	0.05	<0.01
Number of siblings					-0.03	*	0.01	0.01	-0.02		0.01	0.17	-0.02		0.01	0.23
<u>Household level co-variates</u>																
Mother’s age									0.00		0.00	1.00	0.00		0.00	0.95
Mother’s BMI									0.05	***	0.01	<0.001	0.05	***	0.01	<0.001
Mother’s 1ary education complete									0.05		0.06	0.43	0.07		0.06	0.25
Mother’s 2ary education complete									0.22		0.13	0.08	0.25	*	0.13	0.05
Mother’s further education									0.39		0.32	0.22	0.47		0.32	0.15
Mother’s literacy									-0.01		0.08	0.90	-0.00		0.08	0.95
Travel time to medical centre									-0.00		0.00	0.25	0.00		0.00	0.45
Mother’s community participation									0.08		0.07	0.25	0.05		0.06	0.35
Head of h’old 1ary education complete									-0.08		0.06	0.23	-0.08		0.06	0.21
Head of h’old 2ary education complete									-0.01		0.12	0.97	0.02		0.13	0.90
Head of h’old further education									-0.48		0.40	0.24	-0.51		0.40	0.21
Head of household literacy									0.01		0.08	0.92	-0.02		0.08	0.78
Household size									0.00		0.01	0.79	0.00		0.01	0.98
Persons per room									-0.04	***	0.01	<0.001	-0.04	***	0.01	<0.001
Log household wealth									-0.06		0.03	0.11	-0.05		0.03	0.18
Piped water to household									-0.00		0.05	0.94	-0.03		0.06	0.67
Urban household									-0.09		0.06	0.14	-0.03		0.05	0.55
<u>Municipality level co-variates</u>																
Log municipality population													0.04		0.04	0.25
Eligible families in municipality													-0.01		0.03	0.69
Eligible families in urbanized municipality													-0.16	***	0.04	<0.001
Quality of life index													0.00		0.00	0.67
Ratio of doctors to population in municipality													-0.05		0.07	0.50
Ratio of nurses to population in municipality													-0.07		0.04	0.13
Av. municipality household wealth													0.02		0.13	0.88
Av. municipality travel time to medical centre													-0.00		0.00	0.14
Av. municipality piped water to household													0.00		0.00	0.41

Table 11.21: determinants of BMIZ in girls (TBB areas excluded)

	Model A				Model B				Model C				Model D			
	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value
TBB area effect	-0.08		0.09	0.38	-0.11		0.08	0.18	-0.09		0.08	0.24	-0.17		0.09	0.06
TAB area effect	0.00		0.08	0.97	-0.02		0.08	0.79	-0.03		0.06	0.61	-0.05		0.06	0.43
Time effect	-0.35	***	0.03	<0.001	-0.35	***	0.03	<0.001	-0.35	***	0.03	<0.001	-0.35	***	0.03	<0.001
Programme effect	0.14	*	0.06	0.03	0.14	*	0.06	0.03	0.14	*	0.06	0.03	0.14	*	0.06	0.03
Individual level co-variates																
Age					-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001
Hogares Communitarios beneficiary					-0.13	*	0.05	0.01	-0.11	*	0.05	0.01	-0.10	*	0.04	0.03
Number of siblings					-0.02	**	0.01	<0.001	-0.01		0.01	0.26	-0.01		0.01	0.32
Household level co-variates																
Mother’s age									0.00		0.00	0.95	0.00		0.00	0.93
Mother’s BMI									0.05	***	0.01	<0.001	0.05	***	0.01	<0.001
Mother’s 1ary education complete									0.07		0.05	0.15	0.08		0.05	0.11
Mother’s 2ary education complete									0.18		0.10	0.06	0.20	*	0.10	0.04
Mother’s further education									0.56	*	0.27	0.04	0.64	*	0.27	0.02
Mother’s literacy									-0.02		0.06	0.81	-0.02		0.06	0.80
Travel time to medical centre									-0.00		0.00	0.09	-0.00		0.00	0.21
Mother’s community participation									0.08		0.05	0.13	0.06		0.05	0.22
Head of h’old 1ary education complete									-0.07		0.05	0.16	-0.06		0.05	0.23
Head of h’old 2ary education complete									0.06		0.12	0.59	0.09		0.12	0.46
Head of h’old further education									-0.16		0.31	0.60	-0.17		0.31	0.58
Head of household literacy									0.03		0.06	0.60	-0.00		0.06	0.97
Household size									0.00		0.01	0.99	0.00		0.01	0.94
Persons per room									-0.03	**	0.01	<0.01	-0.03	**	0.01	<0.01
Log household wealth									-0.06		0.03	0.06	-0.07	*	0.03	0.03
Piped water to household									0.01		0.04	0.91	-0.01		0.05	0.77
Urban household									-0.11	*	0.05	0.02	-0.06		0.05	0.23
Municipality level co-variates																
Log municipality population													0.03		0.04	0.42
Eligible families in municipality													-0.02		0.03	0.49
Eligible families in urbanized municipality													-0.15	***	0.04	<0.001
Quality of life index													0.01		0.00	0.12
Ratio of doctors to population in municipality													-0.08		0.05	0.09
Ratio of nurses to population in municipality													-0.04		0.03	0.15
Av. municipality household wealth													0.12		0.11	0.29
Av. municipality travel time to medical centre													-0.00		0.00	0.23
Av. municipality piped water to household													0.00		0.00	0.52

Table 11.22: determinants of BMIZ in girls (TBB areas included)

	Model A				Model B				Model C				Model D			
	Coefficient		**S.E.**	**p-value**	**Coefficient**		**S.E.**	**p-value**	**Coefficient**		**S.E.**	**p-value**	**Coefficient**		**S.E.**	**p-value**
TAB area effect	-0.11		0.08	0.18	-0.13		0.08	0.11	-0.11		0.07	0.14	-0.12		0.07	0.09
Time effect	-0.41	***	0.05	<0.001	-0.41	***	0.05	<0.001	-0.41	***	0.05	0.00	-0.41	***	0.05	<0.001
Programme effect	0.16	*	0.06	0.01	0.16	*	0.06	0.01	0.16	*	0.06	0.01	0.16	*	0.06	0.01
Individual level co-variates																
Age					-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001
Hogares Communitarios beneficiary					-0.16	**	0.05	<0.01	-0.14	**	0.05	0.01	-0.12	*	0.05	0.02
Number of siblings					-0.01		0.01	0.49	-0.00		0.02	0.85	-0.00		0.02	0.80
Household level co-variates																
Mother’s age									0.00		0.00	0.43	0.00		0.00	0.58
Mother’s BMI									0.05	***	0.01	<0.001	0.05	***	0.01	<0.001
Mother’s 1ary education complete									0.03		0.05	0.56	0.04		0.05	0.44
Mother’s 2ary education complete									0.02		0.13	0.88	0.02		0.13	0.90
Mother’s further education									-0.10		0.20	0.63	-0.02		0.20	0.92
Mother’s literacy									0.07		0.07	0.35	0.06		0.07	0.40
Travel time to medical centre									0.00		0.00	0.64	0.00		0.00	0.90
Mother’s community participation									-0.01		0.06	0.93	-0.01		0.06	0.81
Head of h’old 1ary education complete									-0.03		0.06	0.61	-0.02		0.06	0.73
Head of h’old 2ary education complete									-0.03		0.14	0.84	-0.00		0.15	0.99
Head of h’old further education									0.10		0.41	0.81	0.18		0.42	0.66
Head of household literacy									0.06		0.07	0.43	0.02		0.06	0.80
Household size									-0.00		0.02	0.88	-0.00		0.02	0.85
Persons per room									-0.00		0.02	0.79	-0.01		0.02	0.67
Log household wealth									0.01		0.05	0.80	0.02		0.04	0.69
Piped water to household									0.08		0.06	0.21	0.10		0.06	0.08
Urban household									-0.05		0.06	0.45	0.02		0.05	0.74
Municipality level co-variates																
Log municipality population													0.01		0.06	0.80
Eligible families in municipality													-0.04		0.04	0.31
Eligible families in urbanized municipality													-0.15	*	0.07	0.03
Quality of life index													0.00		0.00	0.95
Ratio of doctors to population in municipality													-0.09		0.08	0.26
Ratio of nurses to population in municipality													-0.09		0.05	0.10
Av. municipality household wealth													-0.01		0.15	0.93
Av. municipality travel time to medical centre													0.00		0.00	0.90
Av. municipality piped water to household													0.00		0.00	0.88

Table 11.23: determinants of BMIZ in boys (TBB areas excluded)

	Model A				Model B				Model C				Model D			
	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value	Coefficient		S.E.	p-value
TBB area effect	-0.15		0.08	0.07	-0.18	*	0.08	0.03	-0.17	*	0.08	0.03	-0.23	**	0.09	0.01
TAB area effect	-0.12		0.08	0.13	-0.14		0.08	0.07	-0.13		0.07	0.07	-0.14	*	0.07	0.04
Time effect	-0.43	***	0.03	<0.001	-0.43	***	0.03	<0.001	-0.43	***	0.03	<0.001	-0.43	***	0.03	<0.001
Programme effect	0.18	***	0.05	<0.001	0.18	***	0.05	<0.001	0.18	***	0.05	<0.001	0.18	***	0.05	<0.001
Individual level co-variates																
Age					-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001	-0.01	***	0.00	<0.001
Hogares Communitarios beneficiary					-0.16	***	0.04	<0.001	-0.13	**	0.04	<0.01	-0.12	**	0.04	<0.01
Number of siblings					-0.02		0.01	0.10	-0.01		0.01	0.49	-0.01		0.01	0.62
Household level co-variates																
Mother's age									0.00		0.00	0.61	0.00		0.00	0.97
Mother's BMI									0.05	***	0.00	<0.001	0.05	***	0.00	<0.001
Mother's 1ary education complete									0.02		0.04	0.69	0.03		0.04	0.51
Mother's 2ary education complete									0.01		0.11	0.91	0.02		0.11	0.85
Mother's further education									0.02		0.17	0.90	0.06		0.17	0.73
Mother's literacy									0.08		0.06	0.18	0.07		0.06	0.21
Travel time to medical centre									0.00		0.00	0.87	0.00		0.00	0.87
Mother's community participation									0.01		0.05	0.85	0.00		0.05	1.00
Head of h'old 1ary education complete									-0.07		0.05	0.13	-0.07		0.05	0.16
Head of h'old 2ary education complete									-0.09		0.12	0.46	-0.08		0.13	0.57
Head of h'old further education									0.12		0.29	0.68	0.17		0.3	0.57
Head of household literacy									0.04		0.06	0.51	0.01		0.06	0.81
Household size									-0.01		0.01	0.75	-0.00		0.01	0.76
Persons per room									-0.01		0.01	0.53	-0.01		0.01	0.45
Log household wealth									0.03		0.04	0.44	0.03		0.03	0.44
Piped water to household									0.07		0.05	0.15	0.09		0.05	0.07
Urban household									-0.09		0.05	0.07	-0.02		0.05	0.67
Municipality level co-variates																
Log municipality population													0.01		0.04	0.92
Eligible families in municipality													-0.03		0.03	0.39
Eligible families in urbanized municipality													-0.15	**	0.05	<0.01
Quality of life index													0.00		0.00	0.49
Ratio of doctors to population in municipality													-0.09		0.05	0.08
Ratio of nurses to population in municipality													-0.04		0.03	0.29
Av. municipality household wealth													0.02		0.13	0.87
Av. municipality travel time to medical centre													-0.00		0.00	0.37
Av. municipality piped water to household													-0.00		0.00	0.31

Table 11.24: determinants of BMIZ in boys (TBB areas included)

	Model A			Model B			Model C			Model D		
	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value
TAB area effect	0.73	0.16	0.17	0.70	0.16	0.12	0.71	0.17	0.15	0.67	0.17	0.11
Time effect	1.28	0.22	0.16	1.28	0.22	0.16	1.37	0.25	0.09	1.37	0.25	0.09
Programme effect	2.13 **	0.62	<0.001	2.30 **	0.61	<0.001	2.25 **	0.65	<0.001	2.26 **	0.66	0.01
Individual level co-variates												
Age				1.00	0.01	0.50	1.00	0.01	0.86	1.00	0.01	0.79
Hogares Communitarios beneficiary				0.68	0.14	0.07	0.75	0.17	0.20	0.77	0.18	0.26
Number of siblings				0.91 **	0.03	0.01	0.90	0.05	0.05	0.89 *	0.05	0.04
Household level co-variates												
Mother's age							1.03 *	0.01	0.03	1.03 *	0.01	0.02
Mother's BMI							1.12 ***	0.02	<0.001	1.12 ***	0.02	<0.001
Mother's 1ary education complete							1.01	0.22	0.97	1.07	0.22	0.76
Mother's 2ary education complete							1.37	0.52	0.41	1.41	0.55	0.38
Mother's further education							1.56	1.78	0.70	1.66	1.83	0.65
Mother's literacy							0.7	0.22	0.26	0.73	0.23	0.31
Travel time to medical centre							1.00	0.00	0.73	1.00	0.00	0.60
Mother's community participation							1.19	0.29	0.48	1.13	0.25	0.60
Head of h'old 1ary education complete							1.03	0.25	0.91	1.00	0.24	1.00
Head of h'old 2ary education complete							1.18	0.61	0.75	1.14	0.60	0.80
Head of h'old further education							0.77	0.85	0.81	0.62	0.74	0.69
Head of household literacy							1.03	0.33	0.93	1.05	0.33	0.89
Household size							0.98	0.06	0.76	0.97	0.06	0.66
Persons per room							0.89 *	0.05	0.03	0.90 *	0.04	0.03
Log household wealth							1.05	0.17	0.75	1.11	0.17	0.48
Piped water to household							0.85	0.17	0.43	0.83	0.17	0.35
Urban household							1.00	0.23	0.99	1.06	0.26	0.81
Municipality level co-variates												
Log municipality population										1.14	0.13	0.25
Eligible families in municipality										1.06	0.14	0.64
Eligible families in urbanized municipality										0.82	0.11	0.14
Quality of life index										1.01	0.01	0.48
Ratio of doctors to population in municipality										0.83	0.22	0.49
Ratio of nurses to population in municipality										1.24	0.19	0.16
Av. municipality household wealth										0.87	0.44	0.79
Av. municipality travel time to medical centre										1.00	0.01	0.53
Av. municipality piped water to household										1.00	0.01	0.61

Table 11.25: determinants of odds of overweight or obesity in girls (TBB areas excluded)

	Model A				Model B				Model C				Model D			
	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value	Odds Ratio		S.E.	p-value
TBB area effect	0.48	*	0.14	0.01	0.44	**	0.13	<0.01	0.42	**	0.13	<0.001	0.32	***	0.11	<0.001
TAB area effect	0.73		0.16	0.14	0.70		0.15	0.11	0.71		0.17	0.14	0.65		0.15	0.07
Time effect	1.27	*	0.15	0.04	1.27	*	0.15	0.04	1.30	*	0.16	0.03	1.31	*	0.16	0.03
Programme effect	2.30	***	0.53	<0.001	2.31	***	0.53	<0.01	2.35	***	0.59	<0.001	2.36	***	0.60	<0.001
Individual level co-variates																
Age					1.01		0.00	0.27	1.00		0.01	0.47	1.00		0.01	0.45
Hogares Communitarios beneficiary					0.70	*	0.13	0.05	0.74		0.14	0.12	0.78		0.16	0.21
Number of siblings					0.88	***	0.03	<0.001	0.88	**	0.04	0.01	0.88	**	0.04	0.01
Household level co-variates																
Mother's age									1.03	*	0.01	0.01	1.03	*	0.01	0.02
Mother's BMI									1.11	***	0.02	<0.001	1.11	***	0.02	<0.001
Mother's 1ary education complete									1.18		0.22	0.36	1.23		0.22	0.25
Mother's 2ary education complete									1.29		0.37	0.36	1.31		0.38	0.35
Mother's further education									2.27		2.06	0.37	2.60		2.33	0.28
Mother's literacy									0.80		0.21	0.4	0.79		0.21	0.36
Travel time to medical centre									1.00		0.00	0.75	1.00		0.00	0.89
Mother's community participation									1.09		0.22	0.66	1.05		0.20	0.78
Head of h'old 1ary education complete									0.98		0.19	0.93	0.99		0.19	0.94
Head of h'old 2ary education complete									1.09		0.48	0.85	1.12		0.50	0.8
Head of h'old further education									1.40		1.05	0.65	1.22		0.95	0.79
Head of household literacy									1.02		0.26	0.94	0.99		0.25	0.95
Household size									0.99		0.05	0.79	0.98		0.05	0.71
Persons per room									0.93		0.05	0.16	0.93		0.04	0.16
Log household wealth									1.11		0.15	0.47	1.14		0.15	0.3
Piped water to household									0.84		0.14	0.29	0.78		0.14	0.16
Urban household									0.90		0.16	0.56	0.95		0.19	0.79
Municipality level co-variates																
Log municipality population													1.08		0.14	0.54
Eligible families in municipality													1.12		0.13	0.32
Eligible families in urbanized municipality													0.67	**	0.08	<0.001
Quality of life index													1.03	*	0.01	0.05
Ratio of doctors to population in municipality													0.89		0.16	0.51
Ratio of nurses to population in municipality													1.13		0.14	0.34
Av. municipality household wealth													1.04		0.47	0.93
Av. municipality travel time to medical centre													1.00		0.01	0.73
Av. municipality piped water to household													1.00		0.00	0.81

Table 11.26: determinants of odds of overweight or obesity in girls (TBB areas included)

	Model A			Model B			Model C			Model D		
	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value
TAB area effect	1.23	0.28	0.36	1.20	0.27	0.42	1.3	0.34	0.31	1.36	0.34	0.21
Time effect	1.87 ***	0.27	<0.001	1.87 ***	0.28	<0.001	2.04 ***	0.34	<0.001	2.05 ***	0.35	<0.001
Programme effect	0.81	0.16	0.28	0.81	0.16	0.28	0.75	0.16	0.19	0.75	0.16	0.19
<u>Individual level co-variates</u>												
Age				1.01 *	0.01	0.03	1.01 *	0.01	0.03	1.01 *	0.01	0.04
Hogares Communitarios beneficiary				0.78	0.13	0.12	0.81	0.14	0.22	0.84	0.15	0.33
Number of siblings				0.95	0.03	0.08	0.99	0.04	0.77	0.99	0.04	0.72
<u>Household level co-variates</u>												
Mother's age							1.00	0.01	0.84	1.00	0.01	0.95
Mother's BMI							1.12 ***	0.02	<0.001	1.12 ***	0.02	<0.001
Mother's 1ary education complete							1.36	0.25	0.09	1.37	0.25	0.09
Mother's 2ary education complete							1.21	0.47	0.62	1.15	0.47	0.74
Mother's further education							0.33 *	0.17	0.04	0.38	0.20	0.07
Mother's literacy							1.01	0.26	0.96	1.00	0.24	0.99
Travel time to medical centre							1.00	0.00	0.43	1.00	0.00	0.85
Mother's community participation							1.15	0.24	0.50	1.16	0.23	0.46
Head of h'old 1ary education complete							0.71	0.13	0.07	0.70	0.13	0.06
Head of h'old 2ary education complete							1.03	0.38	0.93	1.10	0.44	0.80
Head of h'old further education							2.09	1.87	0.41	2.44	2.41	0.36
Head of household literacy							1.08	0.27	0.75	0.99	0.24	0.98
Household size							0.96	0.05	0.46	0.96	0.05	0.42
Persons per room							0.96	0.05	0.40	0.94	0.05	0.29
Log household wealth							1.03	0.17	0.84	1.08	0.17	0.65
Piped water to household							1.32	0.25	0.14	1.58 *	0.32	0.02
Urban household							0.91	0.19	0.66	1.06	0.21	0.77
<u>Municipality level co-variates</u>												
Log municipality population										1.02	0.20	0.90
Eligible families in municipality										0.90	0.11	0.38
Eligible families in urbanized municipality										0.78	0.16	0.21
Quality of life index										1.01	0.01	0.37
Ratio of doctors to population in municipality										0.78	0.20	0.33
Ratio of nurses to population in municipality										1.04	0.17	0.81
Av. municipality household wealth										0.80	0.34	0.60
Av. municipality travel time to medical centre										1.00	0.00	0.47
Av. municipality piped water to household										0.99 *	0.01	0.03

Table 11.27: determinants of odds of overweight or obesity in boys (TBB areas excluded)

	Model A			Model B			Model C			Model D		
	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value
TBB area effect	0.99	0.24	0.96	0.92	0.22	0.72	0.91	0.24	0.71	0.76	0.22	0.34
TAB area effect	1.04	0.22	0.87	1.00	0.21	1.00	1.05	0.24	0.84	1.03	0.23	0.88
Time effect	1.40 **	0.17	0.01	1.40 **	0.17	0.01	1.48 **	0.20	<0.01	1.49 **	0.20	0.00
Programme effect	1.08	0.19	0.67	1.08	0.2	0.67	1.03	0.20	0.87	1.03	0.20	0.87
Individual level co-variates												
Age				1.01 **	0.00	0.01	1.01 **	0.00	<0.01	1.01 **	0.00	0.01
Hogares Communitarios beneficiary				0.74 *	0.10	0.03	0.76	0.11	0.07	0.79	0.12	0.10
Number of siblings				0.96	0.03	0.14	0.96	0.04	0.31	0.96	0.04	0.29
Household level co-variates												
Mother’s age							1.00	0.01	0.96	1.00	0.01	0.84
Mother’s BMI							1.11 ***	0.02	<0.001	1.11 ***	0.02	<0.001
Mother’s 1ary education complete							1.25	0.20	0.17	1.27	0.21	0.14
Mother’s 2ary education complete							1.03	0.38	0.93	1.04	0.39	0.93
Mother’s further education							0.39	0.24	0.13	0.40	0.26	0.16
Mother’s literacy							0.99	0.22	0.97	0.98	0.21	0.92
Travel time to medical centre							1.00	0.00	0.65	1.00	0.00	0.95
Mother’s community participation							1.03	0.19	0.87	1.01	0.19	0.94
Head of h’old 1ary education complete							0.70	0.13	0.05	0.69	0.13	0.05
Head of h’old 2ary education complete							1.15	0.41	0.69	1.21	0.45	0.61
Head of h’old further education							1.85	1.51	0.45	2.07	1.77	0.40
Head of household literacy							0.90	0.20	0.62	0.86	0.18	0.46
Household size							0.99	0.05	0.78	0.99	0.04	0.79
Persons per room							0.94	0.04	0.17	0.93	0.04	0.15
Log household wealth							1.04	0.14	0.77	1.06	0.14	0.65
Piped water to household							1.33	0.22	0.08	1.52 *	0.26	0.01
Urban household							0.84	0.15	0.31	0.92	0.16	0.65
Municipality level co-variates												
Log municipality population										1.01	0.16	0.94
Eligible families in municipality										0.99	0.11	0.92
Eligible families in urbanized municipality										0.78	0.12	0.11
Quality of life index										1.01	0.01	0.22
Ratio of doctors to population in municipality										0.83	0.15	0.33
Ratio of nurses to population in municipality										0.98	0.11	0.83
Av. municipality household wealth										0.83	0.31	0.62
Av. municipality travel time to medical centre										1.00	0.00	0.61
Av. municipality piped water to household										0.99 *	0.00	0.02

Table 11.28: determinants of odds of overweight or obesity in boys (TBB areas included)

	Model A			Model B			Model C			Model D		
	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value
TAB area effect	2.03	1.17	0.22	1.86	1.08	0.29	2.28	1.62	0.24	1.98	1.50	0.36
Time effect	2.52 *	1.14	0.04	2.53 *	1.15	0.04	3.47 *	1.72	0.01	3.53 *	1.76	0.01
Programme effect	0.60	0.36	0.39	0.60	0.36	0.39	0.44	0.28	0.20	0.44	0.28	0.19
Individual level co-variates												
Age				1.00	0.01	0.83	1.01	0.02	0.55	1.00	0.02	0.77
Hogares Communitarios beneficiary				0.47	0.19	0.07	0.37 *	0.19	0.05	0.4	0.21	0.08
Number of siblings				0.78 *	0.08	0.01	0.89	0.13	0.39	0.87	0.12	0.34
Household level co-variates												
Mother’s age							1.04	0.03	0.19	1.04	0.03	0.24
Mother’s BMI							1.18 ***	0.04	<0.001	1.17 ***	0.04	<0.001
Mother’s 1ary education complete							0.53	0.33	0.31	0.53	0.36	0.35
Mother’s 2ary education complete							1.76	1.71	0.56	1.79	1.84	0.57
Mother’s further education							0.76	0.96	0.83	1.07	1.43	0.96
Mother’s literacy							1.91	1.69	0.47	1.69	1.51	0.56
Travel time to medical centre							1.00	0	0.68	1.00	0.01	0.72
Mother’s community participation							1.95	0.94	0.16	1.86	0.97	0.24
Head of h’old 1ary education complete							1.64	1.07	0.45	1.76	1.22	0.41
Head of h’old 2ary education complete							3.25	3.98	0.34	3.63	4.74	0.32
Head of h’old further education							5.14	7.78	0.28	3.77	6.00	0.40
Head of household literacy							0.73	0.45	0.61	0.69	0.43	0.56
Household size							0.77	0.18	0.28	0.79	0.17	0.28
Persons per room							1.00	0.12	1.00	1.02	0.14	0.89
Log household wealth							1.55	0.63	0.28	1.49	0.64	0.35
Piped water to household							0.51	0.27	0.20	0.37	0.21	0.08
Urban household							1.20	0.54	0.69	1.47	0.78	0.47
Municipality level co-variates												
Log municipality population										0.57	0.21	0.12
Eligible families in municipality										1.41	0.49	0.31
Eligible families in urbanized municipality										0.69	0.22	0.24
Quality of life index										1.04	0.03	0.17
Ratio of doctors to population in municipality										0.72	0.36	0.51
Ratio of nurses to population in municipality										1.10	0.37	0.76
Av. municipality household wealth										1.29	1.45	0.82
Av. municipality travel time to medical centre										1.01	0.01	0.30
Av. municipality piped water to household										1.02	0.01	0.16

Table 11.29: determinants of odds of obesity in girls (TBB areas excluded)

	Model A			Model B			Model C			Model D		
	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value
TBB area effect	1.42	0.94	0.60	1.26	0.87	0.74	0.96	0.87	0.97	0.71	0.62	0.7
TAB area effect	1.81	0.92	0.24	1.75	0.90	0.28	2.06	1.33	0.26	1.62	1.08	0.47
Time effect	2.14 *	0.79	0.04	2.14 *	0.79	0.04	2.58 *	1.13	0.03	2.61 *	1.15	0.03
Programme effect	0.71	0.38	0.51	0.70	0.38	0.51	0.59	0.35	0.38	0.59	0.35	0.37
Individual level co-variates												
Age				1.01	0.01	0.59	1.01	0.01	0.43	1.01	0.01	0.52
Hogares Communitarios beneficiary				0.66	0.25	0.27	0.59	0.29	0.29	0.62	0.31	0.33
Number of siblings				0.81 *	0.09	0.05	0.89	0.10	0.32	0.87	0.10	0.20
Household level co-variates												
Mother’s age							1.02	0.03	0.55	1.02	0.03	0.42
Mother’s BMI							1.13 ***	0.03	<0.001	1.12 ***	0.04	<0.001
Mother’s 1ary education complete							0.55	0.27	0.22	0.55	0.29	0.25
Mother’s 2ary education complete							1.97	1.35	0.33	1.98	1.39	0.33
Mother’s further education							2.02	1.77	0.42	2.66	2.34	0.27
Mother’s literacy							2.27	1.9	0.33	2.01	1.72	0.41
Travel time to medical centre							1.00	0.00	0.92	1.00	0.00	0.91
Mother’s community participation							1.77	0.69	0.15	1.67	0.69	0.22
Head of h’old 1ary education complete							1.6	0.81	0.36	1.71	0.89	0.30
Head of h’old 2ary education complete							2.74	2.57	0.28	2.91	2.81	0.27
Head of h’old further education							6.70 *	5.60	0.02	4.83	4.20	0.07
Head of household literacy							0.89	0.54	0.85	0.83	0.49	0.75
Household size							0.82	0.16	0.31	0.84	0.15	0.32
Persons per room							1.04	0.12	0.71	1.09	0.14	0.53
Log household wealth							1.46	0.58	0.34	1.34	0.58	0.50
Piped water to household							0.48	0.22	0.10	0.34 *	0.17	0.03
Urban household							1.24	0.48	0.57	1.38	0.70	0.52
Municipality level co-variates												
Log municipality population										0.58	0.19	0.10
Eligible families in municipality										1.64	0.54	0.14
Eligible families in urbanized municipality										0.71	0.21	0.26
Quality of life index										1.05	0.03	0.08
Ratio of doctors to population in municipality										0.61	0.26	0.24
Ratio of nurses to population in municipality										1.11	0.29	0.68
Av. municipality household wealth										1.70	1.57	0.57
Av. municipality travel time to medical centre										1.01	0.01	0.54
Av. municipality piped water to household										1.02	0.01	0.12

Table 11.30: determinants of odds of obesity in girls (TBB areas included)

	Model A			Model B			Model C			Model D		
	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value	Odds Ratio	S.E.	p-value
TAB area effect	0.77	0.41	0.62	0.76	0.42	0.62	0.84	0.47	0.76	0.85	0.47	0.77
Time effect	1.89	0.79	0.12	1.90	0.80	0.13	1.93	0.83	0.13	1.94	0.84	0.13
Programme effect	1.39	0.78	0.56	1.39	0.79	0.56	1.41	0.82	0.55	1.41	0.82	0.55
<u>Individual level co-variates</u>												
Age				0.99	0.01	0.65	0.99	0.01	0.56	0.99	0.01	0.48
Hogares Communitarios beneficiary				0.60	0.20	0.14	0.71	0.26	0.35	0.72	0.29	0.42
Number of siblings				0.71 **	0.08	<0.001	0.86	0.09	0.16	0.88	0.09	0.24
<u>Household level co-variates</u>												
Mother's age							0.99	0.03	0.81	0.99	0.03	0.63
Mother's BMI							1.16 ***	0.04	<0.001	1.16 ***	0.04	<0.001
Mother's 1ary education complete							3.09 **	1.33	0.01	2.86 *	1.26	0.02
Mother's 2ary education complete							2.92	2.25	0.16	2.65	2.02	0.20
Mother's further education							. .	.	.	. .	.	.
Mother's literacy							1.12	0.66	0.84	1.09	0.63	0.88
Travel time to medical centre							1.01	0.00	0.08	1.01	0.00	0.12
Mother's community participation							0.91	0.28	0.74	0.99	0.34	0.97
Head of h'old 1ary education complete							0.79	0.35	0.60	0.76	0.33	0.53
Head of h'old 2ary education complete							0.81	0.68	0.80	0.82	0.72	0.82
Head of h'old further education							6.30 *	5.43	0.03	8.97 *	8.94	0.03
Head of household literacy							1.16	0.60	0.78	1.16	0.56	0.76
Household size							0.83	0.12	0.21	0.83	0.13	0.21
Persons per room							1.01	0.16	0.95	1.00	0.15	0.99
Log household wealth							0.93	0.25	0.79	0.93	0.28	0.82
Piped water to household							1.26	0.47	0.54	1.58	0.55	0.19
Urban household							1.14	0.41	0.72	1.19	0.45	0.64
<u>Municipality level co-variates</u>												
Log municipality population										0.68	0.25	0.30
Eligible families in municipality										1.15	0.34	0.63
Eligible families in urbanized municipality										0.70	0.23	0.27
Quality of life index										1.03	0.03	0.30
Ratio of doctors to population in municipality										2.23	1.28	0.16
Ratio of nurses to population in municipality										0.72	0.29	0.41
Av. municipality household wealth										0.74	0.64	0.73
Av. municipality travel time to medical centre										1.00	0.01	0.68
Av. municipality piped water to household										1.00	0.01	0.75

Table 11.31: determinants of odds of obesity in boys (TBB areas excluded)

	Model A			Model B			Model C			Model D		
	Odds Ratio	**S.E.**	**p-value**	**Odds Ratio**	**S.E.**	**p-value**	**Odds Ratio**	**S.E.**	**p-value**	**Odds Ratio**	**S.E.**	**p-value**
TBB area effect	0.70	0.40	0.53	0.61	0.35	0.39	0.59	0.36	0.38	0.59	0.37	0.40
TAB area effect	0.74	0.36	0.53	0.70	0.35	0.48	0.80	0.42	0.67	0.82	0.43	0.70
Time effect	1.76 *	0.49	0.04	1.77 *	0.49	0.04	1.77	0.52	0.05	1.78 *	0.52	0.05
Programme effect	1.49	0.7	0.39	1.49	0.71	0.39	1.52	0.74	0.39	1.53	0.74	0.38
Individual level co-variates												
Age				0.99	0.01	0.49	0.99	0.01	0.42	0.99	0.01	0.43
Hogares Communitarios beneficiary				0.50 *	0.15	0.02	0.56	0.19	0.09	0.58	0.21	0.12
Number of siblings				0.77 **	0.07	0.01	0.75 **	0.08	0.01	0.76 **	0.08	0.01
Household level co-variates												
Mother's age							1.01	0.02	0.84	1.00	0.03	0.97
Mother's BMI							1.15 ***	0.03	<0.001	1.15 ***	0.03	<0.001
Mother's 1ary education complete							1.95	0.67	0.05	1.92	0.66	0.06
Mother's 2ary education complete							2.44	1.41	0.12	2.34	1.31	0.13
Mother's further education							0.64	0.83	0.73	0.69	0.90	0.77
Mother's literacy							0.65	0.28	0.32	0.66	0.30	0.36
Travel time to medical centre							1.00	0.00	0.32	1.00	0.00	0.27
Mother's community participation							0.86	0.24	0.60	0.91	0.27	0.74
Head of h'old 1ary education complete							0.87	0.32	0.72	0.82	0.30	0.59
Head of h'old 2ary education complete							0.71	0.53	0.65	0.69	0.53	0.62
Head of h'old further education							5.25 *	4.04	0.03	5.45 *	4.21	0.03
Head of household literacy							0.98	0.44	0.96	1.00	0.43	0.99
Household size							0.98	0.11	0.85	0.98	0.11	0.88
Persons per room							1.03	0.11	0.82	1.02	0.12	0.87
Log household wealth							1.14	0.25	0.56	1.08	0.26	0.74
Piped water to household							1.26	0.40	0.47	1.42	0.46	0.28
Urban household							1.00	0.3.	0.99	0.97	0.33	0.93
Municipality level co-variates												
Log municipality population										0.75	0.25	0.39
Eligible families in municipality										1.16	0.29	0.54
Eligible families in urbanized municipality										0.88	0.25	0.65
Quality of life index										1.04	0.03	0.16
Ratio of doctors to population in municipality										1.67	0.65	0.19
Ratio of nurses to population in municipality										0.93	0.24	0.78
Av. municipality household wealth										1.15	0.82	0.84
Av. municipality travel time to medical centre										1.00	0.01	0.86
Av. municipality piped water to household										0.99	0.01	0.49

Table 11.32: determinants of odds of obesity in boys (TBB areas included)

Chapter 12: Women's Healthcare Knowledge

Relationship between this chapter and broader thesis

One of the critical elements in the co-production model is investment in people’s knowledge and skills, or ‘human capital’. The importance of human capital in determining health outcomes is well established. For example, female literacy, even if learnt as an adult in a programme which does not contain a major health component, is associated with reductions in child mortality[230]. Additionally, lack of education has been shown to be an important driver of the obesity epidemic in Latin America and elsewhere[164 176 231]. Hence, the relevance of examining the effect of *Familias* on health knowledge is clear, particularly given the findings of the previous two chapters. Given the complexity of the CCTS intervention, examining their impact on human capital may also assist understanding which constituent elements are important in achieving health and welfare gains and avoiding adverse effects where they occur.

Familias might be expected to improve health knowledge because investment in an individual's knowledge and skills is an explicit element of the scheme. Women are encouraged to attend a number of workshops on parenting and health skills, including childhood nutrition. Although the *Familias* evaluation did not survey women’s knowledge of a healthy diet and weight, a set of questions regarding the prevention and home-management of acute childhood diarrhoea was asked. As explained in the next section, this is a major global cause of childhood death and health inequity so is a valuable and relevant analysis to include alongside the preceding two studies.

The hypothesis tested is that **participation in *Familias* is associated with an improvement in women's knowledge and practice around the management and prevention of acute childhood diarrhoea.**

The epidemiology of acute diarrhoeal illness in children

Acute diarrhoeal illness in children (ADI) is one of the largest contributors to childhood mortality, alongside pneumonia, measles, malaria and HIV/AIDS, and is characterised by stark inequalities. The scale of the childhood death is vast: around ten million children die a year, almost all in the developing world: six countries account for 50% of global deaths under five years and the rate of childhood death in sub-Saharan Africa, at 174 per 1000 children per year, is 29 times that seen in industrialized countries[232].

Childhood deaths, however, tend to be characterized by multiple causes, such as infectious disease and malnutrition acting additively, or measles complicated by diarrhoeal illness. The pronounced global differentials in death rates arise because children from impoverished backgrounds are not only exposed to more health risks, such as indoor air pollution or infectious disease vectors; they are also less resistant to them, because of malnourishment or lack of immunization, for example. Poor access to good quality healthcare compounds the problem[233].

Similar differentials exist in the numbers of children experiencing malnourishment[234] and failing to reach full cognitive developmental potential (more than 200m children globally[212]). Although these children survive, such adverse early experiences subject them to "irreversible damage", whether in terms of risk of premature death in adulthood or lost educational and economic potential[235 236].

Such differences in outcome become a matter of equity because childhood deaths in low and middle income countries are preventable. Effective and cost-effective therapeutic interventions exist for all the major causes listed above[237], the most cost-effective being oral rehydration, case-management of diarhoea and pneumonia and measles vaccination[3]. A handful of countries, such as Mexico[238] and Thailand[239], have demonstrated that delivery of these interventions is feasible at a national scale, and have achieved dramatic reductions in rates of childhood mortality as a result - sufficient to meet the Millennium Development Goal to reduce childhood mortality by two-thirds by 2015 (compared to 1990 baseline). These countries are exceptional though. Global coverage for most of these interventions is less than 50%.

If universal availability of preventive and curative interventions were achieved, an estimated 63% of childhood deaths could be prevented[237]. Reasons for low coverage are complex, and several have been identified. Perhaps the most important is lack of sufficient financial investment. Aid for maternal and child health comprises around 3% of total donor aid budgets, lagging far behind spending on AIDS, TB and malaria[5 240]. An estimated $30bn/year is needed if the Millennium Development Goal is to be met[6]. A similar level of underinvestment exists in research funding. The “10/90 gap” is well known and refers to the fact that only 10% of worldwide expenditure on health research is directed towards issues that primarily affect the poorest 90% of the world’s population[241]. More recently, however, the “3/97 gap” has also been identified[242-244]. This exposes the fact that up to 97% of research funding in childhood mortality is directed toward developing new interventions and technologies, and only 3% on understanding how current effective technologies could be scaled-up to universal coverage. It is estimated that three times as many childhood deaths could be averted if this imbalance were redressed; there is strong evidence, for example, that families can be trained to use life-saving technologies such as oral rehydration solutions (ORS) to treat diarrhoeal illness – if given appropriate training and support[242].

ORS is a mixture of water, salt and sugar that can be prepared by the child's carer. Although home-prepared ORS is one of the easiest and most cost-effective interventions to reduce childhood mortality[245], its use is not widespread[75]. One of the reasons why such life-saving interventions are not more widely used is likely to be a mother's or carer's healthcare knowledge. It is known, for example, that children of uneducated mothers are twice as likely to die compared to educated mothers[170]. Although this relationship is mediated by several other factors, such as household wealth, a mother's healthcare knowledge is likely to be critical in recognizing serious childhood illness and instigating appropriate management.

Acute diarrhoeal illness in children and CCTS

There has been no detailed examination of the impact of CCTS on this component of childhood health thus far, although a study is under way in Panama to test the effect of mothers' educational seminars. It is an important area of study, because the contribution of CCTS to reductions in childhood morbidity is known to be modest. Consequently, questions have been raised as to how successfully CCTS can address some of the more 'upstream' determinants of childhood health. In its recent review of CCTS the World Bank suggested that there are important constraints at the household level that are not currently addressed by CCTS such as parental healthcare knowledge and practice, inadequate information, and other inputs into the production of education and health[59]. Given this, and the gap in the literature around carers' healthcare knowledge, this chapter's analysis of the effect of *Familias* on women's knowledge and practice regarding the prevention and management of ADI is likely to offer a useful contribution to the field.

This is not an outcome that has been examined in detail by previous evaluations of *Familias.* By way of background, however, work by the Institute of Fiscal Studies has already shown that *Familias* is associated with a reduction in the proportion of children reported to have suffered ADI the 15 days prior to survey from 32.6 to 22% of children aged under two years, and from 21.3 to 10.4% of children aged between two and four years. No significant impact was found for children older than this[93].

Methods

In addition to the methodology set out in earlier chapters, this section provides specific methodology relevant to the estimation of the effect of *Familias* on women's healthcare knowledge and practice.

Intervention

Familias encourages enrolled women to attend healthcare and parenting workshops, although attendance is not one of the mandated programme conditions. Workshops cover vaccination, management and prevention of diarrhoea, management and prevention of respiratory problems, a healthy home environment, affection between family members, family planning, antenatal care, accidents in the home (a curriculum devised centrally and circulated to local schemes). They take place in community facilities (such as town halls or health centres) and are run by staff from the local health centre, typically other women known to the participants. Around 5 to 30 participants attend and considerable effort is made to ensure that the workshops are appropriate to their learning needs: an educational psychologist is present and meetings begin with women being invited to share what they already know on the topic with further teaching and discussion departing from there.

Women living in control areas will also occasionally attend similar workshops, unrelated to *Familias*.

Analytic sample

The analytic sample comprises women fully observed at baseline; no further exclusion criteria were applied.

Outcome measure

The baseline and follow-up surveys included a short “Knowledge, beliefs and practices” module in which women were asked the following questions, and offered the response options shown in bold:

[1] When a child has diarrhoea, are you meant to give them less liquid than usual, the same amount or more than usual? **less / the same amount / more than usual / do not know.**

[2] When a child has diarrhoea, are you meant to give them less food than usual, the same amount or more than usual? **less / the same amount / more than usual / do not know.**

WHO guidance[246] was used to assign a score to each response, as either "correct" (2 points), "mistaken" (1 point), or "mistaken and probably harmful" (0 points) as shown in the table below:

	correct (2 point)	mistaken (1 points)	mistaken and probably harmful (0 points)
[1] When a child has diarrhoea, are you meant to give them less liquid than usual, the same amount or more than usual?	more than usual	the same amount	less do not know
[2] When a child has diarrhoea, are you meant to give them less food than usual, the same amount or more than usual?	the same amount	more than usual	less do not know

Knowledge score was created by summing the number of points for each respondent at baseline and follow-up (range, 0 to 4). Missing values were treated as zero.

Confounding and mediating variables

Possible confounders or mediators of the hypothesized relationships at the individual, household and municipality levels were identified from the literature and verified with experts who had conducted previous studies using *Familias* data.

Identification and statistical handling of co-variates was conducted as described in the preceding chapter.

Although women's reported workshop attendance was surveyed, and suggests itself as a likely mediator of the effect of *Familias* on healthcare knowledge and practice, it was not included as a right hand side variable. This is because women who report high workshop attendance are likely to differ from other women in systematic, unobserved ways that correlate with the outcome of interest. Thus, including reported workshop attendance in the model is likely to produce a biased error term and unreliable estimates of programme effect. One solution to this problem is to search for an objectively determined variable that can proxy for workshop attendance, but is unlikely to be subject to the bias implied by attendance itself. For this reason, travel time to medical centre (where workshops were held) was included as a right-hand side variable.

Statistical techniques

A double-difference methodology was employed, as earlier described, to account for unobserved differences at baseline and trends over time. Similarly, the issue of TAB / TBB households was handled, as earlier described, by creating a dummy variable that is equal to 1 when the programme was operating and equal to 0 when not, as previously.

The impact of *Familias* on woman's knowledge score was estimated using an ordered logit analysis, in a stepwise approach which first estimated the unadjusted effect of *Familias,* before adding vectors of individual, household and municipality level variables sequentially. Knowledge score treated as an ordered categorical variable and ordered probit analysis used. Ordered logit was chosen because the outcome of interest follows a natural hierarchy although the absolute values themselves are arbitrary.

In each case, a stepwise analytic approach was taken that first estimated the unadjusted effect of the programme before adding in vectors of individual, household and community level variables in sequentially nested models on identical samples. Robust standard errors are reported, clustered at municipality level.

Model A	Area, time, programme operation
Model B	**as Model A,** plus addition of individual-level co-variates: age education literacy travel time to medical centre reported community participation number of live births
Model C	**as Model B,** plus addition of household-level co-variates: head-of-household education head-of-household literacy household size persons per room log household wealth presence of piped water to household urban location
Model D	**as Model C,** plus addition of community-level co-variates: log municipality population eligible families in municipality eligible families in urbanized municipality quality of life index ratio of doctors to population ratio of nurses to population average household weath average travel time to medical centre average presence of household piped water

Table 12.1: Explanatory variables included in sequentially nested models

Missing outcome observations were not replaced but deleted list-wise from the sample.

Given the thesis' emphasis on health equity, interactions between markers of social position (woman's age, literacy, level of completed education, household wealth and urban location) and programme operation were explored.

Differences in baseline co-variates by programme exposure, and in baseline co-variates between the analytic sample and women lost to follow-up, were explored using t-test (for differences in means for continuously distributed variables) or chi-squared test (for categorical variables).

Results

Descriptive statistics of baseline sample

9391 women fulfilled the inclusion criteria at baseline, 3914 from control communities, 2866 from TBB and 2611 from TAB communities. Mean age was 39.2 years (95% CI 38.9, 39.4) and mean knowledge score was 2.26 (95% CI 2.23, 2.28).

The distribution of knowledge scores by exposure group is shown in Figure 12.1 below. Mean score was similar in women from control (2.25, 95% CI 2.21, 2.29) and TBB municipalities (2.27, 95% CI 2.22, 2.31; p=0.64) but was slightly higher in women from TAB municipalities (2.33, 95% CI 2.28, 2.38; p=0.02 compared to controls).

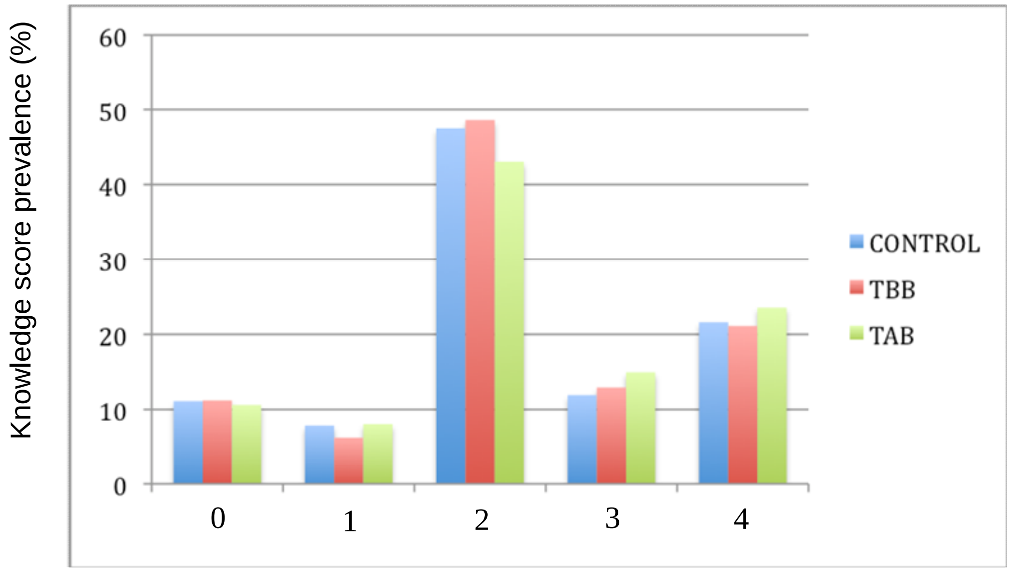


Figure 12.1: distribution of knowledge score at baseline by exposure group

Numerous other differences were apparent between women from different exposure groups at baseline. For example, TAB women were significantly younger (38.0 vs. 39.2 years, $p<0.001$), more likely to report participation in community activities (31.5% vs. 19.3%, $p<0.001$) yet come from municipalities with lower quality of life scores (53.5 vs. 54.4, $p<0.001$) compared to control women. Women from TBB municipalities reported significantly lower parity (4.8 vs. 5.0 live births, $p=0.003$), better head-of-household literacy (75.9 vs. 72.1%, $p=0.001$) and greater household wealth (12.89 vs. 12.77 log pesos, $p<0.001$) compared to control households. Differences in co-variates between exposure groups at baseline are shown in Table 12.10.

Loss to follow-up

7787 (82.9% of original sample size) women were re-surveyed at phase 3, 3207 from control communities, 2418 from TBB and 2162 from TAB communities ($\chi^2=6.94$, $p=0.031$). A flow diagram of participants is given in Figure 12.2

	CONTROL	TBB	TAB
baseline sample	**3914**	**2866**	**2611**
lost to follow-up	-707	-448	-449
sample at phase 3	**3207** (81.9%)	**2418** (84.4%)	**2162** (82.8%)
			χ^2=6.94, p=0.031

Figure 12.2: Flow diagram of participants

The characteristics of women lost to follow-up are given in Table 12.11. Compared to women who comprised the final analytic sample, these women were older (41.1 vs. 38.8 years, $p<0.001$) with less completed formal education (χ^2=9.85, p=0.020) and were less literate (73.8% vs. 76.4%, p=0.021); they came from households less likely to be urban (44.6% vs. 49.6%, $p<0.001$), less likely to have piped water (58.8% vs. 62.7%, p=0.003) and at a greater distance from medical services (43.3 vs. 36.6 min, $p<0.001$). Mean knowledge score at baseline was also greater in women retained in the analytic sample compared to those lost (2.28 vs. 2.15, p=0.002).

Preliminary analyses

Knowledge score appeared to peak then to fall in each exposure group, as shown in Figure 12.3

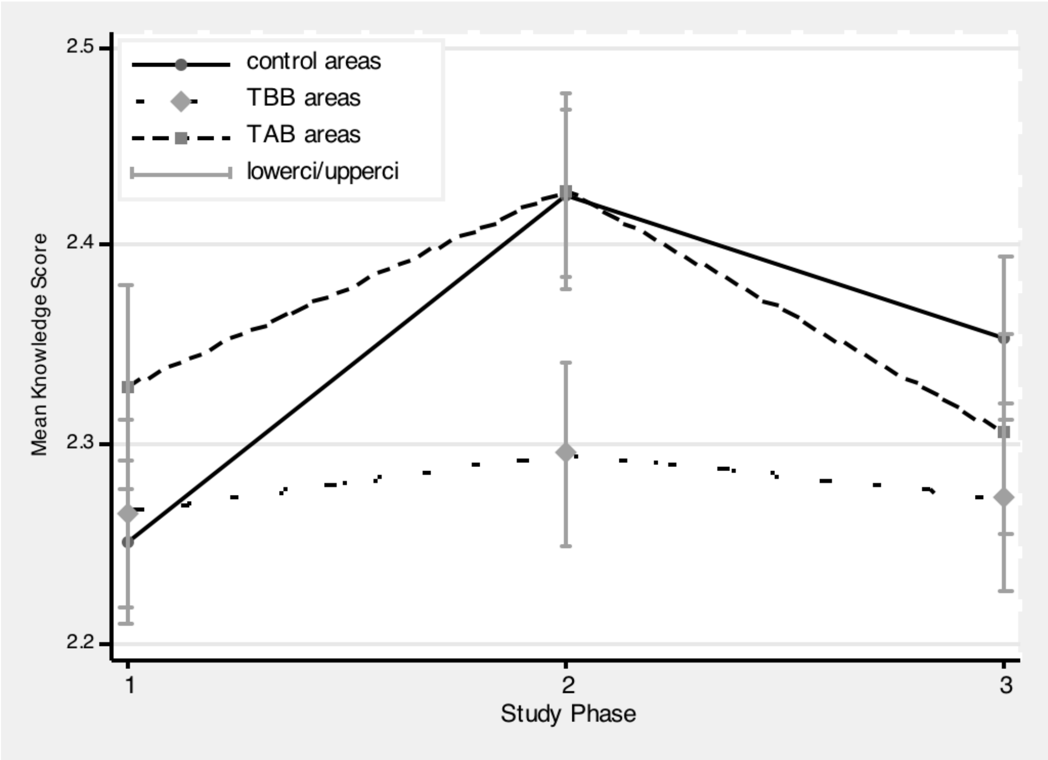


Figure 12.3: trends in crude knowledge score by exposure area

Double-difference tables can be constructed to give a preliminary indication of the impact of the programme. The table below shows crude unadjusted outcomes for women from control and TAB areas, at baseline and second follow-up. For simplicity, women from TBB areas are not included. Direct observation of crude scores suggests that knowledge score showed a marginal increase over time in control areas but not in treatment areas (Table 12.2).

	Control	Treatment	*Diff. across groups*
Baseline (phase 1)	2.25 (2.21, 2.29)	2.33 (2.28, 2.38)	0.08
Follow-up (phase 3)	2.35 (2.31, 2.39)	2.31 (2.25, 2.36)	- 0.05
Difference over time	0.10	-0.02	**- 0.13**

Table 12.2: crude knowledge score (95% CI) and double-difference

As in previous analyses, estimation of the fully adjusted effect of *Familias* begins with ordinary multivariate regression, to verify adequate specification of the statistical model. A fully adjusted ordered logit model of the effect of the programme on knowledge scores (having dropped TBB areas) yields the following diagnostic output:

	Wald-χ^2	479.96 ($p<0.0001$)
	Pseudo-R^2	10.9%
Link test:	Significance of co-efficient on hat	0.064
	Significance of co-efficient on hat-squared	0.673

Table 12.3: regression diagnostics from ordinary ordered logit regression

The highly significant p-value on the Wald-χ^2 indicates that the specified model predicts the data better than an empty (intercept-only) model. Overall explanatory power, however, is low - as suggested by the small pseudo-R^2. This is confirmed by the link test, where the linear predicted value (*hat*) has only borderline significance in its ability to predict the observed outcomes. *Hat-squared* is a non-significant predictor, as expected.

The borderline significance of *hat* prompted a search for non-linear predictors. Box-Tidewell regression suggested that 1/(household size) was a better predictor than household size. When re-run with this transformation, the model performs marginally better - as shown by improved Wald-χ^2 and link test parameters (Table 12.4 below). Accordingly, this transformation was kept in subsequent analyses.

	Wald-χ^2	497.11 ($p<0.0001$)
	Pseudo-R^2	10.9%
Link test:	Significance of co-efficient on hat	0.046
	Significance of co-efficient on hat-squared	0.664

Table 12.4: regression diagnostics, household size replaced by its inverse.

In summary, although the model has weak predictive power, it appears correctly specified. Reassurance on this point means that it is reasonable to restructure the data into a 'long' format and continue with double-difference estimations.

Before proceeding with double-difference estimations, however, it is worth looking at the regression co-efficients yielded by ordinary regression. In the fully-adjusted ordered logit model (with TBB areas dropped), exposure to *Familias* was not associated with any significant effect, as shown in Table 12.5 below. Baseline score, educational attainment, literacy, parity and urban location were significantly positively associated, however, and increasing age and municipality doctor to population ration significantly negatively associated.

	Co-efficient		S.E.	p-value
Exposure to *Familias*	-0.122		0.085	0.154
Baseline score	0.374	***	0.031	<0.001
Age	-0.008	*	0.004	0.034
Primary education complete§	0.160	*	0.067	0.017
Secondary education complete§	0.588	***	0.130	<0.001
Further education§	0.571		0.298	0.055
Literate	0.373	***	0.082	<0.001
Parity	0.027		0.014	0.054
Urban location	0.178	**	0.068	0.009
Municipality ratio of doctors to pop'n	-0.203	*	0.090	0.024

Table 12.5: Determinants of knowledge score at phase 3 (ordinary ordered logit, fully-adjusted model with TBB areas dropped; § compared to primary education incomplete)

Double-difference analyses

Table 12.12 shows estimates of the effect of the programme and other co-variates on knowledge score, with TBB areas dropped. Consistent with preliminary analyses, the operation of the programme does not appear to have any significant effect on knowledge score (logit coefficient -0.204, 95% CI -0.414, 0.005, p=0.06 in Model A).

Inclusion of individual level covariates in Model B finds a number of significant associations with change in knowledge score, all significant at the <0.01 level or less. Increasing age (logit coefficient -0.010, 95% CI -0.014, -0.004, $p<0.001$) and increasing travel time to medical centre (logit coefficient -0.001, 95% CI -0.002, -0.0005, $p<0.01$) are associated with lower knowledge score; literacy (logit coefficient 0.469, 95% CI 0.341, 0.598, $p<0.001$), increasing levels of completed formal education (a trend is evident with a logit coefficient of 0.699, 95% CI 0.293, 1.104, $p<0.001$ for further education compared to incomplete primary education) and parity (logit coefficient 0.029, 95% CI 0.011, 0.048, $p<0.01$) are all associated with greater knowledge score. With the exception of travel time to medical centre, these associations are robust to the inclusion of further co-variates.

Inclusion of household level covariates in Model C finds that smaller household sizes are associated with lower knowledge scores (logit coefficient for 1/(household size) -1.171, 95% CI -1.894, -0.448, $p=0.001$) and urban location (logit coefficient 0.177, 95% CI 0.071, 0.287, $p=0.001$) with higher scores. Inclusion of municipality level covariates in Model D finds that average household wealth is associated with higher knowledge scores (logit coefficient 0.511, 95% CI 0.170, 0.862, $p<0.01$) and increasing population with lower scores (logit coefficient -0.144, 95% CI -0.247, -0.043, $p=0.01$).

Table 12.13 shows estimates of the effect of the programme and other co-variates on knowledge score, with TBB areas included. This model yields very similar co-efficients to the previous model, although the municipality-level co-efficients lose their significance.

Interactions

To explore the health equity impact of the programme, interactions between operation of *Familias* and certain markers of socio-economic position were explored. With TBB areas dropped, none were found to be significiant. The same picture emerged if TBB areas were included, with the exception of a possible weak interaction between operation of the programme and increasing age, as shown in the table below.

Interaction	Co-efficient	S.E.	p-value
Familias * woman's age	-0.005	0.003	0.06
Familias * woman's literacy	-0.085	0.097	0.38
Familias * woman's completed formal education	-0.067	0.051	0.19
Familias * household wealth	0.017	0.062	0.78
Familias * urban residence	-0.121	0.082	0.14

Table 12.6: Interaction between operation of *Familias* and markers of socio-economic position on knowledge score (TBB areas included).

Supplementary analyses

1. Alternative link functions

As a further check against mis-specification the double-difference models were re-run (with and without TBB areas) using different link functions, namely ordered probit and linear regression.

Operation of the programme did not become significant in any model. In all models, literacy, educational attainment and urban residence remained significant positive predictors and age and household size remained significant negative predictors (all $p \leq 0.001$).

2. Inclusion of knowledge score at phase 2 (first follow-up)

To explore whether women may have had experienced initial benefit from *Familias* that attenuated over time (as possibly suggested by Figure 12.3), knowledge score at phase 2 (just over a year after implementation of the programme) was included in the regressions. Dummy variables that reflected operation of the programme were created for models that contained just phase 1 and 2 data or phase 1, 2 and 3 data, with and without TBB areas (four specifications in total, each run with vectors of co-variates sequentially added as models A-D, with robust standard errors).

Operation of the programme did not become significant in any specification. In all specifications, literacy, educational attainment (up to completed secondary education) and urban residence remained significant positive predictors of maternal knowledge (all $p \leq 0.001$) as did reported community participation ($p<0.05$). Age remained a significant negative predictor ($p<0.001$).

For brevity, Table 12.7 below just shows co-efficients associated with programme exposure, age and household wealth, with TBB areas dropped, in the fully adjusted model (Model D).

	Logit co-efficient		**S.E.**	**p-value**
Exposure to *Familias*	-0.12		0.11	0.25
Age	-0.01	***	0.00	<0.001
Primary education complete§	0.23	***	0.05	<0.001
Secondary education complete§	0.57	***	0.11	<0.001
Further education§	0.42		0.28	0.14
Literate	0.35	***	0.07	<0.001
Community participation	0.18	***	0.05	<0.001
Urban location	0.22	***	0.06	<0.001

Table 12.7: Effect of programme and other co-variates on phase 2 knowledge score (§ compared to primary education incomplete)

3. Clinical relevance of knowledge score

The clinical relevance of the constructed knowledge score was explored by linking mothers' scores to the reported severity and duration of acute diarrhoeal illness (ADI) in children at baseline.

1235 children aged 0-7 years were reported to have suffered from ADI in the fortnight preceding the survey. Reported duration was bi-modal as shown in FIgure

12.4 below; the peak at 8 days suggests a reporting bias such as “into a second week” or similar. For this reason, responses on ADI duration were re-categorised as “7 days or less” and “longer than 7 days”.

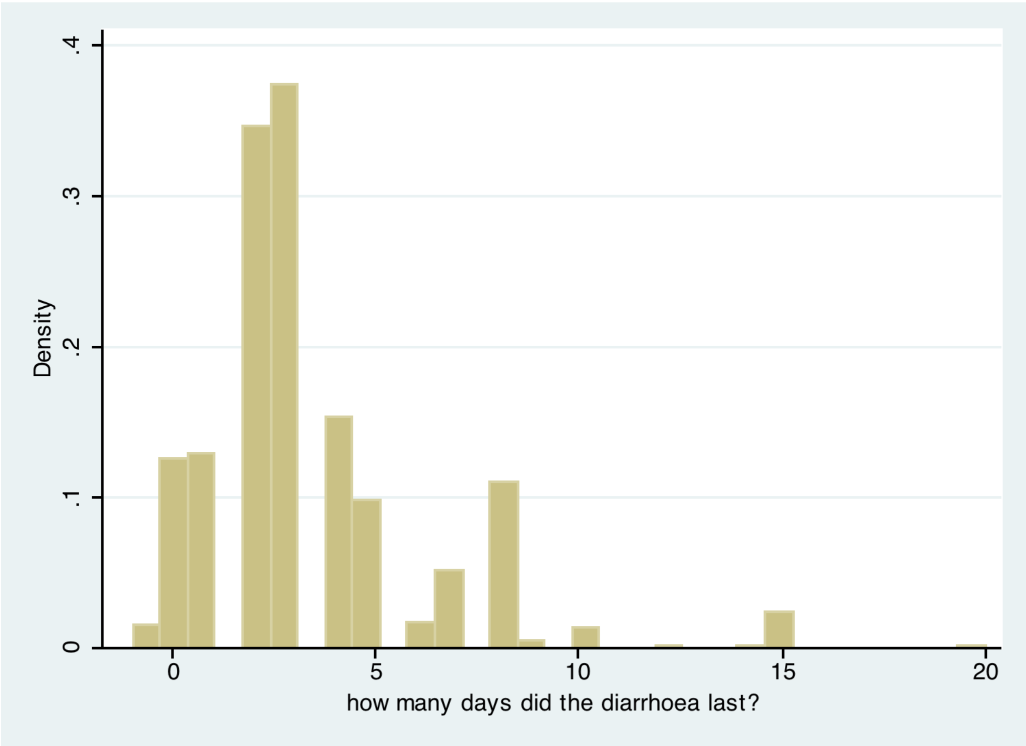


Figure 12.4: reported duration of childhood ADI at baseline

An ordinary logistic regression on this dichotomous outcome (with all exposure-types included, fully adjusted for individual, household and municipality level co-variates and clustered at municipality level) demonstrated a significant negative relationship between knowledge score and the odds of ADI persisting more than a week (O.R. 0.79; 95% CI 0.66, 0.95; p=0.011). This association was also demonstrated if a trichotomous outcome variable (<8, 8-14 or >15 days) was used in an ordered logit regression.

Severity of ADI, as measured by reported daily stool frequency when the child was most ill, was also unevenly distributed as shown in Figure 12.5 below. Values <3 were excluded, as per the World Health Organisation definition of diarrhoea of three or more loose or liquid stools a day.

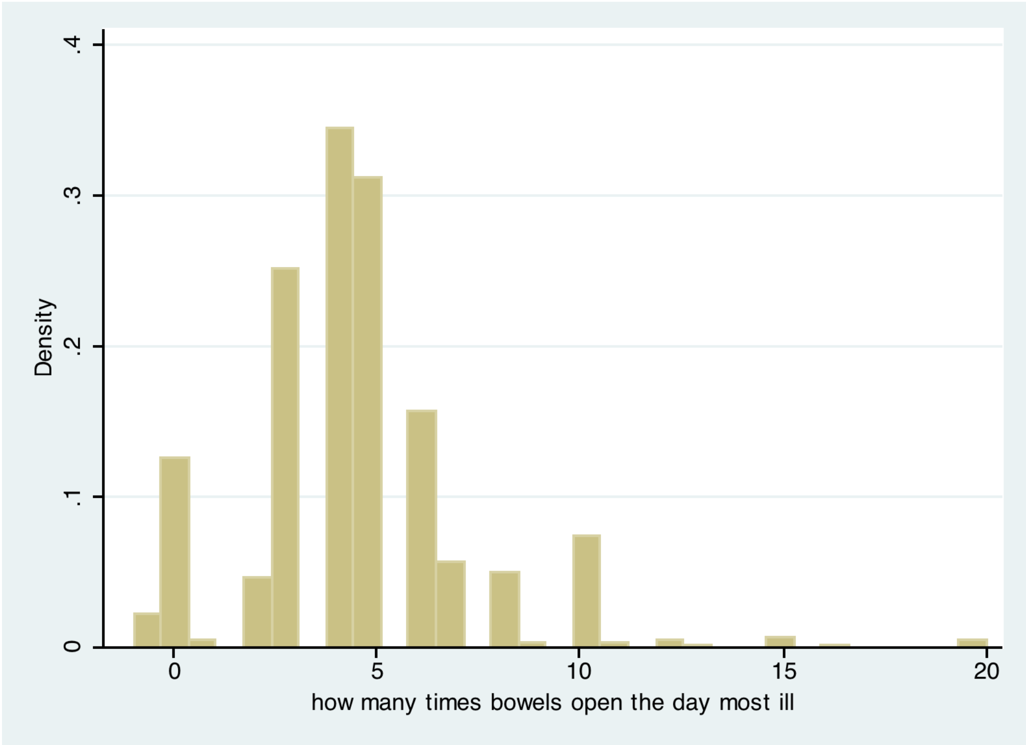


Figure 12.5: reported severity of childhood ADI at baseline

Ordinary regressions on this outcome did not find any association between knowledge score and severity of ADI in a variety of models (ordered logit and linear link functions, unadjusted and fully adjusted models, robust and non-robust standard errors).

4. Workshop attendance:

As explained earlier, women's *reported workshop attendance* was not included as a model predictor because of likely endogeneity (correlation with the error term). Nevertheless, it is clearly a relevant outcome to observe in its own right.

Women were asked to list their attendance within the last six months (yes/no) at each of five workshops at phase 1 and eight workshops[¶] at phase 3; the mean number or workshops attended at each phase is given in Table 12.8 below. It is important to note that workshop attendance is reported by women in both control and treatment areas, which reflects the existence of similar health education initiatives in control areas.

	Control	Treatment	*Diff. across groups*
Baseline (phase 1)	0.93 (0.88, 0.99)	0.95 (0.88, 1.01)	0.01
Follow-up (phase 3)	0.84 (0.77, 0.90)	2.23 (2.10, 2.36)	1.39
Difference over time	-0.10	1.28	**1.38**

Table 12.8: crude number of workshops attended (95% CI) and double-difference

Responses at each phase were bi-modal, with most women at phase 1 reporting either zero attendance (66.8%), attendance at one (9.3%) or attendance at all five workshops (8.4%); and at phase 3 either zero attendance (66.6%) or attendance at all eight (10.9%). For this reason, responses were re-categorised as "zero attendance" or "at least one workshop attended". Counts and proportions of this dichotomous variable by exposure group are given in Table 12.9 below.

	Phase 1			Phase 3		
	Control	TBB	TAB	Control	TBB	TAB
Zero attendance	2760 (70.5)	1880 (65.6)	1718 (65.8)	2489 (77.6)	1457 (60.3)	1236 (57.2)
At least one workshop attended	1154 (29.5)	986 (34.4)	893 (34.2)	718 (22.4)	961 (39.7)	926 (42.8)
	χ^2=24.3; p<0.0001			**χ^2=304.7; p<0.0001**		

Table 12.9: counts (%) of reported workshop attendance at phases 1 and 3

[¶] At phase 1: management of childhood diarrhoea, management of childhood coughs or colds, childhood nutrition, antenatal care, vaccination. At phase 3: the same plus family planning, affection within the family, accident prevention.

A double-difference logistic regression on the dichotomous variable (TBB areas dropped, no other co-variates included) demonstrated a significant association with operation of *Familias*, with an odds ratio of 2.06 (95% CI 1.21, 3.50; p=0.007) for attendance at at least one workshop. Inclusion of TBB areas induced a more conservative estimate (O.R. 1.87, 95% CI 0.98, 2.46, p=0.061).

Discussion

Main result

The study finds that participation in *Familias* is not associated with any improvement in women's knowledge and practice around the management and prevention of acute childhood diarrhoea. This is despite significantly increased rates of workshop attendance in participating women. Women who at baseline are younger, literate, better educated, and who live in more urban households display knowledge gain relative to other women, independent of the programme.

Interpretation

There are a number of possible explanations for these findings. If the finding is real, it appears that *Familias* is ineffective in transmitting health knowledge to participants. This may relate to the way workshops are delivered. Although workshops are led by local women who adapt their material to fit with participants' educational needs, workshop leaders are nevertheless all health professionals whose teaching style may favour literate participants or those with more experience of formal education. Alternatively, it may be that teaching styles are appropriate, but that the workshops are seen as an unimportant part of the programme by women or the healthcare workers providing them.

Another explanation is that *Familias* has no independent additional effect on knowledge because adequate educational programmes are already in place across both treatment and control communities. This seems unlikely, however, since the unmet educational need is clear: 11% of women at baseline scored 0/4 (indicating potential to harm the child); only 22% gave completely correct answers.

Bias may explain the findings. The study was non-blinded and women in treatment areas may have falsely reported workshop attendance as a result. If this were the case, it would support the possibility the workshops were viewed as unimportant. This does not detract, however, from the conclusion that *Familias* is ineffective at improving women's knowledge. Non-blinding should not affect recording of the knowledge score itself; in fact, a false positive finding would be more likely if interviewers encouraged women in treatment areas toward correct responses. Bias may explain the null finding, however, if attrition rates are considered. Illiterate women, who have poorer knowledge scores, are lost to follow-up more than literate women and there are more illiterate women in control areas. At follow-up, therefore, mean knowledge score in control areas may appear falsely high, leading to a false negative result.

Finally, confounding is a possibility. It may be that an unobserved phenomenon in control municipalities was affecting knowledge scores to the same, or to a greater, extent than *Familias* (in other words, a violation of the common trends assumption). Indeed, the crude scores in Table 12.2 seem to suggest this. This seems unlikely though, since it is hard to imagine what this phenomenon might be, especially one uniquely confined to control areas. The null finding may also have been confounded if the survey instrument was poorly constructed or administered, in other words, was insensitive to changes in women's knowledge. This again is relatively unlikely, given that significant associations are seen between the constructed knowledge score and literacy, educational attainment, parity and duration of diarrhoeal illness in children of the same household.

The positive association between knowledge score and woman's literacy or educational attainment is well established, as discussed earlier in the chapter. Increasing age among *Familias* participants was associated with worse knowledge. This may be because older women have beliefs and practices around the prevention and management of ADI that are more at odds with contemporary recommendations or that are more resistant to change, or that older women respond less well to the teaching style used in *Familias* workshops compared to younger women. The negative association with age contrasts with the positive association with parity: women with more children display better knowledge scores (after adjusting for age). This is presumably because women gain more accurate knowledge of the management of childhood illnesses the more children they have. This may come about through increased contact with health professionals, with peers, from personal experience of managing unwell children or some combination of the three.

Relation to other studies

Progresa-Oportunidades evaluated that scheme's impact on participants' knowledge of reproductive health and found that, rurally, participating women had adequate knowledge of contraceptive methods more often than unexposed controls (80.8 vs. 76.9%, $p<0.05$)[142]. This benefit was not seen in urban areas, which the authors ascribe to the multiplicity of information sources in urban settings beyond that provided by the programme, confirmed through focus-groups.

There are, however, no other published studies of the relation between CCTS and women's healthcare knowledge related to childhood health. Some inferences can be drawn, however, from related behaviours such as healthcare use and household spending patterns. Work by the Institute of Fiscal Studies has already shown that *Familias* is associated with an increase in the proportion of children with up to date preventive healthcare visits from 17.2 to 40% of children aged under two years, and from 33.6 to 66.8% of children aged between two and four years. No significant impact was found for children older than this[93]. The scheme was also associated with an increase in food consumption or around 20% (as measured by household spend) in rural areas and 9% in urban areas, going mainly towards protein rich foods. In addition, spending on children's clothing and footwear increased[103].

Strengths and weaknesses of the study

In addition to the strengths and weaknesses of the general evaluation strategy of *Familias* already outlined in Chapter 8, there are specific points to note relevant to this analysis. Strengths include a large sample size of over 9,000 women with complete data on the variables of interest and follow-up rates of over 80%. Foremost, data were prospectively collected and design of the survey instrument was informed by a prior hypothesis that *Familias* would have an impact on women's healthcare knowledge and practice. The main result is plausible and is robust to the inclusion of covariates. Likewise, most covariates have plausible impact. In terms of interest and relevance, women's healthcare knowledge in relation to child health has not been looked at before, but is of undoubted importance as an outcome.

A primary weakness is that the intervention was not randomised. Significant differences are apparent at baseline across communities according to their exposure to the programme. Although several co-variates were included in the analysis and a double-difference approach deployed to take into account any difference in the outcome of interest at baseline as well as its trend due to both observed and unobserved determinants, the possibility of residual confounding cannot be discounted.

Although follow-up rates were good, attrition did vary between communities, being greater in control municipalities and rurally, as in the preceding two analyses. As already discussed, because women in these areas are less educated and literate, this may have biased findings toward a false-negative results. Nevertheless, absolute difference in attrition rates was very small (no more than 2.5%), so are unlikely to have biased results substantially.

Other weaknesses include derivation of the knowledge score from relatively little information. A more sophisticated “Knowledge, beliefs and practices” module was considered when designing the evaluation, but the necessity of collecting other data crowded out inclusion of more items in a survey which already takes 3-4 hours per household to administer.

Policy implications

CCTS appear to be ineffective in building human capital in women, one of their core objectives alongside that of relieving material poverty. This study finds that women with higher pre-existing levels of human capital, as indicated by literacy and completed formal education, show greater improvement in their knowledge around the management and prevention of acute childhood diarrhoea compared to other women. The health outcomes of these women's households may thus improve a faster or more sustained rate than the households of more disadvantaged women.

One implication is that schemes may be more effective if the workshop element of CCTS were adjusted to better suit the learning needs of illiterate and less educated women. Unfortunately, no quantitative or qualitative evaluations of the *Familias* workshops are available. Dissemination of health information in their current format may favour women who are literate and have more experience of formal education. Other formats may be more appropriate. Recent evidence suggests that a collaborative rather than directive teaching style, which enquires about the listener's perspective and emphasises their autonomy over decision making, is much more effective than traditional advice-giving[247]. For example, in a cluster-randomised trial amongst rural women in Nepal, over half of whom were illiterate, peer-led participatory learning was associated with significant reductions in both neonatal and maternal mortality (odds ratio of 0.7 and 0.22 respectively)[248]. Hence, in *Familias* and other CCTS, peer-to-peer training may be more effective. Indeed, this is an approach that is being trialled currently in the field in Colombia, results are expected in 2012.

The relationship between maternal literacy and children's health is well documented[249], even if literacy is learnt as an adult[230]. In the women studied in this analysis, literacy rate (76.2%) was markedly less than the national average (84.6% in rural and 92.4% in urban areas, 2003[146]) and did not improve across phases 1 and 2. Hence, the absence of complementary initiatives to teach women how to read and write may significantly constrain the ability of *Familias* to develop beneficiaries' human capital and contribute to the inequity gap that this analysis suggests is a possible consequence of the programme.

The finding that increasing age is negatively associated with knowledge score similarly implies that some tailoring of the workshops' content and delivery is needed to suit the needs of older participants.

These criticisms should be set against the fact that *Familias* was successful in improving some aspects of childcare, such as immunization uptake (perhaps unsurprisingly, since this was an explicit condition of participation). Furthermore, it was also successful in significantly reducing the incidence of ADI in participating children. Nevertheless, it is likely that even greater reductions in ADI incidence (or severity, duration or consequences) could be achieved if the programme were more effective at communicating correct management of easily managed but frequently life-threatening childhood illness.

The recent World Bank review of CCTS[59] suggested that more could be done to reach into households to support beliefs and practices parenting and other "within-household" activities. This study supports this notion; CCTS are a possible vehicle to support parenting, but could benefit from modification or the support of complementary initiatives to do this more effectively. This implies a greater role for those skilled at imparting knowledge and life skills, such as health promotion specialists. Wider involvement from other members of the health sector, such as midwives, health visitors or community nurses, may also be beneficial.

Relation to conceptual model

This study demonstrates that cash transfers do not adequately or effectively build women's human capital, one of the core elements of co-production. Demonstration of any weak or unexpected adverse 'final' outcomes in individuals or in households therefore, as in the two previous chapters, can at least partly be explained by insufficient investment in this element.

It is worth recalling that the study population comprise households living in the bottom sextile of Colombia's socio-economic distribution. These findings highlight the risk that even tailored, targeted interventions have the potential to widen inequity and create a stratum of households that suffer extreme, possibly increasing, marginalisation unless attention is given to the full range of determinants of health and welfare.

The finding of a null impact on such an important driver or health outcomes is also a particularly strong argument for greater involvement from the health sector in the design, operation and evaluation of cash transfer schemes, particularly health promotion specialists.

	Control			TBB					TAB				
							diff. cf. Control					diff. cf. Control	
	Mean	95% CI		Mean	95% CI		t / χ^2	p	Mean	95% CI		t / χ^2	p
Individual level co-variates													
Mean knowledge score at baseline	**2.25**	2.21	2.29	**2.27**	2.22	2.31	-0.46	0.64	**2.33**	2.28	2.38	-2.31	0.02
Age (yr)	**39.2**	38.8	39.6	**38.9**	38.5	39.4	0.86	0.388	**38.0**	37.6	38.4	3.98	<0.001
1ary education incomplete	**66.9**	65.4	68.3	**67.9**	66.1	69.6			**69.3**	67.6	71.1		
1ary education complete	**28.1**	26.8	29.6	**27.1**	25.5	28.7	χ^2= 0.972	0.808	**26.3**	24.7	28.0	χ^2= 11.53	0.009
2ary education complete	**4.1**	3.4	4.7	**4.2**	3.4	4.9			**4.0**	3.3	4.8		
Further education	**0.9**	0.6	1.2	**0.9**	0.5	0.1			**0.3**	0.1	0.5		
Literate	**74.9**	73.4	76.4	**78.1**	76.5	79.8	-2.79	0.005	**76.8**	75.0	78.6	-1.59	0.112
Travel time to medical centre (min)	**36.5**	34.9	38.1	**38.5**	36.7	40.3	-1.61	0.108	**34.6**	32.8	36.4	1.52	0.129
Community participation	**19.3**	18.0	20.7	**22.8**	21.2	24.5	-3.2	0.001	**31.5**	29.5	33.4	-10.26	<0.001
Number of live births	**5.0**	4.9	5.1	**4.8**	4.7	4.9	3.0	0.003	**5.1**	5.0	5.2	-0.54	0.592
Household level co-variates													
Head of h'hold 1ary education incomplete	**71.4**	70.0	72.9	**71.2**	69.5	72.8			**72.0**	70.2	73.7		
Head of h'hold 1ary education complete	**24.3**	22.9	25.6	**25.2**	23.6	26.8	χ^2= 2.974	0.396	**24.1**	22.4	25.7	χ^2= 1.381	0.710
Head of h'hold 2ary education complete	**3.6**	3.0	4.2	**2.9**	2.3	3.5			**3.5**	2.7	4.1		
Head of h'hold further education	**0.7**	0.5	1.0	**0.7**	0.4	1.0			**0.5**	0.2	1.0		
Literacy of head of household	**72.1**	70.5	73.6	**75.9**	74.2	77.6	-3.23	0.001	**71.7**	69.8	73.6	0.26	0.797
Household size (persons)	**6.0**	5.9	6.0	**5.8**	5.7	5.9	2.06	0.039	**6.1**	6.0	6.2	-1.63	0.104
Persons per room	**2.8**	2.8	2.9	**2.7**	2.7	2.8	2.3	0.022	**2.6**	2.5	2.7	4.89	<0.001
Log household wealth (pesos)	**12.77**	12.75	12.79	**12.89**	12.87	12.91	-7.62	<0.001	**12.79**	12.76	12.81	-0.77	0.438
Piped water to household	**65.3**	63.6	66.9	**54.9**	52.9	56.9	7.91	<0.001	**67.7**	65.7	69.7	-1.86	0.062
Urban household	**55.8**	54.0	57.5	**44.7**	42.7	46.6	8.28	<0.001	**45.8**	43.7	47.9	7.16	<0.001
Municipality level co-variates													
Log municipality population	**9.82**	9.79	9.85	**10.24**	10.21	10.26	-19.84	<0.001	**9.87**	9.84	9.9	-2.5	0.012
Eligible families in municipality	**6.34**	6.3	6.38	**7.26**	7.23	7.3	-34.07	<0.001	**6.80**	6.76	6.83	-16.28	<0.001
Eligible families in urbanized municipality	**3.65**	3.62	3.68	**3.35**	3.32	3.38	13.58	<0.001	**3.54**	3.51	3.58	4.74	<0.001
Quality of life index	**54.4**	54.0	54.8	**53.9**	53.5	54.2	2.1	0.036	**53.3**	52.9	53.7	3.8	<0.001
Log ratio of doctors to pop'n in municipality	**-1.16**	-1.18	-1.15	**-1.41**	-1.43	-1.4	20.68	<0.001	**-1.28**	-1.3	-1.26	9.72	<0.001
Log ratio of nurses to pop'n in municipality	**-0.51**	-0.53	-0.49	**-0.78**	-0.82	-0.75	13.74	<0.001	**-0.52**	-0.56	-0.49	0.79	0.428
Av. log municipality household wealth	**12.91**	12.91	12.92	**12.99**	12.98	13	-16.78	<0.001	**12.92**	12.91	12.93	-1.88	0.060
Av. municipality travel time to medical centre	**37.0**	36.2	37.8	**39.2**	38.4	39.9	-3.74	<0.001	**34.6**	34.0	35.2	4.2	<0.001
Av. municipality piped water to household	**64.8**	64.1	65.6	**53.9**	53.2	54.7	18.78	<0.001	**66.9**	66.1	67.8	-3.49	<0.001

Table 12.10: Characteristics of analytic sample at baseline (figures are percentages unless otherwise indicated)

	Analytic Sample			Lost to follow-up				
	Mean	95% CI		Mean	95% CI		t / χ^2	p
Individual level co-variates								
Mean knowledge score at baseline	**2.28**	2.25	2.30	**2.15**	2.09	2.21	-3.72	<0.01
Age (yr)	**38.8**	38.5	39.0	**41.1**	40.4	41.8	7.424	<0.001
1ary education incomplete	**67.2**	66.2	68.3	**70.8**	68.5	73.0		
1ary education complete	**27.7**	26.7	28.7	**25.6**	23.4	27.7	χ^2=9.85	0.020
2ary education complete	**4.3**	3.8	4.7	**3.2**	2.3	4.0		
Further education	**0.8**	0.5	1.0	**0.5**	0.1	0.8		
Literate	**76.4**	75.5	77.4	**73.8**	71.6	75.9	-2.301	0.021
Community participation	**23.8**	22.8	24.7	**25.6**	23.5	27.8	1.569	0.117
Travel time to medical centre (min)	**36.6**	35.6	37.6	**43.3**	40.7	45.8	5.289	<0.001
Household level co-variates								
Head of h'hold 1ary education incomplete	**70.6**	69.6	71.6	**75.9**	73.8	78.0		
Head of h'old 1ary education complete	**25.3**	24.4	26.3	**20.3**	18.4	22.3	χ^2=19.66	<0.001
Head of h'old 2ary education complete	**3.4**	3.0	3.8	**3.2**	2.8	4.1		
Head of h'old further education	**0.6**	0.4	0.8	**0.5**	0.2	0.8		
Literacy of head of household	**73.2**	72.2	74.1	**69.6**	67.3	71.8	-2.93	0.003
Household size (persons)	**5.9**	5.9	6.0	**5.8**	5.7	5.9	-2.001	0.045
Persons per room	**2.7**	2.6	2.8	**2.7**	2.6	2.8	-0.487	0.626
Log household wealth (pesos)	**12.81**	12.80	12.82	**12.77**	12.74	12.80	-2.847	0.004
Piped water to household	**62.7**	61.7	63.8	**58.8**	56.4	61.2	-2.964	0.003
Urban household	**49.6**	48.4	50.7	**44.6**	42.2	47.1	-3.591	<0.001
Municipality level co-variates								
Log municipality population	**9.96**	9.94	9.98	**9.92**	9.88	9.96	-1.93	0.054
Eligible families in municipality	**6.75**	6.73	6.78	**6.63**	6.58	6.69	-4.138	<0.001
Eligible families in urbanized municipality	**3.53**	3.51	3.55	**3.47**	3.43	3.51	-2.639	0.008
Quality of life index	**53.9**	53.7	54.2	**54.6**	54.1	55.1	2.462	0.014
Log ratio of doctors to pop'n in municipality	**-1.27**	-1.28	-1.26	**-1.3**	-1.32	-1.28	-2.032	0.042
Log ratio of nurses to pop'n in municipality	**-0.59**	-0.61	-0.58	**-0.58**	-0.61	-0.54	0.976	0.329
Av. log municipality household wealth	**12.94**	12.94	12.94	**12.94**	12.93	12.95	0.447	0.655
Av. municipality travel time to medical centre	**37.0**	36.6	37.5	**39.2**	38.2	40.3	4.008	<0.001
Av. municipality piped water to household	**62.0**	61.6	62.5	**61.3**	60.2	62.4	-1.93	0.054

Table 12.11: Characteristics of women lost to follow-up (figures are percentages unless otherwise indicated)

	Model A				Model B				Model C				Model D			
	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value
TAB area effect	**0.131**		0.11	0.25	**0.108**		0.10	0.27	**0.122**		0.10	0.21	**0.127**		0.09	0.15
Time effect	**0.159**	*	0.07	0.02	**0.159**	*	0.07	0.02	**0.160**	*	0.07	0.02	**0.162**	*	0.07	0.02
Programme effect	**-0.204**		0.11	0.06	**-0.210**		0.11	0.06	**-0.211**		0.11	0.06	**-0.213**		0.11	0.06
Individual level co-variates																
Age					**-0.010**	***	0.00	<0.001	**-0.010**	***	0.00	<0.001	**-0.010**	***	0.00	<0.001
Primary education complete					**0.350**	***	0.05	<0.001	**0.288**	***	0.05	<0.001	**0.280**	***	0.05	<0.001
Secondary education complete					**0.762**	***	0.11	<0.001	**0.687**	***	0.11	<0.001	**0.698**	***	0.10	<0.001
Further education					**0.699**	***	0.21	<0.001	**0.669**	***	0.19	<0.001	**0.674**	***	0.19	<0.001
Literate					**0.469**	***	0.07	<0.001	**0.439**	***	0.07	<0.001	**0.406**	***	0.07	<0.01
Travel time to medical centre					**-0.001**	**	0.00	<0.01	**-0.001**		0.00	0.30	**0.001**		0.00	0.77
Community participation					**0.099**		0.06	0.12	**0.091**		0.06	0.15	**0.097**		0.06	0.08
Number of live births					**0.029**	**	0.01	<0.01	**0.028**	**	0.01	0.01	**0.027**	**	0.01	<0.01
Household level co-variates																
Head of household 1ary education complete									**0.095**		0.05	0.07	**0.092**		0.05	0.07
Head of household 2ary education complete									**0.018**		0.11	0.87	**0.036**		0.11	0.74
Head of household further education									**-0.183**		0.29	0.53	**-0.080**		0.28	0.77
Literacy of head of household									**0.086**		0.06	0.15	**0.071**		0.06	0.22
1 / (Household size)									**-1.171**	**	0.30	0.01	**-1.394**	***	0.30	<0.001
Persons per room									**-0.017**		0.02	0.32	**-0.021**		0.02	0.17
Log household wealth									**0.021**		0.04	0.63	**-0.033**		0.04	0.40
Piped water to household									**0.044**		0.06	0.44	**0.023**		0.05	0.65
Urban household									**0.177**	**	0.05	<0.001	**0.199**	***	0.05	<0.001
Municipality level co-variates																
Log municipality population													**-0.144**	**	0.05	0.01
Eligible families in municipality													**-0.027**		0.04	0.44
Eligible families in urbanized municipality													**0.003**		0.05	0.95
Quality of life index													**0.004**		0.00	0.41
Ratio of doctors to population in municipality													**-0.095**		0.09	0.30
Ratio of nurses to population in municipality													**-0.056**		0.07	0.43
Av. municipality household wealth													**0.511**	**	0.18	<0.01
Av. municipality travel time to medical centre													**-0.001**		0.00	0.49
A. municipality piped water to household													**0.002**		0.00	0.30

Table 12.12: Determinants of knowledge score (TBB areas excluded)

	Model A			Model B				Model C				Model D			
	Co-efficient	S.E.	p-value	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value	Co-efficient		S.E.	p-value
TBB area effect	**0.093**	0.12	0.46	**0.089**		0.12	0.46	**0.097**		0.12	0.43	**0.153**		0.13	0.24
TAB area effect	**0.098**	0.11	0.38	**0.075**		0.10	0.45	**0.085**		0.1	0.39	**0.101**		0.09	0.27
Time effect	**0.094**	0.06	0.09	**0.092**		0.06	0.10	**0.093**		0.06	0.10	**0.094**		0.06	0.10
Programme effect	**-0.140**	0.10	0.17	**-0.143**		0.10	0.17	**-0.144**		0.10	0.17	**-0.147**		0.10	0.16
Individual level co-variates															
Age				**-0.012**	***	0.00	<0.001	**-0.012**	***	0.00	<0.001	**-0.012**	***	0.00	<0.001
Primary education complete				**0.332**	***	0.04	<0.001	**0.274**	***	0.04	<0.001	**0.273**	***	0.04	<0.001
Secondary education complete				**0.666**	***	0.09	<0.001	**0.585**	***	0.09	<0.001	**0.603**	***	0.09	<0.001
Further education				**0.619**	***	0.18	<0.001	**0.55**	**	0.17	<0.01	**0.567**	***	0.17	<0.001
Literate				**0.384**	***	0.06	<0.001	**0.353**	***	0.06	<0.001	**0.327**	***	0.06	<0.001
Travel time to medical centre				**-0.001**	**	0.00	<0.01	**-0.001**		0.00	0.14	**0.001**		0.00	0.35
Community participation				**0.080**		0.05	0.13	**0.072**		0.05	0.17	**0.066**		0.05	0.16
Number of live births				**0.024**	**	0.01	<0.01	**0.017**		0.01	0.06	**0.017**	*	0.01	0.04
Household level co-variates															
Head of household 1ary education complete								**0.084**		0.05	0.07	**0.087**		0.05	0.07
Head of household 2ary education complete								**0.039**		0.09	0.67	**0.064**		0.09	0.50
Head of household further education								**-0.061**		0.24	0.80	**-0.008**		0.24	0.97
Literacy of head of household								**0.079**		0.05	0.13	**0.068**		0.05	0.19
1 / (Household size)								**-1.172**	**	0.30	0.01	**-1.341**	***	0.30	<0.001
Persons per room								**-0.013**		0.01	0.37	**-0.015**		0.01	0.28
Log household wealth								**0.049**		0.04	0.19	**0.021**		0.04	0.55
Piped water to household								**0.023**		0.04	0.59	**-0.005**		0.04	0.91
Urban household								**0.122**	**	0.05	0.01	**0.155**	***	0.04	<0.001
Municipality level co-variates															
Log municipality population												**-0.101**		0.05	0.05
Eligible families in municipality												**-0.049**		0.04	0.17
Eligible families in urbanized municipality												**0.005**		0.05	0.91
Quality of life index												**0.003**		0.00	0.57
Ratio of doctors to population in municipality												**-0.119**		0.08	0.12
Ratio of nurses to population in municipality												**-0.004**		0.05	0.94
Av. municipality household wealth												**0.273**		0.19	0.15
Av. municipality travel time to medical centre												**-0.002**		0.00	0.30
Average municipality piped water to household												**0.001**		0.00	0.61

Table 12.13: Determinants of knowledge score (TBB areas included)

PART V

DISCUSSION

Chapter 13: Main findings

Findings from Literature Review

Review of the existing literature finds that CCTS are complex interventions that comprise an offer of significant sums of regular cash to targeted households, as long as they comply with pre-specified behavioural requirements around school attendance, uptake of preventive healthcare and, in some schemes, attendance at workshops on parenting and healthcare skills. The schemes are most prominent in Latin America, but are increasingly being seen in other developing regions and even in some high-income settings.

CCTS stated aims are to relieve the immediate poverty of marginalised households whilst simultaneously building their human capital and longer-term welfare. They aim to contribute to upward social mobility and break the intergenerational transmission of poverty, thus they focus particularly on infants and children. Supporting gender equality is an allied aim – women are designated to receive the household transfer and liaise with programme officials at community level; incentives are often greater for girls' school attendance than boys'.

Ten years of experience with CCTS suggests that they are effective in changing household behaviour, in line with pre-specified behavioural requirements. Antenatal care, childhood immunisation, and child development checks, for example, increase. Less clear, however, is their effect on more 'final' outcomes such as objective measures of health. Some schemes are associated with small improvements in childhood growth, others are not. The same applies to childhood anaemia and rates of acute childhood diarrhoeal and respiratory illness. CCTS are, however, broadly progressive. Compared to wider society CCTS are generally successful in targeting most resources to those most in need and, within the beneficiary group, there is some evidence that the very poorest households gain most in terms of transfer size and some health outcomes.

It remains unclear which elements of the intervention are most instrumental in driving the effects observed. Likewise, it is unclear which elements should be modified to achieve greater health gains whilst avoiding adverse outcomes. Against this evidential background, controversy persists around certain elements of the scheme, such as the appropriateness of imposing behavioural requirements on already marginalised and stigmatised households.

One notable feature of CCTS is the apparent low degree of engagement from the health sector in schemes' design, operation and evaluation. This is perhaps surprising given that health gain is a core objective of every scheme, given that the schemes exert large impacts on health systems and that, where unanticipated adverse outcomes have been observed in association with CCTS, all have occurred within the health domain.

Findings from Quantitative Analyses

New analyses from the Colombian scheme demonstrate adverse outcomes within the health domain. Amongst participating women, whose mean baseline BMI was already on the threshold of being excessively high, the scheme was independently associated with additional weight gain and a significant increase in the prevalence of obese women. Likewise in children, the scheme was associated with significant increases in BMI-for-age and in the numbers of overweight or obese children. These effects were most pronounced in girls and in stunted children. This occurred despite a secular trend of decreasing BMI-for-age in the population studied.

No less disappointing is the finding of a null effect on maternal healthcare knowledge, despite increased attendance at health and parenting workshops and increased contact with healthcare professionals through child growth monitoring, vaccination etc (a mandated part of the programme). Maternal literacy was, however, significantly associated with the correct management of acute childhood diarrhoea. Around a quarter of participants identified themselves as illiterate, but *Familias* does not teach literacy to its participants and literacy rates did not improve over phases 1 and 2 of the evaluation.

Regarding health equity, there was no evidence that *Familias* exerted any inequitable impact amongst beneficiaries. Interaction terms between *Familias* and various markers of socio-economic position for the various outcomes studied were all non-significant. The programme may, however, worsen health inequity when comparing participants with the wider Colombian population – both by worsening rates of overweight and obesity and by failing to teach mothers about management of an important cause of childhood illness and mortality whilst literate and more educated mothers pick up this knowledge through other sources. The regressions demonstrate that this independent knowledge gain occurs within the stratum of society targeted by *Familias,* presumably therefore it also occurs amongst women of higher social position.

In short, this thesis has identified additional adverse health impacts associated with CCTS. In terms of gaining a better understanding which elements of the intervention are successfully delivered and so may be important in achieving programme objectives, one element, that is building of human capital, appears to have been ‘ruled out’, at least in women. The thesis has also shown that if CCTS are progressive compared to wider society in terms of resources transferred, as suggested by the literature review, they may be regressive in terms of certain important health outcomes.

Interpretation

An overarching interpretation of these findings, viewed within the co-production framework, would be that CCTS successfully amplify poor households’ material resources, but fail to build their human capital. The inconsistent positive health impacts reported elsewhere and the negative and null health impacts reported here may therefore be due to inadequate investment in human capital formation – although there may also be scope for further amplification of material resources. CCTS impact on structural opportunities remains unclear from the literature review and has not been tested in the analyses presented here.

Any reported statistical association may, in the very simplest terms, be real or not real. Detailed consideration of each possibility, and the roles of chance, bias and confounding if not real, has been set out in each chapter. The main points in common can be summarised here. In favour of the findings being real, plausible behavioural mechanisms exist for the associations reported. Second, the findings are anticipated by prior work in the CCTS and broader social welfare literature, such as that by the IFS, who reported that household food consumption increased by about 15% in association with *Familias*, and Uauy who advised that welfare programmes targeted solely on socioeconomic criteria without consideration of anthropometric criteria could accelerate the global obesity epidemic. Furthermore, similar effects have been reported elsewhere, such as the work by Fernald, who showed that a doubling of the cash transfer was associated with increased BMI amongst adult beneficiaries of Mexico's *Progresa*. Similarly, the null findings on women's healthcare knowledge are anticipated by recent work which has shown that lifestyle changes are more likely if a guiding, empathic style is used by professionals as opposed to the traditional advice giving style. Finally, the methods employed by the *Familias* evaluation in general and the statistical methods used for these particular analyses were conservative and robust.

Considering the possibility of non-real findings, the following points can be summarised. The role of chance is quantified in each analysis and appears small: seven of the major findings have a p-value of 0.01 or less. The non-randomised nature of the evaluation means that confounding may be present, particularly since control municipalities are known to be substantively different from treatment municipalities in lacking sufficient infrastructure to deliver *Familias.* For the analyses on women's and children's BMI to have been confounded, other food- or cash-based welfare programmes uniquely associated with *Familias* participants (and not their matched controls) would have had to be in operation, formally or informally. This may seem unlikely but was, however, precisely the manner in which *Familias* was implemented. Nevertheless, some reassurance comes from the fact that a condition of enrolment in *Familias* was declaration and resignation from other family welfare programmes. It could also be that energy expenditure dropped uniquely in treatment areas. Confounding of the null finding on women's healthcare knowledge would require a phenomenon that suppressed women's healthcare knowledge uniquely in *Familias* municipalities, or boosted knowledge uniquely in control areas. This does not seem plausible, not least because the crude scores are observed to barely change between baseline and follow-up. This also discounts the possibility of an even increase on knowledge score across all areas.

Bias relating to differential sample attrition affects all analyses. In the analysis on women's healthcare knowledge, significantly greater loss of non-literate women in control areas could have produced a falsely boosted mean knowledge score in control areas and hence a false-negative finding. In the analyses on nutritional outcomes in women and children, differential loss to follow-up is more likely to have led to under-estimates of programme effect, as explained in those chapters.

Strengths and limitations

Strengths of the evaluation include its prospective nature and large scale. Even after application of inclusion criteria and loss to follow-up, over 2000 women and nearly 4000 children are available for BMI analysis and nearly 8000 women for analysis of knowledge score. Loss to follow-up is relatively modest at around 20% after four years and only differs across exposure groups by a few percentage points.

The primary weakness relates to the non-randomised nature of the evaluation. Extensive differences between co-variates, and in some cases the outcome of interest, are found at baseline in all analyses. These differences are adjusted for in multi-variate analyses and all findings are robust to their inclusion. Furthermore, the double-difference specification allows for the outcome of interest to differ by exposure-group at baseline and estimates separate coefficients for each area-type, which will capture further unobserved differences at this level. Nevertheless, the possibility of residual confounding remains.

Further research

Two areas of further work appear particularly important: understanding the mechanisms behind the outcomes observed and continuing follow-up. Regarding mechanisms, a key question is why *Familias* has no impact on knowledge scores whereas increasing parity does. Women appear to gain a better understanding of parenting from having children, presumably from increased contacts with peers, elders and professionals. The implication is that this kind of contact imparts knowledge in ways that *Familias* currently does not. New research could explore the preferred learning styles and most effective teaching methods for all women, but particularly for defined groups within the *Familias* beneficiary cohort, such as older women, women who have completed less formal education and illiterate women. The impact of complementary interventions to teach literacy and support community participation and social activities should also be explored. There is likely to be an important interaction between these interventions and the CCTS itself.

Similarly, exploration of the mechanisms underlying the association between *Familias* and abnormal weight gain is necessary including why the effect in children, for now, appears limited to girls. As discussed earlier, this may be due to changes in food consumption and food share, changes in energy expenditure, physiological mechanisms or some combination of these. These are just the most proximal causes of weight gain and deeper behavioural and socioeconomic determinants will require characterisation as well, at individual, household and community levels.

Continued follow-up should clarify whether increasing exposure to *Familias* has a cumulative effect on abnormal weight gain and whether odds of obesity also increases in children in the longer term. Of particular interest are the cohort of children excluded from this study – that is, those aged under 2. It is known that *Familias* was associated with a small reduction in the probability of stunting in this age group which may reduce their probability of childhood overweight.

Critiquing the utility of co-production as a conceptual framework

Co-production was chosen as the conceptual framework for the thesis because of the objective of better health shared by both co-production and CCTS, because both embody shared responsibility as a key idea and because CCTS separately identify yet jointly address distinct elements of co-production: investment in human capital (by incentivising uptake of health and education services for younger household members and attendance at seminars on health, nutrition and parenting for older household members); and amplification of external resources (through disbursement of nutritional supplements and cash transfers). Although the conceptual model and the policy part company around the third element of co-production, namely creation of a fairer physical, social and economic environment, it was noted that this point of separation was not necessarily disadvantageous. Given any adverse programme effect, it may be that co-production can offer guidance on policy reformulation. As well as reconsideration of the human capital and material resources elements of the intervention, CCTS and allied policies may need to more explicitly address participants' physical, social and economic environment

The thesis did not test the hypothesis that co-production is good for health, nor primarily aim to test the adequacy of CCTS as a model for co-production. Regarding the former, risks and limitations of co-production as a means for achieving better health were considered in Chapter 2 and are not discussed again. Regarding the latter, critical reflection on both of these points follows below.

Summary

Chapter 1 set out that the thesis aimed to advance understanding of the impact of CCTS on health and on health equity and produce insights useful to refining their design and operation, thus making them more effective at improving health and reducing avoidable disparities. The thesis has demonstrated that CCTS appear ineffective at improving health knowledge, at least in women, and additionally are associated with significant adverse weight gain in women and children. Whilst CCTS may be progressive compared to wider society in terms of resources transferred, they may be regressive in terms of these important health outcomes. These new results build on findings from the literature review that CCTS have some positive impacts son health, but some impacts are small, inconsistent and, occasionally, adverse. Furthermore, CCTS appear particularly ineffective at building human capital, despite being a stated aim of all schemes. Viewed through a co-production framework, CCTS could be described as interventions which invest predominantly in material resources at individual and household level, with insufficient investment in the other drivers of co-production, namely human capital formation and structural change to create physical, social and economic environments conducive to better health.

How might these insights refine design and operation of CCTS? Whilst not claiming that CCTS should be a panacea capable of solving the problem of persistent disadvantage at a single stroke, the next Chapter presents a fresh critique of the schemes from a social determinants of health perspectives and suggests several changes to design and operation which may make CCTS more acceptable and effective health and welfare interventions.

Chapter 14: Critique of CCTS from a perspective that prioritises the social determinants of health

This thesis aims to offer new insights into the design, operation and evaluation of CCTS by appraising them from a social determinants of health perspective. Review of the literature finds that CCTS are associated with many positive impacts but some effects, particularly on 'final' health and welfare outcomes, appear small or inconsistent. Furthermore, new analyses of Familias show that CCTS have the potential to worsen health and health inequity.

CCTS are valuable interventions, but could be improved in three ways:

- operationally;
- conceptually; and
- through greater health sector involvement.

Operational implications were set out Chapters 10, 11 & 12 specific to each analysis, e.g. offering literacy classes alongside parenting seminars.

This chapter synthesises the implications flowing from Parts II and IV and presents a conceptual critique of CCTS from the SDH perspective. This is based around the separate elements of the CCTS intervention: the transfer, the conditions and the targeting strategy, drawing out policy implications that emerge from the reappraisal.

The chapter concludes by addressing the lack of health sector involvement in CCTS design, operation and evaluation.

Reappraising Conditional Cash Transfer Schemes

The core problem that CCTS seek to solve is that of inadequate service uptake among disadvantaged households, even where services are believed to be accessible, appropriate and of high quality. Their deeper objectives are to break the intergenerational transmission of poverty by stimulating uptake of services that support children's early education, health and nutrition. They aim to tackle social exclusion, both by contributing to the upward social mobility of future generations as well as by partially relieving the immediate poverty of beneficiary households.

CCTS focus attention entirely on the way the individual or the household behaves and intervene at this level, without considering that there may be drivers of individual and household behaviour that operate at, and thus require intervention at, the social level. Given the uncertainty over final outcomes, it may be necessary to consider such drivers when judging the effectiveness and acceptability of conditional cash transfers. A fresh analysis of the schemes from a social determinants perspective would draw attention to the most deeply situated causes of health inequity and highlight the need for action to improve daily living conditions, tackle unfair distributions of power and resources and quantify the drivers and the effects of action on health inequity. Specifically, CCTS effects on empowerment, rights, service quality and social cohesion, schemes' inter-relation with other welfare policy and participants' views on the schemes are all likely to be important drivers of their effectiveness and acceptability. These are elements about which the CCTS literature, although copious, says little.

The transfer: resources or power?

CCTS appear to transfer resources effectively, but do they do as well at transferring power? The distinction is critical, because social exclusion will persist unless imbalances in both are tackled.

Social exclusion is driven and perpetuated by resource-dependency or power-dependency. Both manifest a relationship where one party is subordinate to the other. Resource-dependency is due to imbalances in money, materials, skills or expertise, and is occasionally necessary, as in the relationship between a parent and child. Clearly, this form of dependency does not imply social exclusion. Other forms of resource-dependency, however, are exclusionary, whether preferable to the dominant party (as characterized by abusive relationships) or preferable to the subordinate party (as characterized by freeloader relationships). Similarly, in power-dependency, the weaker party often does not choose to be in a subordinate position, but power structures keep him or her there.

What is the interplay between conditionality and these two drivers of social exclusion? Regarding resource-dependency, CCTS demonstrate effective transfer of resources to the most marginalized of society, mainly through much better targeting than earlier welfare programmes. As noted earlier, transfers are generous (up to 20% of household income). Coady concluded that 81% benefits go to the poorest 40% families[139] and Soares estimated that CCTS accounted for 21% of inequality reduction in Brazil and Mexico and 15% in Chile between the mid-1990's and mid-2000's[113]. Such figures are surprisingly large given that CCTS transfers are tiny in comparison to mainstream social welfare programmes. Crucially, a recent review of evidence from low income countries concluded that CCTS do not induce financial dependence or lassitude among recipient communities[75].

Much less clear is CCTS' effect on power-dependency. Although CCTS' core narrative of 'co-responsibility' and specific elements (such as nominating the female head-of-household as recipient for cash transfers and a greater incentive for girls' schooling compared to boys) were designed to transfer power, there is little evidence on whether CCTS reduce or promote this driver of social exclusion. Only one study has looked at the issue, discussed earlier. It found that *Progresa* increased women's self-confidence, but it is unclear how the sample was selected[112]. Little is known on whether CCTS empower or disempower participants, relative to baseline or to the rest of society. There is a real risk that CCTS may do little to address social exclusion, principally because CCTS transfer insufficient power. CCTS are liable to encourage a merely mechanistic engagement with public services and fail to generate genuine demand or engagement in a way that would empower users. The deliberate by-passing of unresponsive local bureaucracies further heightens this risk. Although this by-passing is cited as a positive feature where local government is inefficient or weak, such centralisation is not necessarily beneficial. Dysfunctional layers of local government should not be ignored, but reformed[250]. Furthermore, most CCTS do not offer adequate means of responding to needs as voiced by beneficiaries themselves, meaning that they are kept as clients rather than as participants in solving the problem of chronic disadvantage. Taken together, these factors mean that CCTS do little to address societal attitudes to poverty and may perpetuate social exclusion despite any resource transfer.

Hierarchies of power which undermine the control that individuals and communities have over their lives are one of the deep causes of health inequity identified by the Commission on Social Determinants of Health. CCTS should avoid entrenching such hierarchies by giving beneficiaries a say in how schemes are designed, taking the opportunity to transform local government into effective bodies responsible for local welfare and by tempering conditionality with a stronger narrative around entitlements, as explained next.

The conditions: are there other ways to stimulate service uptake?

As discussed in Chapter 5, conditionality has always provoked controversy. There are few evaluations which seek to quantify any additional benefit (or cost) of conditionality. Of those that exist, most derive from unintended mishaps in scheme implementation[105 106 122 123]. Only one head-to-head comparison of conditionality versus non-conditionality has been published which demonstrated divergent results favouring either conditioned transfers (for promoting target behaviours around school attendance in Malawian school girls) or unconditioned transfers (for avoiding target, but non-conditioned, outcomes around teenage marriage and pregnancy)[124]. Given the continuing policy uncertainty on conditionality, it is worth reflecting on other ways to tackle the problem of low service uptake among disadvantaged communities.

Individuals will forego investments in their household's health and education if they perceive the net yield to be less than other options. Thus, efforts to increase services' perceived net gain can be expected to increase demand for them. This is possible through several means. Monetary costs, both direct (such as user fees) and indirect (such as travel costs to inconveniently located facilities) can be cut or subsidized; nonmonetary costs, such as derogatory staff attitudes, must also be minimized or abolished. The perceived value of a service can be augmented both by increasing its true value, that is improving service quality, and its perceived value. The latter is achievable through socially- and culturally-tailored information that corrects misperceptions about the short- or long-run benefits of taking up health and education services. At the same time, such information should make clear users' entitlement to effective, acceptable and accessible services as an established and enforceable right. Such information, once given, is permanent and self-propagating and can drive a continuous process of quality improvement if accompanied by a legal framework of enforceability.

A programme that encompasses all these mechanisms might be thought of as an "entitlements approach". Its defining feature is the transfer of both power and, potentially, resource. Both types of dependency are thus addressed. The risk in a conditionality approach is that these other mechanisms to stimulate demand are forgotten or dealt with tokenistically. This becomes clear in the literature, where issues such as service quality are only cursorily dealt with. For example, even though many CCTS state that parallel investments in health and education were made alongside schemes, the literature barely discusses the quality of services before CCTS or the effect of extra investment. Some sites report services struggling to cope with increased demand and the quality of care deteriorating[144]. This relative imbalance in reporting can reinforce the mindset that escaping poverty is entirely down to the poor themselves. Additionally, conditionality does not provide any obvious mechanism to respond to user feedback, hence no obvious means for quality improvement. Indeed, nothing is known about beneficiaries' views on conditionality itself. Given the academic and political controversy surrounding conditionality, this represents a remarkable deficit in the literature.

Policies to ensure that conditionality is balanced with an equal emphasis on entitlements would include publication of service users' rights backed by a legal framework of enforceability, a shift away from the assumption of adequate service quality towards agenda of continuous quality improvement, independent appraisal of services to ensure that 'hidden costs' such as stigma and discrimination are absent, and opening up services to public scrutiny. Baltimore's *Citistat* and the United Kingdom's *police.uk* platform, already mentioned in Chapter 2, provide examples of this approach in action.

Targeting: what potential in universalizing?

Targeting a service so that only certain groups (typically the poor or otherwise marginalised) receive it helps prevent capture of benefits by the better-off. Targeted services, however, may entrench negative social attitudes about the nature and causes of poverty and lead to a tranche of interventions used only by the poor. Because these communities typically have little political leverage, such services are at risk of being low quality, incoherent and disconnected from the opportunities and safety-nets available in mainstream society - in short, 'residualised'[118]. In contrast, capturing the interest of the better-off by widening or universalizing eligibility may secure a high-quality and sustainable intervention. This is the approach frequently used in European welfare states, where progressive universalism is recognized to contribute to social cohesion and tackle the gradient of unequal life chances that exists throughout society.

In terms of policy, therefore, even where targeting is preferred the potential for universalism should also be considered. There are two ways in which this could be applied to CCTS. First, elements of existing schemes could be extended to higher income groups in ways that do not pay them for doing what they would reliably do anyway. Childhood vaccination may offer an example, given that in some settings vaccination is less popular among families of higher socioeconomic status. Alternatively, CCTS could be developed that operate at community level, where poor and less poor neighbours work together to achieve an area-level condition, with any resulting cash transfer or other benefit invested in community-level infrastructure. An example would be improving the physical fabric of a neighbourhood by organizing litter pick-ups and increasing recycling rates[48].

The related issue is of incoherent policy which does not recognize the multiple dimensions of chronic poverty (which is more than a lack of income)[251] or offer households genuine opportunities to graduate from social assistance to decent employment and training, with appropriate risk-protection. A broad suite of social protection policies is required, that address all the disadvantages associated with chronic poverty in a co-ordinated and inclusive manner. Such a suite would include insurance mechanisms to share risk and pool resources, emergency relief, additional investment in human capital (such as literacy and numeracy skills) beyond that currently offered by CCTS and efforts to tackle stigma. At the same time, wider macroeconomic policy must foster pro-poor distribution within national growth, decent labour standards and action to secure basic rights and socio-political stability[76 77]. Only with action across all these fronts can effective and sustained progress to lift families out of chronic poverty be made. Although this point is self-evident, it is worth restating, because the huge international interest generated by CCTS can exaggerate their overall significance within the wider portfolio of social policy[252]. In particular, CCTS are likely to be weak instruments to overcome the fundamentally inegalitarian nature of most welfare systems, which tend to favour richer quantiles by virtue of being organised through formal employment with a preference for prestigious secondary or tertiary services, at the expense of basic services more relevant to the poor[143].

As yet, very little is known about how CCTS affect social cohesion. Although there is some evidence that CCTS can redress intra-household power imbalances, there is conflicting evidence regarding intra-community cohesion. A quantitative study in Colombia found evidence of a positive impact on social capital[141], however qualitative work in Mexico noted an increase in community tensions as a result of perceived unfairness in who was excluded from CCTS participation[111]. Similarly, there has been little examination of how CCTS inter-relate with other welfare and social protection policies. Further research is needed both from a policy analysis perspective and from the perspective of users, charting their experience as they progress within or across schemes and succeed -or fail- in graduating from welfare assistance to economic independence.

Greater health sector involvement

There are three arguments why the health sector should engage more substantively in CCTS: first, the evidence shows that CCTS can contribute to health sector objectives; second, CCTS have a significant impact on health systems, particularly access; third, the health sector is well placed to offer technical assistance on specific issues and questions such as strengthening the health system and service quality, safeguarding the right and entitlement to health, ensuring provision of high quality health information to users, addressing equity concerns, making appropriate choices around targeting and conditionality setting by setting, collecting and responding to users' views.

The Commission on Social Determinants of Health clearly identified health systems as a pervasive determinant of health inequity and a structural driver that must be addressed not only for its disease-treatment function, but also because of health systems' potential to protect, generate a sense of life security, strengthen health literacy and empower communities and lobby for action on other socioeconomic determinants[1]. A strong focus on primary health care was called for, given compelling evidence on the association between population health and primary care provision. For example, In Costa Rica, improving access to primary care and instituting multidisciplinary health teams was associated with a reduction in infant mortality rate from 60 per 1000 live births in 1970 to 19 per 1000 in 1985, independent of improvements in other health determinants[253].

Scope for more substantive involvement exists at every level. National Ministries of Health and other national and local health agencies should consider cash transfers as a concrete policy option in pursuit of health, health equity and action on the social determinants of health. More substantive engagement with CCTS would align with several other current streams of inter-sectoral action by the health sector. The drive towards *Health in All Policies*[254], for example, recognises that other sectors contribute to and impact on health and that health is a driver of many outcomes in other sectors. This calls upon the health sector to facilitate more collaborative working across sectors. CCTS offer a validated and effective vehicle with which to implement this, given their cross-sectoral objectives (poverty reduction, human capital accumulation, productivity gains, female empowerment, better health) and recognition of the positive reinforcement between all of them. Similarly, the call for the renewal of primary health care[255] re-establishes the central role of primary care in improving health and reducing health inequities in the face of persisting and rapidly evolving challenges. CCTS display many features which align closely with this renewal's agenda: highlighting the importance of primary care, recognising the value of public services, attempting to address the inverse-care law, identifying that the function of health services is to build personal and social capabilities, rather than merely control disease; and advocating coherent action across multiple, non-health, drivers of health outcomes. Together, these suggest that those implementing the report should consider CCTS as a key intervention.

To exploit these opportunities, health agencies should build partnerships with the development, welfare and education sectors to contribute to the design, implementation and evaluation of CCTS. Several issues could benefit from health sector expertise. CCTS, for example, are predicated upon an 'adequate' supply of services, consequently issues around the quality and safety of care are often reduced to a peripheral concern. Little is known whether CCTS (particularly conditional schemes) are responsive to beneficiaries' preferences, whether beneficiaries are truly able to participate in health service decisions that affect them and whether CCTS' dissemination of health information is effective. Each represents an area where the health sector could offer technical assistance. Similarly, decisions whether to universalise or target, or introduce conditionality, are critical. They need to be made setting by setting, and the health sector could underpin these decisions by providing a detailed picture of need and, where possible, communities' preferences. Health agencies could also assist in the mobilization of resources to support CCTS and in innovating to cover previously unmet welfare needs, such as registration and support for children with disabilities.

It is important to remain aware of the risks implied by greater involvement. Indeed, such risks may partly explain the health sector's prior reluctance to be substantively involved with CCTS. First, health professionals may feel uncertain regarding the ethics of mandating behaviour in conditional schemes, or be concerned that CCTS could have negative consequences, such as heightened stigma. Prominent political branding is also typical of the schemes and historically the health sector has preferred to maintain some distance between the political cycle and its work. Second, lack of interest may play a role. Health professionals may view CCTS as a tool for poverty reduction and thus peripheral to their core concern. There is also probably a sense that CCTS are already 'owned' in an intellectual and operational sense by the community of economists beyond the health sector and that public health practitioners should be wary of 'mission creep'. Both views may combine with the belief that public health should predominantly concern itself with proximal interventions within health systems and leave action on upstream or social determinants of health to other agents. Finally, there may simply have been an aversion to the notion that the poor could benefit from something as simple as regular cash, rather than more complex interventions requiring the active management of professionals[77].

Most risks can be mitigated. Certainly the belief that public health has little remit or interest beyond health systems ignores its own history, let alone new developments such as the conclusion of the Commission on Social Determinants of Health that sustained action on upstream determinants is critical if health and health equity objectives are to be met. The risk that health involvement in CCTS may overlap unproductively with that of other agencies' of the schemes rings truer, but the clear convergence between CCTS objectives and health objectives is a strong mandate for involvement. It is appropriate that CCTS remain under remit of Welfare and Labour Ministries, with the health sector in a strong supporting role. The concern that CCTS might have negative consequences is mitigated to a large extent by the evidence that shows broadly positive impacts. Nevertheless, some caution remains necessary given that certain impacts are under-researched, such as discrimination, stigma and service quality. The ethics of conditionality are likely to remain contested for some time. Handling the issue requires an evidence-based view on the acceptability and impact of conditionality, a values-based narrative on CCTS that emphasises the universal right to high-quality healthcare and equitable health outcomes and, fundamentally, the realisation that CCTS are not a magic bullet capable of resolving the complex issue of chronic disadvantage as a single intervention, but must exist within a comprehensive policy suite that addresses the multiple dimensions of chronic poverty and disadvantage. Politicisation of schemes is best mitigated by acknowledging that political interest and support is critical to public health success, whilst advocating for the sustainability and mainstreaming of schemes, irrespective of political expediency.

In conclusion, there is now sufficient experience with cash transfers to argue that the health sector advocate cash transfer schemes as a priority consideration in country level and local social policy, and seek more substantive engagement in their design, implementation and evaluation. Social protection is receiving renewed global interest as a result of the UN Initiative and many of the actions called for are likely to contribute to health sector objectives. Although exploitation of these synergies is at an early stage, CCTS offer ideal territory with which to begin exploring the links between the health and social protection sectors more fully.

Conclusion

CCTS aim to tackle social exclusion by incentivising the most marginalised in society to take up essential health and education services. In their first decade of operation, they have proved effective in stimulating service uptake, but impact on more ‘final’ health outcomes and on their deeper aim of promoting social mobility is much less clear.

Adopting a perspective which emphasises the importance of the social determinants of health advances understanding of CCTS’ impact on health and their potential to improve health and reduce health inequity. Analysis from this perspective offers a set of policy recommendations attuned to the deepest causes of ill-health and health inequity which include: transferring power as well as resource, emphasising entitlements alongside conditionality and universalising elements of the CCTS offer. Practical implementation of these recommendations will vary from setting to setting, depending on local contexts. Further research is also needed to address some clear deficits in the literature, such as service quality or beneficiaries' views on conditionality. Additionally, the schemes would benefit from greater health sector engagement in their design, operation and evaluation.

Chapter 15: Personal reflections on the research process

The thesis was undertaken as part of a research training fellowship. As well as significantly developing literature review, quantitative, foreign language, publishing and presenting skills, there are a number of deeper learning points related to the research process that are worth reflecting upon.

The first pertains to issues that arise from undertaking research on a pre-existing dataset. Although probably the bulk of many epidemiologists' work in their early career and although the *Familias* data set is of good quality in terms of the depth and extent of information gathered, I was frustrated that the hypotheses I could test did not always match the hypotheses I was most interested in. It would, for example, have been desirable to have a richer measure of women's health care knowledge or children's use of time.

This was an issue, of course, of which the evaluation design team was aware. On my first visit to Colombia in 2007, I discussed inclusion of three additional questions in subsequent surveys relating to children's consumption of junk-food and use of time. The survey already took just over three hours to administer and was at the limit of what was tolerable. Even a few extra minutes might have dramatically reduced efficiency (by only allowing two rather than three households to be visited in a day, for example) and compliance. This was a useful insight in itself regarding the practicalities of data collection.

There are two resolutions to the problem. The first is to get involved early on in the design of a trial, to influence the data gathering process. I gained some experience of this being a co-applicant on an IFS grant application on a project closely related to *Familias.* The second is to adapt to the data available, formulating testable hypotheses that are relevant to contemporary questions and interpreting and contextualising results as compellingly as possible.

The problem emerged partly because I was working on the dataset independently, with a prior conceptual approach and set of personal interests. If part of research group with a programme of work, the issue of struggling to pursue personal interests may have resolved itself. Although work at the IFS had largely moved on from the *Familias* evaluation, I learnt something of the research group experience by joining EDePo (the unit within IFS for the Evaluation of Development Policies) for their seminar series and being co-applicant for the successful ESRC project grant mentioned above.

Related to this idea of making results compelling, the second issue of which I became aware was the potential to adapt presentation of analytic findings to engage as wide an audience as possible. The general dislike of null findings and bias against publishing them is well known. Imagining eventual publication of the chapter on women's knowledge, I spent some time trying alternative constructions of the knowledge score to see if the null finding could be avoided, whilst remaining true to the original data. This was an interesting task, contrasting with and complementing that of writing the PhD thesis, whose purpose is to demonstrate one's work in its entirety, including null findings.

Clearly, decisions on which results to present and how to present them are unavoidable, but they are judgements that depend upon a researcher's integrity. I realised that certain safeguards would help avoid making bad judgements: first, an explicit protocol specifying analyses and research output, published before going to field or analysing data. This is now insisted on by some journals and allows the wider research community to detect publication bias more easily. Second, working in a team generally improves integrity since it is promotes collective responsibility. Third, intellectual honesty as a central value requires constant attention and renewal.

Related to risk of publication bias, the third issue that intrigued me was the close involvement of politics and politicians in some research programmes. Specifically, the Government disallowed the randomisation originally planned for *Familias* and insisted the programme start in some areas before baseline data collection. Similarly, the Government insisted that the selection of TBB areas occurred randomly. The evaluation team, however, knew that this was unlikely to have happened for political reasons (as is indeed borne out by baseline co-variates). I learnt of this from others not having been involved in the design and implementation phase of the *Familias* evaluation. Perhaps if I had been, I would have found politicians' interest a frustrating intrusion. Instead, it struck me as a welcome inevitability, welcome because political interest must to some extent be synonymous with an intervention's significance and public profile. Politicians' interference also led to the rewarding challenge of finding statistical solutions to the resulting methodological disruptions.

Contextual knowledge is also vital in interpreting analytic findings. There were many patterns in the *Familias* data that I could not understand without seeing the programme in action, such as the teaching style used in women's parenting workshops. It was valuable to note that the most informative sources were the surveyors themselves. These had a very close and intimate knowledge of the recent historical, political, social contexts of the households they visited and could explain, for example, why it was that older children and boys were less likely to be followed up.

Likewise, the period of time spent at the World Health Organisation deepened my understanding of wider context and relevance of the thesis. In particular, my reading and thinking until that point had been closely focussed on conditional cash transfer schemes. The Health Equity Unit at WHO, in contrast, viewed CCTS dispassionately as one of several policy options whose comparative advantage, if any, would depend upon the local setting. During my time in Geneva, I read around and discussed welfare policy more extensively and placed CCTS in their wider context. I realised that academic expertise is probably most valuable if in regular dialogue with policy makers and if fully conversant with wider issues beyond its immediate concern.

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APPENDICES

Appendix A: data extraction forms for literature review

CCTS Systematic Review	

Author(s):		**Year:**	
Programme:			
Setting:			
Publication type:			
Evaluation design:			
Carried out by:			

Randomised? Method		
	Appropriate method?	
	Any balancing/ stratification?	
	Groups equal at baseline?	

Treatment Cohort:		
	Defined population:	
	Evaluation cohort representative:	
	Everybody included who should have been?	
	Adequate size?	
	Something special about evaluation cohort?	

Control Cohort: Anything special about control cohort?

Intervention:		
	Comprehens-ively described?	
	Systematically applied?	
	Uptake rate given?	

Exposure:		
	Accurately measured?	
	Leakage considered or dealt with?	

Follow-up:				
Baseline:	1st f/u	2nd f/u		
			Long enough?	
			Systematic?	
			Losses a/c for?	
			Sufficient numbers followed-up?	

Outcomes:		
1.	Systemtatically observed?	
	Subj / Obj ?	
	Blinded?	
2.	Systemtatically observed?	

	Subj / Obj ?	
	Blinded?	
3.	Systemtatically observed?	
	Subj / Obj ?	
	Blinded?	
4.	Systemtatically observed?	
	Subj / Obj ?	
	Blinded?	
5.	Systemtatically observed?	
	Subj / Obj ?	
	Blinded?	
6.	Systemtatically observed?	
	Subj / Obj ?	
	Blinded?	
All important outcomes considered?		

Confounding factors:		
	All relevant ones identified?	
	Accounted / adjusted for?	

Statistical analysis:

Overall conclusions reached:

Any other notes:

Quality grade:

CCTS Systematic Review --- *qualitative papers*	

Author(s):		**Year:**	
Programme:			
Setting:			
Publication type:			
Evaluation design:	**Qualtitative study**		
Carried out by:			

Sampling		
	Selection method explained?	
	Justification of why participants were the most appropriate for study question?	
	Discussion of reasons for non-participation?	

Data collection		
	Method explained?	
	Method justified?	
	Data form specified?	
	Saturation discussed?	

Reflexivity		
	Researcher-participant interaction discussed?	
	Researcher bias discussed?	

Data Analysis		
	In-depth description of data analysis process?	
	Sufficient data presented to support findings?	
	Contradictory data taken into account?	

Ethical issues:

Findings:		
1.	Explicit?	
	Adequate discussion of evidence for and against?	
	Credibility discussed?	
2.	Explicit?	
	Adequate discussion of evidence for and against?	
	Credibility discussed?	
3.	Explicit?	
	Adequate discussion of evidence for and against?	
	Credibility discussed?	

4.	Explicit?	
	Adequate discussion of evidence for and against?	
	Credibility discussed?	
5.	Explicit?	
	Adequate discussion of evidence for and against?	
	Credibility discussed?	
6.	Explicit?	
	Adequate discussion of evidence for and against?	
	Credibility discussed?	
All important outcomes considered?		

Value of the research		

Overall conclusions reached:

Any other notes:

Quality grade:

Appendix B: policy content of selected Conditional Cash Transfer Schemes

Country/ Programme	Start date	Total cost, US$	Number of beneficiar-ies	Transfer amount	Targeting	Conditions
Mexico - Progresa / Oportunidades	1997	2.8bn (2004)	5m (18% population)	19.5% of mean consumption of poor households in non-Progresa areas	Households in the poorest wealth quintile	Regular health checks and school attendance rate of at least 93% annually
Nicaragua - Red de Proteccion Social	2000	6.37 (2004)	21,619 families	Food security transfer - 18% per capital expenditure; plus school transfer	Poor households with children under 13	Regular health checks, school attendance rate of at least 85% and grade attainment
Colombia - Familias en Accion	2001	0.2% GDP (2007)	1.7m families	Average US$50: 30% household consumption	Families in poorest sextile not participating in other social assistance programmes	Immunization, growth monitoring and school attendance.
Ecuador - Bono de Desarollo Humano	2003	200	1.2m households	US$15: average of 15% of household expenditure	Household in the poorest two quintiles, or with elderly/disabled member	Intended to be conditional, but not implemented
Kenya – Cash Transfer for Orphans and Vulnerable Children	2004	31.6m (2011)	300,000 children	Up to $27 bimonthly	Poor households fostering orphaned/ vulnerable	Immunization, growth monitoring and school attendance; carer attendance at parenting seminars
Cambodia – Education Sector Support Program	2005	5m over 5years	14% of lower 2nrdry school population	3 transfers of up to $60 each, per student	Children in the poorest quintile who have completed Grade 6 schooling	Regular school attendance and adequate grade attainment
Brazil – Bolsa Familia	2003	5bn, 0.36% GDP (2005)	11.1m households	R$62 per family, R$15 per child <15, R$30 per child 15-17, monthly	Families with per capita income less than R$120/month	Imms, growth monitoring and school attendance; ante-natal care; parent-teacher meetings

Country/ Programme	Start date	Total cost, US$	Number of beneficiar-ies	Transfer amounts	Targeting	Conditions
Chile – Chile Solidario	2002	0.8% GDP (2005)	268,000 households	$21/month tapering to $8/month over 2yrs	Indigent households	Compliance with agreed goals around health, education, employment, housing, family life.
El Salvador – Red Solidaria	2005	$51.4m	100,000 families	Up to $20/month	Families in extreme poverty with children aged 0-15	School attendance rate of at least 80%
Honduras – Programa de Asignación Famliar	1998	$20m (2008)	240,000 families (15% population)	$113/year	Poor households with children under 12 or pregnant women	Regular health checks and school attendance rate of at least 85%
Jamaica – Program of Advancement through Health and Education	2001	$245m (2008)	300,000 individuals (12% population)	J$650/month	Jamaicans <19, >60, or pregnant or disabled	Regular health checks and school attendance rate of at least 85%
Peru – Juntos	2005	$100m, 0.11% GDP (2006)	453,800 households	$33/month	Poor households with children under 14	Regular health checks, school attendance rate of at least 85% and national registration

Source: *Conditional Cash Transfers, reducing past and present poverty.* The World Bank, Washington D.C., 2009[59]

Appendix C: WHO Multicentre Growth Reference Standard curves

Appendix D: Papers, presentations and invitations arising from this thesis

REFERENCE LIST

1. Closing the Gap in a Generation: health equity through action on the social determinants of health: World Health Organisation, 2008.
2. Jamison DT, Breman JG, Measham AR. *Disease Control Priorities in Developing Countries, 2nd edition*: Oxford University Press, 2006.
3. Edejer TT, Aikins M, Black R, Wolfson L, Hutubessy R, Evans DB. Cost effectiveness analysis of strategies for child health in developing countries. *BMJ (Clinical research ed)* 2005;331(7526):1177.
4. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJ. Global and regional burden of disease and risk factors, 2001: systematic analysis of population health data. *Lancet* 2006;367(9524):1747-57.
5. Wibulpolprasert S, Tangcharoensathien V, Kanchanachitra C. Are cost effective interventions enough to achieve the millennium development goals? *BMJ (Clinical research ed* 2005;331(7525):1093-94.
6. Costello A, Osrin D. The case for a new Global Fund for maternal, neonatal, and child survival. *Lancet* 2005;366(9485):603-05.
7. Black D, Morris J, Smith C, Townsend P. Inequalities in health: report of a research working group: Department of Health and Social Security, HM Government, UK., 1980.
8. Wilkinson R. *Socioeconomic differentials in mortality: interpreting size and trends. In Wilkinson RG (ed.) Class and Health: research and longitudinal data*. London: Tavistock, 1986.
9. Bartley M. *Health inequality: an introduction to theories, concepts and methods*. Cambridge: Polity Press, 2004.
10. Marmot MG, Stansfeld S, Patel C, North F, Head J, White I, et al. Health inequalities among British civil servants: the Whitehall II study. *The Lancet* 1991;337(8754):1387-93.
11. Smith GD, Wentworth D, Neaton JD, Stamler R, J. S. Socioeconomic differentials in mortality risk among men screened for the Multiple Risk Factor Intervention Trial: II. Black men. *Am J Public Health* 1996;86(4):497-504.
12. Smith GD, Neaton JD, Wentworth D, Stamler R, J. S. Socioeconomic differentials in mortality risk among men screened for the Multiple Risk Factor Intervention Trial: I. White men. *Am J Public Health* 1996;86(4):486-96.
13. Dahl E, Kjaersgaard P. Social mobility and inequality in mortality, 1993:124-32.
14. Blane D, Davey Smith G, Bartley M. Social selection: what does it contribute to social class differences in health? *Sociology of Health and Illness* 1993;15(1):1-15.
15. Bartley M, Plewis I. Increasing social mobility: an effective policy to reduce inequalities. *J.R.Statist.Soc.* 2007;170(2):469-81.
16. Townsend P, Davidson N, Davidsen N, eds. *Inequalities in Health: The Black Report/the Health Divide*: Penguin UK, 1999.
17. Janz NK, Becker MH. The Health Belief Model: a decade later. *Health Educ Q* 1984;11(1):1-47.
18. Ajzen F, Fishbein M. *Understanding attitudes and predicting social behavior*. New Jersey: Prentice-Hall inc., 1980.
19. Prochaska J, C; D. The Transtheoretical Approach. In: Goldfield N, editor. *Handbook of Psychotherapy Integration*. New York: Oxford University Press, 2005.

20. Link BG, Northridge ME, Phelan JC, Ganz ML. Social epidemiology and the fundamental cause concept: on the structuring of effective cancer screens by socioeconomic status. *Milbank Q.* 1998;76(3):375-75.
21. Syme SL. Historical Perspective: The social determinants of disease - some roots of the movement. *Epidemiol.Perspect.Innov.* 2005;2(1):2.
22. Yen IH. Historical perspective: S. Leonard Syme's influence on the development of social epidemiology and where we go from there. *Epidemiol.Perspect.Innov.* 2005;2:3.
23. Whitehead M. Diffusion of ideas on social inequalities in health: a European perspective. *Milbank Q.* 1998;76(3):469-92, 306.
24. Solar O, Irwin A. A Conceptual Framework for Action on the Social Determinants of Health: Commission on Social Determinants of Health 2007.
25. Tsey K. The control factor: a neglected social determinant of health. *Lancet* 2008;372(9650):1629.
26. Whiteside M, Tsey K, McCalman J, Cadet-James Y, Wilson A. Empowerment as a Framework for Indigenous Workforce Development and Organisational Change. *Australian Social Work* 2006;59(4).
27. Anderson I, Crengle S, Kamaka ML, Chen TH, Palafox N, Jackson-Pulver L. Indigenous health in Australia, New Zealand, and the Pacific. *Lancet* 2006;367(9524):1775-85.
28. Kaufman JS, Poole C. Looking back on "causal thinking in the health sciences". *Annual review of public health* 2000;21:101-19.
29. Krieger N. Proximal, Distal, and the Politics of Causation: What's Level Got to Do With It? *American Journal of Public Health* 2008;98(2):221-30.
30. Susser M, Susser E. Choosing a future for epidemiology: I. Eras and paradigms. *Am.J.Public Health* 1996;86(5):668-73.
31. Susser M, Susser E. Choosing a future for epidemiology: II. From black box to Chinese boxes and eco-epidemiology. *Am.J.Public Health* 1996;86(5):674-77.
32. Glass TA, McAtee MJ. Behavioral science at the crossroads in public health: extending horizons, envisioning the future. *Social science & medicine (1982)* 2006;62(7):1650-71.
33. Nurse J, Campion J. Mental health and well-being in the South East: UK Department of Health, England and Care Services Improvement Partnership, 2006.
34. Resnicow K, Page SE. Embracing Chaos and Complexity: A Quantum Change for Public Health. *American Journal of Public Health* 2008;98(8):1382-89.
35. WHO Framework Convention on Tobacco Control; http://www.who.int/fctc/en/ (accessed 20/10/08).
36. HM Government. Working Together, http://www.hmg.gov.uk/media/15556/workingtogether.pdf 2009.
37. Kingdon J. *Agendas, Alternatives and Public Policies*: Longman 2003.
38. Gollust SE, Lantz PM, Ubel PA. The Polarizing Effect of News Media Messages About the Social Determinants of Health, 2009:AJPH.2009.161414.
39. Forde I, Raine R. Placing the individual within a social determinants approach to health inequity. *Lancet* 2008;372(9650):1694-96.
40. Cahn E, Rowe J. *Time dollars: the new currency that enables Americans to turn their hidden resource -time- into personal security and community renewal*. Emmaus, PA.: Rodale Print, 1992.
41. Parker S, Gallagher N, eds. *The collaborative state: how working together can transform public services*. London: Demos, 2007.
42. Wolff J, De Shalit A. *Disadvantage*. Oxford: Oxford University Press, 2007.

43. Schmidt H. Personal responsibility in the NHS Constitution and the social determinants of health approach: competitive or complementary? *Health Economics, Policy and Law (2009)* 2009;4:129-38.
44. Schmidt H. Bonuses as incentives and rewards for health responsibility: a good thing? *J Med Philos.* 2008;33(3):198-220.
45. Disabled Australian Apprentice Wage Support Program, www.centrelink.gov.au/internet/internet.nsf/services.dawsp.htm (accessed 20/10/08).
46. Jonkoping City Council's Passion for Life program, www.lj.se/passionforlivet (accessed 20/10/08).
47. Forde I, Zeuner D. Financial incentives to promote social mobility. *BMJ (Clinical research ed* 2009;339:b3219.
48. Forde I. Communities in top condition. In: Gregg P, Cooke G, editors. *Liberation Welfare*. London: Demos, 2010.
49. Baltimore CitiStat, www.baltimorecity.gov/government/citistat (accessed 20/10/08).
50. National Policing Improvement Agency: local crime and policing website for England and Wales, www.police.uk (accessed 19/09/11).
51. Pestoff V. Citizens and co-production of welfare services. *Public Management Review* 2006;8(4):503-19.
52. Alford J. Why Do Public-Sector Clients Coproduce?: Toward a Contingency Theory. *Administration & Society* 2002;34(1):32-56.
53. Fulop N, Allen P, Clarke A, Black N. *Studying the Organisation and Delivery of Health Services: Research Methods* Routledge, 2001.
54. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *International Journal of Social Research Methodology,* 2005;8(1):19-32.
55. Undertaking systematic reviews of research on effectiveness: CRD's guidance for those carrying out or commissioning reviews: Centre for Reviews and Dissemination, University of York, 2001.
56. Bates M, Maack Me. *Encyclopedia of Library and Information Sciences*: CRC Press, 2010.
57. Critical Appraisal Skills Programme Public Health Resource Unit, Oxford, UK. Available at http://www.phru.nhs.uk/Pages/PHD/CASP.htm.
58. Weightman A, Ellis S, Cullum A, Sander L, Turley R. Grading evidence and recommendations for public health interventions: developing and piloting a framework. National Institute for Clinical Excellence, London, 2005.
59. Fiszbein A, Schady N. *Conditional Cash Transfers: Reducing Present and Future Poverty* World Bank, 2009.
60. Rawlings LB, Rubio GM. *Evaluating the Impact of Conditional Cash Transfer Programs: Lessons from Latin America*, 2003.
61. Rawlings B. Evaluating the Impact of Conditional Cash Transfer Programs. *The World Bank research observer* 2005;20(1):29.
62. Rawlings B. A new approach to social assistance: Latin America's experience with conditional cash transfer programmes. *Int Social Security Review* 2005;58:133-61.
63. Villatoro P. Conditional cash transfer programmes: experiences from Latin America. *CEPAL Review* 2005;86:83-96.
64. Adato M, Coady J, Ruel M. An operations evaluation of PROGRESA from the perspective of beneficiaries, promotoras, school directors and health staff: final report. Int Food Policy Res Inst, Washington DC, 2000.
65. Handa S, Davis B. The Experience of Conditional Cash Transfers in Latin America and the Caribbean. *Development Policy Review* 2006;24(5):513-36.

66. Kakwani N, Veras Soares F, Son H. Conditional cash transfers in African countries, International Poverty Centre, UNDP, New York. 2005.
67. Chapman K. Using social transfers to scale up equitable access to health and education services: The World Bank; Department for International Development, UK. , 2006.
68. Veras Soares F. Conditional cash transfers: a vaccine against poverty and inequality?: International Poverty Centre, UNDP. , 2004.
69. de Britto TF. Recent trends in the development agenda of Latin America: an analysis of conditional cash transfers. Ministry of Social Development, Brazil, 2005.
70. Nigenda G, Gonzalez-Robledo LM. Lessons offered by Latin American cash transfer programmes, Mexico's Oportunidades and Nicaragua's SPN. Implications for African Countries: DFID Health Systems Resource Centre, 2005.
71. The World Bank's Conditional Cash Transfers page, http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALPROTECTION/EXTSAFTEYNETSANDTRANSFERS
(accessed 15/04/08).
72. Schubert B. Social Cash Transfers in Low-Income African Countries: Conditional or Unconditional? *Development policy review* 2006;24(5):571
73. Glassman A, Gaarder M, Todd J. Demand-Side Incentives for Better Health for the Poor: Conditional Cash Transfer Programs in Latin America and the Caribbean: Inter-American Development Bank, 2006.
74. de Britto TF. Conditional cash transfers: why have they become so prominent in recent poverty reduction strategies in Latin America. International Institute of Social Studies of Erasmus University, The Hague, 2004.
75. Yablonski J, O'Donnell M. Lasting Benefits: the role of cash transfers in tackling child mortality. Save the Children, London, 2009.
76. Promoting pro-poor growth: social protection: Organisation for Economic Cooperation and Development, Paris, 2009.
77. Farrington J, Harvey P, Slater R. Cash Transfers in the Context of Pro-Poor Growth: Overseas Development Institute, 2005.
78. UK Department for International Development. Cash transfers: evidence paper, 2011.
79. Rivera JA, Sotres-Alvarez D, Habicht JP, Shamah T, Villalpando S. Impact of the Mexican program for education, health, and nutrition (Progresa) on rates of growth and anemia in infants and young children: a randomized effectiveness study. *JAMA* 2004;291(21):2563-70.
80. Gertler P. Do Conditional Cash Transfers Improve Child Health? Evidence from PROGRESA's control randomized experiment. *American Economic Review* 2004;94 (2):336-41.
81. Behrman JR, Hoddinott J. Programme evaluation with unobserved heterogeneity and selective implementation: the Mexican Progresa impact on child nutrition. *Oxford Bulletin of Economics and Statistics* 2005;67 (4):547-69.
82. Gertler P, Boyce S. An experiment in incentive-based welfare: the impact of PROGRESA on health in Mexico. Haas School of Business, University of California, Berkeley, 2001.
83. Gertler P. The impact of PROGRESA on health; final report: International Food Policy Research Institute, 2000.
84. Fernald LC, Gertler PJ, Hou X. Cash component of conditional cash transfer program is associated with higher body mass index and blood pressure in adults. *The Journal of nutrition* 2008;138(11):2250-7.

85. Skoufias E. PROGRESA and its impacts on the welfare of rural households in Mexico: International Food Policy Research Institute, 2005.
86. Huerta MC. Child health in rural Mexico: has Progresa reduced children's morbidity risks? *Soc.Policy&Admin.* 2006;40 (6):652-77.
87. Stecklov G, Winters P, Todd J, Regalia F. Demographic Externalities from Poverty Programs in Developing Countries: Experimental Evidence from Latin America. Department of Economics, American University, Washington DC, 2006.
88. Morris SS, Olinto P, Flores R, Nilson EA, Figueiro AC. Conditional cash transfers are associated with a small reduction in the rate of weight gain of preschool children in northeast Brazil. *J.Nutr.* 2004;134(9):2336-41.
89. Cruz C, de la Torre R, Velazquez C. Evaluacion externa de impacto del Programa Oportunidades 2001-2006: Instituto Nacional de Salud Publica, Mexico, 2006.
90. Lagarde M, Haines A, Palmer N. Conditional cash transfers for improving uptake of health interventions in low- and middle-income countries: a systematic review. *JAMA* 2007;298(16):1900-10.
91. Maluccio J, Flores R. Impact evaluation of a conditional cash transfer program: the Nicaragua *Red de Proteccion Social*: International Food Policy Research Institute, 2004.
92. Morris SS, Flores R, Olinto P, Medina JM. Monetary incentives in primary health care and effects on use and coverage of preventive health care interventions in rural Honduras: cluster randomised trial. *Lancet* 2004;364(9450):2030-37.
93. Attanasio O, Battistin E, Fitzsimons E, Mesnard A, Vera-Hernández M. How effective are conditional cash transfers? Evidence from Colombia: The Institute for Fiscal Studies, London. 2005.
94. Fernald LC, Gertler PJ, Neufeld LM. Role of cash in conditional cash transfer programmes for child health, growth, and development: an analysis of Mexico's Oportunidades. *Lancet* 2008;371(9615):828-37.
95. Levy D, Ohls J. Evaluation of Jamaica's PATH program: final report: Mathematica Policy Research, Inc., Princeton, New Jersey, 2007.
96. Attanasio O, Gómez L, Heredia P, Vera-Hernández M. The short-term impact of a conditional cash subsidy on child health and nutrition in Colombia: Institute for Fiscal Studies, 2005.
97. Bando R, Lopez-Calva LF. Conditional cash transfers and indigenous people's health: Is there a differential impact of Progresa between indigenous and non-indigenous households? Tecnológico de Monterrey, Mexico City, 2005.
98. Gillespie D. Buying health in Honduras. *Lancet* 2004;364(9450):1996-97.
99. Macours K, Schady N, Vakis R. Cash transfers, behavioral changes and cognitive development in early childhood: evidence from a randomized experiment, 2008.
100. Paxson C, Schady N. Does Money Matter? The effects of cash transfers on child health and development in rural Ecuador. The World Bank, Washington DC, 2007.
101. Ponce J, Bedi AS. The Impact of a Cash Transfer Program on Cognitive Achievement: The Bono de Desarrollo Humano of Ecuador. Institute for the Study of Labour, Bonn, 2008.
102. Hoddinott J, Skoufias E, Washburn R. The Impact of PROGRESA on Consumption: A Final Report. Int Food Policy Res Inst, Washington DC, 2000.
103. Attanasio O, Mesnard A. The impact of a conditional cash transfer programme on consumption in Colombia: Institute of Fiscal Studies, London, 2005.
104. Attanasio O, Gomez L, Murgueito C, al. e. Baseline report on the evaluation of Familias en Accion The Institute for Fiscal Studies, London, 2004.

105. de Brauw A, Hoddinott J. Must conditional cash transfer programs be conditioned to be effective? Washington DC: International Food Policy Research Institute 2008.
106. Schady N, Caridad Araujo M. Cash transfers, conditions, school enrollment and child work in Ecuador: The World Bank, Washington DC, 2005.
107. Behrman J, Skoufias E. Mitigating Myths about Policy Effectiveness: Evaluation of Mexico's Antipoverty and Human Resource Investment Program. *Ann Am Acad Political and Social Sci.* 2006;606:244-75.
108. Behrman J, Parker S, Todd P. Long-term impacts of the Oportunidades conditional cash transfer program on rural youth in Mexico: Ibero-American Institute for Economic Research, 2005.
109. Palma J, Urzua R. Anti-poverty policies and citizenry: the Chile Solidario Experience. UNESCO, Paris, 2005.
110. An introduction to Chile Solidario - el Programa Puente. http://www.chilesolidario.gob.cl/en/doc/Chile_Solidario_Bridge_Program.pdf accessed (01/06/2008).
111. Adato M. The impact of PROGRESA on community social relationships : final report. Int Food Policy Res Inst, Washington DC, 2000.
112. Adato M, de la Briere B, Mindek D, Quisumbing A. The impact of PROGRESA on women's status and intrahousehold relationships. Int Food Policy Res Inst, Washington DC, 2000.
113. Soares S, Guerriero Osorio R, Veras Soares F, Medeiros M, Zepeda E. Conditional cash transfers in Brazil, Chile and Mexico: impacts upon inequality. *Internatioal Poverty Centre Working Papers*: UNDP Poverty Centre, 2007.
114. Jones N, Vargas R, Villar E. Conditional cash transfers in Peru: tackling the multi-dimensionality of childhood poverty and vulnerability: UNICEF, 2007.
115. El Gobierno de El Salvador. Red Solidaria http://www.redsolidaria.gob.sv/ (accessed 14/04/2008).
116. Espinoza E, Barten F. Health reform in El Salvador: a lost opportunity for reducing health inequity and social exclusion? *Journal of epidemiology and community health* 2008;62(5):380-81.
117. Draibe S, Riesco M. Social policy and development in Latin America: the long view. *Social Policy & Administration* 2009;43(4).
118. Bastagli F. From Social Safety net to Social Policy? The Role of Conditional Cash Transfers in Welfare State Development in Latin America: International Policy Centre for Inclusive Growth, UNDP, Washington DC, 2009.
119. Popay J. Should disadvantaged people be paid to take care of their health? No. *BMJ (Clinical research ed)* 2008;337:a594.
120. Barrientos A, Hulme D. Social protection for the poor and poorest in developing countries: reflections on a quiet revolution. *Brooks World Poverty Institute Working Paper 30*: University of Manchester, 2008.
121. Todd P, Wolpin K. Using a social experiment to validate a dynamic behavioral model of child schooling and fertility: assessing the impact of a school subsidy program in Mexico: Penn Institute for Economic Research, University of Pennsylvania, 2003.
122. Bourguignon F, Ferreira FHG, Leite PG. Conditional Cash Transfers, Schooling, and Child Labor: Micro-Simulating Brazil's Bolsa Escola Program, 2003:229-54.
123. Filmer D, Schady N. Scholarships, school enrollments and work of recipients and their siblings. Washington: The World Bank, 2009.
124. Baird S, McIntosh C, B. O. Cash or condition? Evidence from a cash transfer experiment. *World Bank Policy Research Working Paper No. 5259* 2011.

125. Bastagli F. Conditionality in Public Policy Targeted to the Poor: Promoting Resilience?: Cambridge Journals Online, 2009:127-40.
126. Caldes N, Coady D, Maluccio J-A. The cosst of poverty alleviation transfer programs: a comparative analysis of three programs in Latin America. *World Development* 2006;34(5):818-37.
127. Álvarez C, Devoto F, Winters P. Why do the poor leave the safety net in Mexico? A study of the effects of conditionality on dropouts: American University, Department of Economics, 2006.
128. Mkandawire T. Targeting and universalism in poverty reduction. *Social Policy and Development Programme*: UN Research Institute for Social Development, Geneva, 2005.
129. Handa S, Davis B. The Experience of Conditional Cash Transfers in Latin America and the Caribbean. *Development policy review* 2006;24(5):513.
130. de Janvry A. Making Conditional Cash Transfer Programs More Efficient: Designing for Maximum Effect of the Conditionality. *The World Bank economic review* 2006;20(1):1.
131. Das J. Reassessing Conditional Cash Transfer Programs. *The World Bank research observer* 2005;20(1):57.
132. Behrman JR, Hoddinott J. An evaluation of the impact fo PROGRESA on pre-school child height: IFPRI, Washington DC, 2001.
133. Attanasio O, Mesnard A. The Impact of a Conditional Cash Transfer Programme on Consumption in Colombia*. *Fiscal Studies* 2006;27(4):421-42.
134. Oportunidades: external evaluation documents, http://www.oportunidades.gob.mx/EVALUACION/es/docs/docs_eval_2008.php (accessed 01/02/11), 2008.
135. Lim SS, Dandona L, Hoisington JA, James SL, Hogan MC, Gakidou E. India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: an impact evaluation. *The Lancet*;375(9730):2009-23.
136. McCoy SI, Watts CH, Padian NS. Preventing HIV infection: turning the tide for young women. *The Lancet* 2010;376(9749):1281-82.
137. Behrman JR, Hoddinott J. The Mexican PROGRESA Impact on Child Nutrition. *Oxford Bulletin of Economics and Statistics* 2005;67 (4):547-69.
138. Woolf SH. Social Policy as Health Policy. *JAMA: The Journal of the American Medical Association* 2009;301(11):1166-69.
139. Coady J. The Application of Social Cost-benefit Analysis to the Evaluation of PROGRESA. Int Food Policy Res Inst, Washington DC, 2000.
140. Moore S, Haines V, Hawe P, Shiell A. Lost in translation: a genealogy of the "social capital" concept in public health. *J.Epidemiol.Community Health* 2006;60(8):729-34.
141. Attanasio O, Pellerano L, Polonia S. Building Trust: conditional cash transfers and social capital. Institute Fiscal Studies, London, 2008.
142. Duarte-Gómez MB, Morales-Miranda S, Idrovo-Velandia AJ, Ochoa-Marín SC, Siemon Bult van der Wal, Caballero-García M, et al. Impacto de Oportunidades sobre los conocimientos y prácticas de madres beneficiarias y jóvenes becarios.
Una evaluación de las sesiones educativas para la salud. Evaluación externa de impacto del Programa Oportunidades 2004. Cuernavac, Mexico.: Instituto Nacional de Salud Pública., 2005.
143. Barrientos DA, Santibanez C. Social policy for poverty reduction in lower-income countries in Latin America: lessons and challenges. *Social Policy & Administration* 2009;43(4).

144. Jones N, Vargas R, Villar E. Cash transfers to tackle childhood poverty and vulnerability: an analysis of Peru's Juntos programme. *Environment and Urbanization* 2008;20(1):255-73.
145. United Nations Development Program. Human Development Report for Colombia, 2007/2008.
146. Colombian national statistics, available from www.dane.gov.co.
147. WB Country data: Colombia, http://data.worldbank.org/country/colombia (accessed 01/08/11):
148. WHO Country data: Colombia, www.who.int/countries/col/en (accessed 01/08/11): World Health Organisation.
149. Avances y retos de la politica social en Colombia. Bogota: Departamento Nacional de Planeacion, 2010.
150. Colombian national health statistics, available from www.asivamosensalud.org.
151. Rojas C. Deficit fiscal de la salud y activismo juridico en Colombia. Bogota: Asociacion Nacional de Instituciones Financieras, 2009.
152. Presidente Santos informo sobre millonario desfalco en el sector salud. Bogota: Presidencia de la Republica de Colombia, 2011.
153. Molano D. Hacia el mejoramiento de la politica social en Colombia: Fondo Espana PNUD, 2010.
154. President Santos's address to the United Nations, 20th September 2010, www.un.org/en/ga/65/meetings/.../1/.../634209403965781250CO_en.pdf.
155. Plan nacional de desarollo 2010-2014: prosperidad para todos. Departamento nacional de planeacion, Bogota, Colombia, 2010.
156. UK Government Office for Science. Tackling obesities: future choices: Foresight 2007.
157. Haslam DW, James WP. Obesity. *Lancet* 2005;366(9492):1197-209.
158. Finucane M, Stevens G, Cowan M, Danaei G, Lin J, Paciorek C, et al. National, regional, and global trends in body-mass index since 1980: systematic analysis of health examination surveys and epidemiological studies with 960 country-years and 9·1 million participants. *The Lancet* 2011;377(9765):557-67.
159. Kelly T, Yang W, Chen CS, Reynolds K, He J. Global burden of obesity in 2005 and projections to 2030. *International journal of obesity (2005)* 2008;32(9):1431-7.
160. Friel S, Chopra M, Satcher D. Unequal weight: equity oriented policy responses to the global obesity epidemic. *BMJ (Clinical research ed)* 2007;335(7632):1241-43.
161. Prentice A, Henning B, Fulford A. Evolutionary origins of the obesity epidemic: natural selection of thrifty genes or genetic drift following predation release? *International journal of obesity (2005)* 2008;32(11):1607-10.
162. Ziraba AK, Fotso JC, Ochako R. Overweight and obesity in urban Africa: A problem of the rich or the poor? *BMC public health* 2009;9:465.
163. Caballero B. Introduction. Symposium: Obesity in developing countries: biological and ecological factors. *J.Nutr.* 2001;131(3):866S-70S.
164. Martorell R, Khan LK, Hughes ML, Grummer-Strawn LM. Obesity in Latin American women and children. *The Journal of nutrition* 1998;128(9):1464-73.
165. Popkin BM. The nutrition transition and obesity in the developing world. *J.Nutr.* 2001;131(3):871S-73S.
166. Drewnowski A, Popkin BM. The nutrition transition: new trends in the global diet. *Nutr Rev* 1997;55(2):31-43.
167. Townsend MS, Peerson J, Love B, Achterberg C, Murphy SP. Food Insecurity Is Positively Related to Overweight in Women. J Nutr 2001,**131**(6):1738-45.
168. Florencio TT, Ferreira HS, Cavalcante JC, Luciano SM, Sawaya AL. Food consumed does not account for the higher prevalence of obesity among stunted

adults in a very-low-income population in the Northeast of Brazil (Maceio, Alagoas). *Eur J Clin Nutr* 2003;57(11):1437-46.
169. Barker D. *Fetal and Infant Origins of Adult Disease*. London: BMJ Books, 1992.
170. Delisle HF. Poverty: the double burden of malnutrition in mothers and the intergenerational impact. *Annals of the New York Academy of Sciences* 2008;1136:172-84.
171. Global health risks: mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization, 2009.
172. Puhl R, Henderson K, Brownell K. Social consequences of obesity. In: PG; K, ID; C, Dietz W, editors. *Clinical Obesity*. Oxford: Blackwell Publishing, 2005:29-45.
173. Visscher TLS, Seidell JC, Menotti A, Blackburn H, Nissinen A, Feskens EJM, et al. Underweight and Overweight in Relation to Mortality Among Men Aged 40-59 and 50-69 Years: The Seven Countries Study, 2000:660-66.
174. Ringback Weitoft G, Eliasson M, Rosen M. Underweight, overweight and obesity as risk factors for mortality and hospitalization, 2008:169-76.
175. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess Deaths Associated With Underweight, Overweight, and Obesity, 2005:1861-67.
176. Monteiro CA, Conde WL, Lu B, Popkin BM. Obesity and inequities in health in the developing world. *Int J Obes Relat Metab Disord* 2004;28(9):1181-6.
177. Siahpush M, McNeill A, Hammond D, Fong GT. Socioeconomic and country variations in knowledge of health risks of tobacco smoking and toxic constituents of smoke: results from the 2002 International Tobacco Control (ITC) Four Country Survey. *Tob.Control* 2006;15 Suppl 3:iii65-iii70.
178. 2010 Demographic and Health Survey (Colombia), avaliable from www.measuredhs.com.
179. Monteiro CA, Moura EC, Conde WL, Popkin BM. Socioeconomic status and obesity in adult populations of developing countries: a review. *Bulletin of the World Health Organization* 2004;82(12):940-6.
180. Attanasio O, Costas M, Norbert S. Mexico's conditional cash transfer programme. *The Lancet*;375(9719):980.
181. Ministerio de la Salud de Chile. Encuesta de calidad de vida y salud. Santiago de Chile, 2001.
182. Rose G. Sick individuals and sick populations, Int J Epidem 2001, **30**(3):427-32.
183. Sassi F. Obesity and the economics of prevenion: fit not fat.: Organisation for Economic Cooperation and Development, Paris, 2010.
184. McDonald CM, Baylin A, Arsenault JE, Mora-Plazas M, Villamor E. Overweight is more prevalent than stunting and is associated with socioeconomic status, maternal obesity, and a snacking dietary pattern in school children from Bogota, Colombia. *The Journal of nutrition* 2009;139(2):370-6.
185. Monasta L, Lobstein T, Cole TJ, Vignerova J, Cattaneo A. Defining overweight and obesity in pre-school children: IOTF reference or WHO standard? *Obes Rev*, 2011. **12**(4):295-300
186. Cole TJ, Faith MS, Pietrobelli A, Heo M. What is the best measure of adiposity change in growing children: BMI, BMI %, BMI z-score or BMI centile? *Eur J Clin Nutr* 2005;59(3):419-25.
187. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ (Clinical research ed* 2000;320(7244):1240-43.
188. Lobstein T, Baur L, Uauy R. Obesity in children and young people: a crisis in public health. *Obes Rev* 2004;5 Suppl 1:4-104.

189. WHO Multicentre Growth Reference Group. WHO child growth standards based on length/height, weight and age. *Acta Paediatrica* 2006;Suppl 450:76-85.
190. Han JC, Lawlor DA, Kimm SY. Childhood obesity. *Lancet* 2010;375(9727):1737-48.
191. Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes* 2006;1(1):11-25.
192. Fernald LC, Neufeld LM. Overweight with concurrent stunting in very young children from rural Mexico: prevalence and associated factors. *Eur J Clin Nutr* 2007;61(5):623-32.
193. Adair LS, Popkin BM. Are child eating patterns being transformed globally? *Obes.Res.* 2005;13(7):1281-99.
194. Martorell R, Kettel Khan L, Hughes ML, Grummer-Strawn LM. Overweight and obesity in preschool children from developing countries. *Int J Obes Relat Metab Disord* 2000;24(8):959-67.
195. Wang Y. Cross-national comparison of childhood obesity: the epidemic and the relationship between obesity and socioeconomic status. Int J Epidem, 2001. **30**(5):1129-36.
196. Guimaraes LV, Latorre MD, Barros MB. Risk factors in the occurence of short stature of preschool children. *Cadernos de saude publica / Ministerio da Saude, Fundacao Oswaldo Cruz, Escola Nacional de Saude Publica* 1999;15(3):605-15.
197. Uauy R, Kain J. The epidemiological transition: need to incorporate obesity prevention into nutrition programmes. *Public health nutrition* 2002;5(1A):223-9.
198. Mulder C, Kain J, Uauy R, Seidell JC. Maternal attitudes and child-feeding practices: relationship with the BMI of Chilean children. *Nutrition journal* 2009;8:37.
199. Shibli R, Rubin L, Akons H, Shaoul R. Morbidity of overweight (>or=85th percentile) in the first 2 years of life. *Pediatrics* 2008;122(2):267-72.
200. de Onis M, Blossner M. Prevalence and trends of overweight among preschool children in developing countries. *The American journal of clinical nutrition* 2000;72(4):1032-9.
201. Serdula MK, Ivery D, Coates RJ, Freedman DS, Williamson DF, Byers T. Do Obese Children Become Obese Adults? A Review of the Literature. *Preventive Medicine* 1993;22(2):167-77.
202. Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting Obesity in Young Adulthood from Childhood and Parental Obesity. NEJM, 1997 **337**(13):869-73.
203. Duran P, Caballero B, de Onis M. The association between stunting and overweight in Latin American and Caribbean preschool children. *Food and nutrition bulletin* 2006;27(4):300-5.
204. Popkin BM, Richards MK, Montiero CA. Stunting is associated with overweight in children of four nations that are undergoing the nutrition transition. *The Journal of nutrition* 1996;126(12):3009-16.
205. Doak CM, Adair LS, Bentley M, Monteiro C, Popkin BM. The dual burden household and the nutrition transition paradox. *Int.J.Obes.(Lond)* 2005;29(1):129-36.
206. Doak CM, Adair LS, Monteiro C, Popkin BM. Overweight and Underweight Coexist within Households in Brazil, China and Russia. J Nutr,2000. **130**(12):2965-71.
207. Garrett J, Ruel MT. The coexistence of child undernutrition and maternal overweight: prevalence, hypotheses, and programme and policy implications. *Maternal & child nutrition* 2005;1(3):185-96.

208. Barquera S, Peterson KE, Must A, Rogers BL, Flores M, Houser R, et al. Coexistence of maternal central adiposity and child stunting in Mexico. *International journal of obesity (2005)* 2007;31(4):601-7.
209. 1995 Demographic and Health Survey (Colombia), avaliable from www.measuredhs.com.
210. 2005 Demographic and Health Survey (Colombia), avaliable from www.measuredhs.com.
211. Martorell R. The nature of child malnutrition and long-term implications. *Food and nutrition bulletin* 1999;20(3):288-92.
212. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. *Lancet* 2007;369(9555):60-70.
213. Veugelers PJ, Yip AM. Socioeconomic disparities in health care use: Does universal coverage reduce inequalities in health? *J.Epidemiol.Community Health* 2003;57(6):424-28.
214. Lohman T, Roche A, Martorell R. *Anthropometric standardization reference manual*. Champaign, IL.: Human Kinetics Books, 1988.
215. WHO Anthro, available from http://www.who.int/childgrowth/software/en/ [program], 2011.
216. Prentice AM. Body mass index standards for children. BMJ,1998. **317**(7170):1401-02.
217. Vidmar S, Carlin J, Hesketh K. Standardizing anthropometric measures in children and adolescents with new functions for egen. *The Stata Journal* 2004;4(1):50-55.
218. Monteiro CA, D'A Benicio MH, Conde WL, Popkin BM. Shifting obesity trends in Brazil. *Eur.J.Clin.Nutr.* 2000;54(4):342-46.
219. Hoffman DJ, Sawaya AL, Verreschi I, Tucker KL, Roberts SB. Why are nutritionally stunted children at increased risk of obesity? Studies of metabolic rate and fat oxidation in shantytown children from Sao Paulo, Brazil. *The American journal of clinical nutrition* 2000;72(3):702-7.
220. Kuczmarski RJ, Ogden CL, Guo SS, et al. 2000 CDC growth charts for the United States: methods and development. *Vital Health Statistics* 2002;11(246).
221. Freeman JV, Cole TJ, Chinn S, Jones PRM, White EM, Preece MA. Cross sectional stature and weight reference curves for the UK, 1990. *Arch Dis Child* 1990;72:17-24.
222. Fernald LC, Gertler PJ, Neufeld LM. 10-year effect of Oportunidades, Mexico's conditional cash transfer programme, on child growth, cognition, language, and behaviour: a longitudinal follow-up study. *Lancet* 2009;374(9706):1997-2005.
223. Sawaya AL, Martins PA, Grillo LP, Florencio TT. Long-term effects of early malnutrition on body weight regulation. *Nutr Rev* 2004;62(7 Pt 2):S127-33.
224. Uauy R, Kain J, Mericq V, Rojas J, Corvalan C. Nutrition, child growth, and chronic disease prevention. *Annals of medicine* 2008;40(1):11-20.
225. Penny ME, Creed-Kanashiro HM, Robert RC, Narro MR, Caulfield LE, Black RE. Effectiveness of an educational intervention delivered through the health services to improve nutrition in young children: a cluster-randomised controlled trial. *Lancet* 2005;365(9474):1863-72.
226. Uauy R, Albala C, Kain J. Obesity trends in Latin America: transiting from under- to overweight. *J.Nutr.* 2001;131(3):893S-99S.
227. Kipping RR, Jago R, Lawlor DA. Obesity in children. Part 2: Prevention and management.BMJ **337** doi: 10.1136/bmj.a1848
228. Stein AD, Wang M, Digirolamo A, Hoddinott J, Martorell R, Ramirez-Zea M, et al. Height for age increased while body mass index for age remained stable

between 1968 and 2007 among Guatemalan children. *The Journal of nutrition* 2009;139(2):365-9.
229. Stanojevic S, Kain J, Uauy R. Secular and seasonal trends in obesity in Chilean preschool children, 1996-2004. *Journal of pediatric gastroenterology and nutrition* 2008;47(3):339-43.
230. Sandiford P, J; C, Montenegro M, Sanchez G. The impact of women's literacy on child health and its Interaction with access to health services. *Population Studies* 1995;49(1):5-17.
231. Kain J, Vio F, Albala C. Obesity trends and determinant factors in Latin America. *Cadernos de saude publica / Ministerio da Saude, Fundacao Oswaldo Cruz, Escola Nacional de Saude Publica* 2003;19 Suppl 1:S77-86.
232. Black RE, Morris SS, Bryce J. Where and why are 10 million children dying every year? *Lancet* 2003;361(9376):2226-34.
233. Victora CG, Wagstaff A, Schellenberg JA, Gwatkin D, Claeson M, Habicht JP. Applying an equity lens to child health and mortality: more of the same is not enough. *Lancet* 2003;362(9379):233-41.
234. Horton R. The coming decade for global action on child health. *Lancet* 2006;367(9504):3-5.
235. Sheeran J. The challenge of hunger. *Lancet* 2008;371(9608):180-81.
236. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de OM, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet* 2008;371(9608):243-60.
237. Jones G, Steketee RW, Black RE, Bhutta ZA, Morris SS. How many child deaths can we prevent this year? *Lancet* 2003;362(9377):65-71.
238. Sepulveda J, Bustreo F, Tapia R, Rivera J, Lozano R, Olaiz G, et al. Improvement of child survival in Mexico: the diagonal approach. *Lancet* 2006;368(9551):2017-27.
239. Vapattanawong P, Hogan MC, Hanvoravongchai P, Gakidou E, Vos T, Lopez AD, et al. Reductions in child mortality levels and inequalities in Thailand: analysis of two censuses. *Lancet* 2007;369(9564):850-55.
240. Powell-Jackson T, Borghi J, Mueller DH, Patouillard E, Mills A. Countdown to 2015: tracking donor assistance to maternal, newborn, and child health. *Lancet* 2006;368(9541):1077-87.
241. The Global Forum for Health Research http://www.globalforumhealth.org/ (accessed 20/10/10).
242. Leroy JL, Habicht JP, Pelto G, Bertozzi SM. Current Priorities in Health Research Funding and Lack of Impact on the Number of Child Deaths per Year. *American Journal of Public Health* 2007;97(2):219-23.
243. Lawn JE, Cousens SN, Darmstadt GL, Bhutta ZA, Martines J, Paul V, et al. 1 year after The Lancet Neonatal Survival Series--was the call for action heard? *Lancet* 2006;367(9521):1541-47.
244. Bhutta ZA. Bridging the equity gap in maternal and child health. *BMJ (Clinical research ed* 2005;331(7517):585-86.
245. Evans DB, Edejer TT, Adam T, Lim SS. Methods to assess the costs and health effects of interventions for improving health in developing countries. *BMJ (Clinical research ed* 2005;331(7525):1137-40.
246. *Primary child care: a manual for health workers*. Geneva: World Health Organization, 2009.
247. Rollnick S, Butler CC, Kinnersley P, Gregory J, Mash B. Motivational interviewing. *BMJ (Clinical research ed)*;2010; 340:c1900

248. Manandhar DS, Osrin D, Shrestha BP, Mesko N, Morrison J, Tumbahangphe KM, et al. Effect of a participatory intervention with women's groups on birth outcomes in Nepal: cluster-randomised controlled trial. *Lancet* 2004;364(9438):970-79.
249. LeVine RA, Rowe ML. Maternal Literacy and Child Health in Less-Developed Countries: Evidence, Processes, and Limitations, 2009:340-49 10.1097/DBP.0b013e3181b0eeff.
250. Civil Society Knowledge Network: Final Report to the Commission on Social Determinants of Health, WHO Geneva, 2007.
251. Hulme D, Shepherd A. Conceptualizing Chronic Poverty. *World Development* 2003;31(3):403-23.
252. Lloyd-Sherlock P. Social policy and inequality in Latin America: a review of recent trends. *Social Policy & Administration* 2009;43(4):347-63.
253. Starfield B, Shi L, Macinko J. Contribution of primary care to health systems and health. *Milbank Q.* 2005;83(3):457-502.
254. World Health Organization, Geneva and the Government of South Australia. The Adelaide Statement on Health in All Policies, 2010.
255. World Health Organization. The World Health Report 2008: Primary health care, now more than ever: W.H.O. Geneva, 2008.