

Mundane Market Matters: On Sensitive Metrology and the Governance of Market-Based Interventions for Global Health

Abstract: This article explores how market-based interventions designed to solve public problems, produce new configurations of governance. Our point of focus is on the mundane devices and practices which are crucial to enacting market-based interventions. These devices and practices are given a regulatory purpose through forms of counting and accounting for various sorts of mundane actions; what we term *mundane metrology*. This creates divisions between what is included and excluded from an intervention, making governance through markets possible. These divisions between what is included and excluded will be referred to as the *sensitivity* necessary to mobilise markets for addressing public problems. We treat sensitivity as the actions required to define what needs to be counted and accounted for, and the ongoing retuning of such definitions of need in response to changes in the course of an intervention. Mundane metrology and sensitivity are explored through a particular market-based intervention: the development of an Advance Market Commitment (AMC) designed to stimulate vaccination against diseases associated with high mortality rates in poor countries. This case is used to pose three questions: What are the devices and practices of mundane metrology in market-based interventions designed to solve public problems? How is metrology made (in)sensitive to the apparent needs of intervention? And how does metrology participate in counting, accounting, and accountability for intervention?

Keywords: Mundane markets, Advance Market Commitment, Metrology, Sensitivity, Governance, Vaccination

In calling for “empirical studies that analyse diverse uses of the market as an instrument for managing public problems,” this special issue highlights a need to get close to the action of what we might term market-based interventions. In this article we will explore how such market-based interventions produce new configurations of governance. Our point of focus is on the pervasive, ordinary, everyday—what we will term mundane (Pollner 1974; Woolgar and Neyland 2013)—devices and practices which we suggest are crucial to enacting market-based interventions. These devices and practices are given a regulatory purpose through forms of metrology that count and account for various sorts of mundane actions. In this focus on counting and accounting for the ordinary, we can say that market-based interventions depend on a kind of mundane metrology. Through an appreciation of this *mundane metrology*, we can attend to the practical and pragmatic accomplishment of intervention and make sense of how people, things and actions come to be participants in the world of market-based interventions and play a part in sorting out their future effects. Of particular importance for the article will be the forms of mundane metrology that create a division between what is included (efficacy rates, demand forecasts, price) and excluded (forms of competition, price fluctuation, interventionary demands), and that hence make governance through markets possible.

Market-based interventions designed to engage with public problems are a matter of concern in a broad number of different fields. Public sell offs and their regulation, demands for access to trade, privatisation and marketization, ranking and competitive resource allocation in higher education, windfall profits in CO2 emissions cap and trade systems, public-private partnerships in hospital management, continue to fill headlines. However, the ordinary, taken for granted practices and things that go toward making markets what they are often seem underrepresented in expressions of concern. Yet, these are central to the way policy making can acquire what we will refer to as the *sensitivity* necessary to mobilise markets for addressing public problems. We treat sensitivity as the actions required to define what needs to be counted and accounted for, and the ongoing retuning of such definitions of need in response to (sometimes unexpected) changes in the course of an intervention. Orienting our analysis toward this definition of sensitivity can help us to explore mundane metrology, as both a practice and device, involved in constituting the nature of a problem, how it ought to be resolved through a market-based approach, and who and what ought to be involved. Hence this article will examine how mundane metrology is made sensitive to the needs of an intervention and what needs counting, but also how accountability and responsibility for the counting should be apportioned. We will ask: what are the devices and practices of mundane metrology in market-based interventions designed to solve public problems? How is metrology made (in)sensitive to the apparent needs of intervention? And how does metrology participate in counting, accounting, and being accountable for an intervention?

Our article takes as its example a particular market-based intervention: the development of

an Advance Market Commitment (AMC) designed to stimulate vaccination against diseases associated with high mortality rates in poor countries (here pneumococcal pneumonia and meningitis in infants). The article begins by engaging with approaches to governance and accountability that offer possibilities for analysing market-based interventions. We will suggest that these approaches can be augmented through a consideration of mundane metrology and its sensitivities. Subsequently, we set out the details of the AMC as a market-based intervention which seeks to solve health problems in low income countries. We will examine such matters as pricing, demand, and monitoring. The article concludes with an analysis of how this focus on mundane metrological sensitivity can help us to explore how regulatory interventions produce new configurations of governance.

Counting and accounting in market-based interventions

Our focus on the Advance Market Commitment and the work of GAVI (formerly the Global Alliance for Vaccine and Immunization) in implementing this market-based intervention designed to support vaccination in low income countries, seems particularly apt for considering issues of governance through markets. The case, we argue, points to questions of what counts as governance through markets, how an intervention gets to count, but also how an intervention is rendered accountable. Through the AMC we have the opportunity to explore how, in more than 70 low income countries, vaccination is made possible by overseas aid (the flow of public resources provided by wealthy economies, like the UK, to the governments and populations of poor regions). We are able to analyse how funding is pooled and channelled through GAVI (a public-private partnership also involving philanthropic donors like the Bill and Melinda Gates foundation) and used in contractual arrangements with private pharmaceutical companies. Together these sources of funding, pooling, channelling and contracting act upon the terms of transaction (prices and volumes) through which health administrations in low income countries can access vaccines.

One place to start our exploration of the AMC would be through recent work on market devices (Callon 1998; Muniesa, Millo, and Callon 2007)—a move which demands we investigate otherwise taken for granted features of market activity and pay close attention to the constitutive counting and calculative practices of market work. Following Callon and Muniesa (2005), this article will examine the devices and practices with which an entity like GAVI is equipped to intervene on the production, circulation and use of vaccines as market goods. We will suggest that the governance of the market-based intervention through overseas aid which is the subject of this article, insists upon intervening and delivering an end product (vaccination). In the absence of such practical matters as the delivery of an end product, there would be no money spent. The nature and direction of investment in the AMC is thus distinct from that witness-able in capitalization and

assetization (Doganova and Muniesa 2015; Birch 2016), where the hypothetical possibility of future innovation is used as leverage to produce income streams in the here and now. As we will see, in the AMC governments and philanthropic donors spend money to motivate market actors (pharmaceutical firms) to make investments (in manufacturing capacity) benefiting populations (of low income countries) that otherwise would miss out on biomedical innovation. For donors, return then amounts to a metrological outcome (a health impact). For firms, return in the form of income streams occurs only if a range of criteria on the vaccine are continuously met. To understand this kind of governance through markets attuned to the specific challenges of resolving public problems, we suggest that attention must be drawn to mundane routines that enable intervention to take place. We will argue that it is in composing a responsive metrological infrastructure that exchanges can happen, market actors may be motivated, and the intervention assessed. We will see how these devices and practices enable an organisation like GAVI to become a “centre of calculation” (Latour 1987) that governs at a distance such matters as financial transfers, the delivery of vaccine doses, and public health evidence. Here we will suggest metrology is central to establishing what will, but also what will not, be counted and held to account. Taking inspiration from Law’s (1996) work, the counting and accounting devices of metrology can be considered as promoting “an active process of blocking, summarizing, simplifying and deleting... [that decides] what is to count and what, therefore, becomes counted,” (1996: 291). As we will see, the practices and devices of the AMC seek to make certain market features and choices (such as vaccine prices, forecasted demand, vaccine effective- ness) available to the scrutiny of certain publics (such as donors, manufacturers, epidemiologists), while at the same time dismissing others. The metrological effort forms a labour of division between who and what will count and who and what will not.

In order to understand how metrology and its counting devices make sense of, order, participate in, and give shape to a market-based intervention, our starting suggestion is that composing a world within metrology both sets the terms for participating in the AMC and establishes how it will sort out its effects. Particularly instructive for us is the work of Pollner (1974) who draws on the Latin etymology of the word mundane (*mundus*) to explore how matters are not just pervasive, but become *of the world*. Understanding how people and things become of the world of market-based interventions is central, we will suggest, to exploring the complexity and productivity of metrology. Hence our first question will be: how do market-based interventions create the terms on which people and things will become participants of the metro- logical world being devised?

Taken together, Pollner’s focus on the mundane and Law’s work on the labour of division, suggest that an important focus for forms of governance is the question of who and what gets to count and by what means. According to Callon (1998), markets work precisely by framing transactions through metrological practices, which define the qualities of the good, calculate its price, and organise physical exchanges. Here we will see that a market-based

intervention like the AMC for pneumococcal vaccines also operates by establishing a division between the issues that are addressed and those that are ignored. This division, as we will argue, is dynamic. Concerns can emerge that transform the terms of the intervention even after its initial design has been decided. This article will show that metrological practices and devices are the means by which an intervention is able to notice new problems, make sense of them and react accordingly. In what follows, we will take up this challenge of understanding how mundane metrology in a particular market intervention creates its own devices for counting and sets limits on what gets to count. We will use the term *sensitivity* to explore the capacity to count, not count and change the terms of counting established through the metrological practices and devices of market-based interventions. Hence our second question will be: how is metrology made selectively sensitive in making things participants in the world of a market-based intervention and with what consequence?

Although metrology usefully draws our attention to the detailed and complex practices and devices of counting, the notion of accountability, we suggest, points to metrology's punctuated, unevenly distributed effects—such as who and what is responsible for doing the counting, to which audience, with what consequence. For ethnomethodologists (Sacks 1972; Garfinkel 1967; Woolgar and Neyland 2013; Neyland and Coopman 2014) specific accounts distribute accountability and hence responsibility for action. This is the case because making sense of actions in a setting has a dual meaning of being demonstrably open to inspection as an account of some matter and being able to demonstrate competence in making sense of some matter (Lynch 1993; Dourish 2004). To give an account is thus also to take, and be held responsible for, an account. This has directed attention to the accountable character of keeping records, following instructions, justifying actions in relation to guidelines and informing others what to do and where to go (Lynch 1993). Extending these ideas, studying the AMC as a matter of accountable action would involve exploring the ways its metrology is intimately tied to the matter of making the intervention make sense. Our suggestion will be that what gets to count as appropriate metrology involves the organisational establishment of accountability relations wherein questions are not limited to a division of who and what will or will not count, but also who and what will be responsible for the counting and its results. Hence our third question will be: how does metrology participate in counting, accounting, and accountability for intervention?

The Advance Market Commitment for pneumococcal vaccines

Our research on the Advance Market Commitment for pneumococcal vaccines as a market-based intervention, involved carrying out 31 semi-structured interviews with participants in the field along with fieldwork in Burkina Faso, attendance at scientific conferences and the constitution of a rich documentary corpus. Interviewees included current and former civil servants from the UK Department for International Development (DFID) and HM Treasury, regulatory experts, members of the GAVI Alliance secretariat, economists and

lawyers involved in the design of the AMC, as well as technicians, clinicians and researchers (epidemiologists, biologists, immunologists, and health economists) specialized in pneumococcus. Fieldwork was carried out in April 2015 in Burkina Faso, where one of the authors spent three weeks within a research team in charge of evaluating the epidemiological impact of pneumococcal vaccines. The corpus constituted around the AMC drew on the documentation made available online by GAVI and on scientific publications dedicated to pneumococcal vaccines.

Drawing together this array of empirical material, our analysis involved grouping together data into emerging themes that then formed the sub-sections for this article. We suggest that implementing the AMC to effect enduring and tangible transformations (such as the transfer of resources between economies; the circulation and use of vaccines; and epidemiological changes) requires metrology and a kind of enabling logistics. These set the terms for participation and the type of effects that will (and, as it turns out, will not) be deemed worthy of enactment, measurement and inclusion in accounts of the intervention. It is through metrology that people and things become of the world of the AMC.

The AMC is a market-based intervention in the sense that it acts on vaccine markets in a particular direction: toward making vaccination possible on a large-scale in Africa in order to reduce the burden of disease, particularly among children (Levine, Kremer, and Albright 2005). It pools donor resources together to create something akin to a market proxy—an amount of available funding that can stand as more or less equivalent to a population of disease sufferers financially equipped to purchase suitable vaccines—except that the donors and their delegates continue to heavily influence decisions on the distribution of money on behalf of the population of beneficiaries. The metrological practices we describe are located in sites and processes through which this normative aim of distributing vaccines to otherwise neglected populations (and the trade-offs it involves) takes shape. In this way, the normative aim is not just an abstract term conceived in a policy document, it is realized as part of the world of the AMC, through metrology. Our opening suggestion is that the sensitivity of these metrological devices equates to how attuned they are to spotting new problems and proving able to take them into account.

The AMC first emerged in economic literature, where it was described as a policy initiative that could make economically unattractive diseases affecting poor populations more alluring to large pharmaceutical firms (Kremer 2000a, 2000b). This meant equipping the affected populations (or at least their governmental representatives) with significant funds and creating a conditional advance commitment for buying products able to alleviate their health problems. In mid and late 2000s, the idea of an AMC gained political momentum in discussions of overseas aid (Tremonti 2005) and a pilot was launched involving European and North American governmental donors as well as the Bill and Melinda Gates Foundation, under the management of the newly created partnership GAVI. Donors and

administrators chose to direct the AMC toward the problem of pneumococcus, a bacterium that caused a high number of pneumonia and meningitis cases and deaths among young children worldwide, according to evidence endorsed by the World Health Organization (WHO) (WHO 2008). Vaccines against pneumococcus already existed along with reasonably confident predictions of efficacy in low income settings. With the AMC, donors anticipated an intervention through which two pharmaceutical firms (GSK and Pfizer) would receive a subsidy in return for increasing the supply of their pneumococcal vaccines and meet the substantial needs of the newly solvent demand.

In this sense, governance of overseas aid for health through a market-based intervention became inseparable from governance of a market involving global pharmaceutical firms. The terms of transaction for the market-based intervention were focused around a set of legal conditions to issue supply contracts and disburse a 1.5 billion dollar subsidy (GAVI and IBRD 2011). The AMC for pneumococcal vaccines became a means to incentivize manufacturers to invest in production capacity and sell large volumes of doses to GAVI. Manufacturers would enter into 10-year supply agreements at a fixed and unique cap price (3.5 dollars a dose), when usual supply contracts are two or three years long and prices negotiated bilaterally. In return, firms would receive a subsidy disbursed over the first years of the long-term agreement as a 3.5 dollar top up¹. Though they were indexed on forecasted demand published by GAVI, these long-term contracts remained uncertain. The AMC terms stated that GAVI would honour the purchase and donors allow the disbursement of the subsidy only if the governments of countries eligible for GAVI's support demanded the vaccine (countries whose national income is below a certain threshold according to the World Bank). It was only if health administrations decided to introduce pneumococcal vaccines in their immunization programmes and apply to GAVI for financial support that the long-term agreements could translate into short-term exchanges of vaccine doses and money.

In what follows we suggest that the AMC established particular kinds of metrological requirements. Pricing, demand forecast and impact monitoring became metrological devices through which this market intervention could develop, sensitivity could be attuned as problems were noted and resolved, and people and things could be made participants in the AMC. These three areas also provided a basis for demarcating what would not be incorporated into the metrology of the market intervention, making the AMC insensitive in particular ways. As we will see, running a pilot AMC for pneumococcal vaccines and

¹ The calculation of the total amount of the subsidy received for one supply contract would be established as follows: the supply offer formulated by the manufacturers (X numbers of doses provided annually) is compared to an indicative demand target of 200 million doses annually; the percentage of target demand covered by the offer corresponds to the percentage of the 1.5 billion dollar subsidy pool received for that offer, and the number of doses, whose price would be increased with the 3.5 dollar top up, is calculated accordingly.

the selective sensitivity of the market-based intervention triggered a number of concerns.

Mundane metrology

Price computation

Producing a working version of the AMC involved writing contracts that organized flows of funds between bank accounts, and flows of vaccine doses between airports, attributing governance responsibilities between donors, manufacturers, GAVI and other international organisations (such as the World Bank and UNICEF). A key element within this contractual arrangement was the disbursement conditions of a subsidy structure for pharmaceutical firms that would supply pneumococcal vaccines (the 3.5 dollar top up disbursed over the first years of supply). Designing this structure required legal work as well as pricing computation, which is what this section focuses on.

The subsidy was expected to encourage firms to invest in manufacturing capacity that would ensure large-scale production of pneumococcal vaccines sold below the long-term price cap (3.5 dollars a dose). To achieve a contractual set-up that could have the desired effect, economists, lawyers and industry experts were gathered in an expert group to advise donors and the GAVI secretariat. Their work involved the circulation of Excel spreadsheets to share the outcome of economic modelling, testing price ranges, conceiving decision-making scenarios, and calculating value for money (GAVI 2008a, 2008b).

“[We run] models to try to figure out how assumptions about the demand for vaccine and capacity investment would sort of translated into different financial outcomes for the manufacturers and for GAVI. [...] We have to make an assumption about the cost of building a plant, and the assumption about what it would cost to produce doses of vaccine, and then we have to make assumptions about what the demand would be. There were some estimates that GAVI had produced about the likely demand for pneumococcus vaccine over the next 10 years or whatever it was. And then essentially just doing financial accounting, and say ‘if the price is 4 dollars a dose, this is how much revenue the firm would be making’, ‘would they be able to make a return on investment for building their plants?’, ‘how much money would GAVI ends up spending?’.” (economist involved in the design of the AMC, Skype interview).

As indicated in the quote above, the modelling work undertaken by the expert group sought to simulate the potential effects on manufacturer’s investment decisions of different pricing structures or demand realization scenarios (see Figure 1). This required some insights from the pneumococcal vaccine business, such as the cost of goods (the cost of producing one dose of pneumococcal vaccine) estimated by a consultancy company. Conducted over two years, this calculative activity was scrutinized by donors and the GAVI secretariat, and

punctuated by consultations with manufacturers.

NPVs for 100 Million Dose Annual Capacity Plant; \$7.00 AMC
Price, with a \$3.50 AMC subsidy and a \$3.50 tail price; 10 Year Supply
Commitment (in millions)
The 100 million dose commitment gives the firm nominal AMC Funds of
\$750 Million, based on a 200 million dose target by 2030

Cost Estimates			Demand Realization				
Capital Costs (Mil.)	Annual Fixed Costs (Mil.)	Variable Costs Per Dose	100%	75%	50%	25%	15%
NPV of Firm Profits							
\$110	\$35	\$0.65	\$1,396	\$1,352	\$1,157	\$595	\$307
\$110	\$35	\$1.00	\$1,231	\$1,193	\$1,019	\$520	\$262
\$110	\$35	\$1.75	\$880	\$851	\$723	\$360	\$166
\$200	\$35	\$1.75	\$808	\$779	\$651	\$288	\$94
\$200	\$50	\$2.50	\$381	\$362	\$280	\$53	(\$77)
\$300	\$50	\$2.50	\$301	\$282	\$200	(\$27)	(\$157)
\$300	\$50	\$2.75	\$184	\$168	\$102	(\$80)	(\$189)
\$400	\$50	\$2.75	\$104	\$88	\$22	(\$160)	(\$269)
\$400	\$50	\$3.50	(\$248)	(\$254)	(\$274)	(\$320)	(\$365)
\$400	\$50	\$4.00	(\$483)	(\$482)	(\$472)	(\$427)	(\$429)
NPV of Spending							
Total Spending			\$2,476	\$2,409	\$2,091	\$1,311	\$945
GAVI Spending			\$1,787	\$1,730	\$1,448	\$758	\$455
Country Co-Payment			\$145	\$140	\$117	\$61	\$37
Net DALYs Averted							
Using 10-Valent Vaccine			44	37	25	11	5
Using 13-Valent Vaccine			49	41	28	13	6
Dollar Cost per Net DALY							
Using 10-Valent Vaccine			\$56	\$66	\$83	\$119	\$188
Using 13-Valent Vaccine			\$50	\$59	\$73	\$103	\$156
Dollar Cost per DALY							
Using 10-Valent Vaccine			\$36	\$40	\$45	\$54	\$65
Using 13-Valent Vaccine			\$33	\$37	\$42	\$51	\$61

TABLE 1. – *Net present value estimates for different scenarios of demand realization*

GAVI 2008b: 38. NPVS for 100 million dose annual capacity plant; \$7.00 AMC Price, with a \$3.50 AMC subsidy and a \$3.50 tail price; 10 year supply commitment (in millions). The 100 million dose commitment gives the firm nominal AMC funds of \$750 Million, based on a 200 million dose target by 2030. *Reading:* “Capital costs,” “Annual fixed costs” and “Variable costs per dose” are, according to modellers, the three parameters that manufacturers include in estimating their NPV (the present value of future cash inflows, through the sale of vaccines up to a certain demand, and outflows, through the spending on plants and productions) and make decisions accordingly. The numbers in brackets are negative values. “DALY” stands for Disability Adjusted Life Year. With this variable, the model quantifies the deaths and unhealthy lives prevented by vaccination. It then balances such a health impact with the cost of buying the vaccine, assuming that for 100 dollar spent on an alternative intervention one DALY would have been averted (a conventional value used in overseas aid). The result of the calculation is the “Dollar cost

per net DALYs”, used by some donors to check and justify their aid spending.

Metrological practices used to compute prices combined different types of numbers, balanced different outcomes, and found trade-offs between what was conceived within these calculations as competing aims and constraints.

“The expert group was given a quite difficult job to do. It was to find a set of incentives that would represent good value for money but at the same time will make it very likely that industry would respond and install capacity for manufacturing, additional capacity for manufacturing pneumococcal vaccines. This was a pilot, it was to prove whether the concept works and it had an awful lot of political capital behind it. You know Gordon Brown had put his weight behind it, various Italian politicians their weight behind it. It was a big deal at the time and a failure in terms of no firms committing capacity would have been quite difficult but at the same time they had to be certain that they would have got good value for money.” (former civil servant of the UK Department for International Development 1, interview, London).

Donor representatives, like the one cited above, who were involved in supervising and agreeing on the price structure, viewed the task as a matter of compromise. Having a pilot scheme that on the one hand would be sufficiently attractive financially for companies to agree on the offer, and on the other hand would try to maximize the number of children who could be vaccinated by a fixed financial contribution from donors, was central to the metrology deployed to set the pricing structure of the AMC. Along with information on production costs, this calculative exploration was made possible by previous clinical trials that had quantified the efficacy of pneumococcal vaccines in reducing mortality in poor countries (in particular a trial in the Gambia, see Cutts et al. 2005, Sinha et al. 2007). Projecting the future number of lives that could be saved by the AMC was particularly important for a donor like the UK whose spending on overseas aid had to demonstrate its value for money according to a mandatory procedure. This was part of how the British administration sought to be accountable to tax payers. Value for money standards (such as the World Bank’s criterion of a cost below 100 dollars per healthy life saved, see figure 1 on the notion of cost per net DALYs) accomplished a balance between a pricing structure attractive for private pharmaceutical firms and a wise use of public money given a projected health benefit.

Although this balance in itself seems to establish somewhat complicated and uncertain demands for inclusion (for example, requiring metrological sensitivity to the needs of organisations with distinct aims and interests), the balance could only exist by excluding other potential demands. For example Médecins Sans Frontières argued that the financial metrology of the AMC (based on value for money estimates to assess whether the price is justifiable) was not sensitive enough to what the humanitarian organization saw as the

problem of using public money to subsidize pharmaceutical firms that made huge profits already without further financial help, especially by selling the same product in wealthy economies (Pfizer's vaccine costs more than 130 dollars a dose in the US, see MSF 2011, 2015, p. 26). Given that the chosen price structure met donors' expectations of value for money, the intervention did not question the ethics of multinationals benefiting from tax payers' money.

Another consideration left aside by the AMC concerned market competition and companies' competitive advantage. Donors, the GAVI secretariat, and the expert group suspected that the two firms whose pneumococcal vaccine was ready for manufacturing had different production costs (Cernuschi et al. 2011: 20). Instead of engaging in two bilateral negotiations that might have settled on two different prices and thus increased efficiency (more doses obtained for the same amount of funding), the AMC set in advance a unique price cap associated with a subsidy. The intervention was presented as an offer to any market actor, including companies that did not yet have a commercialized pneumococcal vaccine and could be encouraged to accelerate its development in order to obtain some of the subsidy. One assumption was that these additional vaccine producers, especially from emerging economies, would have considerably lower costs compared to both GSK and Pfizer and might be more willing to bid under the price cap (Dalberg 2013: 10). But manufacturers for example in India complained that there would not be any subsidy left by the time their vaccine achieved licensure.

“[A firm] advocated we should carve out piece of financing that would be available later on [...], which, from my point of view, was a very complicated argument. I think it is important to be aware that [the firm] had vested interests, a commercial interest in saying that. [...] That's said, I understand that there is a very strong argument to be made for freezing some of it. It creates a stronger market, a credential mechanism. [But] we would risk being in a situation where companies have vaccines available that we know are cost-effective, but we are not going to vaccinate children and wait for other companies to develop their vaccines, which they may not succeed in doing. So we felt that, although it was a very powerful argument on a market-based mechanism side, it was not an enough ethically viable argument.” (former civil servant of the UK Department for International Development 2, interview, London).

The request to freeze a proportion of the funding was rejected by donors. As shown in the quote above, they thought that, if other competitors whose vaccine candidates were still under development, could easily access the subsidy in years to come, the companies already manufacturing the product might be dissuaded from investing more in capacity (Dalberg 2013: 80). Freezing part of the subsidy could thus limit short-term production and translate into shortages in vaccine supply if demand for the product turned out to be high.

The market-based intervention was made more sensitive to the need to be able to supply as many vaccine doses as possible, as quickly as possible, to populations in need, than to actively supporting vaccine manufacturers from countries such as India, China and Brazil, even though donors hoped that at least one of those firms would join the AMC later on, introducing a form of competition despite a unique cap price.

To be translated from a normative and idealized policy proposal into an operational, legally binding contractual arrangement focused on supply, the AMC had to leave these other issues aside and consider the trade-off embedded in the pricing structure good enough. This distribution of what had been taken into account in the design of the market-based intervention and what was ignored was made explicit in two evaluations of the AMC launched by GAVI, one in 2013 and the other in 2015 (Dalberg 2013; BCG 2015). Conducted by external consultants, these assessments (made available online²) relied on documentation analysis and interviews during which people involved in the set-up of the intervention were asked to reflect upon their past work. Evaluating the AMC amounted to a collective, critical, and public examination of the numerous compromises that unavoidably make up such an intervention.

What we can see in this first component of the AMC, price computation, are varied efforts to develop a sensitive metrology for the market intervention, balancing distinct interests, calculating the variable stimulus provided by different levels of subsidy and considering donors' concern with value for money and possible health impact. Yet we can also see metrological insensitivity. The demands and desires of various other organisations (manufacturers with pneumococcal vaccines in development) are discarded in order for price computation to remain focused on two commercialized vaccines from two pharmaceutical firms. The AMC operates a fairly strict labour of division (Law 1996), prefiguring what will and will not count. This also establishes an initial basis for accountability. Evaluating the AMC effectively distributes responsibility for the adequacy of metrological sensitivity (that what should be counted is counted) and the necessity of insensitivity (that what has not been counted, needed to be ignored to get on with the practical matters to hand). As we will go on to demonstrate, making people and things participants in the world of a market intervention like the AMC requires this preferential sensitivity and distributions of accountability.

Demand materialization

Although price computation designed to settle the distinct interests of pharmaceutical firms and public and philanthropic donors was important, the AMC involved a number of

² The 2013 report can be found here: <http://www.gavi.org/results/evaluations/pneumococcal-amc-process---design-evaluation/>; and the 2015 report here: <http://www.gavi.org/results/evaluations/pneumococcal-amc-outcomes-and-impact-evaluation/>.

additional measurement practices with associated devices. As shown in this section, metrology continued in the form of demand forecasting and other calculations on the basis of which the volumes of vaccine doses to be contracted with manufacturers could be calculated, allocated, and shipped to health care centers where they would eventually be used.

Conducted twice a year by a dedicated team of GAVI secretariat, strategic demand forecasts combined various indicators. The indicators are based on values which are regularly produced globally by organizations like UNICEF and the WHO (vaccine coverage, wastage rate, demographic trends and patterns of vaccine introduction amongst other matters), to assess the need for pneumococcal vaccines in GAVI-eligible countries 20 years into the future. Strategic demand forecasting was key to the implementation of the AMC. A first forecast for pneumococcal vaccine was published based on which the UNICEF supply division, as the organization in charge of vaccine procurement for GAVI, released a call for offer in September 2009 (GAVI 2009) (see Figure 2). The forecast was provided by GAVI secretariat to manufacturers for them to set the volume of doses they were committing themselves to supply 10 years into the future, with no guarantee that such a commitment would translate into payment. Indeed, the AMC was meant to enact transactions (vaccines in exchange for money) only if demand materialized, that is, if the health administrations of countries eligible for GAVI's support requested pneumococcal vaccines. Several manufacturers responded to the offer and the forecast, demonstrating that despite such uncertainty, the pricing structure was attractive. GSK and Pfizer, who were the only companies with licensed pneumococcal vaccines at the time, entered into two 10-year supply agreements for a supply of 30 million doses a year each. Since then, two additional tenders have been conducted with the same companies so that in 2015 more than 100 million doses were put into circulation across the globe (GAVI 2015a: 13).

As the AMC was implemented, eligible governments applied for support. Their applications stating the amount of vaccine doses requested annually were checked through GAVI's review process involving independent experts. As the reach and scale of such expressed demand progressively became clear, the strategic demand forecast, based on a model and data, was complemented with a slightly different metrology, the adjusted demand forecast (GAVI 2015a: 14). The adjusted forecast anticipated the volume of vaccine doses required using the numbers appearing in the applications submitted by countries to GAVI. And the demand for doses of pneumococcal vaccines turned out to be quite high.

“If you look at the demand of pneumo we have never seen a demand like that, so quickly countries applying.” (former staff member of GAVI secretariat, interview, Geneva).

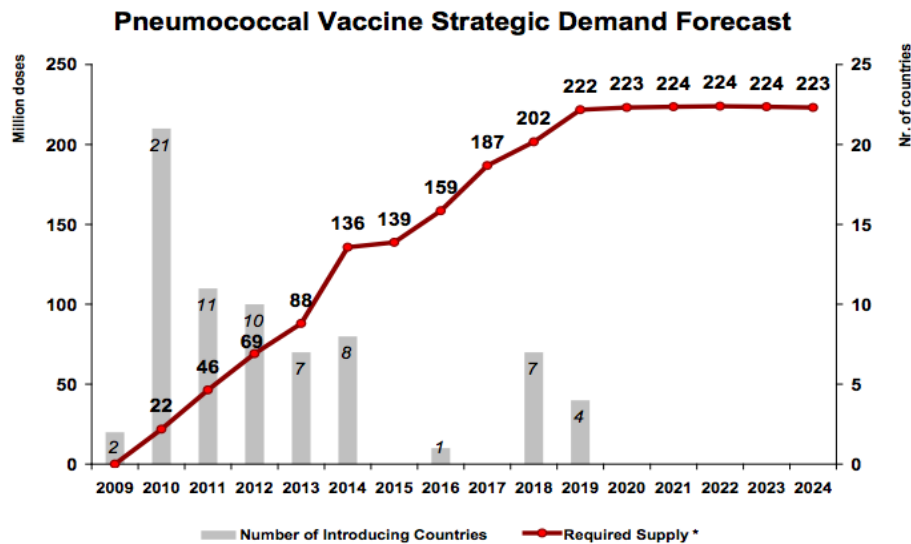


FIGURE 1. – *Strategic Demand Forecast (Required Supply) Version 0—updated as per May 2009 Published 12 June 2009 by GAVI (GAVI 2009)*

That many governments were eager to introduce pneumococcal vaccines in their immunization programmes can be explained by the prior deployment of an advocacy initiative financed by GAVI. This helped establish a worldwide calculation of the number of deaths and disease cases assignable to pneumococcus (the so-called global burden of the disease) and this public health evidence as well as data on the vaccine’s efficacy was circulated among decision-makers in low income countries (Levine et al. 2004).

However, despite an increased sensitivity to the need for pneumococcal vaccines, the GAVI secretariat struggled to meet the materialized demand during the first few years of implementing the AMC. The volumes of vaccine doses that the two companies (GSK and Pfizer) could physically ship to health administrations requesting the vaccine were limited due to production failures in their plants (BCG 2015: 40). As a result of these supply constraints the vaccine was, to begin with, a scarce product while expressed demand was quite high among eligible countries. The scarcity of pneumococcal vaccines required an *ad hoc* metrology to prioritize vaccine introduction among countries.

“The allocation procedure would tell you, ‘ok I’ve received 15 applications from countries to start introducing pneumo, [...] but I only have supply, limited supply, what do I do? Do I go with the large country and give all to them? Or do I pick the other countries? Or do I go with the first one who applied? Or do I go with the one with the larger health impact?’. [...] [The procedure] was a matrix, it was a tool that would factor in health impact, time of application, readiness to introduce, etc., to spit out the name of the country that should go first. And then the other countries

were told to wait.” (former staff member of GAVI secretariat, interview, Geneva).

To deal with a constrained supply of vaccine doses, the GAVI secretariat had to resort to an allocation procedure described in the quote above, which weighed volume of available doses, health impact and likely coverage rate. Intervening through the AMC thus began with this kind of preferential (in)sensitivity: prioritizing certain demands. This insensitivity may actually reappear as the AMC continues. For example, some countries have asked to switch from GSK’s vaccine to Pfizer’s in the future. Countries were originally supposed to have the choice between both products. But Pfizer’s vaccine was requested in more applications than GSK’s. To meet all the eligible demand, GAVI secretariat had on several occasions proposed to some national governments the following decision: your first choice vaccine (Pfizer) with some delay or your second choice (GSK’s product) right now (GAVI 2013, p. 12–13). For those countries that eventually accepted the second option, their agreement with GAVI authorized them to put forward a new request for the preferred vaccine after a few years. But the volume of doses committed and supplied by Pfizer might still not be enough to cover this increase in demand for its product.

Even in the apparently banal relations of supply and demand, metrological sensitivity can enable a market-based intervention to succeed, or fail, in saving lives. After the first few years of imposed rationing, manufacturers were eventually able to produce more and a balance could be found between supply and demand. Over time, the GAVI secretariat also accumulated knowledge about engaging with health administrations around planning issues. It recently started to intervene in calculations of the requested volumes by recording for example the number of left-over vaccine doses from the previous year and adjusting future shipments in consequence. The following quote describes these changes in GAVI methods for anticipating demand:

“We started to take into account the stock from the previous year, we started adapting that, and now we’ve taken a step further [...]. The idea is also to look at [...] the shipment report from UNICEF, to see what [UNICEF] actually shipped and to look at what the country thinks it would achieve in that year. [...] So we start to triangulate all the information that we have, not only from country sources, but also the UNICEF shipment reports [...], and adjusting then the shipments for the following year accordingly, not just relying on what the country requests, but also what we’ve been observing over time, in terms of total shipped, say, over the past five years, total kids immunized over the past five years, do things match up with what the country is requesting or are they over requesting.” (staff member of GAVI secretariat 1, interview, Geneva).

Improving aspects of supply required a stronger focus on countries and their needs, triangulation of information based on past patterns, and better coordination with the

UNICEF supply division. As a result of this mundane metrology, GAVI could be more sensitive to the locations in which it was intervening through the AMC. This sensitivity was essential for the logistical accomplishment of the market-based intervention, enabling it to gain purchase on the management of vaccine stocks and flows, at the same time as controlling price. To do so required that the GAVI secretariat diversified its activity, hired more staff dedicated to its country programme team, bringing in new skills, and broadening its ability to intervene. Metrology not only underpinned the AMC, it also enabled GAVI, as a calculative agency in vaccine markets, to transform itself.

But ensuring that demand could materialize and be met did not stop at the calculation of volumes of vaccine doses. The AMC aimed to buy vaccines for certain users (health administrations), in order to give populations in need access to pneumococcal vaccines and eventually improve their health. Financial access had thus to translate into physical access, which required a metrological sensitivity to the material possibility of supply, beyond the reach of forecasting and calculation of doses. In countries eligible for GAVI's support, vaccines often arrived at the capital airport, from which they would be moved to a central warehouse, later brought to regional cold rooms, and then distributed to districts and local healthcare centres (field notes from Burkina Faso). Because vaccines are biotechnologies, a standard temperature range (between 2 and 8 degrees) would have to be maintained throughout their movement along the cold chain thanks to regular checking of the equipment.

“[The vaccine] is an alive thing [...]. It's like fresh... it's like vegetables!” (staff member of GAVI secretariat 2, Geneva, interview).

In places, such as Burkina Faso, ensuring the careful handling of these semi-living things was a constant challenge. Temperature anomalies could be quite frequent, due to old fridges, power cuts on the national grid, and broken generators. Moreover, reliable information on the number of vaccine doses circulating in the network of healthcare centers was usually lacking. Despite an increased focus on adjusting shipment within GAVI, shortages or overloads regularly occurred.

The difficulty in guaranteeing the integrity of supplied vaccines, due to fragile cold chains, became a concern for the GAVI secretariat only recently, as it could affect the quality of vaccination, and create wastage or missed opportunities for immunization, but also because it could mean financial losses.

“We are putting so much more value of vaccine through that supply chain. [...] If for example you have a hundred doses of a vaccine that costs 10 cents each and it goes bad because of a bad supply chain, ok, you can kind of cope with that. But if you have a hundred doses of a vaccine that cost 10 dollars each, that's a much different value that you've lost in the system.” (staff member of GAVI secretariat

3, Geneva, interview).

The AMC indirectly triggered a sensitivity to supply chain issues. Despite the careful design of the market intervention, the price of pneumococcal vaccines (3.5 dollars a dose in addition to a 3.5. dollar per dose subsidy) remained much higher than the few cents of a measles vaccine³ for example. Wasting doses thus implied wasting large sums of aid money. As an investment, the market intervention was supposed to maximize the volume of doses arriving in good condition at vaccination sites. To improve supply chains, the GAVI secretariat started to interact with supply chain consultants, the WHO, and the Bill and Melinda Gates Foundation (GAVI 2015b: 32). Discussions revolved, for example, around new devices able to track physical flows of vaccine doses (e.g. the use of bar codes on vials for real time stock assessment). However, whether GAVI will develop sophisticated metrology sensitive to supply chain issues and make those issues a matter of future accountability still remains an open question.⁴

Sensitivity in relation to meeting the demand for pneumococcal vaccines was based on a broadening metrology including demand forecasting and calculation of left-over resources. Once again, though, the intervention is predicated on a necessary insensitivity; some concerns are foregrounded and become the focus of much work (such as adjusting physical shipment), while others are downplayed (cold chain management), pushed into the background or ignored entirely (such as eligible health administrations choosing between vaccine products). Metrological sensitivity and insensitivity once again establishes what will become part of the world of the AMC and also makes the public problem of delivering vaccines to save lives an accountable matter. Who and what is responsible for the problem is worked through this sensitivity and insensitivity, with GAVI insisting national governments take decisions regarding vaccine products (and hence accountability and responsibility) for their populations' well-being but simultaneously constraining them in their choices and capacities. At the same moment, being insensitive is a crucial practical matter for GAVI; to start counting some things would then mean taking on accountability and responsibility for those things. As we will see in the next section, forms of sensitivity and insensitivity and accountability shift once again when we focus on the use of the vaccine itself.

Impact monitoring

³ See the UNICEF vaccine price list: https://www.unicef.org/supply/index_57476.html.

⁴ Alongside the purchase of vaccine doses, GAVI had been, since the mid-2000s, providing administrations with cash grants to buy vaccination equipment like syringes and fridges. But, the growing concern with cold chains expressed by its secretariat seems to imply that the financial support channeled through these specific grants had not necessarily translated into efficient cold chains and immunization programmes.

In following the implementation of the AMC, we can notice that metrology does not end with the distribution of vaccines. Indeed the market-based intervention was meant to address a public health problem *a priori* solvable through vaccination: high disease and mortality rates due to the bacterium pneumococcus in low income countries. In this section we will explore the metrological practices of the GAVI secretariat and epidemiologists in monitoring the impact on health of having made pneumococcal vaccines widely available through the AMC.

GAVI has been regularly reporting back to its donors and the general public on a series of indicators meant to capture the impact of its work (e.g. the number of immunized children, the mortality rate of children under five years old, etc.).⁵ With an increasing focus on an investment type logic, donors such as the UK expected to receive a metrological return from their spending on overseas aid. Because the AMC was a unique, pilot intervention, the secretariat published specific annual reports, explaining how much of the subsidy had been spent, listing the countries having requested pneumococcal vaccines, quantifying the volume of doses procured, and estimating vaccination coverage rates (GAVI 2015a: 25–7). As part of this monitoring and evaluation, GAVI had provided epidemiologists with grants to conduct what was called in AMC annual reports “special studies on pneumococcal vaccines” (*ibid.*: 29).

These special studies were epidemiological studies that would establish and hold in place a metrological infrastructure to monitor the effects on the population’s health of routine immunization with pneumococcal vaccines, and communicate such effects back to a range of actors (from the research community to health administrations and donors) potentially interested in knowing if and how vaccination reduced the burden of disease. In places like Kenya, the Gambia, Malawi, and Burkina Faso, the studies were usually led through collaborations between national and foreign institutions. Protocols often included disease surveillance (counting every disease case due to the bacterium, either pneumonia or meningitis, occurring in a given area) and so-called carriage analysis (quantifying and identifying the presence of the bacterium in the noses of people randomly selected). Expectations among epidemiologists were that the occurrence of cases and level of carriage would be significantly lower than before pneumococcal vaccines became routine. *Ex post* monitoring aimed to assess whether such expectations, on the basis of which the vaccine had been supported by the AMC, were fulfilled.

Epidemiological monitoring practices combined epidemiological sensitivity and insensitivity. In Burkina Faso, for example, disease surveillance focused on meningitis monitoring and depended on a relatively old fashioned and bureaucratic practice of metrology: form filling. A circuit of forms was organised to count meningitis cases due to

⁵ See GAVI’s mission indicators (<http://www.gavi.org/results/goal-level-indicators/mission-indicators/>) and GAVI’s goal-level indicators (<http://www.gavi.org/results/goal-level-indicators/>).

pneumococcus. Research protocols set the requirements for the form (see Figure 3) and a certain art of form filling had to be communicated to the healthcare staff handed the job of compiling data.

“We’ve seen the informed consent form, the clinical form and the lab form. There is also the identification form, which remains with the major [a staff member of the healthcare centre] to count the inclusions. The circuit [of documents]: for the consent [form], the yellow part is for the patient and the white is for the data manager [of the healthcare centre], so that I can monitor it.” (clinical research assistant during a training session in a healthcare center, field notes, Burkina Faso).

“Here [a clinical form] the dates are not correct. The date of the treatment at the hospital [on the form] is the same as the date at which the symptoms started, 21 March, while the arrival date is 31 March [this information was missing from the clinical form, but he found it in the medical file]. You see it’s important to work with the original document.” (clinical research assistant during a form checking session at the hospital, field notes, Burkina Faso).

The team leading the study in Burkina Faso would verify compliance with the form filling practices in order to certify the metrological certainty that the data had to inhabit. Monetary incentives were offered to local staff, training sessions put on (such as in the first quote), weekly monitoring visits took place (such as in the second quote) and frequent phone calls followed. Data was then checked against other sources of information (e.g medical files) to further ensure its veracity.

In this sense, the metrology of disease surveillance might appear incredibly sensitive to the settings where data was comprised. It was not enough to assume that the form alone and its initial completion would capture meningitis cases with sufficient sensitivity. The form, form filling practice and other corroboratory information had to be drawn together to lend this sensitivity some certainty. However, this sensitivity also had to work with insensitivity. The practice of collecting reliable and complete epidemiological information required that the studies be detached from clinical drama.

“The problem is that meningitis is a medical emergency, people arrive sometimes in a coma, which makes it impossible to obtain a consent, it’s pretty rare to have a meningitis patient who is able to ride his motorbike and comes over for the consultation!” (a nurse during a training session in a healthcare center, field notes, Burkina Faso).

“[about the first page of a form where three errors have been spotted] I don’t even see what is missing here... [the clinical research assistant points to the identification number of the healthcare centre] Oh, but it’s not medically relevant, it’s

insignificant. I do medicine, ok. This is not medicine, this is just... filling.” (a doctor during a form checking session at the hospital, field notes, Burkina Faso).

The paperwork had to keep human suffering at a distance in order to maintain the pristine integrity and dignity of the form. As shown in the notes above, this created friction with the healthcare staff who, confronted with comatose patients and children’s deaths, had little time to dedicate to the aesthetics of the form and the requirements of a protocol, not considered to be part of doing medicine.

Fiche clinique

Colier ICI étiquette
d'identification du patient

Numéro du centre

Nom du clinicien ayant pris en charge le cas:.....

Identification et Résidence du cas

Nom: 	Prénom: 	Date de naissance (jour / mois / année) : / /
Sexe : <input type="checkbox"/> F <input type="checkbox"/> M	ou âge mois ou ans	
District de résidence du patient : <input type="checkbox"/> Dafra <input type="checkbox"/> Do <input type="checkbox"/> Houndé <input type="checkbox"/> Autre :		
Secteur/Village de résidence : Commune/Arrondissement.....		

Histoire de la maladie

Date de début des symptômes (jour / mois / année)	 / / 		
Notion d'hyperthermie	<input type="checkbox"/> Oui <input type="checkbox"/> Non <input type="checkbox"/> Ne sait pas		
Date d'arrivée dans le service (jour / mois / année)	 / / 		
Heure d'arrivée :	 / h / min		
Patient référé d'une autre structure de soin	<input type="checkbox"/> Oui <input type="checkbox"/> Non		
Si oui, date de référence (jour / mois / année)	 / / 		
Nom de la structure de soin ayant référé le patient			
Traitement antérieur à l'hospitalisation	<input type="checkbox"/> Oui <input type="checkbox"/> Non <input type="checkbox"/> Ne sait pas		
Antibiotique	<input type="checkbox"/> Oui <input type="checkbox"/> Non		
Si oui préciser :			
	Nom du médicament	Début du traitement	Durée du traitement
Antibiotique 1			
Antibiotique 2			
Antibiotique 3			
Antipyrétique	<input type="checkbox"/> Oui <input type="checkbox"/> Non		
Si oui préciser :			
	Nom du médicament	Début du traitement	Durée du traitement
Antipyrétique 1			
Antipyrétique 2			

Données sur la consultation

Signes cliniques (renseigner tous les items après avoir examiné le patient)	
Fièvre soudaine (rectale >38,5°C ou axillaire >38°C)	<input type="checkbox"/> Oui <input type="checkbox"/> Non <input type="checkbox"/> Ne sait pas
Si oui, valeur :	T°C :
Raideur du cou	<input type="checkbox"/> Oui <input type="checkbox"/> Non <input type="checkbox"/> Ne sait pas
Niveau de la conscience	<input type="checkbox"/> Normal <input type="checkbox"/> Obnubilation <input type="checkbox"/> Coma
Convulsions	<input type="checkbox"/> Oui <input type="checkbox"/> Non <input type="checkbox"/> Ne sait pas
Eruption cutanée (pétéchies ou purpura)	<input type="checkbox"/> Oui <input type="checkbox"/> Non <input type="checkbox"/> Ne sait pas
Si oui, est-elle extensive ?	<input type="checkbox"/> Oui <input type="checkbox"/> Non <input type="checkbox"/> Ne sait pas

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FIGURE 2. – *First page of the clinical form used in the disease surveillance conducted in Burkina Faso (obtained by the authors)*

Monitoring did not end with form filling. In Burkina Faso, once a patient was included in the study, a bodily sample was collected, the possible presence of bacteria tested, confirmed by genetic identification, and converted into digits. For carriage analysis, a

similar chain of transformations, from human bodies to a database, was implemented. Healthy people were recruited and nasal swabs conducted. The evaluative metrology had then to be extremely sensitive to the needs of pneumococcus. Germs potentially present in participants' bodies were provided with a very sheltered life within laboratories in order to feed into benchwork. They were placed in a nutritive culture medium and carefully manipulated during a series of tests. A moment of inattention and bacteria potentially extracted from people's noses would die, messing up the validity of data. The purpose of the carriage protocol was to establish the new bacterial population in circulation now that vaccination was routinized. It notably aimed to assess whether a phenomenon called serotype replacement was happening. The two vaccines bought by GAVI through the AMC were molecularly conceived to protect against a limited number of pneumococcal strains (or serotypes), 10 for GSK's vaccine and 13 for Pfizer's vaccine, whereas more than 90 strains of pneumococcus are known to exist. Epidemiological surveys had shown that the strains targeted by the two vaccines could be considered as globally the most prevalent (WHO 2008). But routine vaccination might transform the situation, leading to new strains replacing those against which vaccinated children would be protected.

Epidemiological studies funded by GAVI monitored the public health impact of having made pneumococcal vaccine available on a large-scale thanks to the market-based intervention (the AMC). The studies would make the intervention sensitive to its consequences beyond the purchase of vaccine doses. The AMC annual reports did relay some of their results, claiming "reductions in transmission of the disease" (GAVI 2015a: 30), with no further details. This piece of information was provided amid other indicators (e.g volumes purchased, vaccination coverage) through which the GAVI secretariat kept donors aware of the use of their money. Most of the complexity of epidemiological monitoring, from practical matters to serotype replacement, tended to be kept aside in such public reporting.⁶ Yet epidemiologists' work could actually indicate that the two funded vaccines did not alleviate that significantly the burden of disease. The AMC would not absorb this new concern, remaining insensitive to it, buying and delivering the existing manufactured products. Other interventions might however take it into account. Venture capitalists (for example the Bill and Melinda Gates foundation, Fidler 2014) had already started to invest in start-ups formed around early stage molecules that could become innovative vaccines better targeting the multi-strain bacterium, creating a sort of delegation and distribution of sensitivity.

The sensitivity of epidemiological monitoring to certain aspects of a population's health (translating diseases into forms) was combined with insensitivity to other aspects (the on-

⁶ For an idea of this public reporting beside the AMC annual reports see the webpage: <http://www.gavi.org/funding/pneumococcal-amc/>.

going deaths of children at the hospital) so that cases could be counted, occurrence calculated and evidence produced to assess impact, and track changes in disease patterns and types of pathogens. Although the AMC would remain focused on supplying the two existing pneumococcal vaccines, metrological investigation into the effect of vaccination might reveal the need to innovate and create a new product. What this shows is that sensitivity and insensitivity do not cease for as long as the market-based intervention continues. New issues arise and need to be dealt with or at least considered and ignored. Relations of accountability and who and what is responsible for whom and what need to be recalibrated as these forms of metrological sensitivity and insensitivity are re-shuffled. What we find with the entry of venture capitalists into the field of pneumococcus is that relations of accountability and responsibility move outside the particular market-based intervention examined here (the AMC); metrology and its attendant sensitivities and responsibilities can be taken on by other actors towards other ends (start-ups and innovation).

Conclusion

This article has examined the development of an Advance Market Commitment designed to deliver pneumococcal vaccines to low income countries. The AMC has been used to explore the ways in which such market-based interventions oriented toward solving public problems stimulate new requirements and configurations of governance. We have suggested that in order to make sense of these types of intervention wherein anticipated market relations are focused around exchange, the stimulation of market actors such as pharmaceutical firms and investments from donors that forecast returns in the form of health benefits, we need to understand how forms of governance depend on a specific metrological structure. To understand the latter requires close scrutiny of accountability and forms of (in)sensitivity. We drew on the work of Callon and Muniesa (2005), Law (1996), and Pollner (1974) to consider how metrology and its devices set particular kinds of demands for including and excluding modes of counting and accounting, along with items that will and will not count. We suggested that ethnomethodological work can be used as a basis for expanding this focus on who and what will count to investigate who and what will be responsible and accountable for whom and what. We used the term sensitivity as a basis for working through who and what gets to count, on what terms, through specific methods for recognising and demonstrating awareness of emerging problems. As a market-based intervention into public problems, the AMC thus steered away from the high drama of capitalization and assetization toward an exchange-based model that mixed together economic notions such as investment with more typical public administration activities (such as measurement) characteristic of overseas aid.

We used these ideas to pose three questions. How do market-based interventions create the

terms on which people and things become participants of the metrological world being devised? How is metrology made selectively sensitive in making entities participants in the world of the market-based intervention and with what consequence? How does metrology participate in counting, accounting, and being accountable for intervention? Addressing these questions, we organised our inquiry into three aspects of the AMC. First, we looked at price computation. Here we analysed the work of experts in, for example, value for money calculations conceived through economic modelling and the testing of price ranges. We suggested that the AMC had to strike a balance in being sensitive to potentially incommensurate demands of donors and private pharmaceutical firms. The balance, we argued, established a complicated demand for sensitivity, in trying to satisfy and combine distinct demands from different organisations. Pricing also could only continue to exist in a sensible form by being insensitive to other conditions, such as those expressed by emerging country manufacturers.

Second we looked at the challenges of meeting a market demand. Here demand forecasting provided the basis for a metrological foregrounding of some concerns (for example, which countries would demand what numbers of vaccine doses) and dismissal of alternative concerns (for example, the choices that national governments expressed regarding their vaccine preferences).

Our final empirical section looked at impact monitoring. For monitoring to succeed, a metrological practice was required in the shape of forms, specific form filling practices and other corroboratory data demonstrating that the completed forms were correct. Surveillance of the form filling seemed to be a requirement for ensuring that metrological sensitivity (taking into account all the things that needed to be taken into account) also equated to metrological certainty (that all the items accounted for, had been accounted correctly). Once again this sensitivity was combined with insensitivity as paperwork practices had to keep human suffering at a distance in order to maintain the pristine integrity and dignity of the form. What we found as we ended our study was that sensitivity and insensitivity required continued (re)calibration. With the emergence of new interventions triggered by the outcomes of impact monitoring (e.g. a need for innovation in the field of pneumococcus to develop better vaccines), new actors and issues would arise and relations of accountability would need to be re-worked.

This combination of metrology, accountability, sensitivity and insensitivity leads us to make five concluding remarks regarding the nature of governing market-based interventions oriented towards solving public problems.

First, mundane metrology seems to be a requirement for market-based interventions in order to give them regulatory purpose and effect. Without metrology as a demonstrable practice and set of devices and without metrological results, action would appear to be

difficult. Mundane metrology is crucial to translating (and adjusting) loosely defined normative policy goals into action.

Second, what we have termed sensitivity—the ability to recognise and take into account problems as they arise and require attention—also appears to be a requirement to ensure mundane metrology survives interventions into public problems where demands from multiple parties proliferate. Sensitivity provides the basis on which people and things can become of the world of the intervention.

Third, metrological sensitivity cannot exist without insensitivity. To attempt to take everything into account would prove impossible, creating an overwhelming flood of traces that would need to be continually kept at bay. Insensitivity is thus also a practical matter for deciding what will not count, what will be kept out of the metrological world of the intervention in order to get on with the practical matters to hand.

Fourth, insensitivity provides an important basis for limiting accountability. It is not just that insensitivity sets limits on what will and will not count; by not counting, by not making some people and things of its metrological world, the intervention can pre-empt and avoid future accountability concerns. To count some matter may be to become accountable for some matter.

Fifth, metrological devices and practices, combined with forms of sensitivity and insensitivity, are ceaseless; they are continually checked and if necessary recalibrated for as long as an intervention continues.

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References

Birch, K. (2017) 'Rethinking *Value* in the Bio-economy: Finance, Assetization, and the Management of Value' *Science Technology and Human Values* 42(3): 460-490.

Boston Consulting Group (BCG) (2015, December) *The Advance Market Commitment*

Pilot for Pneumococcal Vaccines: Outcomes and Impact Evaluation. Retrieved from: <http://www.gavi.org/results/evaluations/pneumococcal-amc-outcomes-and-impact-evaluation/>

Callon, M. (1998) 'An essay on framing and overflowing: economic externalities revisited by sociology'. In *The Laws of the Market*, edited by M. Callon, 244-269, Oxford: Blackwell Publishers.

Callon, M. and Muniesa, F. (2005) 'Economic Markets as Calculative Collective Devices' *Organisation Studies* 26(8): 1229-50.

Cernuschi, T., Furrer E., McAdams S., Jones A., Fihman J., and Schwalbe N. (2011) *Pneumococcal Advance Market Commitment: Lessons Learnt on Disease and Design Choices and Processes*. The GAVI Alliance White Paper.

Cutts, F.T., Zaman S. M. A., Enwere G. Y., Jaffar S., Levine O. S., Okoko J. B., ... and Adegbola R. A. (2005). 'Efficacy of nine-valent pneumococcal conjugate vaccine against pneumonia and invasive pneumococcal disease in The Gambia: Randomised, double-blind, placebo-controlled trial' *The Lancet*, 365(9465), 1139-1146.

Dalberg (2013, February) *The Advance Market Commitment for Pneumococcal Vaccines: Process and Design Evaluation*. Retrieved from: <http://www.gavi.org/results/evaluations/pneumococcal-amc-process---design-evaluation/>

Doganova, L. and Muniesa, F. (2015) 'Capitalization Devices: Business Models and the Renewal of Markets'. In *Making Things Valuable*, edited by M. Kornberger, L. Jutesen, J. Mouritsen, and A. K. Madsen, 109-25. Oxford, UK: Oxford University Press.

Dourish, P. (2004). *Where the Action is: The foundations of embodied interactions*. Cambridge, MA: MIT Press.

Fidler, B. (2014, October) 'Backed by Gates, Affinivax Ramps up Velcro-like Vaccine Tech'. Retrieved from: <http://www.xconomy.com/boston/2014/10/30/backed-by-gates-affinivax-ramps-up-velcro-like-vaccine-tech/>

Garfinkel, H. (1967) *Studies in ethnomethodology*, Englewood Cliffs, N.J.: Prentice-Hall

GAVI the Vaccine Alliance (2008a, April) *Advance Market Commitment for pneumococcal vaccine: Expert group report*. Retrieved from: <http://www.gavi.org/library/gavi-documents/amc/>

GAVI the Vaccine Alliance (2008b, July) *Advance Market Commitment for pneumococcal vaccine: Implementation working group report*. Retrieved from:

<http://www.gavi.org/library/gavi-documents/amc/>

GAVI the Vaccine Alliance (2009, June) Pneumococcal Vaccine Strategic Demand Forecast. Retrieved from: <http://www.gavi.org/funding/pneumococcal-amc/manufacturers/remaining-amc-offer/>

GAVI, The Vaccine Alliance (2013) *Advance Market Commitment for Pneumococcal Vaccines: Annual Report, 1 April 2012 - 31 March 2013*.

Retrieved from: <http://www.gavi.org/funding/pneumococcal-amc/>

GAVI, The Vaccine Alliance (GAVI) (2015a) *Advance Market Commitment for Pneumococcal Vaccines: Annual Report, 1 January 2015 – 31 December 2015*. Retrieved from: <http://www.gavi.org/funding/pneumococcal-amc/>

GAVI, The Vaccine Alliance (GAVI) (2015b) *Every child counts: The Vaccine Alliance progress report 2014*. Retrieved from: <http://www.gavi.org/results/gavi-progress-reports/>

GAVI the Vaccine Alliance, and the International Bank for Reconstruction and Development (GAVI and IBRD) (2011, March) *Offer Agreement relating to the Advance Market Commitment for Pneumococcal Vaccines*. Retrieved from: <http://www.gavi.org/funding/pneumococcal-amc/amc-legal-agreements/>

Kremer, M. (2000a) 'Creating markets for new vaccines - Part I: Rationale'. NBER Working Paper Series, Working paper 7716.

Kremer, M. (2000b) 'Creating markets for new vaccines - Part II: Design issues'. NBER Working Paper Series, Working paper 7717.

Latour, B. (1987) *Science In Action: How to Follow Scientists and Engineers Through Society*. Milton Keynes: Open University Press.

Law, J. (1996) 'Organizing accountabilities: ontology and the mode of accounting'. In *Accountability: Power, Ethos & Technologies of Managing* edited by R. Munro and J. Mouritsen, 283-306. London: International Thomson Business Press.

Levine, O. S., Cherian T., Shah R., and Batson A. (2004) 'PneumoADIP: an example of translational research to accelerate pneumococcal vaccination in developing countries'. *Journal of Health, Population and Nutrition*, 268-274.

Levine, R., Kremer M., and Albright A. (2005) *Making Markets for Vaccines: Ideas to action*. Report of the Center for Global Development Advance Market Commitment Working Group.

Lynch, M. (1993) *Scientific Practice and Ordinary Action. Ethnomethodology and Social Studies of Science*. Cambridge: Cambridge University Press.

Médecins Sans Frontières (MSF) (2011, June 10). 'GAVI money welcome but could it be more wisely spent?', Retrieved from: <http://www.msf.org.uk/article/gavi-money-welcome-could-it-be-more-wisely-spent>

Médecins Sans Frontières (MSF) (2015, January). *The right shot: Bringing down barriers to affordable and adapted vaccines*. Second edition, Access campaign. Retrieved from: <http://www.doctorswithoutborders.org/article/right-shot-bringing-down-barriers-affordable-and-adapted-vaccines-2nd-edition>

Muniesa, F., Millo Y. and Callon M. (2007) *Market Devices*. Blackwells: Oxford

Neyland, D. and Coopmans, C. (2014) 'Visual Accountability' *Sociological Review* 62(1): 1-23.

Pollner, M. (1974) *Mundane Reason: Reality in everyday and sociological discourse*. Cambridge: Cambridge University Press.

Sacks, H. (1972) 'Notes on police assessment of moral character'. In *Studies in Social Interaction* edited by D. Sudnow, 280–293 . New York: Free Press

Sinha A., Levine O., Knoll M. D., Muhib F., and Lieu T. A. (2007). 'Cost-effectiveness of pneumococcal conjugate vaccination in the prevention of child mortality: an international economic analysis'. *The Lancet*, 369(9559), 389-396.

Tremonti, G. (2005) *Background papers to Advanced Market Commitments for vaccines: A new tool in the fight against disease and poverty*. Report to the G8 Finance Ministers, London, 2 December 2005.

Woolgar, S. and Neyland, D. (2013) *Mundane Governance: Ontology & Accountability*. Oxford: Oxford University Press.

World Health Organization (WHO) (2008, December 18). *Part II: Target Product Profile (TPP) for the Advance Market Commitment for Pneumococcal Conjugate Vaccine: Supplementary Information*. Retrieved from: <http://www.gavi.org/library/gavi-documents/amc/>