International Journal of
Men's Social and Community Health

doi: 10.22374/ijmsch.v3i1.20

EVALUATION OF THE PSYCHOMETRIC PROPERTIES OF A VERSION OF THE LONDON MEASURE OF UNPLANNED PREGNANCY FOR WOMEN'S PARTNERS

Geraldine Barrett, MSc, PhD[1]; Jennifer A. Hall, MSc, PhD[1]; Beth Howden, MSc[2]; Dilisha Patel, MSc[1]; Jill Shawe, MSc, PhD[3]; Judith Stephenson, FFPH[1]

[1]Research Department of Reproductive Health, UCL Elizabeth Garrett Anderson Institute for Women's Health, University College London, London, UK.

[2]Bristol Medical School, University of Bristol, Bristol, UK.

[3]Institute of Health and Community, University of Plymouth, Plymouth, UK.

Author for correspondence: Geraldine Barrett, MSc, PhD: g.barrett@ucl.ac.uk

ABBREVIATIONS

CFA – Confirmatory factor analysis
LMUP – London Measure of Unplanned Pregnancy
PCA – Principal components analysis
SD – Standard deviation

ABSTRACT

Background

The role of women's partners in pregnancy planning has gained importance with the development of preconception care. The measurement of pregnancy planning/intention has also changed in the last two decades with the development of psychometric measures such as the London Measure of Unplanned Pregnancy (LMUP). This analysis aimed to evaluate the psychometric properties of a version of the LMUP for women's partners in the UK.

Methods

The LMUP items, adapted for completion by partners, were piloted and included in a survey of (mainly male) partners in three antenatal clinics in London, UK, as part of a study of pre-pregnancy health and care. The psychometric properties of the partner LMUP were assessed according to the principles of Classical Test Theory.

Results

There were 575 partners of pregnant women in the sample, 573 (99.7%) being men. There were high completion rates for all the LMUP items. The distribution of LMUP scores ranged from 1–12, with a negative skew (biased towards planned/intended pregnancies). In terms of reliability (internal consistency), Cronbach's alpha was 0.69, item-rest correlations were >0.2 for five items, and all inter-item correlations were positive. In terms of construct validity, principal components analysis showed that measurement was unidimensional, confirmatory factor analysis showed good model fit, and the convergent validity hypothesis of non-perfect, moderate-to-good agreement between couples' LMUP scores was met.

Conclusions
The partner LMUP performed well in terms of reliability and validity according to internationally-accepted criteria for the performance of psychometric measures and can be used in future research on men and couples. However, we recommend further research relating to the concept of pregnancy planning/intention among partners of all gender identities to understand whether additional content would enhance the measurement of the construct. In particular, we recommend further conceptual exploration with men who have experienced unplanned pregnancies.

Keywords: *Pregnancy; Intention; Planning; Unplanned; Unintended; Psychometric; Validation; Measurement; Preconception, Men*

BACKGROUND

Much attention has been paid to the measurement of pregnancy planning/intention in the last two decades, with new ways of measuring this concept being proposed.[1–3] The focus of these new measurement efforts has been with women. This is unsurprising given that national and international estimates of pregnancy planning/intention have, for the last 70 years, been based on data from women.[4–10] This is not to say that the role of men has gone unrecognized: for instance, the international Demographic and Health Surveys have always included male interviews as part of the household survey, asking about many aspects of fertility and reproductive health; the U.S. National Survey of Family Growth has included a survey of men, with questions on pregnancy intention, since 2006[11,12]; and there have been other national and sub-national studies which have focused on couples or men, with perspectives on male pregnancy intention reported by the man.[13–21] However, it is only more recently, particularly with the development of interventions around preconception health and care,[22–26] that the role of men in planning for pregnancy has gained new importance. There has been for some time recognition of the importance of men in all aspects of women's reproductive health and a call for their greater involvement in both research and health care.[27–30]

As with women, the measurement of pregnancy intention among men, when it has happened, has tended to be by a single survey question or by a set of survey questions such as those used by the U.S. National Survey of Family Growth.[11,12] In contrast, the newer methods of measurement used with women have employed psychometric measurement techniques thereby providing more valid and reliable measurement. The rationale behind psychometric measures is that the construct of interest (or latent-trait) is not easily observed with a single question, and therefore psychometric/statistical techniques are used to combine multiple items that can then be used to produce a scale that relates to the construct of interest. Of the new measures, the London Measure of Unplanned Pregnancy (LMUP), which was developed in the UK, has been the most widely used, with, to date, 16 evaluated language versions across 11 countries[1,31–40] and many more psychometric evaluation studies currently in progress.[41]

The LMUP comprises six items covering contraceptive use, the timing of motherhood, intention, desire for a baby, discussion with the partner, and pre-conceptual preparations. The items are scored 0, 1, or 2, giving a total from 0 to 12, with each increase in score representing an increase in the degree of pregnancy intention. The questions relate to pregnancies that have already occurred, with women recalling the time around conception. Compared with other questions used to assess pregnancy intention, the LMUP has several advantages: it has established psychometric properties; its development was based on lay views; it does not rely on women having fully formed childbearing plans; it does not assume a particular form of a family building; it does not assume that women have clearly defined intentions and/or actions consistent with intentions; and it is suitable for use with any pregnancy regardless of the outcome, i.e. birth, abortion, or miscarriage.[1] The LMUP was

developed to produce valid and reliable population prevalence estimates of pregnancy planning/intention. It has also been used in many studies in which pregnancy intention/planning is a variable of interest. More recently, it has been recommended as an outcome measure concerning preconception care.[42,43]

The LMUP has now been adapted several times for administration to women's partners because of the need for a comparable measure of pregnancy intention when researching couples.[44–48] The first adaptation was in the UK when a screening tool was needed to find young men with planned pregnancies for an interview study.[44] Subsequent adaptations for men were in Sweden and Malawi.[45,47] In keeping with international guidelines,[49–51] an analysis of the psychometric properties of the adapted measure is required to know whether an adaptation for partners is valid. So far, the only evaluation of psychometric properties that has been carried out has been with the Malawian Chichewa-language version for men, which showed excellent psychometric properties. No similar analysis has been carried out in the UK. This study aims to evaluate the psychometric properties of the LMUP adapted for use with women's partners in the UK.

METHODS

The data for this analysis were collected as part of the UK Department of Health-funded "Pre-pregnancy Health and Care in England" project, findings of which have been reported elsewhere.[48,52–56] The study was approved by the National Research Ethics Service, NRES Committee London – Bromley (REC reference 11/LO/0881).

We carried out a cross-sectional survey of the partners of pregnant women who were attending antenatal clinics at three hospitals in London. The pregnant women themselves were also surveyed at the same time. Findings from both surveys have already been reported.[48,53,56] Convenience sampling was used; all partners in the clinic waiting rooms were approached by a researcher and invited to participate. Potential participants were given the project information sheet and allowed time to consider whether they wished to participate, and a record of refusals was kept. In keeping with the terms of our research ethics approval, consent was implied by the completion of the paper questionnaire. No identifiable data were collected. The items of the questionnaire, for the most part, mirrored those of the women's survey. From observation in clinics, we could see that couples generally completed their questionnaires independently, without discussion.

The six LMUP items, contained in the middle of the partner questionnaire, had minor adaptations which made them suitable for completion by partners (which at the start of the study we assumed to be men), for instance, wording change such as "your partner" instead of "you", "...for her to be pregnant" instead of "you to be pregnant", "her pregnancy" instead of "your pregnancy", etc.[57] The only gender-specific phrase included was "becoming a father" in item 2. Five of the adapted questions (items 1–5) had previously been used with young men in a study of teenage pregnancy.[44] Other questions in the survey questionnaire covered topics such as sources of pre-pregnancy care and advice, pre-pregnancy consumption of vitamin, mineral and other supplements, behaviour change once pregnancy was confirmed, and health and sociodemographic information. The partner questionnaire was piloted with a diverse reproductive health user group which comprised service users and members of the local community. The LMUP items appeared to be well understood and acceptable to participants.

Data entry of the questionnaire data was carried out by a professional data entry company (Abacus), and the data were cleaned and verified by study researchers (BH and DP). The anonymous data were stored on secure UCL password-protected servers. Data analysis was carried out using Stata 15. The psychometric properties of the partner LMUP were assessed according to the principles of Classical Test Theory, which underpinned the development of the original LMUP:

Missing Data and Targeting

The level of missing data for each item was assessed because high levels of missing data can indicate a problem with the understanding or acceptability of an item.[58] Ideally, missing data should be less than 10% or, more stringently, 5%, with the latter figure used in the original LMUP development and evaluation study as a criterion for initial item selection.[1]

As with the original LMUP, respondents who had answered three or more LMUP items were eligible for the imputation of missing data and calculation of a total LMUP score.[1] The distribution of total scores was examined to assess the targeting of the scale. Item discrimination was assessed by examination of the endorsement of item response options; in the original LMUP development and evaluation study, values of <80% for a single response option were a criterion for initial item selection.[1]

Reliability

Reliability (internal consistency) was evaluated using Cronbach's alpha,[59] using the standard cut off point of 0.7.[51,60] Also, item-rest correlations (i.e., the correlation of the item with the other items in the measure) were calculated (>0.2 considered acceptable)[60,61] and inter-item correlations were examined to check that they were all positive. The stability of the partner LMUP, in terms of test-retest reliability, was not assessed as the survey was anonymous and therefore no two-week follow up could be carried out.

Validity

The construct validity of the partner LMUP was assessed in several ways. First, in keeping with previous evaluations of the LMUP, the structural validity of the scale was assessed using principal components analysis. The partner LMUP was considered valid if all items loaded onto one component with an Eigenvalue larger than 1, meaning that they were all measuring the same construct.[62] Further, in keeping with recently recommended standards of assessment,[63] confirmatory factor analysis was also carried out to assess model fit (in this case the six items to a unidimensional model). Model fit was assessed by the CFI (comparative fit index, >0.95 indicating acceptable model fit) and SRMR (standardized root mean squared residual, <0.08 indicating acceptable model fit). Finally, convergent validity was assessed by examining the association of the partner LMUP scores with the scores of the pregnant women (i.e. scores relating to the same pregnancy). The relationship was examined visually using a scattergram with a line of best fit, and assessed using Spearman's Rho correlation coefficient for non-parametric data, Cohen's kappa with quadratic weights, a measure of agreement, and the linear regression coefficient (R^2). Landis and Koch suggest the following interpretation of the kappa coefficient: 0.41–0.60, moderate; 0.61–0.80, substantial; and 0.81–1.00, almost perfect agreement.[64] We hypothesized that the scores should be significantly related, albeit without perfect agreement as partners within a couple may have genuinely differing perceptions about the same pregnancy. It was not possible to assess concurrent criterion validity of the partner LMUP (i.e., to use a currently available external criterion to assess validity) as no agreed "gold standard" validated measure currently exists for this construct.

Scaling

Finally, as with several evaluations of the LMUP for pregnant or recently pregnant women,[32,35,38] a Mokken scaling procedure (monotone homogeneity assumption) was carried out as an exploratory analysis based on the principles of modern test theory (as opposed to Classical Test Theory). Items with a Loevinger H coefficient of 0.3 or above were eligible for scaling.[65,66] (The Loevinger H coefficient relates to Guttman errors, with a lower H value indicating more observed Guttman errors.) The results of Mokken analysis allows investigators to see whether the items conform to a probabilistic Guttman structure, for example, that items vary in 'difficulty', some being easy to endorse, some being more difficult to endorse, and that respondents who have a particular level of the construct (in this case pregnancy planning/intention) broadly endorse items up to the level of their construct and then do not endorse items beyond that. The whole scale is also assessed by the Loevinger H coefficient, with <0.4 meaning the scale is "weak", 0.4–0.49 meaning that the scale is "medium", and >0.5 meaning that the scale is "strong."[65] The construction of an adequate scale confirms that the raw score can be used to order respondents on the construct being measured.[66]

RESULTS

Sample

Of the 624 partners of pregnant women attending clinics invited to take part in the survey, 575 (92%) completed a questionnaire. The majority of the partners

were men, aged over 30 years, and working full-time (Table 1). Two-thirds of the sample were educated to degree level, and about three-quarters classified themselves as white. The 575 partners related to approximately half of the participants in the women's survey (Table 2). Pregnant women who were from ethnic minority groups or had below degree level education were significantly less likely to have a partner who completed a partner survey questionnaire (Table 2). The LMUP scores of the women who had a partner participating in the survey (mean 10.1, SD 2.4) were slightly, but significantly, higher than those who did not (mean 9.7, SD 2.6) (Mann Whitney U, $p<0.001$).

Missing Data and Targeting

There were low levels of missing data for all the LMUP items (Table 3). Of the 575 partners, 98.3% (565) completed three or more LMUP items and therefore were eligible for calculation of a full LMUP score. Total LMUP scores ranged from 1 to 12 (mean 9.7, SD 2.1, median 10, inter-quartile range 2), with a strong negative skew (Figure 1). The item responses showed the bias towards higher scoring response options on items 1–5, with item 6 showing a different response pattern (Table 3).

Reliability

The Cronbach's alpha for the six LMUP items was 0.69. The item-rest correlations were above 0.2 for items 1-5, and 0.15 for item 6 (Table 4). Without item 6, the Cronbach's alpha for the remaining items was 0.80. All inter-item correlations were positive. The relationship between item 6 and the total LMUP score showed the expected pattern of positive association.

Validity

The principal components analysis showed that all items loaded onto one component (Eigenvalue = 2.8). Component loadings were moderate to high for items 1–5, and lowest for item 6 at 0.22 (Table 4). Confirmatory factor analysis showed model fit (CFI =

TABLE 1 Sociodemographic Characteristics of Partner Sample

Partners' characteristics	% (n)
Gender (n=575)	
Male	99.7 (573)
Female	0.3 (2)
Ethnicity (n=519)	
White	73.8 (383)
Mixed	4.4 (23)
Asian	12.1 (63)
Black	6.6 (34)
Other	3.1 (16)
Academic qualification (n=508)	
Degree or above	66.7 (339)
Below degree	33.3 (169)
Age group (n=575)	
<25	3.7 (21)
25-29	12.5 (72)
30-34	34.3 (197)
35-39	23.8 (137)
40+	25.7 (148)
Employment status (n=519)	
Full-time (35 or more hours per week)	84.0 (436)
Part-time (<35 hours per week)	6.9 (36)
Unemployed	4.0 (21)
Long term sick/disability	0.4 (2)
Full-time education	2.3 (12)
Other	2.3 (12)

TABLE 2 Women's Survey: Those Whose Partners Completed a Questionnaire

Women's characteristics	% (n) whose partners completed questionnaire	P value	Adjusted odds ratio* (95% confidence interval)	P value
All women (1173)	49.0 (575)	-	-	-
Who women live with:		0.007		0.283
Husband	46.8 (328)		1.00	
Partner	48.9 (114)		1.16 (0.85-1.59)	
Not husband or partner	31.0 (31)		0.77 (0.47-1.25)	
Ethnicity		<0.001		<0.001
White	47.7 (336)		1.00	
Mixed	41.4 (24)		0.83 (0.47-1.48)	
Asian	50.8 (61)		1.19 (0.79-1.78)	
Black	18.8 (19)		0.30 (0.18-0.52)	
Other	57.6 (34)		1.44 (0.82-2.51)	
Academic qualification		<0.001		<0.001
Degree or above	51.8 (332)		1.00	
Below degree	35.4 (135)		0.55 (0.42-0.73)	
Age		0.647	-	-
<25	45.1 (37)			
25-29	44.7 (92)			
30-34	48.4 (203)			
35-39	44.5 (114)			
40+	39.7 (27)			

**Each odds ratio adjusted for other variables in the model*

FIG. 1 Histogram of partner LMUP scores.

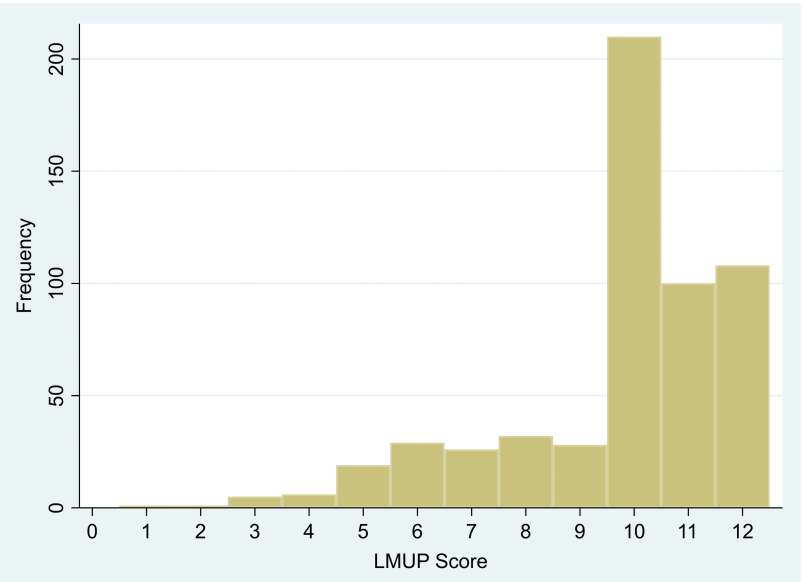


TABLE 3 Frequencies of Partner LMUP Item Response Options

Item no.	Summary of item content	% (n)
1	In the month that your partner became pregnant...	
	0. Always used contraception	1.6 (9)
	1. Inconsistent use/Failure	7.1 (41)
	2. Not using contraception	87.5 (503)
	missing	3.8 (22)
2	In terms of becoming a father...	
	0. Wrong time	0.9 (5)
	1. Ok, but not quite right time	12.5 (72)
	2. Right time	84.4 (485)
	missing	2.3 (13)
3	Just before your partner became pregnant...	
	0. Did not intend to get pregnant	12.5 (72)
	1. Intentions kept changing	8.0 (46)
	2. Intended to get pregnant	76.4 (439)
	missing	3.1 (18)
4	Just before your partner became pregnant...	
	0. Did not want a baby	1.6 (9)
	1. Had mixed feelings about having a baby	14.3 (82)
	2. Wanted to have a baby	80.7 (464)
	missing	3.5 (20)
5	Before your partner became pregnant...	
	0. Never discussed having children together	1.6 (9)
	1. Discussed but had not agreed	15.1 (87)
	2. Agreed we would like her to be pregnant	80.9 (465)
	missing	2.4 (14)
6	Before pregnancy...	
	0. No pre-pregnancy actions	52.5 (302)
	1. One pre-pregnancy action	21.6 (124)
	2. Two or more pre-pregnancy actions	19.7 (113)
	missing	6.3 (36)

TABLE 4 Item-Rest Correlations, Component Loadings, and Loevinger H Values

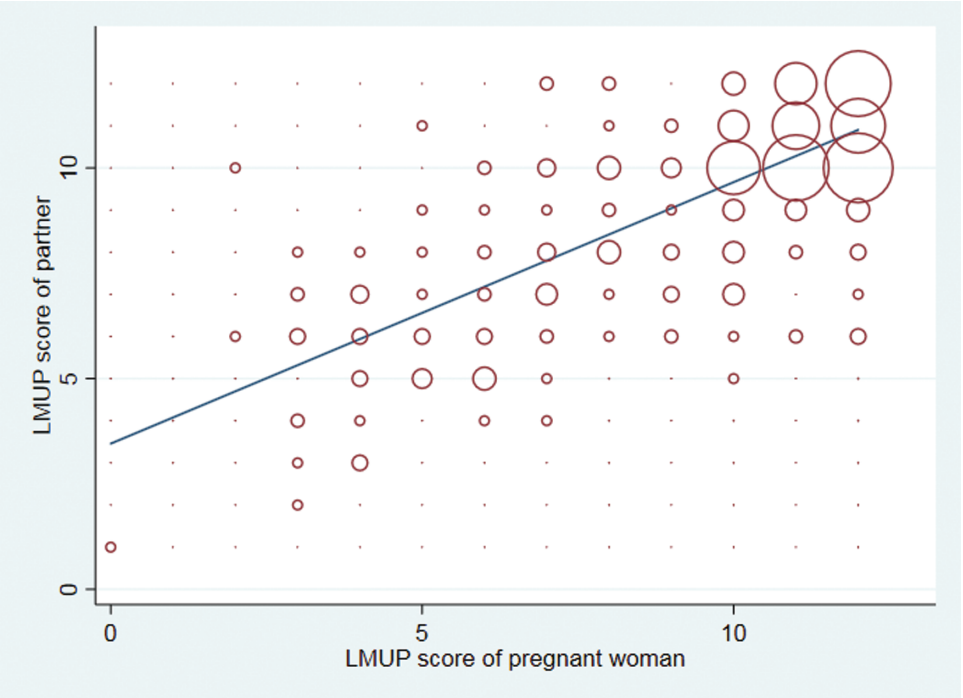
Items	Item-rest correlations	PCA: Component loadings	CFA: Factor loadings	Mokken: Loevinger H
1 – contraception	0.38	0.58	0.44	0.44
2 – timing	0.45	0.68	0.55	0.43
3 – intention	0.66	0.87	0.91	0.60
4 – desire	0.55	0.74	0.59	0.45
5 – discussion	0.63	0.83	0.81	0.58
6 - preparations	0.15	0.22	0.16	0.34

CFA = confirmatory factor analysis; PCA = principal components analysis

0.97 and SRMR = 0.038), with moderate to high factor loadings for items 1–5, with item 6 at 0.16 (Table 4).

LMUP scores for both pregnant women and their partners were available for 519 couples. (The LMUP scores of the 519 partners with corresponding female partner scores were not significantly different to the 46 partners without a corresponding female partner score, such as respectively, mean 9.75, SD 2.04 versus

FIG. 2 Scattergram of couples' LMUP scores.



9.48, SD 2.39, Mann Whitney U test, p=0.652.) The relationship between the scores of the 519 couples is shown in Figure 2. Of the 519 couples, 30.8% (160) had the same LMUP score, 36.6% (190) were one score apart, 21.6% (112) were two scores apart, 6.2% (32) were three points apart, and 4.8% (25) were four or more points apart. The mean LMUP score of the female partners was 10.14, SD 2.41 compared with 9.7, SD 2.1 (as reported above), Wilcoxon matched pairs test, p<0.001. For the 519 couples' scores, Spearman's rho was 0.57 (p<0.001), weighted kappa 0.71, and R^2 0.54.

Scaling

The Mokken analysis showed that the items conformed to a basic Guttman structure with all Loevinger H values above 0.3 (Table 4). Items 1, 2, 4, and 5 differed only slightly in their difficulty to endorse (ranging from item 2 at 0.008 to item 1 at 0.016), followed by item 3 (0.129), and item 6 (0.560) being the most difficult to endorse. The Mokken Scaling Procedure selected five items into the scale (items 1-5) giving a Loevinger H coefficient of 0.56 for the overall scale. Retaining item 6 in the scale gave a Loevinger H coefficient of 0.50.

Discussion

Overall, our analysis showed that the partner LMUP performed well according to internationally-accepted criteria for the performance of psychometric measures, and remarkably like the women's LMUP as originally developed and in subsequent evaluations. Notably, the partner LMUP appeared to be well understood, acceptable, and had high levels of item completion. The measurement was demonstrated to be unidimensional, with relationships between the items following the same pattern as seen in the women's LMUP (i.e., with items 2–5 most strongly correlated with the overall score, and the behaviour-related items,1 and 6, less strongly correlated, and all items positively correlated with each other), plus acceptable reliability.

Only one other study has examined the psychometric properties of the LMUP adapted for partners. Yeatman and Smith-Greenaway[47] adapted the women's Chichewa LMUP[33] for Malawian men, including modification of item 6 (pre-conceptual preparations)

to suit the local context, followed by pre-testing and piloting. They found a bi-modal distribution of LMUP scores (similar to the Malawian women in their sample) and excellent psychometric properties. In terms of reliability/internal consistency, Cronbach's alpha was 0.91 and all item-rest correlations >0.2 (with a pattern of correlations similar to that of the women in their sample, which is also similar to that found internationally). In terms of construct validity, principal components analysis showed that measurement was unidimensional and hypothesis testing showed that the LMUP scores performed in the way expected. The Malawian sample, with its full range of pregnancy intention (notably, there is no legal abortion in Malawi) provides reassurance that excellent psychometric properties are possible (including for item 6, pre-conceptual preparations) when the full range of the construct is present.

The reliability (internal consistency) of the partner LMUP was at the threshold of the accepted standard (Cronbach's alpha >0.7) for group-level comparisons, and without item 6 (pre-conceptual preparations) the alpha increased to 0.8. We believe that the sample composition and endorsement patterns (i.e., the skew toward more planned pregnancies due to the sample being of men attending antenatal care) affected the alpha value and we recommend retaining item 6 for reasons of content validity in line with recommendations[51,61] and future evaluation. Preconception care for men is likely to develop over time as part of the wider development of preconception care.[67,68] The modification of item 6 to fit local circumstances (i.e., listing pre-conceptual preparations that are most relevant to a particular population) is well established with the women's LMUP and in future or other contexts, if necessary, item 6 in the partner LMUP can be extended or adjusted to optimize relevant content.

The construct validity of the partner LMUP was excellent. In terms of structural validity, both the principal components analysis and the confirmatory factor analysis showed that measurement was unidimensional, even with the lower component/factor loading of item 6 (pre-conceptual preparations). In terms of convergent validity, our hypothesis of non-perfect, moderate-to-good agreement between partners in their assessment of the same pregnancy was met. The presence of couples' LMUP scores in this analysis is a strength.

In terms of content validity, no issues or problems with the understanding of the LMUP items were raised and there were very few missing data in our study (the most on item 6, pre-conceptual preparations). However, although there was piloting of the partner LMUP before use in the main study, there were no cognitive interviews so we have not conducted a comprehensive investigation here. Further, our main concern is that there may be other aspects of pregnancy intention/planning which are unique to men/partners that are not captured by the partner LMUP. We did not carry out our own independent qualitative fieldwork, such as a body of in-depth interviews focused on men's/ partner's conceptualizations of pregnancy intention/ planning. There is relatively little existing qualitative work to draw on but what is available suggests that men's conceptualizations of pregnancy intention largely overlap with women's.[69] There may, however, be other aspects too. For instance, a range of ideas about responsibility for pregnancy exist,[70–75] there appears to be an ideal of financial stability as a pre-requisite for pregnancy planning,[72,76,77] and there is a possible pejorative discourse of unintended pregnancy as entrapment among a minority of men.[69,71]

Our sample included two female partners. Our partner questionnaire was originally focused on partners being of the male gender but we quickly realized during data collection that there would be some female partners. The wording of the partner LMUP was gender-neutral apart from the phrase "in terms of becoming a father" in item 2 (one female partner omitted the item, the other answered). Both female partners answered sufficient items to have a total LMUP score. So, although not perfect, the partner LMUP appeared to be usable by female partners. It would be possible, if desired, to change the phrase in item 2 to "in terms of becoming a parent" to ensure completely gender-neutral wording. However, social and legal change in the UK has been rapid over the last 10–15 years, the trend towards same-sex couples having children is set to increase, and the awareness of the needs of same-sex couples (and other modern forms of family formation) by researchers, including ourselves, and maternity services has grown. In the

longer term, further work to assess the content validity of the partner LMUP among partners (including male, female, trans, non-binary, etc) may determine whether separate partner versions for men and other groups may be a more suitable way forward.

Limitations

The sample was a convenience sample of partners (mainly men, but also two women) who were in antenatal clinics. Therefore, they were likely to be the partners who had personal employment circumstances that allowed them to attend the clinic and possibly were those who were more invested in their partner's pregnancy. Our sample was under-represented in terms of the partners of black and mixed ethnicity women, those with below degree level education, and those not living with a partner, all factors known to be associated with unplanned pregnancies. Also, being a sample drawn from antenatal clinics, pregnancies ending in abortion were excluded. The overall effect of this sample composition was that lower intention pregnancies were under-represented. In Classical Test Theory (the basis for this analysis), the composition of the sample and the distribution of the construct (pregnancy planning/intention, which we know is highly socially patterned) can affect the psychometric properties produced. For instance, the endorsements of item response options on items 1-5 included some very high values (the bias towards planned pregnancies), and these values would likely be more in the mid-range in a more balanced sample. Similarly, therefore, item 6 (pre-conceptual preparations) with its lower endorsement stands out as different from the other items in this analysis, appearing to perform less well. Nearly half the sample reported at least one pre-conceptual preparation and this "poorer" performance of the item is likely an artefact of the pattern of endorsements. There is no suggestion that the item was irrelevant, nor that it was being misunderstood. Overall, even with the under-representation of unplanned pregnancies in the sample and its effect on item endorsement patterns, the partner LMUP performed well in terms of its psychometric properties.

As the data collected in our sample were anonymous, it was not possible to re-contact survey participants to assess the stability (test-retest reliability) of the partner LMUP, so ideally this should be tested in future studies. In terms of construct validity, unlike the women's LMUP, we did not carry out any hypothesis tests of expected relationships of the construct with other variables. Although we can make guesses at relationships, actual empirical evidence is limited currently and we were not sufficiently confident to form hypotheses against which the partner measure would be judged (as opposed to an exploratory analysis which one could conduct outside a psychometric evaluation). We hope that over time, with a greater research interest in partner's perspectives on pregnancy planning/intention, the evidence base in this area will increase and this new form of measurement will assist this.

CONCLUSIONS

The partner LMUP performed well in terms of reliability and validity according to internationally-accepted criteria for the performance of psychometric measures. Therefore, it is a good partner measure to the female LMUP in research on couples. The partner LMUP is certainly better than existing single survey questions (or sets of survey questions) on pregnancy intention/planning. However, we recommend further research relating to the concept of pregnancy intention/planning among partners of all gender identities to know whether there are any key additional areas of the construct that would be important to represent in the content to enhance measurement. In particular, we recommend further conceptual exploration with men who have experienced unplanned pregnancies.

COMPETING INTERESTS

The authors declare there are no competing interests.

FUNDING

This is independent research funded by the Department of Health Policy Research Programme: Pre-Pregnancy Health and Care in England: Exploring Implementation and Public Health Impact, 006/0068. The views expressed in this publication are those of the authors and not necessarily those of the Department of Health.

ACKNOWLEDGEMENTS

We thank all the men and women who took part in the study. We thank the project team and steering group including Pranav Pandya (UCLH), Emma

Sydenham (lay member), Pat Doyle (LSHTM), Tina Agrawal (General Practitioner), Shruti Patel (UCL), Alison Elderfield, Neil Paterson, Jane Verity and Zoltan Bozoky (Department of Health). We are also grateful for the support of the Margaret Pyke Trust for their on-going contribution to the program of reproductive health research at UCL.

REFERENCES

1. Barrett G, Smith SC, Wellings K. Conceptualisation, development, and evaluation of a measure of unplanned pregnancy. J Epidemiol Community Health 2004;58(5):426–33.
2. Morin P, Payette H, Moos MK, et al. Measuring the intensity of pregnancy planning effort. Paediatr Perinat Epidemiol 2003;17(1):97–105.
3. Santelli JS, Lindberg LD, Orr MG, et al. Toward a multidimensional measure of pregnancy intentions: evidence from the United States. Stud Fam Plann 2009;40(2):87–100.
4. Freedman R, Whelpton PK, Campbell AA. Family Planning, Sterility and Population Growth. New York: McGraw Hill; 1959.
5. Cartwright A. Parents and Family Planning Services. London: Routledge Kegan Paul; 1970.
6. Ryder NB, Westoff CF. Reproduction in the United States, 1965. New Jersey: Princeton University Press; 1971.
7. Cleland J, Scott C. The World Fertility Survey: an assessment. Oxford: Oxford University Press; 1987.
8. Fleissig A. Unintended pregnancies and the use of contraception: changes from 1984 to 1989. BMJ 1991;302(6769):147.
9. Mosher WD, Jones J, Abma JC. Intended and unintended births in the United States: 1982-2010. Natl Health Stat Report. 2012(55):1–28.
10. (USAID) USAfID. The DHS Program: Demographic and Health Surveys 2019 [Available from: https://www.dhsprogram.com/.
11. Magnusson B, Lapane K. Fathers' pregnancy intentions. Perspect Sex Reprod Health 2009;41(2):132.
12. Lindberg LD, Kost K. Exploring U.S. men's birth intentions. Matern Child Health J 2014;18(3):625–33.
13. Carter M, Speizer IS. Pregnancy intentions among Salvadoran fathers: results from the 2003 National Male Reproductive Health Survey. Int Fam Plan Perspect 2005;31(4):179–82.
14. Huang CC. Pregnancy intention from men's perspectives: does child support enforcement matter? Perspect Sex Reprod Health 2005;37(3):119–24.
15. Waller MR, Bitler MP. The link between couples' pregnancy intentions and behavior: does it matter who is asked? Perspect Sex Reprod Health 2008;40(4):194–201.
16. Hohmann-Marriott B. The couple context of pregnancy and its effects on prenatal care and birth outcomes. Matern Child Health J 2009;13(6):745–54.
17. Sipsma H, Divney AA, Niccolai LM, et al. Pregnancy desire among a sample of young couples who are expecting a baby. Perspect Sex Reprod Health 2012;44(4):244–51.
18. Lewin A, Mitchell SJ, Hodgkinson S, et al. Pregnancy intentions among expectant adolescent couples. J Pediatr Adolesc Gynecol 2014;27(3):172–6.
19. Kagesten A, Bajos N, Bohet A, Moreau C. Male experiences of unintended pregnancy: characteristics and prevalence. Hum Reprod 2015;30(1):186–96.
20. Bodin M, Kall L, Tyden T, et al. Exploring men's pregnancy-planning behaviour and fertility knowledge:a survey among fathers in Sweden. Ups J Med Sci 2017;122(2):127–35.
21. Stykes JB. Methodological Considerations in Couples' Fertility Intentions: Missing Men and the Viability of Women's Proxy Reports. Matern Child Health J 2018;22(8):1164–71.
22. Freda MC, Moos MK, Curtis M. The history of preconception care: evolving guidelines and standards. Matern Child Health J 2006;10(5 Suppl):S43–S52.
23. Johnson K, Posner SF, Biermann J, et al. Recommendations to improve preconception health and health care--United States. A report of the CDC/ATSDR Preconception Care Work Group and the Select Panel on Preconception Care. MMWR Recomm Rep. 2006;55(RR-6):1–23.
24. Frey KA, Navarro SM, Kotelchuck M, Lu MC. The clinical content of preconception care: preconception care for men. Am J Obstet Gynecol 2008;199(6 Suppl 2):S389–95.
25. Shawe J, Delbaere I, Ekstrand M, et al. Preconception care policy, guidelines, recommendations and services across six European countries: Belgium (Flanders), Denmark, Italy, the Netherlands, Sweden and the United Kingdom. Eur J Contracept Reprod Health Care 2014:1–11.
26. Kotelchuck M, Lu M. Father's Role in Preconception Health. Matern Child Health J 2017;21(11):2025–39.

27. Wegner MN, Landry E, Wilkinson D, Tzanis J. Men as partners in reproductive health: from issues to action. Int Fam Plan Perspect 1998;24(1):38–42.
28. Dudgeon MR, Inhorn MC. Men's influences on women's reproductive health: medical anthropological perspectives. Soc Sci Med 2004;59(7):1379–95.
29. Bond MJ. The missing link in MCH: paternal involvement in pregnancy outcomes. Am J Mens Health 2010;4(4):285–6.
30. Guadagno M, Mackert M, Rochlen A. Improving prenatal health: setting the agenda for increased male involvement. Am J Mens Health 2013;7(6):523–6.
31. Rocca CH, Krishnan S, Barrett G, Wilson M. Measuring pregnancy planning: An assessment of the London Measure of Unplanned Pregnancy among urban, south Indian women. Demogr Res 2010;23:293–34.
32. Morof D, Steinauer J, Haider S, et al. Evaluation of the London Measure of Unplanned Pregnancy in a United States population of women. PLoS One 2012;7(4):e35381.
33. Hall J, Barrett G, Mbwana N, et al. Understanding pregnancy planning in a low-income country setting: validation of the London measure of unplanned pregnancy in Malawi. BMC Pregnancy Childbirth 2013;13:200.
34. Roshanaei S, Shaghaghi A, Jafarabadi MA, Kousha A. Measuring unintended pregnancies in postpartum Iranian women: validation of the London Measure of Unplannned Pregnancy. Eastern Medi Health J 2015;21(8):572–8.
35. Borges AL, Barrett G, Dos Santos OA, et al. Evaluation of the psychometric properties of the London Measure of Unplanned Pregnancy in Brazilian Portuguese. BMC Pregnancy Childbirth 2016;16:244.
36. Habib MA, Raynes-Greenow C, Nausheen S, et al. Prevalence and determinants of unintended pregnancies amongst women attending antenatal clinics in Pakistan. BMC Pregnancy Childbirth. 2017;17(1):156.
37. Almaghaslah E, Rochat R, Farhat G. Validation of a pregnancy planning measure for Arabic-speaking women. PLoS One 2017;12(10):e0185433.
38. Goossens J, Verhaeghe S, Van Hecke A, et al. Psychometric properties of the Dutch version of the London Measure of Unplanned Pregnancy in women with pregnancies ending in birth. PLoS One 2018;13(4):e0194033.
39. Lang AY, Hall JA, Boyle JA, et al. Validation of the London Measure of Unplanned Pregnancy among pregnant Australian women. PLoS One 2019;14(8):e0220774.
40. Bukenya JN, Nalwadda CK, Neema S, et al. Pregnancy planning among female sex workers: evaluation of the psychometric properties of the London Measure of Unplanned Pregnancy. African J Reproduct Health 2019;23(3):79–95.
41. London Measure of Unplanned Pregnancy: LMUP versions 2020 [Available from: www.lmup.org.uk/versions.htm.
42. Frayne DJ, Verbiest S, Chelmow D, et al. Health Care System Measures to Advance Preconception Wellness: Consensus Recommendations of the Clinical Workgroup of the National Preconception Health and Health Care Initiative. Obstet Gynecol 2016;127(5):863–72.
43. Stephenson J, Vogel C, Hall J, et al. Preconception health in England: a proposal for annual reporting with core metrics. Lancet 2019;393(10187):2262–71.
44. Cater S, Coleman L. 'Planned' teenage pregnancy: perspectives of young parents from disadvantaged backgrounds. Bristol; 2006.
45. Bodin M, Stern J, Kall LF, et al. Coherence of pregnancy planning within couples expecting a child. Midwifery 2015;31(10):973–8.
46. Yeatman S. The relationship between pregnancy plannedness and parental and child health in Malawi. Contraception 2016;94:424.
47. Yeatman S, Smith-Greenaway E. Birth Planning and Women's and Men's Health in Malawi. Stud Fam Plann 2018.
48. Shawe J, Patel D, Joy M, et al. Preparation for fatherhood: A survey of men's preconception health knowledge and behaviour in England. PLoS One 2019;14(3):e0213897.
49. U.S.Department of Health and Human Services FaDA. Guidance for Industry, Patient-Reported Outcome Measures: Use in Medical Product Development to Support Labeling Claims. 2009 2009.
50. Mokkink LB, Terwee CB, Patrick DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. J Clin Epidemiol 2010;63(7):737–45.
51. Reeve BB, Wyrwich KW, Wu AW, et al. ISOQOL recommends minimum standards for patient-reported outcome measures used in patient-centered outcomes and comparative effectiveness research. Qual Life Res 2013;22(8):1889–905.
52. Flower A, Shawe J, Stephenson J, Doyle P. Pregnancy planning, smoking behaviour during pregnancy, and neonatal outcome: UK Millennium Cohort Study. BMC Pregnancy Childbirth 2013;13:238.

53. Stephenson J, Patel D, Barrett G, et al. How do women prepare for pregnancy? Preconception experiences of women attending antenatal services and views of health professionals. PLoS One 2014;9(7):e103085.
54. Barrett G, Shawe J, Howden B, et al. Why do women invest in pre-pregnancy health and care? A qualitative investigation with women attending maternity services. BMC Pregnancy Childbirth 2015;15:236.
55. Ojukwu O, Patel D, Stephenson J, et al. General practitioners' knowledge, attitudes and views of providing preconception care: a qualitative investigation. Ups J Med Sci 2016:1–8.
56. Bye A, Shawe J, Stephenson J, et al. Differences in preconception and pregnancy healthy lifestyle advice by maternal BMI: Findings from a cross sectional survey. Midwifery 2016;42:38–45.
57. London Measure of Unplanned Pregnancy: Partner version 2020 [Available from: www.lmup.org.uk/docs/LMUP_partnerversion.pdf.
58. Loewenthal KM. An Introduction to Psychological Tests and Scales. 2nd Edition ed. London: Psychology Press; 2001.
59. Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrika 1951;16:297–334.
60. Streiner DL, Norman GR. Health Measurement Scales: A Practical Guide to their Development and Use. Fourth ed. Oxford: Oxford University Press; 2008.
61. Kline P. A Handbook of Test Construction: Introduction to Psychometric Design. London: Methuen; 1986.
62. Kline P. The New Psychometrics: Science, Psychology and Measurement. London: Routledge; 1998.
63. Prinsen CAC, Mokkink LB, Bouter LM, et al. COSMIN guideline for systematic reviews of patient-reported outcome measures. Qual Life Res 2018;27(5):1147–57.
64. Landis JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977;33(1):159–74.
65. Mokken RJ. A theory and procedure of scale analysis. Berlin: De Gruyter; 1971.
66. Sijtsma K, Molenaar IW. Introduction to Nonparametric Item Response Theory. Thousand Oaks, CA: Sage; 2002.
67. Fleming TP, Watkins AJ, Velazquez MA, et al. Origins of lifetime health around the time of conception: causes and consequences. Lancet 2018;391(10132):1842–52.
68. Barker M, Dombrowski SU, Colbourn T, et al. Intervention strategies to improve nutrition and health behaviours before conception. Lancet 2018;391(10132):1853–64.
69. Kirkman M, Stubber C, Rowe H, et al. Subjective meanings of 'unintended' pregnancy: interviews from understanding fertility management in contemporary Australia. Cult Health Sex 2017;19(2):179–93.
70. Johnson SD, Williams LB. Deference, denial, and exclusion: men talk about contraception and unintended pregnancy. Internat J Men's Health 2005;4(3):15.
71. Reich JA, Brindis CD. Conceiving risk and responsibility: a qualitative examination of men's experiences of unintended pregnancy and abortion. Internat J Men's Health 2006;5(2):133–52.
72. Buston KM. Experiences of, and attitudes towards, pregnancy and fatherhood amongst incarcerated young male offenders: findings from a qualitative study. Soc Sci Med 2010;71(12):2212–8.
73. Olmstead SB, Koon JT, Puhlman DJ, et al. College men, unplanned pregnancy, and marriage: what do they expect? J Sex Res 2013;50(8):808–19.
74. Daugherty J. How young men at high risk of fathering an unintended pregnancy talk about their procreative identities. J Family Issues 2016;37(3):1817–42.
75. Woodhams E, Sipsma H, Hill BJ, Gilliam M. Perceived responsibility for pregnancy and sexually transmitted infection prevention among young African American men: An exploratory focus group study. Sex Reprod Healthc 2018;16:86–91.
76. Hamm M, Miller E, Jackson Foster L, et al. The financial is the main issue, it's not even the child: exploring the role of finances in men's concepts of fatherhood and fertility intention. Am J Mens Health 2018;12(4):1074–83.
77. Jackson E, Karasz A, Gold M. Family formation in the inner city: low-income men's perception of their role in unplanned conception and pregnancy prevention. J Health Care Poor Underserved 2011;22(1):71–82.