**ORIGINAL RESEARCH ARTICLE**

# Evaluation of the Portuguese version of the London measure of unplanned pregnancy in Mozambique: A psychometric measurement study

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*Belarmina R Muleva[1*], Ana Luiza V Borges[2], Jennifer A Hall[3], Geraldine Barrett[4]*

Faculty of Health Sciences, Lúrio University, Nampula, Mozambique[1]; Public Health Nursing Department, University of São Paulo School of Nursing, São Paulo, Brazil[2]; Research Department of Reproductive Health, UCL Elizabeth Garrett Anderson Institute for Women's Health, University College London, London, UK[3]; Research Department of Reproductive Health, UCL Elizabeth Garrett Anderson Institute for Women's Health, University College London, London, UK[4]

***For Correspondence:** Email: *belarminareis@alumni.usp.br*; Phone: +258 868656002

## Abstract

Robust forms of measurement such as the London Measure of Unplanned Pregnancy (LMUP), which recognise the complexity of the construct of pregnancy planning/intention, are being adopted worldwide. The aim of this study was to evaluate the psychometric properties of the Mozambican Portuguese version of the LMUP. The Brazilian Portuguese interviewer-administered LMUP was culturally adapted for use in Mozambique and pre-tested with 28 women. Field testing included 524 women aged 16-42. Completion rates of LMUP items were 100%. LMUP scores 0-12 were captured. In terms of reliability (internal consistency), Cronbach's alpha was 0.90, item-rest correlations were >0.2, 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 all hypotheses were met. We conclude that the Mozambican Portuguese LMUP is reliable, valid and suitable to use in Mozambique. *(Afr J Reprod Health 2022; 26[2]: 47-57).*

**Keywords:** Pregnancy; psychometric validation; pregnancy planning; unplanned; Portuguese; Mozambique

## Résumé

Des formes solides d´évaluation, comme le test de Londres sur la Mesure des Grossesses non Planifiées (LMUP), qui reconnaissent la complexité de la construction de la planification/désir de grossesse sont actuellement adoptées dans le monde entier. L´objectif de cette étude était d´évaluer les propriétés psychométriques de la version Mozambicaine en portugais du LMUP. Le LMUP administré par un intervieweur en portugais du Brésil a été adapté culturellement pour être utilisé au Mozambique et a été prétesté auprès de 28 femmes. Les tests sur le terrain ont inclus 524 femmes âgées de 16 à 42 ans. Le pourcentage de réponses aux questions a été de 100%. Les ponctuations du LMUP 0-12 ont été saisies. En termes de fiabilité (consistance interne), l´alfa do Cronbach a été de 0,90, les corrélations *item-rest* étaient > 0,2 et toutes les corrélations entre les questions étaient positives. En termes de validité de la construction, l´analyse des principaux points montre que la mesure a été unidimensionnelle, l´analyse des facteurs de confirmation a montré une bonne adéquation du modèle et toutes les hypothèses ont été vérifiées. Nous pouvons conclure que le LMUP mozambicain en portugais est fiable, valide et approprié pour un usage au Mozambique. *(Afr J Reprod Health 2022; 26[2]: 47-57).*

**Mots-clés**: Grossesse; validation psychométrique; planification de la grossesse; non planifiée; Portugais; Mozambique

## Introduction

Even though the rates of unintended pregnancy declined 17% from 1990-94 to 2010-14 worldwide[1], the world still faces around 74 million unintended pregnancies a year[2]. In spite of this drop, the phenomenon remains high in sub-Saharan Africa[3]. A study that included 29 sub-Saharan African countries with recent data from the Demographic and Health Surveys (DHS) showed that the prevalence of unintended pregnancies ranged from 10.8% in Nigeria to 54.5% in Namibia, with an overall prevalence rate as 29.0%[4].

Mozambique was not included in that analysis but, as with other sub-Saharan African countries, the occurrence of unintended pregnancy

remains a public health issue in the country. Mozambique is located in Southeast Africa and has a population of 28 million. In its 11 provinces, only 30% of the people live in urban areas. With a life expectancy of 56.5 years and a fertility rate of 5.3[5-6], Mozambique stands among the countries with the lowest Human Development Index, ranked 180th in 188 countries[7]. The 2015 DHS data showed that 22% of the births were unintended[5]. While this rate is low compared to for example, 44% in Europe and 48% in North America[8], there is evidence that a significant proportion of unintended pregnancies result in (unsafe) abortion or other adverse maternal outcomes[9], like symptoms of depression[10-11]. Abortion law in Mozambique was liberalized in 2014, with elective termination in the first 12 weeks of pregnancy becoming legal[12].

In a scenario of low contraceptive prevalence, with a quarter of women using modern contraceptives in 2015, mainly injections (13%) and pills (6%), 23% with unmet need for contraception, and a maternal mortality rate of around 450 per 100,000[5-6], the only information on Mozambican women's pregnancy intention is available from the DHS question. Although DHS data allow comparisons across more than 80 low and middle-income countries and over time, the question used to measure pregnancy intention presents many limitations. These include being a survey question rather than a validated psychometric measure, having no scope for the reporting of ambivalence or uncertainty, a lack of documented reliability, and no consideration of pregnancies ending in abortions or miscarriages, among others[13-17].

In order to decrease the unmet need for contraception and track progress towards the achievement of reproductive goals, there is a need to better understand pregnancy intentions[1]. A measure called the London Measure of Unplanned Pregnancy (LMUP), developed in the United Kingdom[18] and validated and used in many contexts worldwide[19-30], including other African countries like Malawi, Sierra Leone and Uganda, is a tool for understanding pregnancy intention in a more robust way.

The LMUP comprises six items covering contraceptive use, timing of motherhood, intention, desire for a baby, discussion with the partner, and pre-conceptual preparations. The items are scored zero, one or two, giving a total score of zero to 12, with each increase in score representing an increase in the degree of pregnancy planning/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 a number of advantages: it has established psychometric properties; its development was based on women's views; it does not assume a particular form of family building nor rely on women having fully formed childbearing plans; 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 outcome, that is birth, abortion, or miscarriage. The LMUP was developed in order to produce valid and reliable population prevalence estimates of pregnancy planning/intention, and it has been used in many studies in which pregnancy planning/intention is a variable of interest, including studies in Africa[11, 31-37]. More recently, it has been recommended as an outcome measure in relation to preconception care[38, 39]. Our aim was to create an LMUP adaption for the Mozambican context and assess its psychometric properties. The study was carried out in the city of Nampula, which is the capital of the province with the same name and the third largest city in the country, with approximately 740,000 inhabitants.

## Methods

This was a mixed methods study to adapt, and evaluate, a version of the LMUP for the Mozambican Portuguese spoken context.

### *Cultural adaptation*

Due to the fact that Mozambique remained under Portugal's rule until 1975, the official language is Portuguese, although there are other common native languages coexisting. As there is a version of LMUP already available in Portuguese – the one validated to the Portuguese spoken in Brazil[23] – we started the process of adaptation by modifying the spelling, vocabulary, and other syntactical differences from the Brazilian Portuguese to the one spoken in Mozambique. A Mozambican Portuguese

Language expert, who teaches Portuguese at university level, adjusted the version to be assessed by a committee of experts. At this time-point, he included or excluded some articles, and replaced words that are not commonly used in Mozambique.

The experts' committee was composed of four health professionals with experience in research and practice in the women`s health field in Mozambique and only broadly aware of the purpose of LMUP. Two were maternal health nurses who worked in antenatal care, one with high-risk pregnancies and the other in low-risk settings; the third was an obstetrician who worked with high-risk pregnancies and at a labour birth centre; the last was a psychologist who was a Lecturer of Clinical Psychology at a regional university and who had large experience in psychometrics research. They evaluated semantical, idiomatic, cultural and conceptual equivalences of the LMUP proposed to be used in Mozambique and the one validated in Brazil. The main contribution of the committee experts was the inclusion of other options of preconception measures that is part of item six. Accordingly, the Mozambique LMUP version includes preconception measures: "stopped having so many partners", "controlled my viral load", "started doing physical activity" and "searched for family support". The other difference from the Brazilian LMUP is the use of the term "family planning methods" instead of "contraceptive methods", as this is the most common expression in the country. Two co-authors, BRM and ALVB, compared the versions and agreed the final version that was pretested.

We performed pre-test interviews with a range of women including those who had recently given birth either in a maternity hospital or at home, those currently pregnant and attending antenatal care, and women who had received post-abortion care. The LMUP was applied via a face-to-face interview, the same as in Brazil, due to the low literacy level of Mozambican women (39% of Mozambican population is illiterate[6]). Women were stimulated to express doubts about the questions as well as to suggest any word or expression that could improve the understanding of the questions. At the end of each pre-test interview, women answered specific questions about how much they understood the questions and if the questions were acceptable. Pre-test interviews continued until all aspects of the translation were well understood and no more changes were required[40].

## *Field testing*

This study was part of a broader cross-sectional study that aimed to assess antenatal care quality in Nampula city, so part of our sample and field work was planned to capture information among postpartum women. As 30% of Mozambican women have home based delivery and the rest health facility based delivery[5, 6], we approached postpartum women both in a hospital institution and at households in order to capture different types of access and experiences with antenatal care irrespective if it was performed in public or private services.

Maternal services are offered in the country through three ways: public health services from the National Healthcare System, that are free and universal; private services for those who can afford it; and Traditional Medicine, largely used by the population. Traditional Medicine services are integrated within the National Healthcare System and therefore traditional practitioners, including traditional midwives, are approved by the government[41]. Women were then recruited at the hospital and households since they had given birth in the previous 24 hours while in hospital and in the previous 15 days those who had delivered at home.

In order to capture information from women who were still pregnant or had terminated their pregnancy, we also interviewed those attending a post-abortion service (within the first 24 hours of hospitalization) and those who were currently pregnant and attending antenatal care. To recruit these groups, we interviewed women in one hospital and in a primary and a secondary health care facilities.

Data collection for the field testing of the Mozambican Portuguese version of the LMUP took place at three public health institutions (one primary health care facility, one secondary health care facility, and one hospital) and at households, all of them located in Nampula city, from September to December 2019. In order to participate, women had to be in good enough health to be interviewed and be able to speak Portuguese. The exclusion criterion

was having antenatal care classified as high risk. One of the authors (BRM) did all the interviews.

We contacted women to take part in the study in different ways according to the setting. In the hospital, we went three times a week to the maternity ward and invited all post-partum women up to 24 hours after delivery from September to December 2019. In the households, we first talked to the traditional midwives of three neighbourhoods where the university plays a role in providing health care and asked them to list all women with home-based deliveries who would be able to participate in the study in the same period. We then went household by household accompanied by a traditional midwife to do the interviews. In the primary and secondary health care facilities, we went three days a week for two weeks in December 2019 and invited all women who were waiting for consultation, irrespective of gestational age. Concerning post-abortion women, we went three days in one week of December 2019 at the hospital where they were hospitalised for post-abortion care and invited all of them to take part in the study while waiting for hospital discharge. The guidance for sample sizes in psychometric studies is not strictly prescribed, ranging from minimum item to variable ratios, such as 10 subjects per variable, to a minimum overall sample size of 100[42,43]. Given the broader aim of the cross-section study of antenatal care in which this analysis was nested, we aimed for a sample size of 500; this sample size is similar to other LMUP validation studies[18, 23,25,26,30].

Women were interviewed in quiet places in the clinics or at a room of her choice when at home. Besides the LMUP, they all answered structured questions about their sociodemographic and reproductive characteristics. Women's answers were recorded via a tablet using Google-forms and the interview took about 15 minutes to be completed.

This research was approved by the Research Ethics Board of the Lúrio University and was authorized by the Coordination of Health Services of Nampula. We explained the aims and procedures of the study, then read informed consent to every participant and later they signed with either signature or thumbprint.

### *Analysis of psychometric properties*

As Classical Test Theory was used to develop the LMUP and has been used in subsequent evaluations, it was applied here to facilitate comparisons. The acceptability of the LMUP was primarily assessed through the pre-test interviews. Further, rates of missing data in the field test were examined to give an indication of items that might have a problem with acceptability. Targeting was assessed by examining the distribution of total LMUP scores to see if the full range of scores was achieved. We examined item category endorsement values for insight into item discrimination, particularly looking for any category that had an endorsement frequency of >80%.

To assess reliability (internal consistency) we examined: Cronbach's alpha, using the standard cut off of 0.7[44-45]; item-rest correlations (>0.2 considered an acceptable); and inter-item correlations (checking that they were all positive) [46]. We were not able to assess test-retest reliability, as there was no follow up sample.

To assess construct validity (in terms of structural validity) we used Principal Components Analysis in order to evaluate whether all items related to one construct, that is, that measurement was unidimensional, meaning all items loaded onto one component with an Eigenvalue >1. This analysis allowed direct comparison with the original LMUP development study and subsequent LMUP evaluations. More recent guidelines on psychometric testing have recommended Confirmatory Factor Analysis to assess structural validity[47], so we carried this out also 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).

We also assessed construct validity in terms of hypothesis testing. We had three hypotheses: 1) that women who continued their pregnancy to term would (overall) have higher scores than those recruited via the post-abortion service; 2) that women living with a partner would have higher

scores than those not living with a partner; and that women with 0-3 children would have higher scores than those with 4+ children. The non-parametric test Mann-Whitney U was used to assess significance since we carried out Shapiro-Wilk Test to test for normality and it showed evidence for non-normality (p=0.058). We also analysed the histogram to view the distribution of the total LMUP score and concluded that the variable is not normally distributed.

As with several other studies, including the validation of the Brazilian Portuguese LMUP, an exploratory analysis, based on the principles of modern test theory (as opposed to Classical Test Theory), was carried out[20, 23, 26]. A Mokken scaling procedure (monotone homogeneity assumption) was applied, and items with a Loevinger H coefficient >0.3 were eligible for scaling[44-45] (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, in other words, 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"[48]. The construction of an adequate scale confirms that the raw score can be used to order respondents on the construct being measured[49].

In addition to the psychometric analyses, we carried out a simple exploratory analysis of the LMUP scores within the sample using the both the full and categorised scores. The categorised scores are intended to help with interpretation of prevalence estimates of unintended pregnancy (0-3 unplanned, 4-9 ambivalent, 10-12 planned), and using the cutpoint 9/10 to distinguish unplanned/planned pregnancies if dichotomising the scale[18]. All analyses were carried out using Stata 15.

# Results

### *Pre-test interviews: sample characteristics and findings*

Twenty-eight women took part in pre-test interviews: 19 who had recently given birth either in a maternity hospital or at home; six pregnant women attending antenatal care, and three attending post-abortion care (their age range varied from 17 to 39 years-old, mean age 23.8; with mean of 7.8 years of education, SD 3.0; and mean of 2.2 children, SD 1.2). All women reported full understanding of all questions and found the questions acceptable. There was no need to change any part or wording of the questionnaire before the field test.

### *Field test: sample characteristics*

Regarding the field work, we were able to invite 543 to take part in the field test, and 524 (96.5%) participated. The 19 women who refused mainly did so because they did not trust being interviewed using a tablet. The socio-demographic characteristics of the women are shown in Table 1. Of the 524 women in the sample, 281 were post-partum whose delivery occurred in the previous 24 hours in a hospital, 122 were post-partum whose delivery occurred in the previous 15 days in their own households, 80 were pregnant and attending antenatal care, and 41 had been hospitalised for post-abortion care. Women's ages ranged from 16-42, mean age 25.8, SD 6.0. Approximately three-quarters of the sample had at least one child before the current/recent pregnancy, and most women lived with a partner.

### *Acceptability and targeting*

There were no missing data on any LMUP items. The full range of LMUP scores were present (Figure 1). As shown in Table 2, there was only one item response category with >80% endorsement: the "no pre-conceptual preparations" category of item 6. Concerning the new included preconception measures, "searched for family support" achieved 4.0% of the responses, a little lower than the most

**Table 1:** Socio-demographic characteristics of the sample

| Variables | N (%) |
|---|---|
| **Pregnancy** | |
| Currently pregnant | 80 (15.3) |
| Postnatal | 403 (76.9) |
| Post-abortion | 41 (7.8) |
| **Age** | |
| <20 | 100 (19.1) |
| 20-24 | 139 (26.5) |
| 25-29 | 133 (25.4) |
| 30-34 | 93 (17.8) |
| 35+ | 59 (11.3) |
| **Religion** | |
| No religion | 4 (0.8) |
| Catholic | 184 (35.1) |
| Protestant | 35 (6.7) |
| Pentecostal | 64 (12.2) |
| Anglican | 13 (2.5) |
| Islamic | 213 (40.7) |
| Zione/Sion | 4 (0.8) |
| Other | 7 (1.3) |
| **Years of education** | |
| <5 years | 111 (21.2) |
| 5-9 years | 209 (39.9) |
| 10+ years | 204 (38.9) |
| **In paid work** | |
| No | 446 (85.4) |
| Yes | 76 (14.6) |
| **Lives with partner** | |
| No | 75 (14.3) |
| Yes | 449 (85.7) |
| **Attends private health services** | |
| No | 474 (91.0) |
| Yes | 47 (9.0) |
| **Number of children (before current/recent pregnancy)** | |
| 0 | 143 (27.3) |
| 1 | 113 (21.6) |
| 2 | 104 (19.9) |
| 3 | 81 (15.5) |
| 4 | 44 (8.4) |
| 5 | 29 (5.5) |
| 6 | 4 (0.8) |
| 7 | 6 (1.2) |

reported measure that was "took folic acid", with 6.1%. The other new measures also had endorsement: "controlled my viral load" with 3.1%, "started doing physical activity" with 1.5% and "stopped having so many partners" with 1.1%.

## *Reliability*

The Cronbach alpha for the items was 0.90. All item-rest correlations were >0.2 (Table 3), and all inter-item correlations were positive (data not shown).

## *Construct validity*

The principal components analysis confirmed that all variables loaded onto one component (Eigenvalue=4.0), with all component loadings >0.4 (Table 3). The confirmatory factor analysis showed good model fit (CFI = 0.99, SRMR = 0.03), with all factor loadings >0.3 (Table 3).

The results of hypothesis testing demonstrated that all three hypotheses were met (Figure 2): women who continued their pregnancies to term had significantly higher LMUP scores than women who had been hospitalised for post-abortion care (p=0.001); women who were living with a partner had significantly higher scores than those not living with a partner (p<0.001); and women who had 0-3 children before the current/recent pregnancy had significantly higher scores than those who had 4 or more children (p=0.015).

## *Mokken analysis*

The Mokken analysis showed that the items conformed to a basic Guttman structure with all item Loevinger H values above 0.6 (table 3). Item 1 (contraception) was the "easiest" to endorse, followed by items 2, 4, 3, 5, and lastly item 6 (pre-conceptual preparations). The Mokken scaling procedure selected all items into the scale with an overall Loevinger H value of 0.85, indicating a strong scale.

## *Exploring LMUP scores*

In the full sample, the mean LMUP score was 6.5 (SD 3.9) and median 7.5 (inter-quartile range 2-10), with 34.0% (178) of women scoring 0-3, 25.2% (132) scoring 4-9, and 40.8% (214) scoring 10-12. Including only women who continued (or were continuing) their pregnancy to birth (n=483), the mean LMUP score was 6.7 (SD 3.9) and median 8 (inter-quartile range 2-10), with 31.3% (151) women scoring 0-3, 26.9% (130) scoring 4-9, and 41.8% (202) scoring 10-12. Using the cutpoint 9/10, we observed in our full sample, 40.8% (214) women scoring 10-12 ("planned") and 59.1% (310) scoring 0-9 ("unplanned").

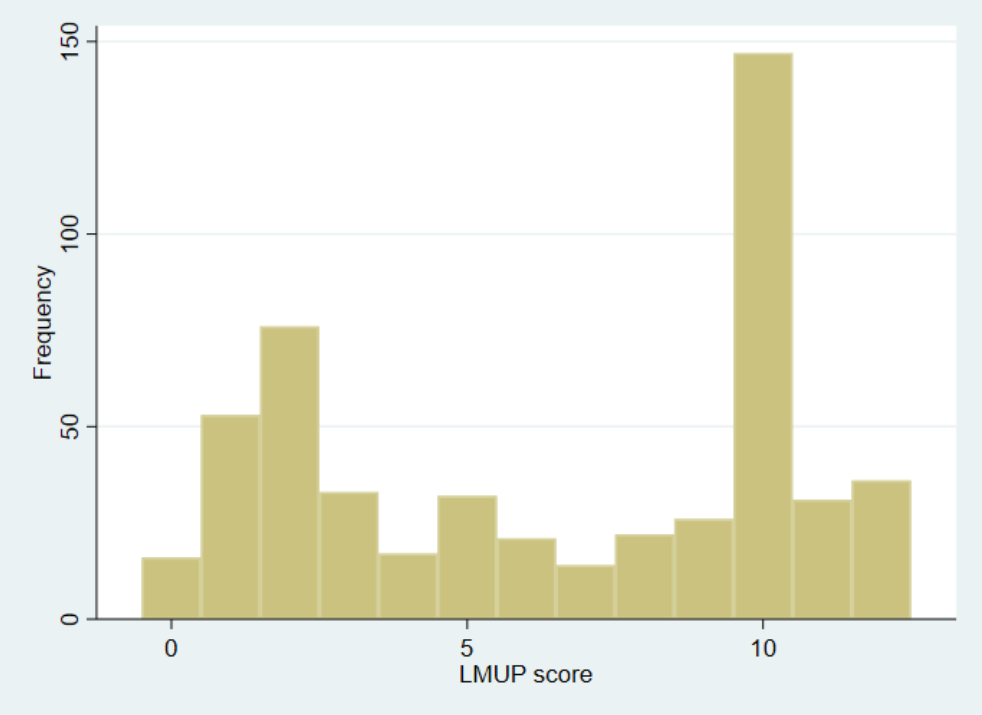


**Figure 1:** Frequency distribution of LMUP scores

**Table 2:** Item category endorsement frequencies

| **Item 1: contraception** | **N (%)** |
|---|---|
| 0 – always using contraception | 26 (5.0) |
| 1 – using sometimes or failed at least once | 111 (21.2) |
| 2 – not using contraception | 387 (73.9) |
| **Item 2: timing** | |
| 0 – wrong time | 151 (28.8) |
| 1 – ok, but not quite right time | 99 (18.9) |
| 2 – wrong time | 274 (52.3) |
| **Item 3: intention** | |
| 0 – did not intend to get pregnant | 177 (33.8) |
| 1 – intentions kept changing | 76 (14.5) |
| 2 – intended to get pregnant | 271 (51.7) |
| **Item 4: desire for a baby** | |
| 0 – did not want to have a baby | 176 (33.6) |
| 1 – mixed feelings about having a baby | 78 (14.9) |
| 2 – wanted to have a baby | 270 (51.5) |
| **Item 5: partner discussion** | |
| 0 – never discussed getting pregnant | 224 (42.8) |
| 1 – discussed but not agreed to get pregnant | 71 (13.6) |
| 2 – agreed to get pregnant | 229 (43.7) |
| **Item 6: preconception preparations** | |
| 0 – did no preparatory behaviours | 448 (85.5) |
| 1 – did 1 preparatory behaviour | 40 (7.6) |
| 2 – did 2 or more preparatory behaviours | 36 (6.9) |

Among the 483 women who continued/were continuing their pregnancy to birth, 41.8% (202) scored 10-12 ("planned") and 58.2% (281) scored 0-9 ("unplanned").

## Discussion

Our evaluation of the Mozambican Portuguese version of the LMUP indicates that it is valid and reliable in terms of acceptability, targeting, internal consistency, and construct validity according to internationally accepted criteria[45, 47, 50, 51]. The pattern of the relationship between the items reflected the original LMUP and other versions. All items performed extremely well, including the behavioural item on contraception (item 1). This performance is better than in some other African countries. For instance, in Sierra Leone, where contraceptive prevalence is low, item 1 performed less well as it had little discrimination (most women reported not using contraception when they became pregnant). Weaker performance of item 1 was also found in the initial Malawi LMUP validation[21] but in subsequent studies in Malawi item 1 has performed much better (meeting psychometric requirements for reliability and validity)[31,34]. Despite the fact that contraceptive prevalence use in sub-Saharan African countries is relatively low and

**Table 3:** Item-rest correlations, Principal component analysis loadings, Confirmatory factor analysis loadings, and Mokken analysis Loevinger H coefficients

| LMUP items | Item-rest correlations | PCA: component loadings | CFA: factor loadings | Mokken: Loevinger H |
|---|---|---|---|---|
| 1 | 0.45 | 0.56 | 0.45 | 0.61 |
| 2 | 0.89 | 0.94 | 0.93 | 0.87 |
| 3 | 0.91 | 0.95 | 0.97 | 0.88 |
| 4 | 0.91 | 0.95 | 0.97 | 0.89 |
| 5 | 0.84 | 0.90 | 0.85 | 0.87 |
| 6 | 0.36 | 0.46 | 0.34 | 0.93 |


**Figure 2:** LMUP scores by construct validity hypotheses

somewhat steady[52], as well as in Mozambique, we captured the full range of LMUP scores in our study indicating adequate targeting of the scale.

Item 6 (preconception preparations) also performed well in the study in terms of reliability and validity with approximately 15% of women in the sample reported carrying out at least one preconceptual action. Adding the new preconception measures to the Mozambique LMUP may have contributed positive results observed in item 6 performance since they received more than 50 answers altogether, which confirms they were relevant to the context. To our knowledge, this is currently the only information on preconception care practices in Mozambique.

In our simple exploration of the LMUP scores, we found that highly planned pregnancies (LMUP score 10+) were in a minority in the sample. This is interesting in light of the most recent DHS data for Mozambique, which estimated 78% of births to be intended[5]. Among the closest comparison group in our sample (pregnancies continuing/continued to birth), the estimate was 42%, which is considerably different to the DHS estimate. Similarly, in a previous direct comparison of the DHS with LMUP, carried out with data from Malawi, the LMUP produced a lower estimate of intended pregnancy at every timepoint than the DHS and was found to be more reliable/stable than the DHS[17]. There may be many reasons for such differences, such as different

recall periods and sampling methods, in addition to the questions themselves. DHS are nationally representative household surveys with samples that are usually based on a stratified two-stage cluster design. Their question about pregnancy intention is answered only by women who report at least one alive newborn in the previous five years. Research has previously shown that the reporting of pregnancy planning/intention can increase after birth and/or over time[16-17]. Future work in Mozambique could investigate the apparent difference between the LMUP and DHS estimates, ideally examining the utility of each in predicting outcomes.

One point to be highlighted is the use of tablets to interview women participating in our study. We are not sure of how much this has influenced the results, since some women refused to take part due to concerns on their privacy, especially because they thought their voices could be recorded. To minimize this, we took steps to always have a printed version of LMUP so they could choose one of them. Much of what is known about the use of electronic devices on surveys is a result of studies that aimed at assessing which devices are better for getting the best out of each respondent[53]. However, those studies usually focus on self-filled surveys on internet, which was not applicable in our case.

This study has some limitations. One of them is that we have not carried out test-retests, so we cannot assess Mozambique LMUP`s stability nor compare its full reliability with other LMUP validations conducted elsewhere. Even though we achieved good psychometric attributes, we need to consider that Portuguese is a language spoken by the majority of Mozambican women, but not all of them. Other studies evaluating the LMUP performance among Mozambican women who speak other native languages may be necessary, so a robust measure of pregnancy planning can be used across the whole country. Apart from these limitations, this study tested LMUP with pregnant and newly postnatal women and those who had abortions, with a diverse sample of women in terms of age, education, religion and number of prior children, which is certainly a strength. The fact that we recruited women from both health facility and household may have positively impacted the validity of our findings since their different characteristics and experiences reflect the range of our target population, that is women who have had a pregnancy experience. Additionally, as a result of our study, reproductive health researchers from Mozambique may now count on a robust instrument that can also provide information on preconception care behaviours, as this is a gap in the knowledge about maternal and reproductive health in the country.

## Conclusion

Our results show that the Mozambican Portuguese LMUP is a valid and reliable measure of pregnancy intention and therefore can be used with Portuguese speakers in Mozambique. The successful validation of the Mozambican Portuguese LMUP contributes to a wider body of work relating to the LMUP worldwide, especially advancing measurement opportunities in Sub-Saharan African.

## Contribution of authors

BRM, ALVB, JAH and GB conceived and designed the study. BRM collected the data. ALVB, JH and GB analysed the data. BRM, ALVB, JH and GB prepared the manuscript. All authors approved the manuscript.

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