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# Toward the development of a short multi-country person-centered maternity care scale

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## Abstract

**Objective**: To develop a shortened, valid and reliable scale applicable across multiple settings for routine monitoring of person-centered maternity care (PCMC).

**Methods**: Exploratory analysis was used to generate parsimonious versions of a 30-item PCMC scale in four datasets from cross-sectional surveys conducted between August 2016 and October 2017, involving women aged 15–49 years in Kenya, Ghana and India who had recently given birth. Analysis was informed by expert opinion via a separate online survey of global maternal and child health experts. Items retained in each dataset were compared, and those unique to a single setting removed. The remaining items were pooled and assessed for construct and criterion validity and reliability in each setting.

**Results**: Thirteen items were retained for a potential multi-setting short PCMC scale, incorporating the domains of dignity and respect, communication and autonomy, and supportive care. Cronbach's alpha for the scale was >0.7 in each setting. Scores on the 13-item scale were correlated with the 30-item scale scores, and with global measures of care satisfaction in Kenya and India.

**Conclusion**: Analysis yielded a 47% shorter PCMC scale, that showed promise for routine assessment of women's experience of care during childbirth across multiple settings. However, further validation is needed.

KEYWORDS

Ghana; India; Kenya; Maternity care; Measurement; Person-centered care; Respectful maternity care; Validation

## 1 | INTRODUCTION

Although maternal mortality declined 44% globally between 1990 and 2015,[1] this falls short of the 75% reduction targeted in the Millennium Development Goals, and rates remain unacceptably high—particularly in low- and middle-income countries (LMICs).[1] Non-use of maternal health services and poor quality care are critical factors contributing to these deaths.[2–4] Accumulated evidence suggests poor person-centered maternity care (PCMC)—manifested as disrespect, abuse, and neglect—contributes significantly to poor maternal and child health (MCH) outcomes.[5,6] This has led to calls to action on MCH quality of care that emphasize PCMC as necessary to achieve the Sustainable Development Goals target of less than 70 maternal deaths per 100 000 live births.[4,6,7]

Person-centered maternity care is "respectful of and responsive to individual women and their families' preferences, needs, and values"—in accordance with the Institute of Medicine's definition of

person-centered care.[8–10] The concepts of respectful maternity care (RMC) are incorporated in PCMC as part of the broader interest in person-centered care,[11,12] and capture the experience dimensions in the WHO vision for quality of maternal and newborn health.[7]

While there is growing consensus on the importance of PCMC, much work is needed to operationalize it in developing settings. A recent systematic review found 36 instruments in the literature for measuring women's birth experiences (as of January 2016). Only seven of the tools had psychometric properties indicative of high quality scales, and none were validated in an LMIC; furthermore, only three were sufficiently broad to holistically measure PCMC.[13] Since this review, two scales have been published for measuring women's birth experiences in LMICs, both demonstrating high validity and reliability: the 15-item RMC perception scale by Sheferaw et al.[14] measured on a 5-point Likert scale and validated in Ethiopia; and the 30-item PCMC scale by Afulani et al.,[9] measured on a 4-point frequency scale and validated in Kenya. The PCMC scale represents a broader measure of women's experience than the RMC perception scale and uses a response format that proved easier to interpret in cognitive interviews.[9] The PCMC scale was rigorously developed, including a thorough literature review, expert reviews and cognitive interviews, yielding strong content validity. It has been applied in urban and rural contexts in Kenya, India and Ghana, increasing its generalizability for use in LMICs, compared to existing tools; however, given its length, one limitation of the PCMC scale is its applicability to program settings—it was developed to be comprehensive, informing its large number of items. While this is useful for research and comprehensive needs assessment, program implementers tend to value shorter, easier-to-implement, measurement tools. Additionally, because of the context-specific nature of certain PCMC dimensions, only a subset of the items may be applicable to most settings. To ensure that not only was PCMC measurable—but that PCMC *was measured routinely*—a scale was required that was easier to administer and interpret. For these reasons, the aim of the present study was to develop a shorter, more simplified PCMC tool that could be applied by program implementers across multiple settings.

## 2 | MATERIALS AND METHODS

The 30-item PCMC scale was applied in four studies in three LMICs—Kenya, Ghana, and India. The eligibility criteria for all studies were women aged 15–49 years who had recently given birth in a health facility (postpartum <9 weeks for rural Kenya, <1 week for urban Kenya, <8 weeks for Ghana, and <48 hours for India). In Kenya, the surveys were conducted in randomly selected health units in all eight sub-counties in Migori County—a rural county in western Kenya—from August to September 2016 in English, Swahili, and Luo; and in seven health facilities in Nairobi and Kiambu counties (urban counties) from August to December 2016 in English, and Swahili. The India survey was conducted in Hindi in 40 public health facilities in 20 districts of Uttar Pradesh from August to October 2017. The Ghana survey was conducted in five health facilities in East Mamprusi district (a rural district in northern Ghana) from March to April 2017 in Mampruli and Konkomba. Women were recruited for interviews by research assistants in health facilities in urban Kenya, India, and Ghana, and in health facilities and homes in rural Kenya. The methodology for all four surveys are described in detail elsewhere.[9,15,16] These studies were approved by the University of California, San Francisco Committee for Human Subjects, the Kenya Medical Research Institute Scientific and Ethics Review Unit, the Navrongo Health Research Center in Ghana, and the Community Empowerment Lab in India. All respondents provided written informed consent. Women who delivered in a health facility and who answered at least 21 of the 30 items were included in the present analysis.

A convenience sample of global MCH experts completed an online survey via REDCap in October 2017, in which they were asked to prioritize 15 of 30 items in the PCMC scale. Respondents were recruited through the Global RMC Council Google Group, HIPNet, the Women's Health, Gender and Empowerment mailing lists, the Maternal Health Task Force social media platforms, and direct email communication based on authors' contacts.

The analysis to develop a shortened scale occurred in several stages. First, items were removed that assessed health facility environment (to exclude items that require more structural and systemic changes to improve) and items selected by fewer than one-third of MCH experts in the online survey. Items for the final scale were then identified by generating parsimonious scales in each of the settings. The two datasets from Kenya were combined for this analysis. Negatively worded items were reverse coded and univariate imputation used to replace missing values where respondents did not answer or answered, "not applicable." A correlation matrix was constructed and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy examined for all remaining scale items.

Exploratory Factor Analysis (EFA) was then conducted using split-half reliability datasets for each setting. EFA was an iterative process replicated consistently across settings. Because the domains of PCMC are theoretically related, oblique rotation was used to allow for correlations between the rotated factors. Items that loaded with a uniqueness value above 0.80 or loaded below 0.30 on any factor were removed. Efforts were made to retain highly regarded items by lowering this threshold to 0.10 for items with more than 80% expert backing. The shortened setting-specific scales were tested in the remaining sample, using confirmatory factor analysis (CFA).

To identify a core scale in accordance with the study objective, items retained throughout the process of scale shortening in any two of the three samples were included in a final set of questions representing a potential multiple-setting PCMC scale. A final round of EFA was conducted using the principal factoring method and oblique rotation to identify the underlying factor structure and examined Cronbach's alpha for each of the resulting factors. Confirmatory factor analysis was performed to identify the goodness-of-fit of the core scale in each setting, allowing error terms to correlate between items within the same proposed domain. Goodness-of-fit was estimated using root mean square error of approximation (RMSEA) and the comparative fit index (CFI). Criterion validity of the shortened scale was assessed by summing responses on the items in the final scale to generate scores, which were regressed on measures of satisfaction with maternity services. Finally, intraclass correlation (ICC) analysis was conducted to examine the relationship between scores derived from the short

**TABLE 1** Demographic characteristics of respondents included in the analytic sample.

| Variable | Kenya | | | Ghana | | | India | | |
|---|---|---|---|---|---|---|---|---|---|
| | All women (n=1419) | Estimation sample (n=710) | Confirmation sample (n=709) | All women (n=226) | Estimation Sample (n=113) | Confirmation Sample (n=113) | All women (n=2018) | Estimation Sample (n=1009) | Confirmation Sample (n=1009) |
| Age, years (mean [SD]) | 25.2 (5.5) | 25.3 (5.6) | 25.1 (5.4) | 29.5 (6.7) | 30.3 (6.8) | 28.8 (6.6) | 25.0 (4.0) | 24.9 (3.9) | 25.1 (4.2) |
| Parity, no. (mean [SD]) | 2.5 (1.6) | 2.5 (1.5) | 2.4 (1.6) | 3.3 (1.9) | 3.4 (1.7) | 3.3 (2.0) | 4.4 (3.5) | 4.4 (3.5) | 4.4 (3.5) |
| Marital status (No. [%]) | | | | | | | | | |
| Not married | 340 (24.0) | 165 (23.2) | 175 (24.7) | 13 (5.8) | 3 (2.7) | 10 (8.8) | 5 (0.2) | 2 (0.2) | 3 (0.3) |
| Currently married | 1079 (76.0) | 545 (76.8) | 534 (75.3) | 213 (94.2) | 110 (97.3) | 103 (91.2) | 2013 (99.8) | 1007 (99.8) | 1006 (99.7) |
| Education (No. [%]) | | | | | | | | | |
| No school/primary | 704 (49.6) | 351 (49.4) | 353 (49.8) | 165 (73.0) | 86 (76.1) | 79 (69.9) | 941 (46.6) | 477 (47.3) | 464 (46.0) |
| Post-primary/ vocational/ secondary | 516 (36.4) | 264 (37.2) | 252 (35.5) | 58 (25.7) | 26 (23.0) | 32 (28.3) | 831 (41.2) | 421 (41.7) | 410 (40.6) |
| College or higher | 199 (14.0) | 95 (13.4) | 104 (14.7) | 3 (1.3) | 1 (0.9) | 2 (1.8) | 246 (12.2) | 111 (11.0) | 135 (13.4) |

version and the original 30-item scale in each setting. $P<0.05$ was considered statistically significant.

## 3 | RESULTS

Surveys were collected from 1425 women in Kenya (894 rural and 531 urban), 227 women in Ghana, and 2018 women in India who had

**TABLE 2** Expert backing in order of selection frequency (N=96).

| Item no. | Scale item | N | % |
|---|---|---|---|
| 1. | Examinations and procedures are explained | 86 | 89.6 |
| 2. | Consent to examinations and procedures | 81 | 84.4 |
| 3. | Treated with respect | 75 | 78.1 |
| 4. | Spoken to in a language they understand | 74 | 77.1 |
| 5. | Providers pay attention when help is needed | 73 | 76.0 |
| 6. | Verbal abuse | 72 | 75.0 |
| 7. | Feel comfortable to ask questions of providers | 70 | 72.9 |
| 8. | Covered up so they do not feel exposed | 63 | 65.6 |
| 9. | Physical abuse | 62 | 64.6 |
| 10. | Allowed a labor companion | 56 | 58.3 |
| 11. | Allowed a delivery companion | 56 | 58.3 |
| 12. | Feel safe in the facility | 55 | 57.3 |
| 13. | Feel facility is clean | 55 | 57.3 |
| 14. | Trust providers | 51 | 53.1 |
| 15. | Allowed position of choice at delivery | 49 | 51.0 |
| 16. | Providers introduce themselves | 48 | 50.0 |
| 17. | Purpose of medicines is explained | 45 | 46.9 |
| 18. | Feel involved in care | 45 | 46.9 |
| 19. | Feel health information will be kept confidential | 44 | 45.8 |
| 20. | Feel providers took the best care of them | 40 | 41.7 |
| 21. | Treated in a friendly manner | 35 | 36.5 |
| 22. | Providers call woman by her name | 35 | 36.5 |
| 23. | Providers talk to woman about how she is feeling | 33 | 34.4 |
| 24. | Feel providers did their best to control pain | 30 | 31.2 |
| 25. | Feel there were enough providers | 28 | 29.2 |
| 26. | Facility had water | 28 | 29.2 |
| 27. | Providers support woman's anxieties | 25 | 26.0 |
| 28. | Perception of wait time | 16 | 16.7 |
| 29. | Facility had electricity | 11 | 11.5 |
| 30. | Feel facility is crowded | 9 | 9.4 |

**TABLE 3** Reliability, distribution, and goodness-of-fit statistics for the 13-item PCMC scale in the confirmation samples in all three settings.[a]

| Study population | Cronbach's alpha | Score distribution | | | | Fit index | |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | Min | Max | RMSEA | CFI |
| Kenya | 0.8216 | 24.16 | 8.16 | 2 | 39 | 0.065 [0.056–0.074] | 0.936 |
| Ghana | 0.7644 | 15.64 | 4.57 | 6 | 29 | 0.084 [0.57–0.110] | 0.895 |
| India | 0.8233 | 19.40 | 7.37 | 0 | 39 | 0.080 [0.073–0.087] | 0.937 |

Abbreviations: CFI, comparative fit index; Min, Minimum; Max, Maximum; RMSEA, root mean square error of approximation.
[a]The possible range of scores on the 13-item unidimensional scale is 0 to 39. To better understand goodness-of-fit, the scale structures identified in each setting were tested across the three settings. The 2-factor structure identified in India provided the best fit, and only those statistics are reported here for clarity. Error terms were allowed to correlate between items within the same proposed domain.

recently given birth in a health facility. Six women from the rural sample in Kenya and one woman in Ghana were excluded from the present analysis owing to missing data on >9 items on the survey. The full sample in India was used. Table 1 shows the demographic characteristics of respondents in the estimation and confirmation samples in each country. Most women were aged 20–29 and married. Women in Kenya and India had accessed a higher level of education than women in Ghana. Single missing responses were imputed for 17 (1.9%) women in rural Kenya, 1 (0.2%) woman in urban Kenya, and 27 (11.9%) women in Ghana. "Not applicable" responses were imputed for six scale items pertaining to visual privacy, involvement in care, explanation of medications, anxiety, and having a support person for labor and delivery. Across those six items, an average of 14.5% of responses in Kenya, 0.5% in Ghana, and 0.4% in India were replaced.

Ninety-six responses were received to the online survey of global MCH experts between September and November 2017. Table S1 shows the characteristics of the experts surveyed: 86% of respondents were women, with 13 years' MCH experience on average. Table 2 summarizes the frequency with which experts selected items as important to measuring PCMC, with items ordered from 1 to 30 by frequency of selection. Items related to the structural environment (items numbered 26, 29, and 30 in Table 2) and those with low expert backing (items 24, 25, 27, and 28) were removed prior to factor analysis.

Items with low loadings and high uniqueness in each sample were iteratively removed to obtain a shortened setting-specific scale of 16 items for Kenya, and 12 items for Ghana and India. Although there was significant overlap between the items retained in each setting, a number of items were unique to one setting. Items unique to only one setting were removed, such that 13 items remained which loaded highly in at least two of the three samples. These items had already met minimally acceptable criteria regarding expert opinion, correlation, and sampling adequacy in each setting.

A final round of EFA on the resulting 13 items within each country's estimation sample revealed a two-factor structure in Ghana and India, while a single dominant factor emerged in Kenya. The salient features of these setting-specific scales are detailed in Tables S2 and S3. Confirmatory factor analysis was conducted in each confirmation sample to identify which, if any, of the three different factor structures could be uniformly applied across settings. Confirmatory factor analysis indicated that the two-factor structure identified in India had the best fit in all three settings; however, the reliability of the unidimensional scale, measured by Cronbach's alpha, was high in all three samples (Table 3). Tests of criterion validity were conducted on the unidimensional, 13-item scale, which captured domains of dignity and respect, communication and autonomy, and supportive care.

The mean and range of summative scores on the 13-item scale are presented in Table 3. Increasing scores on the 13-item scale were significantly correlated with willingness to deliver in the facility again in India ($P<0.001$) and Kenya ($P<0.001$), and with satisfaction in Kenya ($P<0.001$) (Table 4). Finally, correlations between the scores from the original scale and the 13-item scale were high in each setting: 0.93 (0.72–0.99) in Ghana, 0.88 (0.59–0.99) in India, and 0.81 (0.46–0.99) across the combined Kenya sample. In Kenya, score correlations were higher among the urban sample (0.85 [0.53–0.99]) than the rural sample (0.78 [0.42–0.99]). The disposition of each variable is summarized in Table 5, indicating which items from the full scale comprise the shortened, multi-setting scale.

**TABLE 4** Regression of 13-item core PCMC scale scores on global measures of satisfaction with maternity services.[a]

| | OR | 95% CI | *P* value[b] |
|---|---|---|---|
| Kenya | | | |
| Level of satisfaction | | | |
| 13-item PCMC scale score | 1.093 | 1.070–1.118 | <0.001 |
| Will deliver in same place again | | | |
| 13-item PCMC scale score | 1.059 | 1.032–1.086 | <0.001 |
| India | | | |
| Will deliver in same facility in the future | | | |
| 13-item PCMC scale score | 1.191 | 1.118–1.269 | <0.001 |

Abbreviations: CI, confidence interval; OR, odds ratio; PCMC, person-centered maternity care.
[a]In Kenya, ordered logistic regression was used to determine if PCMC scores can predict patient-reported levels of satisfaction and willingness to deliver in the same place again. In India, logistic regression was used to determine if PCMC scores can predict willingness to deliver in the same facility. In Ghana, all women indicated high levels of satisfaction, so the analysis was not conducted. An increase in PCMC scores (as measured by the 13-item reduced scale) was associated with an increase in the odds of reporting higher general satisfaction in Kenya, and with willingness to deliver in the same place again in both Kenya and in India.
[b]$P<0.05$ was considered statistically significant.

## 4 | DISCUSSION

The present study used a data-driven approach to shorten the 30-item PCMC scale developed in Kenya by 47% to 13 items while maintaining high validity and reliability.[11] The EFA indicated high construct validity, although it presented both a unidimensional and two-dimensional factor structure, both of which fit the data in all three countries. Given that EFA can produce excessive factors with ordinal items, the authors

**TABLE 5** Items from the 30-item PCMC scale by the initial domains, showing those retained in the short multi-setting scale.

| Proposed domain | Scale item[9,15a] | Disposition | | | Included in short scale? |
|---|---|---|---|---|---|
| | | Ghana | Kenya | India | |
| Dignity/respect | 1. Did the doctors, nurses or other healthcare providers introduce themselves to you when they first came to see you? | Retained | Low loading | Low loading | No |
| | 2. Did the doctors, nurses or other healthcare providers call you by your name? | Low loading | Retained | Retained | Yes |
| | 3. Did the doctors, nurses or other staff at the facility treat you with respect? | Retained | Retained | Retained | Yes |
| | 4. Did the doctors, nurses or other staff at the facility treat you in a friendly manner? | Retained | Retained | Retained | Yes |
| | 5. How did you feel about the amount of time you waited? Would you say that it was very short, just a little long, somewhat long, or very long? | Low provider backing | | | No |
| | 6. Did you feel the doctors, nurses or other healthcare providers shouted at you, scolded you, insulted, threatened or talked to you rudely? | Low loading | Low loading | Retained | No |
| | 7. Did you feel like you were treated roughly, for instance were you pushed, beaten, slapped, pinched, physically restrained, or gagged? | Low loading | Low loading | Low loading | No |
| Privacy/ confidentiality | 8. Do you feel like your health information was or will be kept confidential in this facility? | Low loading | Retained | Low loading | No |
| | 9. During examinations in the labor room, were you covered up with a cloth or blanket or screened with a curtain so that you did not feel exposed? | Low loading | Retained | Retained | Yes |
| Autonomy | 10. Did you feel like the doctors, nurses or other staff at the facility involved you in decisions about your care? | Low loading | Retained | Retained | Yes |
| | 11. Did the doctors, nurses or other staff at the facility ask your permission/consent before carrying out procedures and examinations? | Low loading | Retained | Retained | Yes |
| | 12. During the delivery, do you feel like you were able to be in the position of your choice? | Retained | Low loading | Retained | Yes |
| Communication | 13. Did the doctors, nurses or other staff at the facility speak to you in a language you could understand? | Low loading | Retained | Low loading | No |
| | 14. Did the doctors and nurses explain to you why they were carrying out examinations or procedures? | Retained | Retained | Retained | Yes |
| | 15. Did the doctors and nurses explain to you why they were giving you any medicine? | Retained | Retained | Retained | Yes |
| | 16. Did you feel you could ask the doctors, nurses or other staff at the facility any questions you had? | Retained | Retained | Low loading | Yes |
| Supportive care | 17. Did the doctors and nurses at the facility talk to you about how you were feeling? | Retained | Retained | Retained | Yes |
| | 18. Did the doctors, nurses or other staff at the facility support your anxieties and fears? | Low provider backing | | | No |
| | 19. When you needed help, did you feel the doctors, nurses or other staff at the facility paid attention? | Retained | Retained | Retained | Yes |
| | 20. Do you feel the doctors or nurses did everything they could to help control your pain? | Low provider backing | | | No |

(Continues)

**TABLE 5** (Continued)

| Proposed domain | Scale item[9,15a] | Disposition | | | Included in short scale? |
|---|---|---|---|---|---|
| | | Ghana | Kenya | India | |
| Social support | 21. Were you allowed to have someone you wanted (outside of staff at the facility, such as family or friends) to stay with you during labor? | Retained | Low loading | Highly correlated with delivery support item | No |
| | 22. Were you allowed to have someone you wanted to stay with you during delivery? | Retained | Low loading | Low loading | No |
| Trust | 23. Did you feel the doctors, nurses or other staff at the facility took the best care of you? | Low loading | Retained | Retained | Yes |
| | 24. Did you feel you could completely trust the doctors, nurses or other staff at the facility with regard to your care? | Low loading | Retained | Low loading | No |
| Facility environment | 25. Did you think there was a sufficient number of healthcare staff in the facility to care for you? | Low provider backing | | | No |
| | 26. Thinking about the labor and postnatal wards, did you feel the health facility was crowded? | Low provider backing | | | No |
| | 27. Thinking about the wards, washrooms and the general environment of the health facility, would you say the facility was very clean, clean, dirty or very dirty? | Low loading | Low loading | Low loading | No |
| | 28. In general, did you feel safe in the health facility? | Low loading | Retained | Low loading | No |
| | 29. Was there water in the facility? | Low provider backing | | | No |
| | 30. Was there electricity in the facility? | Low provider backing | | | No |

Abbreviations: PCMC, person-centered maternity care.

[a]These 30 items represent the original PCMC scale, previously published by Afulani et al.,[9] from which the short multi-country version of the PCMC scale presented herein was derived.

were confident that the 13 items represented a unidimensional PCMC scale that could be applied across the settings.[17] Hypothesis testing for convergent validity in the India and Kenya samples suggested higher PCMC on the 13-item scale was associated with the willingness of women to deliver in the facility again in Kenya and India, and with increased satisfaction in Kenya.

Person-centered maternity care is a healthcare related patient-reported outcome, akin to measures of patient experience used for other in-patient and out-patient needs.[18,19] Minimum standards for patient-reported outcome measures provided a systematic approach to assess the shortened PCMC measure.[18,20] The COSMIN (COnsensus-based Standards for the selection of health Measurement Instruments, www.cosmin.nl) initiative offers eight questions to assess internal consistency including adequacy of sample size, application of factor analysis, calculation of Cronbach's alpha, and other elements. Employing these questions against the 13-item PCMC scale, it was found that, for all eight applicable questions on internal consistency, the scale in the present study scored "excellent". To assess reliability, Reeve et al.[18] suggest a Cronbach's alpha of 0.7 or greater as a minimum criterion, which the unidimensional scale for all three countries in the present study achieved—exceeding the COSMIN recommendation of two independent measurements. Split-half reliability was used, building the scale on a random 50% of respondents in each country, and testing its dimensionality and reliability on the other half. The relationship between scores derived from the 13-item scale and the original scale in each setting was also examined. The high correlations between these pairs of measures provided further evidence that both versions assessed the same construct. Finally, the scale simplification process utilized a second independent expert opinion to prioritize items and applied the shortened scale among three varied samples of women who had recently given birth.

A data-driven approach was consciously prioritized to test the feasibility of a shorter PCMC scale. Yet, the simplified 13-item scale presented had limitations. First, the short scale excluded questions on some issues which had been noted to be of importance to women,[21–23] such as confidentiality, presence of a birth companion, verbal and physical abuse, and factors associated with the facility environment. In particular, companionship and physical and verbal abuse, which were rated highly by experts, were not included because they did not meet the statistical criteria for retention used in the iterative factor analysis to develop this short multi-setting scale. This was likely due to the low prevalence of abuse, and a high proportion of "not applicable" responses on birth companionship from women who did not desire it—characteristics which also made these items poorly suited to the goal of minimizing the burden of PCMC measurement. The current version of the short scale therefore did not capture extreme forms of poor PCMC (verbal and physical abuse), as well birth companionship, for which women may

have different preferences.[24] However, the authors recognized the importance of these items and further work to refine the short PCMC scale will consider ways in which to prioritize their inclusion. Items were excluded which were related to the facility environment based on the initial criteria to remove items that might be beyond the capacity of individual providers to change. Also, the experts whose opinions informed the first iteration of scale shortening did not consider the questions related to water, electricity, waiting time, and crowding to be priorities in assessing PCMC, so these items were excluded in the shortened scale. This may have reflected an assumption that infrastructural inputs were foundational requirements in care settings. Many experts were involved in research or program implementation associated with international efforts or organizations, so their own experiences as to a "normal" baseline of care may have influenced the exclusion of more basic inputs to the provision of care. The full 30-item PCMC scale included all of these items and presented a more comprehensive alternative to the shortened scale. Second, the data for these analyses were based on convenience samples within facilities and health units, and so the findings for each setting was not generalizable to the whole country or even the particular setting. Selection bias was also a potential limitation of the non-random sample.

Despite these limitations, this shortened PCMC scale showed promise in being able to routinely assess the experience of care that women receive during childbirth. With only 13 items, program managers could easily determine which items receive low scores, and work to make improvements on aspects of care within their control. The generalizability of the scale needs to be assessed in more representative samples and in additional settings, including Latin American and Southeast Asian populations, and with more women receiving care in the private sector. Finally, data from a wider range of women and at multiple time points will help to determine if the measure is responsive and actionable, and will allow for greater interpretability of scores, particularly when correlated with other clinical and patient-reported outcomes.

## AUTHOR CONTRIBUTIONS

PA and KF contributed equally to this manuscript. PA contributed to the conception and design of the study, data collection, and data analysis. KF contributed to the design of the study and data analysis. MS contributed to the design of the study and data collection. RA contributed to data collection. DM contributed to the design of the study. NC contributed to the design of the study and data analysis. All authors contributed to writing the manuscript, and reviewed and approved the final draft of the manuscript.

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## CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Table S1.** Distribution of Respondents in MCH Expert Survey.

**Table S2.** Items in the reduced scales generated in each setting.

**Table S3.** Factor loadings from EFA of the 13-item core scale in each setting.