Supplementary Material 01: Psychometric assessment of the 18-item knowledge scale on pregnancy, contraception, and abortion

Introduction

This supplementary material provides the psychometric evidence supporting the use of the 18-item knowledge instrument on pregnancy, contraception, and abortion in the Colombo respondent-driven sampling (RDS) survey of female sex workers (FSWs). Because the scale was designed to cover multiple, policy-relevant SRH domains (pregnancy, contraception, abortion law, and sexuality), the analyses aim to demonstrate that the summed score functions as a coherent and sufficiently reliable composite index for population-level description, subgroup comparisons, and regression modelling of social gradients. We report complementary evidence from content validation (expert review), classical test theory item statistics (difficulty and discrimination), structural validity diagnostics using tetrachoric correlations and categorical confirmatory factor analysis (CFA), and item functioning and fit using Rasch (1PL) modelling. Convergent (known-groups) validity is assessed using expected differences by education level, and reliability is summarized using KR-20, McDonald's omega total, and Rasch EAP reliability. Together, these results justify interpreting the total score as a pragmatic SRH knowledge index and support the program-facing dichotomization into "good" (≥11/18) versus "poor" (≤10/18) knowledge for equity-focused analyses.

Methods

The knowledge instrument comprised 18 items covering pregnancy, contraception, abortion law, and sexuality. Each item had three response options (correct/incorrect/don't know). Responses were coded dichotomously (1=correct; 0=incorrect or don't know), and summed to generate a total score (range 0–18). Psychometric analyses were undertaken in the analytic sample (N=551) to evaluate item performance, structural validity, reliability, and convergent/known-groups validity. For program interpretability and modelling of social gradients, the total score was additionally dichotomised into good knowledge (≥11/18) versus poor knowledge (≤10/18). This threshold corresponds to correct responses on a majority of items and enables regression results to be interpreted as the probability/odds of 'good overall knowledge'.

Content validity was assessed through structured review by 10 experts in public health, SRH, FSW program implementation, and survey research, focusing on item relevance, clarity, and contextual appropriateness. Construct validity was examined using (i) classical item difficulty/discrimination indices, (ii) exploratory adequacy checks using tetrachoric correlations, and (iii) one-factor categorical confirmatory factor analysis (CFA; WLSMV). To evaluate item functioning along a single continuum, a Rasch (1PL) model was fitted, producing item difficulty (logit) estimates, item-fit statistics (infit/outfit mean squares), and EAP reliability. Convergent/known-groups validity was evaluated by testing whether overall knowledge varied across education strata, and reliability was assessed using KR-20, McDonald's omega total, and Rasch EAP reliability.

Results

Content validity

Expert review supported retaining 18 of the 20 initially earmarked items to preserve domain coverage, with minor wording refinements to improve comprehension and contextual alignment.

Item difficulty and discrimination

Item difficulty (proportion correct) ranged from 0.289 to 0.947, indicating that the scale included both difficult and easy items and therefore covered a broad knowledge spectrum. Corrected item–total correlations (r_drop) suggested variable discrimination across items, which is expected in multi-domain knowledge instruments.

Table 1: Classical item statistics (difficulty and discrimination)

	Statement	Sample		[1]
		n	%	r_drop
Knowledge of pregnancy and unintended pregnancy				
01	There are specific days in the menstrual cycle when the chance of becoming pregnant is relatively high	399	72.40	0.271
02	A woman cannot get pregnant during her menstrual period	159	28.90	0.121
03	Pregnancy can occur if sperm enters the vagina, even without ejaculation	308	55.90	0.178
04	There are test kits available in Sri Lanka that allow you to test for pregnancy at home.	522	94.70	0.271
05	A valid prescription is necessary to purchase pregnancy test kits from pharmacies in Sri Lanka.	428	77.70	0.301
Knowledge of contraceptives and emergency contraceptives				
06	Any modern contraceptive method is not 100% secure in preventing a pregnancy	254	46.10	0.084
07	Using more than one family planning method together, like condoms and pills (Ex, Mithuri), can increase protection against pregnancy	352	63.90	0.133
08	There are some drugs which can be taken even after an unsafe sexual encounter to reduce the risk of pregnancy	506	91.80	0.437
09	Emergency contraceptives can be taken within 7 days after an unsafe sexual encounter in order to avoid an unintended pregnancy	358	65.00	0.336
10	A valid prescription from a medical doctor is necessary to purchase Emergency Contraceptive Pills from the pharmacies in Sri Lanka	454	82.40	0.378
11	Frequent use of emergency contraceptives does not have adverse effects.	387	70.20	0.340
Knowledge of induced abortion				
12	In which of the following situations is induced abortion legal in Sri Lanka?	229	41.60	0.038
13	Provision of treatment for a woman who has gone through an illegal abortion is an offence as per the present abortion law	300	54.40	0.145

14	A pregnant woman can receive free, safe abortion services from a government hospital if her medical condition with the pregnancy is deemed life-threatening.	297	53.90	0.110
15	After a medical abortion, follow-up care is crucial to ensure that the abortion is complete and to check for any complications.	445	80.80	0.397
Knowledge on Sex and Sexuality				
16	Sexual consent must be given freely, without pressure and can be withdrawn at any time.	433	78.60	0.469
17	Sexual consent is only necessary the first time sexual activity occurs with a partner.	295	53.50	-0.009
18	Sexual health concerns are only physical and do not include psychological aspects.	348	63.20	0.168

[1]Note: r_drop is the corrected item–total correlation. Negative or near-zero values suggest weak discrimination and may warrant future revision.

Construct validity

Tetrachoric correlation adequacy was acceptable (KMO=0.789; Bartlett's test $\chi^2(153)=1047.26$, $p<0.001$), indicating that the binary items shared sufficient common variance for factor modelling. One-factor categorical CFA showed mixed fit ($\chi^2(135)=430.4$, $p<0.001$; CFI=0.70, TLI=0.66, RMSEA=0.063, SRMR=0.117), consistent with the instrument intentionally spanning multiple related knowledge domains rather than a narrowly defined reflective construct. Accordingly, the total score was interpreted as a pragmatic composite knowledge index suitable for group-level comparisons and regression modelling, rather than as a strictly unidimensional latent trait score.

Rasch (1PL) modelling

Rasch (1PL) modelling supported overall measurement coherence. Item difficulties ranged from -3.092 to 0.992 logits, confirming coverage from very easy to more difficult items. Overall measurement precision was moderate (EAP reliability=0.595), appropriate for population-level inference in applied public health studies. Item fit statistics were generally close to 1.00, indicating acceptable consistency with Rasch expectations. One item (K_17) displayed minor underfit, suggesting potential conceptual ambiguity or local dependence; however, fit values remained within commonly used practical thresholds for survey knowledge items and did not undermine the overall index.

Table 2: Rasch item difficulty and fit (1PL)

	Statement	Item fit		Difficulty (Logit)
		In MSQ	Out MSQ	
Knowledge of pregnancy and unintended pregnancy				
01	There are specific days in the menstrual cycle when the chance of becoming pregnant is relatively high	0.979	0.980	-0.822
02	A woman cannot get pregnant during her menstrual period	1.049	0.992	0.992
03	Pregnancy can occur if sperm enters the vagina, even without ejaculation	1.077	1.061	0.101
04	There are test kits available in Sri Lanka that allow you to test for pregnancy at home.	0.849	0.970	-3.092

05	A valid prescription is necessary to purchase pregnancy test kits from pharmacies in Sri Lanka.	0.990	0.992	-1.061
Knowledge of contraceptives and emergency contraceptives				
06	Any modern contraceptive method is not 100% secure in preventing a pregnancy	1.041	1.036	0.230
07	Using more than one family planning method together, like condoms and pills (Ex, Mithuri), can increase protection against pregnancy	1.056	1.047	-0.565
08	There are some drugs which can be taken even after an unsafe sexual encounter to reduce the risk of pregnancy	0.827	0.955	-2.431
09	Emergency contraceptives can be taken within 7 days after an unsafe sexual encounter in order to avoid an unintended pregnancy	0.938	0.951	-0.560
10	A valid prescription from a medical doctor is necessary to purchase Emergency Contraceptive Pills from the pharmacies in Sri Lanka	0.900	0.944	-1.623
11	Frequent use of emergency contraceptives does not have adverse effects.	0.908	0.923	-0.746
Knowledge of induced abortion				
12	In which of the following situations is induced abortion legal in Sri Lanka?	1.081	1.059	0.405
13	Provision of treatment for a woman who has gone through an illegal abortion is an offence as per the present abortion law	1.065	1.049	-0.063
14	A pregnant woman can receive free, safe abortion services from a government hospital if her medical condition with the pregnancy is deemed life-threatening.	1.042	1.037	-0.056
15	After a medical abortion, follow-up care is crucial to ensure that the abortion is complete and to check for any complications.	0.835	0.924	-1.505
Knowledge on sex and sexuality				
16	Sexual consent must be given freely, without pressure and can be withdrawn at any time.	0.815	0.905	-1.207
17	Sexual consent is only necessary the first time sexual activity occurs with a partner.	1.115	1.101	-0.066
18	Sexual health concerns are only physical and do not include psychological aspects.	0.987	0.990	-0.553

Note: MSQ values close to 1.0 indicate good fit. Values >1.1 may indicate underfit; values <0.9 may indicate overfit/redundancy.

Convergent (known-groups) validity

Knowledge scores varied across education strata in the expected direction. Mean total score was higher in the higher-education group (mean 12.40) compared with the lower-education group (mean 11.31), with mean difference 1.09 points (95% CI 0.62–1.56; $p<0.001$). Using the dichotomized outcome, higher education was associated with approximately twice the odds of good knowledge (OR=2.01, 95% CI 1.37–2.97; $p<0.001$). Model-based predicted probabilities of good knowledge were 0.63 in the lower education group versus 0.77 in the higher education group. Spearman correlation supported a positive gradient ($\rho=0.187$, $p<0.001$).

Reliability

Internal consistency for binary items was modest (KR-20=0.598), reflecting heterogeneity of content across SRH domains. McDonald's omega total was higher (ωt=0.778), supporting good composite reliability for group-level analysis. Rasch EAP reliability (0.595) was consistent with moderate precision suitable for population-level comparisons.

Interpretation and justification for the analytic approach

Overall, the findings support the use of the 0–18 summed score as a pragmatic knowledge index: items spanned a broad difficulty range, most demonstrated acceptable discrimination and Rasch fit, and the composite reliability was adequate for epidemiological modelling and programme monitoring. While strict unidimensional CFA fit was mixed, this is expected for knowledge instruments that intentionally combine multiple related domains; therefore, the index is best interpreted as an overall indicator of knowledge about pregnancy, contraception, and abortion rather than a single reflective latent trait.

Dichotomization into good (≥11/18) versus poor (≤10/18) knowledge is defensible as a policy-facing operationalisation that supports straightforward interpretation of associations with socioeconomic position and access to information (e.g., odds/probability of good knowledge), while retaining the continuous total score for descriptive reporting.

Measurement limitations and future work

First, dimensionality diagnostics suggest the scale functions as a composite index rather than a strictly unidimensional latent construct; future work may explore multidomain or bifactor structures. Second, one item (K_17) showed minor Rasch underfit and weak item–total correlation, and could be revised to improve coherence. Third, dichotomisation improves interpretability but can reduce information; therefore, reporting the continuous score alongside the binary classification is recommended. Finally, test–retest reliability, measurement invariance (DIF), and external convergent measures were not assessed and represent priorities for future validation.