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Digital divide and socio-economic gradients in pregnancy-, contraception-, and abortion-related knowledge among female sex workers in Colombo, Sri Lanka

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Abstract

Knowledge relating to pregnancy, contraception and induced abortion supports informed reproductive decision-making and timely service utilization. In marginalized settings, expanding digital information pathways may improve access while widening knowledge gaps across socio-economic strata. Pregnancy-, contraception- and abortion-related knowledge was assessed among female sex workers (FSWs) in Colombo District, Sri Lanka, and socio-economic gradients and the digital divide in “good” overall knowledge were examined. A cross-sectional survey was conducted from March to June 2025 using respondent-driven sampling (N=551). Knowledge was measured using an 18-item binary scale (0–18) and categorized as good ($\geq 11/18$) versus poor ($\leq 10/18$). Psychometric assessment supported the use of the summed score as a pragmatic composite index with adequate reliability for population-level comparisons. RDS-weighted prevalence estimates were generated using Gile’s successive sampling estimator, and unweighted logistic regression examined correlates. Access to information was digital-first but uneven: 90.5% owned a mobile phone and 62.1% used social media, yet 35.8% reported no internet use. Mean knowledge was 11.75 ± 2.87 , and the weighted prevalence of good knowledge was 63.5% (95% CI 59.2–67.8). Misconceptions remained on the effectiveness of contraceptive methods, the timing of emergency contraception, abortion law and post-abortion care. A steep income gradient persisted, with suggestive effect modification by education, and not accepting unprotected sex for extra pay was strongly associated with good knowledge. Overall, moderate-to-high knowledge coexisted with pronounced within-group inequality. Digital-first strategies should be complemented with equity-sensitive offline channels and locally aligned, language-appropriate content to reach women excluded from routine internet use in a legally constrained setting.

Keywords: Female sex workers, Reproductive health knowledge, Information access, Socio-economic gradient, Digital divide

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Introduction

Knowledge on pregnancy, contraception and abortion is a key enabling determinant of reproductive autonomy, timely service use and safer decision-making (World Health Organization, 2014). In practice, it affects whether people recognize pregnancy early, understand method effectiveness, choose an appropriate contraceptive method and seek accurate guidance when faced with an unintended pregnancy (Oppong et al., 2021). Where sexual and reproductive health (SRH) services and information pathways are fragmented, stigmatized or legally restricted, knowledge becomes more critical because misinformation can spread quickly and contribute to risk-taking, delayed care-seeking and unsafe pathways (Amri et al., 2022). This is specifically relevant for socially marginalized populations who face multiple barriers to healthcare and often rely on informal networks for information (Lim et al., 2015).

Knowledge is not only an “individual attribute”; it is socially produced and unevenly distributed (Jeffres et al., 2012). Three complementary perspectives help explain why knowledge is shaped by social inequality. First, a social determinants and capability approach emphasizes that socio-economic resources, such as income, education, literacy, and language, shape a person’s ability to obtain, interpret, and use SRH information (Davis & Chapa, 2015). Second, the health literacy perspective specifies the mechanism: the capacity to access, understand, appraise and apply health information depends on educational opportunities, communication environments and the availability of information in a preferred language and usable format (Sørensen et al., 2012). Third, knowledge-gap and digital divide theory suggest that when new information channels expand, more advantaged groups acquire information faster, widening inequalities unless compensatory strategies are used (Tichenor et al., 1970; Hargittai, 2002). Together, these lenses imply that population averages can hide substantial within-group inequity, with the largest gaps among those facing poverty, low literacy, language barriers and limited access to trusted information channels (Ramanadhan & Viswanath, 2008).

Female sex workers (FSWs) are a population for whom pregnancy prevention, method choice and interpretation of SRH information are routine practical decisions rather than abstract issues. In many settings, FSWs face frequent pregnancy risk, condom negotiation and engagement with services (Khezri et al., 2023; Suranga et al., 2025), which may strengthen applied knowledge through lived experience and repeated contact with peers, outreach workers and clinics (Ampt et al., 2020). However, FSW communities in Sri Lanka are internally diverse (Bozicevic et al., 2020; Suranga et al., 2020), and knowledge is unlikely to be evenly distributed within them (Manathunge et al., 2020). This creates a policy-relevant paradox: overall knowledge may appear relatively strong because information is repeatedly used in daily life, yet important gaps may persist and be concentrated among women with the highest structural vulnerability (Suranga et al., 2023).

Colombo’s high penetration of mobile technology and social media, alongside declining print media, has created a “digital-first” ecosystem in which information circulates quickly but unevenly (De Silva et al., 2024; Suranga et al., 2017). This landscape is shaped by a digital divide: differences in connectivity, affordability, digital literacy, language-accessible content and privacy constraints can determine who accesses timely, credible information and who remains reliant on partial or informal sources (Delaporte et al., 2022). Online content may also be discreet and easy

to access, but it is not always accurate or aligned with local legal and service realities, particularly for sensitive or legally restricted topics (De Silva et al., 2024). Sri Lanka's restrictive legal context; permitting abortion only to save the pregnant woman's life makes accurate knowledge of abortion law and unintended pregnancy pathways especially important (Arambepola & Rajapaksa, 2014; De Silva et al., 2023; Suranga et al., 2016).

Against this background, evidence from Sri Lanka is limited in studies that simultaneously (i) quantify pregnancy-, contraception- and abortion-related knowledge among FSWs, (ii) describe variation in information access across digital and traditional channels, and (iii) assess whether knowledge follows socio-economic gradients and markers of vulnerability within the FSW community (Suranga et al., 2025). Accordingly, this study assessed knowledge on pregnancy, contraception and abortion among FSWs in Colombo, Sri Lanka, and examined whether socio-economic position and access to information through digital and traditional media are associated with inequalities in overall knowledge.

Methodology

A cross-sectional, community-based quantitative study was conducted among FSWs in Colombo District, using respondent-driven sampling (RDS). Data were collected from March to June 2025. RDS was used because it is a common method for recruiting hidden populations through peer referral and for generating population estimates using network-based weights (Heckathorn, 2002; Word Health Organization, 2013). As this was a cross-sectional study, the analysis was limited to identifying associations, and the design could not establish temporal sequence or cause-and-effect relationships between socio-economic position, information access, behavioral factors and overall knowledge.

Study Population and Sampling

The study population included biologically female individuals who self-identified as FSWs and reported exchanging sex for money or material benefit in the past six months. Participants were eligible if they were aged ≥ 18 years, resided in Colombo district and could provide informed consent. RDS recruitment began with four purposively selected seeds to reflect diversity in age, ethnicity, education and sex-work typology. Seed selection and recruitment procedures were guided by a formative assessment and prior understanding of FSW networks in Colombo. The initial seeds were selected because they were socially connected within different segments of the FSW community and were considered able to recruit eligible peers without coercion. Each seed received three recruitment coupons to invite eligible peers from her social network, and each subsequent participant received up to three coupons to continue recruitment chains. Coupons included a unique serial number, an expiry date and brief instructions, and participants were asked to distribute coupons only to peers who met the study eligibility criteria. Potential respondents who presented with a valid coupon were first screened by trained field staff using a brief eligibility checklist covering age, residence in Colombo District, sex, self-identification as an FSW, and exchange of sex for money or material benefit during the previous six months. Eligible respondents were then invited to participate in the interview after the study information was explained and informed consent obtained. The consent process was conducted in a private setting by trained field staff, and participants were informed that participation was voluntary, that they

could refuse to answer any question or withdraw at any point, and that refusal would not affect access to any services or support.

Recruitment used a hybrid model, combining a fixed survey site with mobile data collection arrangements to improve access, privacy and convenience for participants. Interviews were conducted in a private setting by trained interviewers using a structured questionnaire. To reduce duplicate participation while maintaining anonymity, participants were tracked using coupon serial numbers and a non-identifying unique ID code; no direct identifiers were collected. Recruitment continued until the target sample size was reached. As RDS relies on peer referral through participants' social networks, recruitment may be affected by network structure and homophily, where participants are more likely to recruit peers with similar socio-demographic, behavioral or service-access characteristics. Therefore, seed diversity, recruitment depth and RDS diagnostics were considered when interpreting the representativeness of the final sample.

The minimum sample size was calculated to estimate the prevalence of "good overall knowledge" with adequate precision in an RDS survey (Word Health Organization, 2013). Because no prior population-level estimate was available for FSWs in Colombo, we assumed a conservative prevalence of 50% to maximize variance. Using a 95% confidence level ($Z = 1.96$), absolute precision of $\pm 5.0\%$, and a design effect of 2.0 to account for dependence on peer-referral recruitment, the initial sample size was estimated. A finite population correction was then applied using an estimated FSW population in Colombo adjusted for the targeted age group of $N \approx 4,205$ (Bozicevic et al., 2020; Manathunge et al., 2020), which reduced the required sample to approximately 551 (Cochran, 1977).

Measures

Overall knowledge on pregnancy, contraception, induced abortion, and sexuality was measured using an 18-item scale (1 = correct; 0 = incorrect/don't know). For item 12, which assessed knowledge of the legal grounds for induced abortion in Sri Lanka, participants were presented with multiple response options, and the response was coded as correct when the participant identified "to save the life of the mother" as the legal ground. Item scores were summed to give a total score from 0 to 18. For program interpretability, the total score was then categorized as good knowledge ($\geq 11/18$) and poor knowledge ($\leq 10/18$). The ≥ 11 cut-off was selected a priori because it corresponds to at least 60% correct responses and follows a modified Bloom-type approach commonly used in knowledge, attitudes and practices research (Kleinhans et al., 2025). This binary classification was used to provide a practical summary indicator for program planning and regression modelling, while the continuous total score and item-level results were also reported to retain more detailed information on the distribution and content of knowledge.

Access to information was assessed using both digital indicators (mobile phone ownership, internet use, social media use) and traditional media exposure (newspapers, television, radio). These variables captured access to selected digital and traditional information channels. They did not measure the quality, credibility, depth or digital literacy related to information use, nor whether these channels were used specifically to obtain pregnancy-, contraception-, abortion- or sexuality-related information. Also, the questionnaire did not directly measure interpersonal sources of SRH knowledge, such as family members, relatives, friends, partners, peers, clients,

outreach workers or health-care providers. For regression analyses, routine exposure was generally defined as at least weekly use. To assess inequities, socio-economic and capability indicators (education, literacy, language, income) and work-related vulnerability factors (typology, duration, and entry into sex work) were included as key correlates of knowledge. Participants' personal network size, required for Gile's successive sampling (SS) estimator, was measured using standardized questions about the number of other FSWs the participant knew and the number seen in the past 30 days (Gile, 2011).

Psychometric assessment of the knowledge scale

Psychometric analyses were conducted to support the use of the 18-item total score as a pragmatic composite knowledge index for population-level description and modelling. Content validity was assessed through a review by 10 experts (SRH, public health, and social research), focusing on item relevance, clarity, and contextual fit. Structural validity was examined using categorical confirmatory factor analysis (CFA) with WLSMV for binary items, recognizing that multi-domain knowledge measures may not be strictly unidimensional (Flora & Curran, 2004). Item performance and coverage across a latent ability continuum were also assessed using Rasch (1PL) modelling, supporting interpretation of the total score as a coherent overall knowledge index for applied use (Rasch, 1980). Known-groups (convergent) validity was assessed by testing expected gradients between overall knowledge and education/information access indicators (Terwee et al., 2007). Internal consistency was assessed using KR-20 (Kuder & Richardson, 1937) and McDonald's omega (Dunn et al., 2014), supported by Rasch-based reliability indices appropriate for binary item sets (Rasch, 1980). The reliability indices indicated moderate internal consistency; therefore, the summed score was interpreted as a pragmatic composite index for population-level description and program-oriented comparison, rather than as a highly precise latent scale. Detailed psychometric outputs are reported in Supplementary Material 1.

Data analysis

Participant characteristics were summarized using frequencies and percentages. Knowledge was reported as: (i) item-level proportion correct, (ii) mean (SD) total score, and (iii) prevalence of "good knowledge" using the predefined threshold ($\geq 11/18$). The mean, standard deviation, median, and item-level estimates were presented to describe the score distribution and to avoid reliance on the dichotomized outcome. The binary outcome was retained for the main regression analysis because it was pre-specified and easier to interpret for program decision-making.

RDS-weighted prevalence estimates and confidence intervals were generated using Gile's SS estimator (Gile, 2011). For Gile's SS estimation, an external population size estimate for FSWs in Colombo, adjusted to the reproductive-age population (4,205; range 3,785–4,626) (Bozicevic et al., 2020). Estimator sensitivity was assessed by comparing Gile's SS estimates with alternative RDS estimators (e.g., RDS-I and RDS-II). RDS diagnostics (recruitment trees, wave distributions and homophily) were examined (Gile et al., 2015). Associations between participant characteristics and "good knowledge" were assessed using logistic regression, reporting odds ratios (ORs) and 95% confidence intervals. The regression models were intended to identify correlates of good overall knowledge rather than causal determinants. Although key socio-economic, capability, information-access and work-related variables were included, the models

may not fully account for prior exposure to SRH programs, outreach services, clinic contact, peer educators or other service-related factors that could influence both knowledge and behavior.

RDS weights were used for estimating population prevalence, whereas logistic regression models were fitted without RDS weights for association analysis. This approach was selected because simulation studies suggest that applying RDS weights in regression models can increase bias, reduce confidence-interval coverage and give disproportionate influence on participants with small, reported network sizes. Therefore, unweighted regression was considered more appropriate for estimating associations between participant characteristics and good overall knowledge. However, because RDS recruitment is not equivalent to simple random sampling, the regression findings were interpreted cautiously as associational patterns that may still be affected by recruitment-network structure and residual selection bias (Avery et al., 2019; Manathunge et al., 2020). RDS-weighted estimates and diagnostic outputs were generated using RDS Analyst (version 3.6.0). Regression models were fitted using SAS University Edition (version 9.4 M8), and psychometric analyses and plots were produced in RStudio (version 4.3.2).

Contextual item-level comparisons were conducted to place the FSW findings alongside two prior Sri Lankan female comparator datasets that used comparable knowledge items: adult females in Colombo (Suranga et al., 2017b) and female factory workers (Suranga et al., 2023). Only knowledge items that were sufficiently comparable across the three studies were included in this comparison. For each item, the percentage of respondents giving the correct response and corresponding 95% confidence intervals were presented. For the FSW sample, item-level estimates were based on the present RDS survey, while comparator estimates were drawn from the previous studies. Pairwise differences between FSWs and each comparator group were assessed using tests for differences in proportions, with Holm adjustment applied to account for multiple item-level comparisons. These comparisons were intended for descriptive contextualization only, because the comparator studies differed in sampling frame, population characteristics and survey context; therefore, they were not interpreted as direct population-equivalent comparisons.

Results

Overall, 559 individuals were screened, and 551 eligible participants were enrolled and completed the interview. Recruitment began with four seeds and reached the final sample across nine waves. Two seed chains accounted for about 70% of participants (220 and 166 recruits), while the other two seeds accounted for the remainder. Most participants (74%; 406/551) were recruited in waves 4–7. Participant characteristics are shown in Table 1. RDS diagnostics indicated adequate mixing by overall knowledge status. Recruitment homophily for overall knowledge was close to 1 (homophily = 0.96), suggesting near-random recruitment by knowledge level, with no evidence of differential recruitment between knowledge groups ($\chi^2 = 1.55$, $df = 1$, $p = 0.214$). Convergence plots indicated that the estimate of “good overall knowledge” stabilised by around the first 180 participants and remained near equilibrium thereafter. Bottleneck plots showed early differences across seed chains followed by convergence, suggesting limited seed dependence for the primary outcome. However, because two recruitment chains contributed a large proportion of the final sample, the possibility of some chain-level influence cannot be fully excluded. The RDS-weighted estimates should therefore be interpreted as population estimates

supported by available diagnostics, rather than as estimates entirely free from recruitment-network effects.

Table 1: Socio-demographic characteristics of the participants (n=551).

Variable	Level	Sample		Population Estimate (95% CI) ¹
		Frequency	Percentage	
Age	Youth (<25)	56	10%	9.32 (06.92 - 11.60)
	Adults	495	90%	90.68 (88.40 - 93.08)
Speaking Language	Sinhalese	480	87%	85.89 (83.09 - 89.04)
	Tamil	70	13%	14.01 (10.86 - 16.82)
	English	1	0%	0.09 (0.03 - 0.23)
Level of Education	No Education	21	4%	03.92 (02.26 - 5.58)
	Grade 1 to 5	69	13%	13.39 (10.49 - 16.32)
	Grade 6 to 11 (up to O/L)	240	44%	43.19 (38.57 - 47.62)
	Passed GCE O/L	181	33%	31.21 (27.29 - 35.35)
	Passed GCE A/L	33	6%	06.71 (04.44 - 08.94)
	Above A/L	7	1%	01.18 (0.13 - 2.20)
Can Read & Write	Yes	468	85%	82.85 (79.44 - 86.15)
	No	52	9%	9.07 (6.73 - 11.54)
	can't Say	31	6%	8.08 (5.47 - 10.68)
Marital Status	Never Married	50	9%	10.43 (07.73 - 13.12)
	Currently Married (First)	114	21%	23.68 (19.98 - 27.61)
	Currently Married (Remarried)	64	12%	12.06 (08.85 - 15.28)
	Divorced or Separated	267	48%	42.85 (38.29 - 46.99)
	widowed	44	8%	8.07 (05.92 - 10.40)
	Declined to Answer	12	2%	2.90 (01.32 - 04.51)
FSW Type	Street Based	125	23%	23.55 (19.69 - 27.42)
	Massage Centre Based	133	24%	24.22 (20.25 - 28.00)
	Brothel Based	75	14%	13.89 (10.95 - 17.01)
	Hotel Based	103	19%	17.08 (13.68 - 20.69)
	Home Based	27	5%	5.65 (03.51 - 07.78)
	Lodge Based	32	6%	5.67 (03.46 - 07.78)
	Night Clubs	16	3%	3.19 (01.22 - 05.22)
	other	39	7%	6.73 (04.56 - 08.77)
Monthly Income	30000 or Less	47	9%	11.93 (08.97 - 15.10)
	30001 to 50000	161	29%	31.92 (28.13 - 35.92)
	50001 to 100000	208	38%	35.31 (30.92 - 39.49)
	100001 to 150000	107	19%	16.81 (13.68 - 19.72)
	More than 150000	26	5%	4.03 (02.37 - 05.71)

Note: ¹Population estimates (95% CI) are RDS-weighted using Gile's SS estimator

Access to information

Participants' access to communication channels showed a largely digital-first profile, alongside a sizeable subgroup with limited or no routine internet access (Table 2). RDS-weighted estimates indicated that most FSWs owned a mobile phone (90.5%), including 66.7% who owned a smartphone. Just over half (55.4%) reported daily internet use, while 43.4% reported never using

the internet. Social media use was common (62.1%); Facebook was the most used platform (63%), followed by TikTok (30%) and Instagram (23%). Among social media users, 38.6% had ever used online platforms to find clients, most often via Facebook (30.1%), Instagram (15.1%), TikTok (12.8%) and WhatsApp (8.4%). Smaller proportions reported using online advertising platforms, including Lanka Ads (3.8%) and OK Ads (0.9%). In contrast, use of traditional media was low: 7.8% read newspapers daily or weekly, and 14.3% listened to the radio daily. Television was the most used traditional channel, with 24.7% reporting daily viewing.

Table 2: Access to information through traditional and digital media (n=551)

Variable	Level	Sample		Population Estimate (95% CI) ¹
		Frequency	Percentage	
Traditional Media Engagement				
Do you read newspapers or magazines?	Yes - daily	19	3.45%	04.13 (02.43 - 05.82)
	Yes - weekly	22	3.99%	03.59 (02.05 - 05.13)
	Yes - occasionally	215	39.02%	39.15 (34.69 - 43.60)
	No	295	53.54%	53.14 (48.87 - 57.41)
Do you watch television?	Yes - daily	145	26.32%	24.72 (20.95 - 28.50)
	Yes - weekly	12	2.18%	02.63 (01.08 - 04.19)
	Yes - occasionally	213	38.66%	39.89 (35.83 - 43.96)
	No	181	32.85%	32.76 (28.92 - 36.57)
Do you listen to the radio?	Yes - daily	87	15.79%	14.3 (11.41 - 17.22)
	Yes - weekly	5	0.91%	0.82 (0.07 - 01.57)
	Yes - occasionally	182	33.03%	33.95 (30.00 - 37.88)
	No	277	50.27%	50.91 (46.48 - 55.36)
Digital Media Engagement				
Do you own a mobile phone?	Yes - a smartphone	376	68.24%	66.70 (62.60 - 70.75)
	Yes - a basic phone	123	22.32%	23.80 (19.92 - 27.71)
	No	52	9.44%	09.50 (06.87 - 12.15)
Do you use the internet?	Yes - daily	324	58.80%	55.38 (50.87 - 59.89)
	Yes - weekly	8	01.45%	01.51 (0.33 - 02.69)
	Yes - occasionally	32	05.81%	07.31 (04.98 - 09.64)
	No	187	33.94%	35.80 (31.65 - 39.94)
Are you using any social media?	Yes	357	64.80%	62.10 (58.12 - 66.09)
	No	194	35.20%	37.90 (33.91 - 41.88)
Have you ever used social media platforms to find clients? (n=133)	Yes	133	38.60%	34.40 (28.90 - 39.57)
	No	212	61.40%	65.60 (60.43 - 71.10)

Note: ¹Population estimates (95% CI) are RDS-weighted using Gile's SS estimator.

Knowledge on pregnancy, contraception and abortion

Overall knowledge scores ranged from 3 to 18, with a mean of 11.75 (SD = 2.87) and a median of 12. Using the predefined cut-off, 68.8% had "good knowledge" (11–18) and 31.2% had "poor knowledge" (0–10). Under Gile's SS estimator, the RDS-weighted prevalence of good knowledge was 63.5% (95% CI: 59.25–67.78). Estimates were similar across alternative estimators (63.4% with RDS-I and 63.1% with RDS-II).

At the item level, several items showed strong knowledge of practical concepts (Table 3). For example, 94.14% correctly identified urine tests as a home method to confirm pregnancy, and 90.2% knew that emergency contraception (EC) pills exist. In addition, 71.0% correctly identified that pregnancy is more likely around the middle of the menstrual cycle. However, important gaps remained in areas that require more precise knowledge and are prone to misinformation. Only 44.8% correctly rejected the statement that “family planning methods are 100% safe”. Knowledge related to abortion law and post-abortion care also showed uncertainty: only 41.3% correctly identified that induced abortion is legally permitted in Sri Lanka when performed to save the life of the pregnant woman, and 46.3% correctly rejected the statement that “receiving post-abortion care is a legal offence.” Knowledge of the EC time window was also limited, with 57.4% correctly identifying the 72-hour timeframe

Table 3: Item-level knowledge on pregnancy, contraception, induced abortion, and sexuality among FSWs in Colombo, Sri Lanka. (n=551)

Statement	Sample		Population Estimate (95% CI) ¹	
	n	%		
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	71.00 (67.23 - 74.70)
02	A woman cannot get pregnant during her menstrual period	159	28.90	28.40 (24.54 - 32.36)
03	Pregnancy can occur if sperm enters the vagina, even without ejaculation	308	55.90	56.50 (52.02 - 61.04)
04	There are test kits available in Sri Lanka that allow you to test for pregnancy at home.	522	94.70	94.14 (91.97 - 96.32)
05	A valid prescription is necessary to purchase pregnancy test kits from pharmacies in Sri Lanka.	428	77.70	76.30 (72.50 - 80.10)
Knowledge of contraceptives and emergency contraceptives				
06	Any modern contraceptive method is not 100% secure in preventing a pregnancy	254	46.10	44.80 (40.45 - 49.14)
07	Using more than one family planning method together, like condoms and pills (Ex, Mithuri), can increase protection against pregnancy	352	63.90	60.50 (56.35 - 64.65)
08	There are some drugs which can be taken even after an unsafe sexual encounter to reduce the risk of pregnancy	506	91.80	90.29 (87.66 - 92.93)
09	Emergency contraceptives can be taken within 7 days after an unsafe sexual encounter to avoid an unintended pregnancy	358	65.00	57.40 (52.80 - 61.94)
10	A valid prescription from a medical doctor is necessary to purchase Emergency Contraceptive Pills from the pharmacies in Sri Lanka	454	82.40	78.80 (75.09 - 82.51)
11	Frequent use of emergency contraceptives does not have adverse effects.	387	70.20	64.50 (60.53 - 68.45)
Knowledge of induced abortion				
12	Correctly identified that induced abortion is legally permitted in Sri Lanka when performed to save the life of the pregnant woman.	229	41.60	41.30 (37.15 - 45.36)
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	46.30 (42.20 - 50.40)
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	55.40 (51.16 - 59.71)
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	79.00 (75.21 - 82.83)

Knowledge on sex and sexuality				
16	Sexual consent must be given freely, without pressure and can be withdrawn at any time.	433	78.60	72.60 (68.51 - 76.78)
17	Sexual consent is only necessary the first time sexual activity occurs with a partner.	295	53.50	58.60 (54.26 - 62.91)
18	Sexual health concerns are only physical and do not include psychological aspects.	348	63.20	64.30 (60.25 - 68.32)

Note: For all items, *n*, %, and population estimates indicate the proportion of respondents who gave the correct response. Item 12 was collected as a multiple-response question; the correct response was identifying “to save the life of the mother” as the legal ground for induced abortion in Sri Lanka. ¹Population estimates (95% CI) are RDS-weighted using Gile’s SS estimator, *n* = Frequency, % = Percentage

Socio-economic gradient and digital divide

As shown in Supplementary Material 2, univariable logistic regression indicated a clear socio-economic gradient in overall knowledge. Higher odds of good knowledge (11–18) were observed among participants who were younger, had higher monthly income, had higher education, were literate and primarily spoke Sinhala at home. Information access indicators also showed consistent associations: participants who listened to the radio, watched television, owned a mobile phone and used the internet were more likely to have good knowledge. Inequality was also evident in the work context, with poor knowledge (0–10) more common among street-based FSWs than among those working in hotels/brothels and spas. Longer duration in sex work, accepting unprotected sex for extra pay, and not currently using a non-barrier contraceptive method were associated with significantly lower odds of good knowledge.

Digital access was high but uneven, indicating a digital divide. RDS-weighted estimates showed that 9.5% (95% CI 6.87–12.15) did not own a mobile phone, 35.8% (95% CI 31.65–39.94) reported no internet use, and 37.9% (95% CI 33.91–41.88) did not use social media (Table 2). Consistent with this, univariable regression analyses showed lower knowledge among digitally excluded participants: good knowledge was 78.3% among internet users versus 54.3% among non-users (OR = 0.33; 95% CI 0.23–0.48), and 70.9% among phone owners versus 48.1% among those without a phone (OR = 0.38; 95% CI 0.21–0.68).

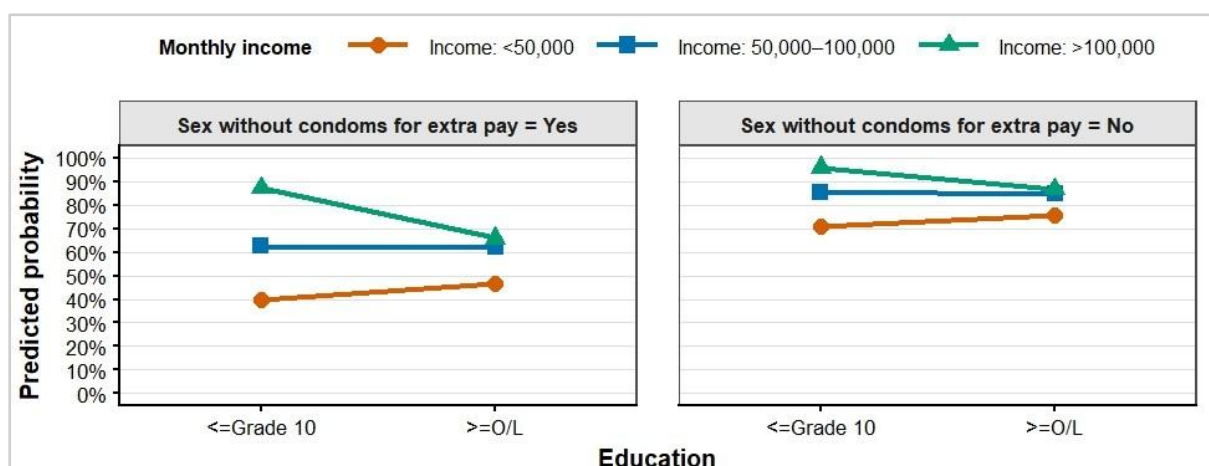
Results of the multivariable logistic model

In the multivariable logistic model, monthly income remained a strong independent predictor of good overall knowledge (Table 04). There was suggestive evidence of effect modification by education, indicating that the income–knowledge association differed by schooling level. Among participants with lower education, higher income was strongly associated with higher odds of good knowledge, with increased odds for both LKR 50,000–100,000 (OR = 2.54; 95% CI 1.36–4.74) and >LKR 100,000 (OR = 11.12; 95% CI 4.03–30.68), compared with <LKR 50,000. In contrast, among participants with higher education, the income gradient was weaker and imprecisely estimated, suggesting that education may partly buffer income-related inequality in knowledge. Predicted probabilities supported this pattern (Figure 01).

Table 4: Socio-economic and behavioral correlates of good overall knowledge ($\geq 11/18$) among FSWs in Colombo, Sri Lanka; unadjusted and adjusted odds ratios

Variable and Levels		Univariable Logistic Model (Unadjusted)		Multivariable Logistic Model (Adjusted)	
Variable	Levels	Odds Ratio (95% CI)	P Value	Odds Ratio (95% CI)	P Value
Monthly income (I)	<50k	1.00 (ref)			
	50k to 100k	3.28 (2.16-4.99)	<.0001		0.0034
	>100k	8.83 (4.77-16.37)	<.0001		<.0001
	Wald χ^2		<.0001		<.0001
Level of education (E)	≤ 10	1.00 (ref)			
	$\geq$ GCE O/L	2.01 (1.36-2.95)	0.0004		0.5410
	Wald χ^2		0.0004		0.5410
Language you speak most at home	Sinhalese	1.00 (ref)		1.00 (ref)	
	Tamil	0.32 (0.19-0.54)	<.0001	0.59 (0.32-1.11)	0.1037
	Wald χ^2		<.0001		0.1037
Unprotected sex for extra pay	Yes	1.00 (ref)		1.00 (ref)	
	No	3.77 (2.48-5.73)	<.0001	3.68 (2.30-5.88)	<.0001
	Wald χ^2		<.0001		<.0001
I*E	Wald χ^2				0.0883
Odds Ratios of the Interaction Effect (I*E)					
Income 50,000-100,000 vs <50,000 at Education= ≤ 10				2.54 (1.36-4.74)	0.0034
Income >100,000 vs <50,000 at Education= ≤ 10				11.12 (4.03-30.68)	<.0001
Income 50,000-100,000 vs >100,000 at Education= ≤ 10				0.23 (0.08-0.67)	0.0070
Income 50,000-100,000 vs <50,000 at Education= $\geq$ GCE O/L				1.94 (0.84-4.48)	0.1195
Income >100,000 vs <50,000 at Education= $\geq$ GCE O/L				2.33 (0.89-6.10)	0.0864
Income 50,000-100,000 vs >100,000 at Education= $\geq$ GCE O/L				0.84 (0.34-2.07)	0.6969

Note: The outcome variable was good overall knowledge (score 11–18) versus poor knowledge (score 0–10) based on the 18-item knowledge index. Reference categories are indicated as 1.00 (ref). Wald χ^2 p-values correspond to global Type 3 tests for each predictor. Stratum-specific interaction ORs are presented below the main model results. k = thousand Sri Lankan rupees.

**Figure 1.** Predicted probability of good overall knowledge by education and income, stratified by accepting unprotected sex for extra pay (Yes vs No)

A clear behavioral gradient was observed: FSWs who did not report unprotected sex for extra pay had substantially higher odds of good knowledge (aOR = 3.68; 95% CI 2.30–5.88; $p < 0.0001$). This supports the interpretation that higher knowledge may be associated with greater capacity

to negotiate safer practices, likely reflecting better access to accurate information, confidence and more supportive enabling environments. The language difference seen in univariable analyses was reduced after adjustment (Tamil vs Sinhala: adjusted OR = 0.59; 95% CI 0.32–1.11; $p = 0.104$), suggesting that part of the language gradient operates through socio-economic position. Model performance was acceptable (AUC = 0.752; 72.1% concordance) and well calibrated (Hosmer–Lemeshow $p = 0.922$).

Contextual comparisons

Item-level comparison with two Sri Lankan female comparator populations is shown in Figure 2. Compared with prior studies using the same knowledge items among adult females in Colombo (Suranga et al., 2017b) and female factory workers (Suranga et al., 2023), FSWs showed higher correct knowledge on several practical SRH items, including emergency contraception awareness and selected post-abortion care-related items. These comparisons are presented descriptively to contextualize the FSW findings, recognizing that the comparator studies involved different sampling frames and populations.

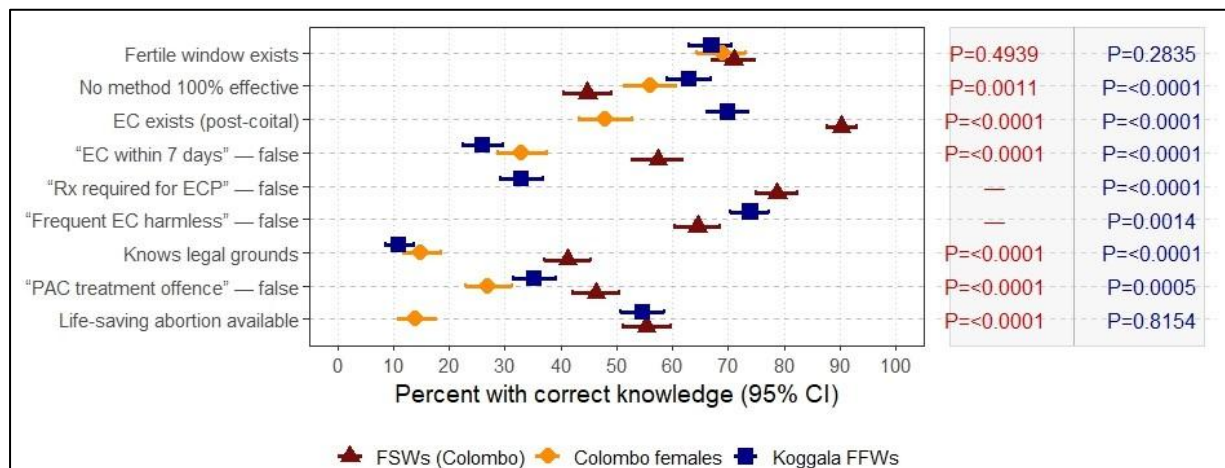


Figure 2. Item-level comparison of correct knowledge among FSWs and two comparator female populations in Sri Lanka.

Points show the percentage of respondents with correct knowledge for each statement; horizontal bars indicate 95% confidence intervals). Comparator estimates are from prior surveys of adult females in Colombo and female factory workers. Right-hand columns report Holm-adjusted P-values for cross-study differences (red: FSW vs Colombo females; blue: FSW vs FFWs).

Discussion

This study adds evidence on how access to information and socio-economic position shape inequalities in knowledge on pregnancy, contraception and abortion among FSWs in Colombo. Three related findings stand out. First, the information environment was mainly digital, but not universal, creating both reach and exclusion. Second, overall knowledge was moderate to high on average, but key misconceptions remained. Third, average scores masked a steep socio-economic gradient, driven most strongly by income and further patterned by education and behavioral vulnerability.

These findings should be interpreted within the everyday social worlds of women engaged in sex work, rather than as individual attributes detached from relationships and lived circumstances. Participants are not only information users or risk-bearers, but also mothers, partners, daughters, friends, peers, workers and community members whose SRH knowledge is shaped through both connections and disconnections. In addition, sex work should not be reduced to sexual intercourse alone, as client interactions may also involve negotiation, companionship, emotional labor, safety considerations, economic dependence, and expectations that vary across work settings and individual circumstances. Their knowledge may be influenced by interactions with peers, clients, intimate partners, family members, outreach workers, health-care providers and digital or social networks, as well as by experiences of stigma, mobility, privacy concerns and economic pressure. From this perspective, income, education, language and work typology should not be read only as individual characteristics, but also as markers of differential access to trusted relationships, safe spaces, supportive services and credible information. This socially grounded interpretation helps explain why some women may acquire practical knowledge through peer networks and service contact, while others remain excluded from reliable SRH information despite living and working within the same urban setting.

Participants showed a largely digital-first information profile, alongside clear digital exclusion. Mobile phone ownership and smartphone access were high, but routine internet use was not universal, and a sizeable subgroup reported never using the internet. Social media use was common, and many participants had used online platforms to find clients, indicating that digital channels are embedded within the social and economic ecology of sex work in Colombo. However, these digital practices should not be interpreted merely as technical information channels; they also reflect how work, privacy, safety, social contact and economic survival are negotiated within women's everyday networks. At the same time, ownership or use of digital platforms should not be interpreted as equivalent to access to accurate, trusted or health-specific SRH information. Traditional media exposure was lower, especially newspapers and radio, while television remained the most used non-digital channel. At the same time, SRH knowledge should not be understood as flowing only through media channels; it is also likely to be shaped by interpersonal communication with peers, friends, partners, family members, outreach workers and health-care providers, although these pathways were not directly measured in the present study (Suranga et al., 2017a). These patterns suggest SRH communication is likely to be most efficient via digital channels; however, digital-only strategies may widen inequities by missing women with limited internet access, particularly street-based FSWs.

The comparative item-level findings support the 'paradox' framing of this study: frequent exposure to pregnancy risk, contraception negotiation, peer networks and service contact may strengthen practical knowledge among many FSWs (Kerrigan et al., 2015; LaFort et al., 2016). Many FSWs appeared to have relatively strong practical knowledge, possibly through repeated exposure to pregnancy risk, contraception negotiation, peer networks and service contact. However, this practical familiarity did not ensure accurate knowledge on more technical or legally complex issues. The persistence of misconceptions on emergency contraception timing, contraceptive effectiveness, abortion law and post-abortion care indicates that program strategies should focus not only on increasing general awareness, but also on correcting specific misinformation with potentially important consequences for care-seeking and reproductive decision-making.

Taken together, these findings contribute to the existing debate in three ways. First, they challenge a simple deficit-based interpretation of SRH knowledge among FSWs. The results suggest that many women may acquire practical knowledge through lived experience, yet this does not guarantee accuracy on technically or legally complex issues such as emergency contraception timing, contraceptive method effectiveness, abortion law or post-abortion care. Second, the findings extend digital-divide arguments to a hidden and marginalized urban population by showing that high mobile-phone ownership and social media use can coexist with substantial exclusion from routine internet use and uncertainty about SRH information. Therefore, digital access should be understood not only as physical access to devices or platforms, but also as unequal access to credible, private, language-appropriate and locally relevant health information. Third, the study shows that inequality is not only between FSWs and other women, but also within the FSW community itself. Income, education, language, work setting and service contact may shape who is able to obtain, interpret and act on accurate SRH information. The central program question is therefore not only how to increase average knowledge, but how to reach women who remain outside reliable information and service networks.

A major contribution of this study is the documentation of within-group inequality through a strong socio-economic gradient. In multivariable analyses, income remained the dominant **correlate** of good knowledge, suggesting an independent role of resources and capability. Effect modification indicated that the income–knowledge gradient differed by education: among women with lower education, higher income was linked to large gains in good knowledge, while among those with higher education the gradient was smaller and imprecise. This pattern is consistent with partial buffering by schooling, while income remains especially important for knowledge acquisition among those with lower formal education. Programmatically, the largest gains are likely if interventions prioritise women with both low income and low education, where constraints appear most concentrated.

A clear behavioral gradient was also observed: participants who did not report unprotected sex for extra pay had substantially higher odds of good knowledge. This association should not be interpreted as evidence that knowledge alone directly determines safer behavior. Several confounding or shared-cause pathways are plausible. Women with better access to outreach services, peer educators, STD clinics, public health midwives, NGOs, community organizations or other supportive networks may be more likely both to receive accurate SRH information and to have greater confidence, resources or support to negotiate condom use. Conversely, women facing stronger economic pressure, limited-service contact, stigma, mobility or weaker peer support may have both lower knowledge and less negotiating power. Therefore, the observed behavioral association is best understood as reflecting a wider enabling environment, rather than an isolated individual-level knowledge effect.

The programmatic implications are therefore practical and equity-focused. First, digital communication can be used where it already reaches women, but it should not become the only route for SRH education. Digital messages should be complemented by trusted offline channels, including peer educators, outreach workers, STD clinics, public health midwives, NGO and community-based services, and discreet counselling opportunities. Second, content should prioritize the misconceptions identified in this study, especially contraceptive method effectiveness, correct timing of emergency contraception, legal grounds for abortion, and the legality and importance of post-abortion care. Third, interventions should be tailored for women

with lower income, lower education, limited literacy, limited internet use and street-based or more isolated work settings, as these groups may be least reached by standard digital-first approaches. Fourth, communication should be available in accessible language and formats, with attention to privacy, stigma, mobility and trust. Finally, future programs should monitor not only message reach, but also whether women understand, trust and can act on the information in real-life negotiation and care-seeking contexts.

Limitations

Findings should be interpreted with limitations in mind. The cross-sectional design precludes causal inference, and observed gradients may be influenced by residual or unmeasured confounding. Particularly, prior exposure to SRH programs, outreach workers, peer educators, STD clinics, public health midwives, NGO or community-based services, and other health-service contacts may influence both SRH knowledge and behaviors such as condom negotiation or use of contraception. Because these service-exposure pathways were not comprehensively modelled in the present analysis, the adjusted associations should be interpreted as correlational patterns rather than independent causal effects. Self-reported measures may be affected by recall and social desirability bias, particularly for sensitive behaviors. In addition, the knowledge scale demonstrated moderate reliability. Although this was acceptable for describing broad population-level patterns, it may have introduced measurement errors when the knowledge score was used as the outcome in regression analysis. Therefore, the adjusted associations should be interpreted as correlates of a broad program-oriented knowledge index, rather than as associations with a highly precise latent knowledge construct.

As a quantitative survey, the study could not fully capture the social, emotional, relational and experiential dimensions of sex work, including family and peer relationships, client expectations, emotional labor, non-sexual aspects of client encounters, social support, stigma and exclusion. Therefore, the findings should be interpreted as population-level patterns in knowledge and information access, rather than as a complete account of the lived experiences of women engaged in sex work. In addition, information access was measured using broad indicators of digital and traditional media exposure. These indicators did not capture the quality, credibility, depth, privacy or digital literacy dimensions of information use, nor whether participants used these sources specifically for pregnancy-, contraception-, abortion- or sexuality-related information. Social media variables also captured platform/account use rather than intensity, purpose or trustworthiness of SRH information received. This may have introduced measurement errors and limits the ability of the study to explain how accurate SRH knowledge was acquired, interpreted or socially shared within participants' networks. In addition, the tool did not capture interpersonal pathways through which SRH knowledge may be transmitted, including communication with family members, relatives, friends, partners, peers, outreach workers or health-care providers. This limits the ability of the study to explain how knowledge was acquired or socially shared within participants' networks. The use of a binary good/poor knowledge outcome may have reduced some information contained in the original 0–18 score. Therefore, the regression findings should be interpreted alongside the reported mean score, score distribution and item-level knowledge estimates. Finally, although RDS procedures and diagnostics supported adequate recruitment performance for the primary outcome, peer-referral sampling remains dependent on network connectivity and may under-represent more isolated or weakly networked FSWs. The use of four seeds and the fact that two recruitment chains

contributed a large share of the final sample may also have introduced some chain-level influence, even though homophily, convergence and bottleneck diagnostics suggested adequate mixing and limited seed dependence for overall knowledge. Therefore, the RDS-weighted estimates should be interpreted with appropriate caution.

Conclusion

Overall, SRH knowledge on pregnancy, contraception and abortion among FSWs in Colombo was moderate to high. However, several program-critical gaps remained, particularly on contraceptive method effectiveness, correct timing of EC, and the legal grounds for abortion and post-abortion care; areas where misinformation may have serious consequences in a legally restricted context. Importantly, the findings show that average knowledge masks substantial within-group inequality. A steep socio-economic gradient was observed, with higher knowledge concentrated among women with greater economic resources, and evidence that education may partly buffer income-related disparities. In a largely digital-first communication environment, high smartphone ownership coexisted with a sizeable subgroup reporting no routine internet use, highlighting a digital divide that can limit access to timely, credible information and potentially widen knowledge gaps among those already structurally disadvantaged.

An equity-sensitive response is therefore needed. Interventions should prioritize low-income and low-education subgroups and combine digital dissemination with trusted offline delivery routes. Digital strategies may be useful for women already connected to mobile phones, internet and social media, but they should be complemented by peer-sensitive outreach, clinic-based counselling, community-based services and confidential interpersonal communication for women excluded from routine internet use. Content should directly address program-critical misconceptions on contraceptive method effectiveness, emergency contraception timing, abortion law and post-abortion care, and should be delivered in accessible formats and local languages. Future programs should also assess the quality, credibility and health-specific use of information channels, rather than assuming that digital access alone ensures accurate SRH knowledge.

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The authors declare that no external funding was received.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

Ethics Statement

Ethical approval for this study was obtained from the Ethics Review Committee of the University of Kelaniya, Sri Lanka (Reference No. UOK/ERC/MDS/2024/038), with effect from 15 January 2025. Written informed consent was obtained from all participants prior to data collection, in accordance with an ethics-approved consent process. Before consent was obtained, trained field

staff explained the study purpose, the voluntary nature of participation, confidentiality protections, and the right to refuse or withdraw without any consequences. No direct identifiers were collected in the questionnaire, and survey responses were recorded using coupon serial numbers and non-identifying study codes. Consent-related documentation was kept separate from survey data, and participant anonymity and confidentiality were strictly maintained throughout the study.

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Disclaimer

The views and opinions expressed in this article are solely those of the authors and do not necessarily reflect the views, positions, or policies of their affiliated institutions, unless explicitly stated in the manuscript.

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