



Impact of a Scalable Digital Platform on Digital and Sexual and Reproductive Health Literacy Among Rural Adolescent Girls in Jharkhand, India: A Quasi-Experimental Study

Aparajita Gogoi, Vandana Nair, Shikha Bhasin* and Mercy Manoranjini

Centre for Catalyzing Change, India

*Corresponding Author: Shikha Bhasin, Centre for Catalyzing Change, India.

DOI: 10.31080/ASMS.2026.10.2299

Received: September 10, 2026

Published: October 14, 2026

© All rights are reserved by Shikha Bhasin, et al.

Abstract

Background: Gender disparities, limited digital access, and socio-cultural taboos continue to constrain adolescent girls' access to education, digital literacy, and sexual and reproductive health and rights (SRHR) information in rural India. This study assesses the impact of a multi-component intervention combining digital literacy and adolescent health education among rural adolescent girls in Gumla district, Jharkhand.

Method: A quasi experimental non-equivalent control group design was employed using quantitative surveys conducted pre (2021) and post (2022) intervention across selected intervention and non-intervention blocks. 450 adolescent girls (12–19 years) were selected using multistage probability proportional to size sampling. The intervention implemented through schools and Anganwadi centres, focused on improving digital navigation skills, cyber safety awareness, and SRHR knowledge, alongside life skills and empowerment training. Data were analysed using descriptive statistics and chi-square tests to assess changes over time and between groups.

Results: Findings indicate significant improvements among the intervention group in mobile and internet use for health information (10% to 47%) and awareness of cyberbullying. Increases were observed in SRHR knowledge, including pregnancy processes (38% to 87%), condom awareness (36% to 89%), HIV/AIDS (26% to 70%), anaemia (62% to 98%), and legal age of consent (3% to 34%). Adolescent Health Day participation increased from 30% to 70%, Adolescent Friendly Health Clinics, awareness (30% to 87%), also increased.

Conclusion: Integrating digital literacy with structured adolescent health education can overcome socio-cultural barriers to information access, leading to enhanced SRHR knowledge, digital agency, and service utilization among rural adolescent girls.

Keywords: Adolescent Girls; Digital Literacy; Sexual and Reproductive Health; HIV/AIDS Knowledge; Health Seeking

Abbreviations

AH: Adolescent Health; AHD: Adolescent Health Day (AHD); AFHC: Adolescent Friendly Health Clinics (Yuva Maitri Kendra); AIDS: Acquired Immunodeficiency Syndrome; ASHA: Accredited Social

Health Activist; AWW: Anganwadi Worker; CSE: Comprehensive Sexuality Education; CAPI: Computer-Assisted Personal Interviewing; DiD: Difference in Difference; GBV: Gender-Based Violence; HIV: Human Immunodeficiency Virus; IFA: Iron and Folic Acid; IPV: Intimate Partner Violence; OBC: Other Backward Class;

PPS: Probability Proportional to Size; RKSK: Rashtriya Kishor Swasthya Karyakram; ST: Scheduled Tribe (ST); SRH: Sexual and Reproductive Health; SRHR: Sexual and Reproductive Health and Rights; STDs: Sexually Transmitted Diseases.

Introduction

Gender disparities and socio-economic barriers continue to hinder adolescent girls' access to education, digital literacy, and reproductive health knowledge, particularly in rural and low-income settings. In India, the digital divide is stark: only 4% of rural households own a computer. While 72.3% of men own a mobile phone, only 46.6% of women have ownership, with fewer than 25% of rural women having ever used the internet [1]. These disparities intersect with restrictions on girls' mobility, schooling, and access to health services, reinforcing cycles of limited information, reduced agency, and poor health outcomes. Yet, studies show that when women gain access to digital tools, they are more likely than men to use mobile phones as their primary medium, highlighting the potential of digital platforms to expand access to health information and services for adolescent girls. Despite this potential, adolescent girls face significant challenges in accessing sexual and reproductive health (SRH) services. Cultural stigma, lack of privacy, limited mobility, and inadequate institutional support often prevent them from seeking care [2]. While formal education can improve SRH outcomes, evidence shows its impact on delaying sexual activity, contraceptive use, and STI prevention remains inconsistent [3]. In contrast, digital interventions have shown promise in improving SRH knowledge, attitudes, and help-seeking behaviours across diverse settings, including low-resource contexts [4]. Yet, challenges such as limited internet access, weak digital literacy, data privacy concerns, and absence of tailored approaches persist, particularly in low- and middle-income countries.

Emerging evidence highlights that access alone is insufficient without adequate digital health literacy. Studies indicate that while perceiving themselves as digitally competent, many adolescent girls often overestimate their ability to critically evaluate the credibility and reliability of online health information [5]. An evaluation of effectiveness of a web-based interactive tool specifically designed to enhance eHealth literacy among adolescent girls indicated significant improvements in participants' confidence and skills in discerning high-quality health resources from low-quality ones on

the internet and underscores the importance of tailored educational interventions in bridging the gap between adolescents' perceived and actual digital health literacy skills [6]. Similar research from diverse contexts underscores the importance of structured, age-appropriate, and culturally sensitive digital literacy interventions to bridge the gap between perceived and actual competencies, and in turn improve indicators such as girls continuing education, perceived physical security and knowledge about government schemes [7,8].

Digital platforms have particular relevance for SRH education in societies where open discussions of sexuality and reproduction are stigmatized. Health interventions delivered through digital tools can provide confidentiality and anonymity, which is crucial for girls seeking sensitive SRH or GBV-related support [2]. A study in Iran finds that there is a necessity of age-relevant, culturally appropriate educational strategies to enhance sexual health literacy. Given the similar socio-cultural obstacles in India as well especially in rural India, where sexual health is still a taboo subject for discussion among adolescent there is a need for comprehensive, contextually appropriate SRH education strategies that can reduce stigma, counter misinformation, and support informed decision-making among adolescents [9]. However, while digital and SRH interventions have been studied separately, there is limited evidence on integrated models that combine digital literacy and SRHR education tap into dissemination through existing public systems including schools and Anganwadi centres, particularly in rural and tribal settings in India.

To address the aforementioned gap, C3 carried out a targeted multi-component intervention in Jharkhand, India, leveraging scalable digital platforms to enhance digital and health literacy among adolescent girls.

This assessment aims to assess the impact of a multi-component intervention integrating digital literacy, adolescent health education, and empowerment delivered through public-sector platforms to adolescent girls in Gumla, Jharkhand. The main objective of the assessment is to measure the change in adolescent girl's knowledge regarding SRH, digital health literacy, and utilisation of adolescent-friendly health services following the intervention. It is hypothesised that integrating digital literacy with SRHR education within existing systems will lead to significant

improvements in knowledge, attitudes, and health-seeking behaviours among adolescent girls.

Materials and Methods

A quasi-experimental non-equivalent control group design was adopted, employing a quantitative approach to assess the impact of the digital literacy and adolescent health intervention. The assessment included pre-intervention (2021) and post-intervention (2022) surveys, conducted across both intervention and non-intervention blocks. All three implementing blocks were selected purposively. 2 geographically adjacent blocks with similar population profile were selected for non-intervention (comparison arm) purposively. Random assignment was not possible and is acknowledged as a study limitation.

The study was conducted in Gumla district, Jharkhand, India. Intervention activities were implemented in Sisai, Kamdara, and Raidih blocks, while Dumri and Bharno blocks served as non-intervention (comparison) areas.

Study population and sampling

A multistage probability proportional to size (PPS) systematic random sampling technique was used to select adolescent girls aged 12–19 years from both intervention and non-intervention blocks. The sample size of 300 Adolescent girls across intervention blocks and 150 across non-intervention blocks was calculated using the standard formulae given below assuming 90% confidence and 80% power [10] for measuring 10% change in intervention group from baseline to endline while 15% change in comparison group as intervention blocks are more inaccessible compared to non-intervention blocks.

$$n = [Z_{1-\alpha/2} \times \sqrt{2P(1-P)} + Z_{1-\beta} \times \sqrt{P_1(1-P_1) + P_2(1-P_2)}]^2 / (P_1 - P_2)^2$$

In the intervention blocks (Sisai, Kamdara, and Raidih), a comprehensive list of program participants was stratified by block, and the required sample was allocated proportionately. Respondents were selected using systematic random sampling, with an additional 20% buffer to address potential non-response. In the non-intervention blocks (Dumri and Bharno), eight villages per block were selected using probability proportional to size (PPS) sampling. Within each selected village, 10 eligible adolescent girls were identified through a systematic household selection

procedure, beginning from the northeast corner and skipping at least five households between interviews to minimize selection bias.

Intervention description

The intervention consisted of two integrated components: digital literacy and adolescent health education, delivered through schools and Anganwadi centres targeting 15,000 adolescent girls aged 10–19.

The intervention covered learnings on Life Skills; Livelihood; Digital Literacy; Gender Equality; Agency; SRH Information and Skilling. It aimed to increase access of girls to the internet, mobile phones, and communication technological services to yield higher access to knowledge and information.

Data collection methods

Data were collected using structured questionnaires administered through computer-assisted personal interviewing (CAPI) using SurveyCTO software. Pre-intervention, data was collected telephonically, while post intervention data was collected face to face. All interviews were conducted by trained female interviewers to ensure comfort and confidentiality, particularly for sensitive topics. Two all-female field teams were deployed, each consisting of four interviewers and one supervisor. Informed consent was obtained prior to data collection. For respondents aged ≥ 18 years, verbal consent was taken before scheduling telephonic surveys, while for minors (< 18 years), consent was sought from a parent or guardian, followed by the adolescent's assent. The consent process was audio-recorded for documentation.

A four-level quality assurance process was implemented, including real-time feedback, supervisor monitoring of 10% of interviews, backchecking 20% of responses, and interactive dashboard-based data monitoring. Data collection faced challenges such as identifying sampled respondents accurately and delays due to local festivals. Data processing involved cleaning and cross-tabulation across key indicators, with chi-square tests and Difference-in-Difference approach to assess changes between intervention and non-intervention groups. Data security was ensured through password-protected devices, locked cabinets, and de-identification before analysis.

The assessment protocols for both pre-intervention and post-intervention assessments were reviewed and approved by

Convergent IRB, an Institutional Review Board registered with the Office for Human Research Protections (OHRP), USA (IRB Registration Num: IORG0010818).

Results and Discussion

Participant characteristics

Figure 1 presents the participant flow for the quasi-experimental assessment, and Table 1 summarizes baseline socio-demographic characteristics of adolescents in intervention and non-intervention groups. The intervention sample for the post-intervention assessment consisted majority (55%) of the respondents from the Other Backward Class (OBC) category, and 36% were from the Scheduled Tribe (ST) category, while at the pre-intervention, the majority (63%) of the respondents were ST, and 31% were OBC. Amongst the non-intervention group, 68% of respondents at pre-intervention were ST, which rose to 75% at post-intervention, while the percentage of OBC respondents decreased from 23% to 15%.

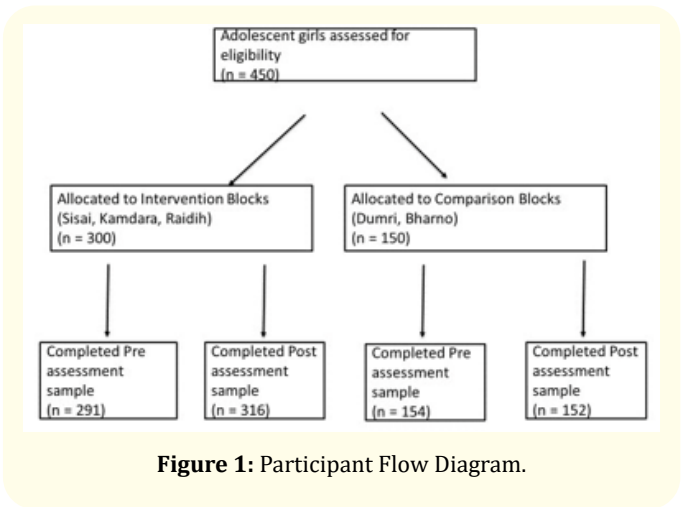


Figure 1: Participant Flow Diagram.

Characteristic	Intervention Group (Pre-Intervention) n (%)	Non-Intervention Group (Pre-Intervention) n (%)
Sample size	291	154
Age group (years)		
12–14	33.3	36.9
15–17	42.6	46.7
18–19	24.1	16.4
Religion		
Hindu	43	43.5

Sarna	29	42.2
Islam	4	1.3
Christian	24	13
Social category		
Scheduled Tribe (ST)	63%	68%
Other Backward Class (OBC)	31%	23%
Scheduled Cast +Other	6%	9%
Marital Status		
Never married	98.5	99
Married and living with spouse	1.5	0
Divorced	0	1
School enrolment status		
Currently enrolled	82.1%	92.2%

Table 1: Baseline Characteristics of Adolescent Girls in Intervention and Non-Intervention Groups.

Mobile phone access, internet use, and digital engagement

Figure 2 presents changes in access to mobile phones and internet use patterns across assessment rounds. The percentage of participants with access to mobile phones increased from 69% to 83% in the intervention group ($p < 0.01$) and from 75% to 83% in the non-intervention group ($p < 0.05$) during the assessment period, yielding a net intervention effect of +6 percentage points.

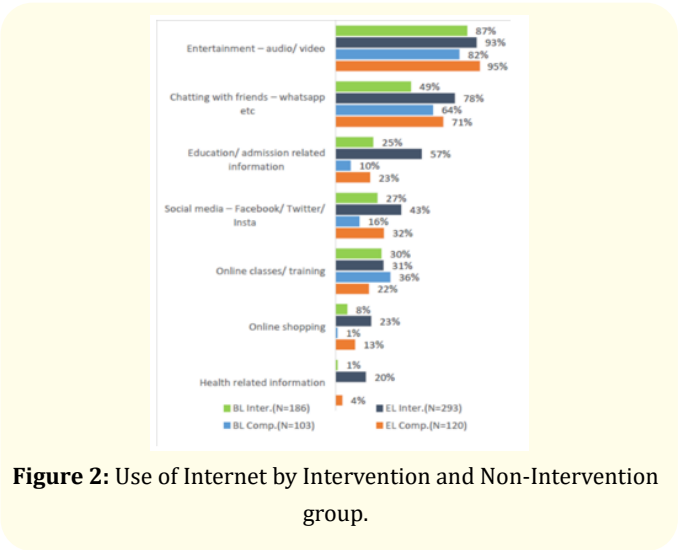


Figure 2: Use of Internet by Intervention and Non-Intervention group.

While almost all respondents in both pre-intervention and post-intervention knew how to make a call, awareness of application usage like WhatsApp and Facebook was significantly greater in the intervention group at post-intervention than in both pre-intervention and the non-intervention group (For Whatsapp: Intervention group: 59% to 86% ($p < 0.00$); Non-intervention group: 57% to 63% ($p > 0.05$; DiD=21 percentage points; $p < 0.01$) and for Facebook Intervention group: 37% to 57% ($p < 0.01$); Non-intervention group: 28% to 40% ($p < 0.05$; DiD=7 percentage points; $p < 0.05$). Further, 47% of intervention group respondents at post-intervention mentioned that they had received health information through mobile phones, as compared to 10% at pre-intervention ($p < 0.01$). In the non-intervention group, this percentage rose slightly from 5% to 11% ($p < 0.05$), yielding a significant net intervention effect (DiD estimate: 31 percentage points; $p < 0.01$). Daily internet use increased by 17 percentage points in the intervention group ($p < 0.01$) but declined by 8 percentage points in the non-intervention group ($p > 0.05$), resulting in a significant net intervention effect (DiD estimate: +25 percentage points; $p < 0.01$). This can also be seen in the rise in the use of Youtube platform, while Instagram remained low (Table 2).

Awareness of cyberbullying and online safety

Unawareness of any kind of cyberbullying fell from 72% at pre-intervention to 30% at post-intervention ($p < 0.01$), but increased in the non-intervention group (73% to 84%; $p < 0.01$), indicating a statistically significant intervention effect (DiD estimate:

	Post Intervention Group	Post Intervention Comparison Group
Base	293	120
Frequency of using Instagram		
Never	68.3%	80.0%
Rarely	11.3%	5.0%
Almost every day	10.6%	6.7%
At least once a week	7.8%	5.0%
At least once a month	2.0%	3.3%
Frequency of using YouTube		
Almost every day	56.7%	48.3%
At least once a week	18.8%	28.3%
Rarely	16.4%	11.7%
At least once a month	6.5%	6.7%
Never	1.7%	5.0%

Table 2: Frequency of using Instagram and YouTube.

41 percentage points; $p < 0.01$);. Among post-intervention respondents in intervention groups, 60% pinpointed cyberbullying with “sending text or email messages,” 47% with “verbally name-calling,” 27% with “spreading rumors through social media or via email,” and 30% with “online harassment through a false profile”, as seen in table 3.

	Pre Intervention Group	Post Intervention Group	Pre Intervention Comparison Group	Post Intervention Comparison Group
Base	186	293	103	120
Sending mean text messages or emails	20.4%	60.1%	25.2%	13.3%
Verbally calling names	23.7%	47.4%	23.3%	10.0%
Harassing someone through fake profiles	11.3%	30.0%	1.9%	2.5%
Circulating rumors through social networking sites or email	11.3%	26.6%	2.9%	0.0%
Other	1.1%	0.3%	0.0%	0.0%
Don't know	72.0%	30.4%	72.8%	84.2%

Table 3: Knowledge about “cyber bullying” / “online bullying”.

Sexual and reproductive health rights (SRHR) knowledge and education exposure

Exposure to adolescent health education increased substantially in intervention areas. At post-intervention, 26% of intervention respondents reported NGOs as their main SRHR source of information, followed by teachers/schools (23%), ASHA workers (23%), and Anganwadi workers (14%). 95% of intervention participants reported having attended an Adolescent Health (AH) education program, compared to 31% at pre-intervention ($p < 0.01$) and 47% and 44% respectively in the non-intervention group ($p > 0.05$; DiD=61 percentage points; $p < 0.01$).

Participation in Rashtriya Kishor Swasthya Karyakram (RKSK) increased from 14% to 59% in intervention group ($p < 0.01$) while decreased from 17% to 0% in non-intervention group ($p < 0.01$); thus the difference in difference was significantly high at 62 percentage points ($p < 0.01$).

Participants who had attended any Rashtriya Kishor Swasthya Karyakram (RKSK) sessions or learned health information from a peer educator were requested to report the number of sessions that they attended in the last 12 months. All intervention participants attended Adolescent health sessions for more than seven months, averaging 22 sessions, with 44% attending weekly. 97% had Anganwadi sessions, and 77% completed the course. Table 4 shows the regularity (or lack of it) in attending SRH session for the intervention group.

	Post Intervention Group
Base: Attended any adolescent health/ family life/sex education program in last one year	156
Last Session	
This Month	14.7%
1 month ago	23.1%
2 months ago	16.0%
3-4 months ago	25.0%
5-6 months ago	5.8%
7-9 months ago	7.1%
10-12 months ago	7.7%
>12 months ago	0.0%
Don't know	0.6%

Joined Session	
This Month	2.6%
1 month ago	14.1%
2 months ago	7.1%
3-4 months ago	9.0%
5-6 months ago	7.1%
7-9 months ago	39.1%
10-12 months ago	18.6%
>12 months ago	2.6%
Don't know	0.0%

Table 4: Gap in Attended sessions by Adolescents during the Intervention.

Awareness and attitudes toward menstruation health, age of consent and physical changes during adolescence

The three most discussed topics were Nutrition and Health (Pre-Intervention-83%; Post-Intervention-91%), Growing Up (Adolescent Changes) (Pre-Intervention-67%; Post-Intervention-82%), and Menstrual Health and Hygiene (Pre-Intervention-76%; Post-Intervention-77%). There was a large improvement in SRH awareness, with first-time pregnancy risk awareness increasing from 17% to 69% among the intervention group ($p < 0.01$), and knowledge of fertility periods increasing from 21% to 70%, while decreasing in the non-intervention group (25% to 12%; $p < 0.01$; DiD=65 percentage points; $p < 0.01$) as shown in figure 3.

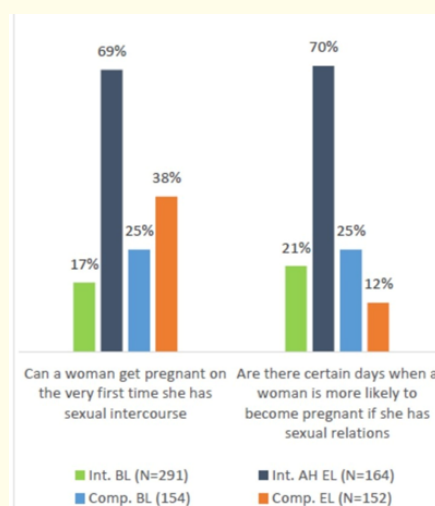


Figure 3: Awareness about pregnancy related matters.

Table 5 presents results from awareness regarding changes which take place during adolescence. Knowledge of physical changes during adolescence, including growth spurts, menstruation, and the development of body hair, were high in both assessment groups. However, awareness of less obvious adolescent changes was enhanced more in the intervention group. At post-

intervention, 53% of intervention respondents (compared to 14% at pre-intervention ($p < 0.01$)) accurately named nightfall as a male-specific phenomenon, whereas in the non-intervention group, awareness rose from 10% to 26% ($p < 0.01$; DiD=23 percentage points; $p < 0.01$).

	Pre Intervention Group	Post Intervention Group (AH)	Pre Intervention Comparison Group	Post Intervention Comparison Group
Base	291	164	154	152
Does Increase in height and weight take place among only boys, only girls or both?				
Only among boys	6.9%	1.2%	6.5%	0.7%
Only among girls	3.1%	0.6%	1.3%	0.7%
Among both	82.5%	98.2%	89.6%	95.4%
Don't know	7.6%	0.0%	2.6%	3.3%
Does Menstruation take place among only boys, only girls or both?				
Only among boys	0.0%	0.0%	0.0%	0.0%
Only among girls	91.1%	97.6%	92.2%	94.1%
Among both	3.1%	1.8%	3.2%	3.9%
Don't know	5.8%	0.6%	4.5%	2.0%
Does growth of hair in private parts take place among only boys, only girls or both?				
Only among boys	0.7%	0.6%	0.6%	0.0%
Only among girls	7.6%	7.3%	10.4%	12.5%
Among both	72.2%	91.5%	84.4%	76.3%
Don't know	19.6%	0.6%	4.5%	11.2%
Does broadening of hips take place among only boys, only girls or both?				
Only among boys	25.8%	9.1%	23.4%	0.7%
Only among girls	5.8%	46.3%	18.2%	46.7%
Among both	45.7%	42.7%	39.0%	38.2%
Don't know	22.7%	1.8%	19.5%	14.5%
Does the development of breasts take place among only boys, only girls or both?				
Only among boys	0.7%	0.0%	0.0%	2.6%
Only among girls	69.1%	96.3%	91.6%	85.5%
Among both	16.2%	3.7%	5.8%	8.6%
Don't know	14.1%	0.0%	2.6%	3.3%
Does change in voice take place among only boys, only girls or both?				
Only among boys	27.5%	76.2%	25.3%	56.6%
Only among girls	1.0%	0.0%	1.9%	5.9%
Among both	68.0%	23.8%	69.5%	34.2%

Don't know	3.4%	0.0%	3.2%	3.3%
Base: Age between 15 and 19 years	194	107	97	88
Does Emission / ejaculation of semen in sleep / getting wet in sleep take place among only boys, only girls or both?				
Only among boys	14.4%	53.3%	10.3%	26.1%
Only among girls	3.6%	6.5%	1.0%	8.0%
Among both	25.8%	29.0%	17.5%	31.8%
Don't know	56.2%	11.2%	71.1%	34.1%

Table 5: Changes during Adolescence Knowledge regrading SRH due to Intervention.

One indicator that did not show a positive outcome was an increase in adolescents thinking that Emission/ejaculation of semen in sleep takes place only in girls for intervention group (3.6% to 6.5%) as seen in [figure 4](#).

Agreement that menstruation does not restrict routine activities increased, with 92% at post-intervention (versus 67% at pre-intervention) (75% to 84% in non-intervention group; DiD estimate: 16 percentage points; $p < 0.01$) concurring that a girl can cook while menstruating, whereas in the non-intervention group, this percentage rose from 75% to 84%. Table 6 highlights changes in some of the common misconceptions regarding menstruation.

Legal age for consent to sex awareness rose from 3% to 34% ($p < 0.01$) in the intervention group while it remained same at 3%-4% in non-intervention group (DiD estimate: 33 percentage points; $p < 0.01$) Respondents were asked what according to them should be the appropriate age for a girl at first child birth. Over 80% mentioned appropriate age for a girl at first childbirth between 20 and 24 years of age in pre-intervention compared to around 45% in post-intervention period.

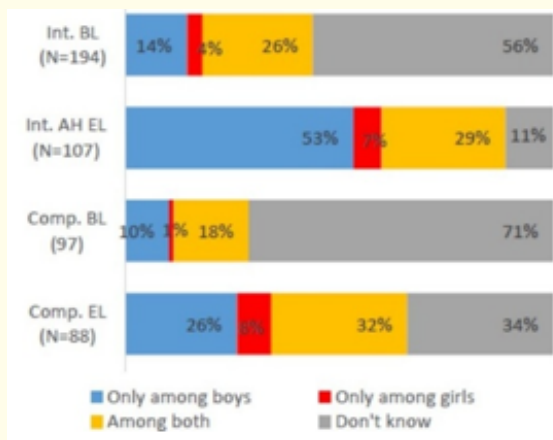


Figure 4: Knowledge about Nightfall Awareness among Adolescent Girls.

	Pre Intervention Group	Post Intervention Group (AH)	Pre Intervention Comparison Group	Post Intervention Comparison Group
Base	291	164	154	152
During menstruation girls can cook	66.7%	92.1%	74.7%	83.6%
While menstruating girls can play	53.3%	81.1%	64.9%	63.2%
While menstruating girls can touch pickles	26.5%	59.8%	27.9%	33.6%
During menstruation, a woman can visit places like temple/mosque	28.5%	56.1%	30.5%	21.1%
During menstruation one has to stay away from others	28.9%	6.7%	15.6%	16.4%

Table 6: Respondents who do not believe in myths regarding menstruation.

Awareness of contraception, HIV/AIDS, and STDs

At post-intervention, there was a high level of awareness of contraception among the intervention group, as shown in Table 7, with oral pill knowledge increasing from 45% to 92%, condoms from 36% to 89%, and Emergency Contraceptive Pills (ECPs) from 13% to 63%. Awareness of IUDs and injectables also increased, with accurate knowledge of condom use rising from 35% to 83%.

Knowledge regarding correct usage among those aware of the method has also increased. More respondents know how often

a woman should take oral pills in intervention and comparison area. 69% of respondents in intervention area who knew about Emergency Contraceptive Pills said that it should be taken upto three days or 72/48 hours after sexual intercourse. Proportion of respondents who said that one condom can be used for only one act of sexual intercourse has increased considerably in intervention area (Pre-Intervention: 35%; Post-Intervention: 83%) than non-intervention area (Pre Non-Intervention: 33%; Post Non-Intervention: 49%) with DiD at 33 percentage points; $p < 0.01$)

	Pre Intervention Group	Post Intervention Group (AH)	Pre Intervention Comparison Group	Post Intervention Comparison Group
Base	194	107	97	88
Oral pills	44.8%	91.6%	50.5%	60.2%
Emergency Contraceptive Pills	13.4%	62.6%	18.6%	23.9%
Condoms	35.6%	88.8%	46.4%	55.7%
IUD	19.6%	79.4%	24.7%	39.8%
Injectables	24.2%	80.4%	33.0%	29.5%
Male sterilization	3.1%	56.1%	2.1%	27.3%
Female sterilization	20.1%	81.3%	11.3%	75.0%
safe period/ SDM	1.5%	6.5%	0.0%	1.1%
Abstinence	1.5%	0.0%	1.0%	2.3%
None	75.8%	18.7%	86.6%	23.9%
Other	3.6%	0.9%	1.0%	1.1%

Table 7: Awareness about contraceptive methods for avoiding conception or delaying pregnancy.

When asked where they can get a contraceptive, most of the respondents in intervention area mentioned Govt. / Private Facility / Doctor/ Nurse (94%), 2/3rd mentioned Paan shop/chemist and

more than ½ said ASHA/ Sahiya/ AWW (53%). 20% also mentioned AFHC (Yuva Maitri Kendra) which was not mentioned at all in pre-intervention or in non-intervention area.

	Pre Intervention Group	Post Intervention Group (AH)	Pre Intervention Comparison Group	Post Intervention Comparison Group
Base	103	104	58	65
Govt. / Private Facility / Doctor/ Nurse	74.8%	94.2%	87.9%	78.5%
Paan shop/chemist	56.3%	66.3%	63.8%	43.1%
ASHA/ Sahiya/ AWW	22.3%	52.9%	25.9%	50.8%
ANM	13.6%	23.1%	22.4%	29.2%
AFHC (Yuva Maitri Kendra)	0.0%	20.2%	0.0%	0.0%

NGO	0.0%	1.0%	0.0%	0.0%
Don't Know	14.6%	0.0%	0.0%	4.6%
Other (specify)	0.0%	0.0%	0.0%	1.5%

Table 8: Knowledge on procuring contraceptives.

HIV/AIDS awareness increased from 26% to 70%, while it decreased in the non-intervention group (23% to 18%), yielding a significant net intervention effect (DiD estimate: 49 percentage points; $p < 0.01$). Table 9 shows that a higher proportion in post-intervention area said that one can get AIDS by sharing needles,

syringes with someone infected with AIDS virus; reduce chances of getting AIDS by using a condom every time they have sex and by having just one sex partner. However, proportion of respondents who believed that one can get AIDS from mosquito bites and can tell by looking at a person where s/he has HIV also increased.

	Pre Intervention Group	Post Intervention Group (AH)	Pre Intervention Comparison Group	Post Intervention Comparison Group
Base	291	164	154	152
Heard of HIV/AIDS	26.1%	70.1%	23.4%	17.8%
Base: Heard of HIV/AIDS	76	115	36	27*
A person can get AIDS by sharing needles, syringes with someone infected with AIDS virus	82.9%	95.7%	86.1%	
People can reduce their chances of getting the AIDS virus by using a condom every time they have sex	36.8%	80.0%	61.1%	
People can reduce their chances of getting the AIDS virus by having just one sex partner	40.8%	79.1%	72.2%	
People can get the AIDS virus by sharing food with a person who has AIDS	14.5%	22.6%	30.6%	
People can get the AIDS virus from mosquito bites	14.5%	18.3%	19.4%	
You can tell by looking at a person whether s/he has HIV	1.3%	8.7%	2.8%	

Table 9: Knowledge of HIV/AIDS.

Knowledge about other STDs during pre-intervention assessment was low. Proportion of respondents who have heard about any infections that people can get from sexual contacts apart from HIV/AIDS increased post intervention. In terms of treatment options, all respondents in intervention area said that they can get treatment from traditional healer; 95% mentioned Government facility/doctor and 84% mentioned Private facility/doctor post the intervention.

Knowledge of anaemia rose from 62% to 98% ($p < 0.01$) in the intervention group and from 58% to 78% ($p < 0.01$ with DiD=16; $p < 0.01$) in the non-intervention group. Knowledge of anaemia

symptoms and causes also increased more in the intervention group compared to the comparison group.

Among the respondents who were aware, higher proportion of respondents from intervention group covered in post-intervention could identify the symptoms and reasons for Anaemia than the respondents covered in pre-intervention areas and the respondents covered in non-intervention areas across pre and post survey. Maximum respondents in intervention areas could identify the following 3 symptoms – tiredness/ weakness in the body (87%), skin and palm looks pale (86%) and lack of redness in lips, tongue, nails, etc (86%). The proportion of respondents from intervention

group who did not know about any symptoms in pre-intervention was 29% which reduced to only 1% in post-intervention.

Utilisation of adolescent health services

Utilisation of adolescent-friendly health services increased markedly in intervention areas. The percentage of adolescents receiving school-based health care from a nurse or doctor rose from 12% to 65% within the intervention group, compared to 11% to 33% in the non-intervention group (with significant DiD=31 percentage points; $p < 0.01$).

Adolescent Health Day (AHD) participation was raised from 30% to 70% in the intervention group, whereas it dropped from 29% to 3% in the non-intervention group (with significant DiD=66 percentage points; $p < 0.01$). Adolescent Friendly Health Clinics (AFHC) awareness increased from 30% to 87% in the intervention group, whereas it dropped from 29% to 6% in the non-intervention group (with significant DiD=80 percentage points; $p < 0.01$), with AFHC visits being raised from 21% to 48%. Maximum adolescents who had attended AHD received counselling (69%) followed by IFA supplements (49%) and height measurement (40%). The proportions who received these services in pre-intervention was lower – 54%, 40% and 36% respectively. The percentage of adolescents received health information and/or services from ASHA dropped from 38% to 5% in the intervention group, whereas in the non-intervention group, it went down from 47% to 38%. This could be attributed to adolescents now seeking information and services from other sources, such as AFHCs, school-based healthcare etc.

There was increase in awareness about the government schemes and programs for adolescents among both intervention (75% in Pre-Intervention to 98% in Post-Intervention). The awareness of specific schemes and programs was significantly higher among intervention group than comparison group in post-assessment with the highest awareness for the School Health and Wellness Program (42% intervention group, 29% non-intervention group) followed by RKSK (32% intervention group, 4% non-intervention group) and AFHC (27% intervention group and 1% non-intervention group).

Discussion

Advancement in adolescent health and education is most closely linked with low fertility rates and better maternal and child health

[11]. This study demonstrates that integrating digital literacy with adolescent health education leads to significant improvements in digital access, SRHR knowledge, and utilization of adolescent-friendly health services among adolescent girls in Jharkhand. Key outcomes included increased mobile and internet use for health information, higher awareness of cyber bullying, substantial gains in SRHR knowledge across different domains (menstruation, contraception, HIV/AIDS, anaemia, and legal rights), and markedly improved uptake of services such as Adolescent Health Days (AHDs) and Adolescent Friendly Health Clinics (AFHCs).

Earlier studies have advocated for comprehensive sexuality education (CSE) that leverages digital platforms to make content accessible and relatable to adolescents, especially in settings where classroom-based education on SRH remains limited [12,13]. Consistent with this literature, the intervention arm showed a nearly fourfold increase in the use of mobile phones for accessing health information (10% to 47%), alongside improvements in social media engagement and cyber safety awareness.

The findings suggest that the intervention was effective not just due to information provision, but through specific mechanisms that strengthened adolescents' self-efficacy and agency. This likely enabled more active and confident information-seeking behaviors, which when combined with structured, age-appropriate SRHR content delivered through trusted institutions such as schools and Anganwadi centers translated into improved knowledge and service uptake. These results corroborate past literature, which indicates that digital tools not only enhance SRH knowledge but also promote informed decision-making and health-seeking habits [2,5,6]. Additionally, multi-component, culturally adapted interventions were found to decrease negative gender norms and enhance health outcomes, underlining the demand for scalable, community-driven models that span digital and health literacy gaps [11,12].

Some counterintuitive findings were present, such as a rise in misconceptions related to HIV transmission (e.g., mosquito bites) and an increase in incorrect beliefs about nightfall. These underscore the complexity of learning processes during adolescence. These patterns may reflect partial knowledge acquisition, increased exposure to health terminology without sufficient reinforcement, or confusion arising during early stages of concept formation. Similar phenomena have been documented

in other digital and school-based SRHR programs, emphasizing the importance of iterative reinforcement, clearer distinction between myths and facts, and periodic refresher sessions to consolidate accurate understanding [8]. Addressing these gaps is critical for refining curriculum content and pedagogy in future iterations of the intervention.

The intervention combined digital literacy with health education, delivered by schools and Anganwadi centers, enabling wide coverage and community engagement. The quasi-experimental pre-post design with a comparison group allowed design assessment of changes over time, although causal inference remains limited. In spite of its robustness, there are several limitations in the assessment. The non-random assignment of intervention and comparison blocks introduces potential selection bias; baseline differences in caste composition, service access, or community engagement may have influenced outcomes. The self-report measures of SRH behavior and knowledge are also prone to social desirability bias. The follow-up period of approximately one year limits conclusions about long-term retention of knowledge and sustained behavior change. Also, without the presence of qualitative data, it is impossible to understand contextualise the changes attributable to the intervention. Generalizability of the results may further be restricted to comparable rural environments only since urban adolescents might have varying access to online resources and SRH care. Subsequent assessments must involve longitudinal studies to determine the long-term effects of digital literacy programs on SRH outcomes.

Conclusion

The effectiveness of this intervention highlights the importance of embedding digital literacy in adolescent health interventions in LMICs. Policy efforts could focus on integrating a certified digital and health literacy module into the Rashtriya Kishor Swasthya Karyakram (RKSK), delivered through existing public platforms using tablet-based or mobile tools, prioritising reaching rural regions [14]. Digital SRH interventions should also include age-appropriate and culturally responsive content to counter stigma and myths around reproductive health [9]. Given persistent gaps in addressing gender-based violence (GBV) and intimate partner violence (IPV) within SRHR programs, future digital curricula should explicitly include these components in contextually appropriate ways [2]. Strengthened collaborations between health

professionals, educators, and digital platforms could further improve trustworthiness, contextual appropriateness and ease of access to online SRH information. Subsequent research should evaluate parental and community involvement in maintaining digital SRH literacy. In addition, common study designs within various settings would allow for comparisons and policy guidance to implement proven interventions on an international scale [3].

Overall, this study contributes to the growing evidence base that community-based, multi-component digital literacy and SRHR interventions can address structural barriers to information, agency, and service access for adolescent girls. It focusses on change-oriented potential of digital literacy to upgrade adolescent girls' health information, self-confidence, and agency for SRH service utilization. By providing girls with the digital skills and tools to seek out, critically evaluate, and act on health information, the intervention facilitated enhanced agency, diminished gender-based myths and taboos, and enhanced knowledge of timely use of health services. Replicating and scaling similar intervention models to larger areas in low-resource contexts, while upholding cultural compatibility, sustained engagement and stakeholder partnership, has the potential to advance adolescent health, gender equity, and broader public health goals in low-resource settings.

Acknowledgements

The authors gratefully acknowledge Craft Consultancy as the technical agency for carrying out data collection and initial analysis.

Conflict of Interest

The authors declare no conflicts of interest.

Bibliography

1. International Institute for Population Sciences (IIPS), and ICF. National Family Health Survey (NFHS-5) (2019–21: India. IIPS, (2021).
2. Huang KY, *et al.* "Applying Technology to Promote Sexual and Reproductive Health and Prevent Gender-Based Violence for Adolescents in Low- and Middle-Income Countries: Digital Health Strategies Synthesis from an Umbrella Review". *BMC Health Services Research* 22 (2022): 1373.

3. Psaki SR, *et al.* "Causal Effects of Education on Sexual and Reproductive Health in Low- and Middle-Income Countries: A Systematic Review and Meta-Analysis". *SSM - Population Health* 8 (2019): 100386.
4. Halpern C T, *et al.* "Effectiveness of Web-Based Education on Kenyan and Brazilian Adolescents' Knowledge about HIV/AIDS, Abortion Law, and Emergency Contraception: Findings from Teen Web". *Social Science and Medicine* 67.4 (2008): 628-637.
5. Taba M., *et al.* "Adolescents' Self-Efficacy and Digital Health Literacy: A Cross-Sectional Mixed Methods Study". *BMC Public Health* 22 (2022): 1223.
6. Zaim H., *et al.* "Improving Teen Girls' Skills for Using Electronic Health Information". *Health Literacy Research and Practice* 5.1 (2021): e26-34.
7. Gogoi A., *et al.* "Design and Implementation of Digital Literacy Training Programme: Findings of a Quasi-Experimental Study from Rural India". *PLOS Digital Health* 4.4 (2025): e0000617.
8. Purnamasari ERW and RDD Rosa. "Digital Literacy, Health, and Reproductive Health in Early Adolescent Girls". *Malaysian Journal of Medicine and Health Sciences* 20.3 (2024).
9. Mirmoghtadaie ZS., *et al.* "Effectiveness of E-Learning on Sexual Health among Students of Shahid Beheshti University of Medical Sciences Based on the Kirkpatrick Model". *Journal of Education and Health Promotion* 13 (2024): 221.
10. Lwanga S K and S Lemeshow. "Sample Size Determination in Health Studies: A Practical Manual". World Health Organization (1991).
11. Azzopardi PS, *et al.* "Progress in Adolescent Health and Wellbeing: Tracking 12 Headline Indicators for 195 Countries and Territories, 1990–2016". *The Lancet* 393.10176 (2019): 1101-1118.
12. Chandra-Mouli V, *et al.* "What Does Not Work in Adolescent Sexual and Reproductive Health: A Review of Evidence on Interventions Commonly Accepted as Best Practices". *Global Health: Science and Practice* 3.3 (2015): 333-340.
13. UNESCO. International Technical Guidance on Sexuality Education: An Evidence-Informed Approach. United Nations Educational, Scientific and Cultural Organization (2018).
14. GSMA. Connected Women: The Mobile Gender Gap Report 2021. GSMA (2021).