THE EFFECTIVE EVALUATION OF DIGITAL REPRODUCTIVE HEALTH LITERACY INTERVENTION ON SERVICE COMPETENCIES OF HEALTH PROVIDERS IN ADOLESCENT AND YOUTH HEALTH CLINICS IN THAILAND

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ABSTRACT

INTRODUCTION: Globally, reproductive health remains concerning due to the insufficient knowledge and understanding among healthcare providers. This knowledge gap also extends to their limited ability to utilize technology for delivering services. The purpose of this research was to find the effectiveness of the Digital Reproductive Health Literacy (DRHL) intervention to enhance service competencies.

METHODS: The randomized controlled trials (RCTs) were conducted from January to July 2023. The 60 participants aged 20 to 60 working in adolescent and youth clinics were selected through random assignment and 30 were allocated to 12 hours of intervention in 6 modules, consisting of knowledge, digital skills, communication skills, provider attitudes, digital-based services, and networking skills. 30 participants were assigned in the control group. The data were collected using the DRHL scale with a reliability of 0.97, and a discriminant power of 0.2 to 0.8. Data were analyzed using MANCOVA.

RESULTS: The results showed that health providers in the experimental group had a significantly higher mean score of DRHL (Mean = 90.83, 80.60) and competencies (Mean 69.60, 62.00) than the control group at after treatment and follow-up (Mean = 93.13, 81.13; Mean= 70.57, 62.97, $p<.01$). The mean score of the experimental group with DRHL and competencies by domains at follow-up were higher than the mean score before treatment ($p < .05$). The DRHL intervention effectively enhance the competencies of health providers.

CONCLUSION: Human resources specialists or administrators could apply DRHL intervention to promote DRHL and competencies for health providers working in adolescent and youth health clinics.

KEYWORDS: reproductive health, health literacy, digital literacy, adolescent and youth, competency

(The Ethiopian Journal of Reproductive Health; 2023; 15; 57-67)

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INTRODUCTION

Reproductive health has emerged as a global concern since 1994, with maternal deaths primarily linked to pregnancy and delivery, particularly in middle- to low-income countries[1]. Adolescent girls aged 10 to 14 face a higher risk of complications and death during pregnancy[2]. Equipping adolescents with reproductive health knowledge before conception, during pregnancy, and post-childbirth is crucial in preventing unplanned pregnancies, unsafe abortions, and related consequences, ultimately saving lives[3]. The World Health Organization (WHO) has established a benchmark for total fertility rates (TFR) at 2.1 for individuals. A TFR below this threshold can impact the labor force and contribute to an aging society, thereby affecting a nation's economy and social fabric[4,5]. WHO's research reveals a significant proportion of maternal deaths worldwide are linked to pregnancy and childbirth, with a staggering 94% occurring in low- and middle-income countries. Notably, adolescent girls aged 10-14 face a higher risk of pregnancy-related complications and fatalities. This is partly attributed to inadequate reproductive health knowledge, a lack of skills, limited access to online health information, and insufficient planning abilities among health providers[6-8]. Moreover, there is a deficiency in interpersonal communication, capacity for problem-solving, and effective use of technology as a tool in their work[6,9]. Addressing these challenges necessitates the establishment of adolescent and youth health clinics staffed by knowledgeable professionals proficient in digital reproductive health. This approach promises more convenient, efficient, and cost-effective healthcare services, enhancing accessibility without discrimination. Recognizing the critical role of personnel in reproductive health, WHO emphasizes continuous development, ensuring that health providers possess the requisite knowledge and skills to offer advice[10], thereby promoting equitable access to rights and treatments[11]. This investment in human capital is a cornerstone of a robust healthcare system, tailor-made to address the prevailing circumstances[12,13]. Furthermore, WHO advocates for the integration of digital health solutions among healthcare providers and their clientele as a secure and cost-efficient strategy for the future[14]. This approach promises enhanced satisfaction and outcomes for the target audience, setting new standards for healthcare provision[15]. In summarizing previous research, it is evident that there is a substantial deficit in reproductive health education among health providers in adolescent and youth health clinics, with knowledge gaps often extending beyond digital channels. The researcher has developed a digital intervention that combines various methodologies from related works of literature to promote Digital Reproductive Health Literacy (DRHL) among health providers in adolescent and youth health clinics. This intervention equips providers with the skills to access, understand, assess, and apply information related to reproductive health. Consequently, it enhances their knowledge, skills, and attitudes, leading to improved competencies in their work.

OBJECTIVE

The aim of this research is to find the effectiveness of Digital Reproductive Health Literacy (DRHL) intervention to enhance service competencies among health providers that can foster greater satisfaction among service recipients, thereby increasing the number of teenagers and young people seeking quality reproductive health services through digital channels.

METHODS

Research Design

The randomized controlled trials (RCTs) with pretest, posttest, and follow-up that was conducted from January to July 2023. The research question was "Does the DRHL intervention effectively enhance the competencies of health providers in adolescent and youth health clinics?" Three research hypotheses are H1: the health providers in the experimental group have significantly higher

scores in digital reproductive health knowledge and competencies in the post-experiment compared to the control group, H2: the health providers in the experimental group have significantly greater scores in digital reproductive health knowledge and competencies in the follow-up period compared to the control group, and H3: the health providers in the experimental group have significantly higher scores in digital reproductive health knowledge and competencies in the follow-up period compared to the before treatment.

Participants

The research used an assignment random sampling design for an experimental design, specifically targeting 60 health providers from population of 899 accredited service centers under the Ministry of Public Health across Thailand. These individuals possessed a minimum of one year of experience working in adolescent and youth clinics and had not received previous training in DRHL. The DRHL intervention was certified for human research ethics from Srinakharinwirot University. Project No. SLUEC-G- 015/2023. Certification Date 3rd February 2023.

Evaluation Design

The aim of this research was to find the effectiveness of Digital Reproductive Health Literacy (DRHL) and intervention to enhance service competencies among health providers . An integrated research methodology was employed, featuring an experimental model, pre-post intervention, and follow-up. This methodological approach was devised in accordance with Creswell's framework[17]. A questionnaire of DRHL was integrated with concepts from the Self-Efficacy Theory[18], Experiential Learning Theory[19], and Human Resource Development concept. A questionnaire of competencies in this research was employed by the Youth Friendly Health Services standards and Cooper's 19 operational competency concept. The content of each activity was derived from Sørensen's conceptualization of health literacy, encompassing four key components: access, understand, appraise, and apply health information20.

Data Collection

The gathered data from related works of literature was utilized to design the DRHL intervention for health providers in the clinics. Assessments included a DRHL assessment consisting of 20 questions for health providers in adolescent and youth clinics with a reliability of 0.93 and a competency assessment questionnaire comprising 15 questions for working with adolescents in these clinics with a reliability of 0.94, respectively, which were considered by five experts with an IOC value range from 0.26 to 0.97.21 The appropriateness of the intervention was evaluated by five experts in reproductive health, health promotion, and behavioral science, utilizing an intervention conformity assessment form. The study employed an experimental design with samples consisting of medical and public health personnel providing services in hospitals or health clinics. The sample was selected through random assignment sampling, resulting in 30 participants in the experimental group and 30 in the control group. The sample size was determined based on the principle of Cohen 19 and G*Power. 19 with a power value of 0.85, an error of .05, and a medium effect size of 0.25. The researcher added 10% to the sample in case of resignation by the participants; therefore, 60 cases were yielded. The study evaluated the results before and after the experiment, as well as one-month follow-up, comparing the experimental and control groups.

Measurement

The intervention was designed and developed to encompass1 education,2 practical operational skills, and3 fostering a positive service provider attitude to facilitate widespread participation., A 12-hour online training intervention was organized in March, taking advantage of a two-day public holiday. Additionally, the intervention 's content and activities including 6 modules of total 720 minutes or 12 hours were delineated. as the detail follows in Table 1

Table 1. DRHL Intervention on Competencies Enhancement of Health providers.

Module	Time	Activities
Module 1: Related Knowledge	90 minutes	The lecture covers topics related to digital reproductive health and standardized service delivery for adolescents. The session includes activities such as watching short video clips, engaging in discussions, and expressing opinions. Participants also have the opportunity to make observations and reflect on the content they've learned. Additionally, the session concludes with the acknowledgment of achievements, including rewarding compliments and other recognitions.opportunity to make observations and reflect on the content they've learned. Additionally, the session concludes with the acknowledgment of achievements, including rewarding compliments and other recognitions.
Module 2: Digital Adaptation Skills	90 minutes	Engaging in a knowledge-sharing session where we explore challenges and the significance of adapting to adolescents in the digital age. This involves critical questioning, open discussions of opinions, and the recognition of valuable contributions, including rewarding compliments and other forms of acknowledgment.
Module 3: communica-tion skills	90 minutes	Training in creative communication skills, which includes fostering critical questioning, facilitating open discussions of opinions, and acknowledging achievements through rewarding compliments and other forms of recognition.
Module 4: Provider attitude and awareness	90 minutes	Engaging in an attitude exchange among health providers, which involves critical questioning, open discussions of opinions, and interactive role-playing exercises. The session also includes the recognition of valuable contributions, including rewarding compliments and other forms of acknowledgment.
Module 5: Digital based services	180 minutes	Training in creative communication skills, which encompasses critical questioning, open discussions of opinions, interactive role-playing, and the acknowledgment of achievements through rewarding compliments and other forms of recognition.
Module 6: Networking skills	180 minutes	Training to enhance service competency through the development of critical questioning skills, open discussions of opinions, interactive role-play activities, and the recognition of achievements through rewarding compliments and other incentives.

Data Analysis

The selection of subjects in this study was independent, and the normality assumption of the data was assessed by examining skewness and kurtosis using the Shapiro-Wilk test and parametric statistics. The results indicated a significant difference in mean scores between the experimental and control groups for DRHL and competencies with p-value < 0.05 and < .01, using MANCOVA revealed a statistically significant increase in the total score of DRHL and competencies for the experimental group after the treatment.

RESULTS

Absolute Variation

The population had a minimum of one year of experience working in adolescent and youth clinics and had not received previous training in DRHL. The result of the data analysis revealed that the DRHL mean scores of the health providers in the experimental and control groups were before treatment of 71.83 and 80.60, after of 90.83 and 80.73, and follow-up (1 month) of 93.13 and 81.13. The competencies mean scores were before treatment of 54.03 and 60.90, after of 69.60 and 62.00, and follow-up (1 month) of 70.57 and 62.97 respectively as followed in Table 2.

Table 2. Mean and standard deviation of DRHL and Competencies classified by experimental group and control group.

DRHL, Competencies and Components	Experimental group		Control group		Total	
	M	SD	M	SD	M	SD
DRHL						
Before treatment	71.83	10.08	80.60	8.22	76.22	10.13
After treatment	90.83	6.77	80.73	8.18	85.78	9.02
Follow-up	93.13	3.63	81.13	4.66	87.13	7.33
Access						
Before treatment	21.43	3.34	24.20	2.63	22.82	3.23
After treatment	27.40	2.33	24.57	3.03	25.98	3.03
Follow-up	28.03	1.35	24.20	1.90	26.12	2.53
Understand						
Before treatment	18.63	2.86	20.10	2.40	19.37	2.72
After treatment	22.43	2.03	19.57	2.33	21.00	2.60
Follow-up	23.27	1.08	20.20	1.86	21.73	2.16
Appraise						
Before treatment	21.07	3.29	24.00	2.74	22.53	3.35
After treatment	27.47	2.30	24.43	2.80	25.95	2.97
Follow-up	27.73	1.53	24.33	2.26	26.03	2.57
Apply						
Before treatment	10.70	1.62	12.30	1.18	11.50	1.62
After treatment	13.53	1.31	12.17	1.34	12.85	1.48
Follow-up	14.10	0.92	12.40	1.40	13.25	1.46
COMPETENCIES						
Before treatment	54.03	8.65	60.90	8.64	57.47	9.25
After treatment	69.60	5.30	62.00	8.52	65.80	8.01
Follow-up	70.57	3.20	62.97	3.76	66.77	5.16
Knowledge						
Before treatment	20.57	3.36	23.27	3.11	21.92	3.49
After treatment	27.60	2.42	24.43	3.43	26.02	3.35
Follow-up	28.00	1.74	24.80	1.88	26.40	2.42
Skill						
Before treatment	17.80	3.77	20.47	3.25	19.13	3.72
After treatment	22.97	2.09	20.50	2.95	21.73	2.82
Follow-up	23.50	1.41	20.97	1.81	22.23	2.05
Attitude						
Before treatment	15.67	2.77	17.17	2.83	16.42	2.88
After treatment	19.03	1.27	17.07	2.75	18.05	2.35
Follow-up	19.07	0.87	17.20	1.54	18.13	1.56

Table 2 shows that DRHL and competencies scores before treatment of the experimental and control groups were different. These results indicate that before treatment, the health providers in the experimental group had a lower score than those in the control group. However, after treatment and follow-up shows that DRHL and competencies scores of health providers in experimental group were higher than in control groups. The result of preliminary assumption found that all variables were normally distributed. In addition, testing the influence of variables that may affect the experimental variables was eliminated by comparison scores in before treatment as following in Table 3.

Table 3 Multivariate analysis of DRHL and competencies scores in the before treatment.

Source of variation	Wilk's lambda	Hypothesisdf	Errordf	MultivariateF test	p-value
Group	.639	7	52	4.20	.001

Table 3 showed that the before treatment, the health providers in the experimental group had significantly lower scores of DRHL and competencies than compared to the control group. Therefore, MANCOVA was used in hypothesis testing. The scores in the before treatment period was covariance.

Results of Hypotheses Testing

The testing of Hypothesis 1: In the post-experiment, the health providers in the experimental group had significantly higher scores of DRHL and competencies than compared to the control group as following in Table 4.

Table 4. MANCOVA Analysis, Testing the Differences Between Groups After Treatment

Source of variation		SS	MS	F	p-value
DRHL					
- Access	Group	87.66	87.66	14.94**	.001
	Error	299.27	5.87		
- Understand	Group	67.92	67.92	14.78**	.001
	Error	234.32	4.60		
- Appraise	Group	114.20	114.20	18.91**	.001
	Error	308.03	6.04		
- Apply	Group	17.47	17.47	9.55**	.003
	Error	93.31	1.83		
Competencies					
- Knowledge					
	Group	72.42	72.42	9.77**	.003
	Error	378.01	7.41		
- Attitude	Group	54.51	54.51	9.79**	.003
	Error	284.02	5.57		
- Skill	Group	57.75	57.75	15.53**	.001
	Error	189.65	3.72		

*p<.05, ** p<.01

Table 4 MACOVA analysis in after treatment period, the results of test of between-subjects effects showed that the DRHL and competencies of the experimental group significantly differed from the control group across all four domains at the .05 level.

The testing of Hypothesis 2: The health providers in the experimental group had significantly higher scores of digital reproductive health knowledge and competencies in the follow-up period compared to the control group as following in Table 5.

Table 5. MANCOVA Analysis, Testing the Differences Between Groups at Follow-Up.

Source of variation		SS	MS	F	p-value
DRHL					
- Access	Group	135.89	135.89	47.49**	.001
	Error	145.92	2.86		
- Understand	Group	86.60	86.60	35.12**	.001
	Error	128.66	2.52		
- Appraise	Group	117.75	117.75	32.24**	.001
	Error	186.25	3.65		
- Apply	Group	19.53	19.53	13.34**	.001
	Error	74.66	1.46		
Competencies					
- Knowledge					
	Group	59.36	59.36	20.53**	.001
	Error	147.47	2.89		
- Attitude	Group	55.813	55.81	20.53**	.001
	Error	138.68	2.72		
- Skill	Group	18.44	18.44	11.53**	.001
	Error	81.60	1.60		

*p<.05, ** p<.01

Table 5 MACOVA analysis in follow-up period, the results of test of between-subjects effects showed that the DRHL and competencies of the experimental group significantly differed from the control group across all four domains at the .05 level.

The testing of Hypothesis 3: The health providers in the experimental group had significantly higher scores of DRHL and competencies in the follow-up period compared to the before treatment as following in Table 6.

Table 6. Comparison of mean scores by domains between before treatment and the follow-up period in the experimental group.

Components	Period	M	SD	Mean Different (d)	SE	p-value
DRHL						
- Access	Before	21.43	3.34	6.60	0.64	.001
	Follow-up	28.03	1.35			
-Understand	Before	18.63	2.86	4.64	0.59	.001
	Follow-up	23.27	1.08			
- Appraise	Before	21.07	3.29	6.66	0.70	.001
	Follow-up	27.73	1.53			
- Apply	Before	10.70	1.62	3.40	0.37	.001
	Follow-up	14.10	0.92			
Competencies						
-Knowledge						
	Before	20.57	3.36	7.43	0.68	.001
	Follow-up	28.00	1.74			
-Attitude	Before	17.80	3.77	5.70	0.76	.001
	Follow-up	23.50	1.41			
-Skill	Before	15.67	2.77	3.40	0.50	.001
	Follow-up	19.07	0.87			

Table 6: In comparison the mean scores of DRHL and competencies in follow-up period had significantly the highest scores in the before treatment period in experimental group (p<.001)

DISCUSSION

After treatment and follow-up shows that DRHL and competencies scores of health providers in experimental group were higher than in control groups. The before treatment, the health providers in the experimental group had significantly lower scores of DRHL and competencies than compared to the control group. The post-experiment, the health providers in the experimental group had significantly higher scores of DRHL and competencies than compared to the control group. The health providers in the experimental group had significantly higher scores of digital reproductive health knowledge and competencies in the follow-up period compared to the control group. In comparison the mean scores of DRHL and competencies in the follow-up period had significantly the highest scores in the before treatment period in experimental group. In enhancing DRHL according to the H1, H2, and H3, the findings can be analyzed regarding experimental group who has a strong knowledge of DRHL and competencies in the post-experimental and follow-up period. For the reason that many health clinics have used technology to improve services to be convenient and faster for the competencies of personnel, it consists of three components according to competency assessment concept of Carlton Cooper 19;[1] knowledge of service personnel,[2] attitudes of service personnel, and[3] skills of service personnel. This signifies that enhancing job-related knowledge exerts the most significant influence in comparison to other competencies components when it comes to boosting work efficiency. Consequently, it becomes imperative to prioritize the augmentation of work-related knowledge, alongside the incorporation of additional elements of operational competency among service personnel. Knowledge entails the possession of information, facts, or insights acquired through study, observations, and experiences. This encompasses a range of attributes, such as individual traits, factual knowledge, and expertise. When this knowledge is combined with

the ability to access information, comprehend data, and apply digital reproductive health information effectively, it results in the highest knowledge score. Following knowledge, practical training, or skill development for participation in the intervention holds the next highest position in terms of its impact on competencies. Attitude toward service, which involves expressing one's perspective and its manifestation in behavior, including emotions, beliefs, and actions, also plays a crucial role.

This DRHL intervention focused on the practical applications of reproductive health information through digital platforms and online networking skills. Therefore, health providers have the service skills to promote health literacy for adolescents at risk for sexual and reproductive health (SRH) issues, so that they have help-seeking from correct government service and information sources through online to take care of their own health. efore coming to receive services in Adolescent and Youths' Clinics. An umbrella review study of Huang et al22. in seventeen review articles supported that digital health literacy intervention related SRH for adolescent development and health promotion had effectively utlized web-based health information and health media design for adolescent use. Additionally, several digital health strategies have also been identified that can be used to further develop integrated SRH-informed services to improve adolescent health outcomes. Health providers generated several strategies to guide future digital based SRH promotion. For the primary prevention focused DRHL interventions, greater emphasis is on using technology to promote knowledge, healthy SRH behaviors (e.g. behaviors for preventing pregnancy or sexually transmitted disease), and screening and follow-up through public health campaigns23. Some interventions also provide online counseling or referral support to link users to essential SRH services when needed (e.g., medically assisted abortion, family planning, STI, HIV care)[23]. In accordance with the policy of WHO, newcomers to digital health can use it as a start-to-finish primer on how to collaboratively and responsibly develop youth-centered digital health interventions. WHO guidelines provided recommendations on digital health interventions for health system strengthening. It included recommendations on using targeted client communication (TCC) to transmit health information, including health education, to specific audiences based on health status or demographic profile[24]. Such information might be for health promotion, spreading awareness of services and behaviors, reminding people about services or adherence to treatments, or notifying people about diagnostic results. Information might be transmitted via text message, voice, interactive voice response, applications or social media[25].

CONCLUSION

The DRHL intervention effectively showcased a statistically significant enhancement in the DRHL and operational competency of healthcare providers working in adolescent and youth health clinics. This achievement was made possible through the successful integration of theoretical concepts with practical techniques and methodologies. However, it is vital to acknowledge that the promotion of reproductive health among adolescents and young individuals is not the sole responsibility of health providers in these clinics. Parents, guardians, community volunteers, religious leaders, and teachers also wield significant influence in educating and supporting young individuals. Therefore, it is advisable that relevant agencies extend the implementation of the DRHL intervention to encompass broader contexts. This expansion should aim to enhance the competencies of health providers while striving for optimal outcomes in the broader community, considering the pivotal roles played by various stakeholders in promoting reproductive health among adolescents and young people.

DECLARATIONS

Limitations

The study targeted medical and public health personnel working in government facilities nationwide, a population known for their heavy workload and duty on holidays. Despite organizing the intervention during public holidays and online, limited participation in the training was observed. Given the inability to employ proportional random sampling across different regions, the study employed the Assignment Random Sampling method to divide participants into the experimental and control groups. As the DRHL intervention was conducted through online meetings, there is a potential limitation regarding participants' access to communication devices or internet signal, which could hinder their active participation in the sessions.

Availability of data and materials

The datasets used for this research are all included within the main text.

Abbreviations

DRHL - Digital Reproductive Health Literacy

Acknowledgements

The authors offer their gratitude to all the participants in this study. We were financially supported by Graduate School, Srinakharinwirot University.

Authors' Contributions KD: Conceptual research, designed the research, supervised, designed questionnaire, analyzed the data, drafted and reviewed the manuscript UI: supervised, designed the research, designed questionnaire, reviewed the manuscript. PP: Designed the research, designed questionnaire, analyzed data.

Declaration of Conflicting Interests

The authors have declared that no interest exists.

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