Development of a Web-based Sexual Risk Behavior Prevention Database with the Benefit of 4G LTE by Using Community Participation

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Abstract

Sexual risk behavior seems to be a sensitive issue for participants' self-report. This community-based participatory research aimed to develop and validate the web-based sexual risk behavior prevention database for adolescents and their parents in a community in the northern Thailand. It emphasized participation of stakeholders in the community. The process of web-based sexual risk behavior prevention database development included five steps: (1) community partnership formation; (2) draft questionnaire development; (3) psychometric validation; (4) system development, and (5) database evaluation. Both qualitative and quantitative data were collected from March 2015 to March 2016. The findings of this study showed that the sexual risk behavior prevention database was comprised of two parts, including (1) household information which was designed to collect the data regarding household, sexual risk behavior prevention among adolescents, and sexual risk behavior prevention among parents, and (2) data output. Results from implementing the database among adolescents and parents showed that 85% of the adolescents had a boyfriend/ girlfriend and 25% of them engaged in sexual intercourse. For the needs for sexual risk behavior prevention in the community, all of the adolescents and parents suggested providing a campaign to change community member's attitudes towards sexual risk behavior among adolescents. In addition, most of the participants revealed that the use of the web-based sexual risk behavior prevention database with newly 4G LTE wireless network technology where adaptively enhanced features adapted was comfortable and provided a sense of confidentiality, and the data output was helpful for presenting sexual risk behavior situation in the community.

Keywords: Adolescent, community-based participatory research, Sexual risk behavior, Web-based instrument, 4G cellular technology

1 Introduction

Nowadays, an increase in sexual risk behaviors is causing public health problems in both developed and developing countries. Each year, there are approximately 357 million new cases of sexually transmitted infections (STIs), including chlamydia, gonorrhea, syphilis, and trichomoniasis, globally [1]. There are also an estimated 25 million unsafe abortions each year, of which over half were in Asia [2]. In Thailand, according to the Ministry of Public Health, there was a rise in STIs among people who were 15-24 years-old, from 52.3 cases per 100,000 population in 2013 to 97.7 cases per 100,000 population in 2017 [3]. Additionally, there was a constant increase in the number of adolescent mothers, from 24.5 cases per 1,000 population in 2006 to 28.5 cases per 1,000 population in 2013 [4].

Sexual and reproductive health, especially sexual risk behaviors, is a sensitive issue nationwide. The sexual double standard is found in Thai society [5], in which engagement in sexual risk behaviors is considered acceptable for males while females are expected to abstain from having sexual experiences [6]. Thus, answering questions about sexual risk behaviors on paper-based questionnaires is considered embarrassing for adolescent females [7]. To enhance the knowledge of sexual risk behaviors and their factors that could lead to the development of an appropriate intervention for preventing adolescent sexual risk behavior in the community, it is vital to acquire accurate data from the self-report of participants [8]. In international countries, gathering research data using internet-based or web-based survey instrument has become popular. Previous studies revealed that online data collection could give researchers access to a large and diverse population and could reduce time for answering questions [9, 10]. Using online survey instrument enhances the ability of

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participants to take part anonymously, which means more participants can be comfortable to fill out a sensitive question and willing to participate in research study [10]. At the same time, as suggested by experts, the validity and reliability of research is increased by the use of online survey results [11] because the online system automatically gathers all data from participants and compiles them in an Excel file [9] that can reduce human error in data analysis. Also, 4G technology which is an evolution of broadband wireless technologies is available and well known these days. The 4G technology is recently widely used in mobile internet access and many wireless multimedia applications support 4G wireless standard. Mobile standards and features typically use the network architecture with two wireless technologies including the fourth generation (4G) and long-term evolution (LTE).

In Thailand, most sexual risk behavior questionnaires were paper-and-pencil questionnaires and focused on collecting sexual behavior and its factors in which the researcher was interested. Therefore, the goal of this study was to develop and validate a web-based sexual risk prevention database for adolescents (10-19 years) and their parents in collaboration with all stakeholders in a community in the northern Thailand. By participation in community partnership, community members could understand community issues with regard to adolescent sexual risk behaviors and develop a practical web-based sexual risk prevention database that could mobilize sexual risk behavior prevention in the community.

Moreover, since architecture of 4G is built upon the third generation (3G) wireless technology, its network architecture resembles that of 3G thus 4G can be seen as an extension version of 3G. This newer generation extends greater available bandwidth, supports variety of existing services and can be interfaced with various types of networks.

For mobile technology, 4G is supposed to promise the following features:

(1) Full mobility.

(2) Data rates with high speed.

(3) High capacity of services and applications which are based on internet protocol (IP).

(4) Full compatibility.

According to the view of users, main features of services that the users will be interested may include:

(1) Air interfaces.

(2) Quality of services.

(3) Adaptability of applications with a possibly high traffic.

(4) Radio environment.

Thus, one can see that 4G mobile technology can fulfil key features of interest of users.

Theoretically, 4G LTE [22] provides a net bit-rate speed of up to 100 Mbps (Megabits per second) in a downlink and up to 50 Mbps for an uplink if a communication channel of 20 MHz bandwidth is used. But if a multiple-input, multiple-output (MIMO) communication channel [23] is used, the bit-rate capacity can be higher. In addition, 4G LTE technology claims to enable the maximum data rates of 150 Mbps for download and 75 Mbps for upload.

Generally, 4G cell radius is shorter than that of 3G, in other words, cell size of 4G technology is smaller than cell size of 3G one and thus 4G can provide a higher transmission bit rate and a higher frequency band. Unfortunately, using such higher bit rate requires a higher threshold of signal level than the signal threshold transmitted at a lower bit rate in order to achieve a good level of signal to noise ratio (SNR) [24] – unless the propagation loss may be increased. This is because signal transmission at a higher bit rate can be more affected by noise.

2 Methods

2.1 Research Design

This study employed a community-based participatory research approach to develop the web-based sexual risk behavior prevention database for adolescents aged 10-19 years and their parents in a community in the northern Thailand.

To explain why our web-based database better uses 4G technology, firstly, we have to know that similar to 3G wireless technology, 4G services can be used as services supported by 3G. However, 4G technology aims to provide services for applications with higher speed and larger group of users. In order to achieve such major goal of this new wireless technology, data access requires a high-speed internet and it should allow user-interactive features. We explain some example services requiring high-speed communication and relating to a number of users as follows.

Video conference among multiple users require a very high speed of communication through both voice and video image since this conference service typically uses a real-time application. However, voice traffic of 4G technology will be treated as packet data.

Mobile applications like online games that require a cellular network architecture need a high-speed internet to communicate with other users playing the same game at the same time. These kinds of applications are obviously real-time and need to support many users concurrently. This feature of mobility is one major advancement of 4G, i.e. the technology integrates wireless local area network (WLAN) into a total mobile network. A WLAN is an extension of a wired LAN such that WLAN utilizes electromagnetic radio waves for communication whereas LAN utilizes cables. Consequently, with such wireless (or air) interfaces, no wired infrastructure is required at all. Up until now, one very useful and widely used air networking is an ad hoc networking

using Bluetooth and, surely, 4G supports it.

Applications relevant to geographical location such as online traffic information report, weather forecast, nearby gas station or restaurant search, etc. also require a high-speed internet to get a recent report.

According to examples given above, it is obviously seen that many services require a network architecture which can handle a very high degree of multimedia traffic. Also, it must be capable of advanced level in mobility management with seamless services.

Nevertheless, 4G network technology now supports diverse applications including our web-based sexual risk behavior prevention database. We could use our system with 4G technology embedded in various bands of recently available mobile phones, tablets, personal computers, or laptops.

As we know that 4G will have varied service quality with respect to the distance from urban or metropolitan areas. Fortunately, in cases of a remote area from urban community, 3G technology will be typically utilized.

As mentioned earlier that the major advancement of 4G is the integration with WLANs so that data transmission can be done over air, reducing cabling. As a result, 4G with wireless transmission offers various advantages such as productivity, convenience, cost, simplicity, flexibility, scalability, etc. Since many mobile devices available these days are compatible and capable of accessing 4G backbone, we exercise the combination of data connectivity and user mobility via mobile devices with 4G in order to increase users' flexibility. This way allows users to access to our web-based database anywhere they want or whenever they feel comfortable to provide us additional information. Furthermore, we can be sure that our users will be offered with a high degree of service quality because 4G technology is normally adequate to support high levels of quality of service (QoS) [25] required for several transmission services.

2.2 Research Participants

The purposive and snowball sampling techniques were used to recruit the research participants as follows:

2.2.1 Community Researchers

Twenty-two community members, consisting of eleven adolescents who were 10-19 years-old, five parents, one foundation staff, one teacher, one public health officer, one municipal council member, one village health volunteer, and one community development volunteer, voluntarily participated in the entire process of the study. Of all the adolescent community researchers, there were four males and seven females with the mean age of 14.5 years (SD = 2.9). All of them practiced Buddhism and most (n = 10) were single. Among these, about three-fifth (n = 7) had boyfriends or girlfriends. Of all the adult community researchers, there were five males and six females with the average age of 41.5 years (SD = 11.9). Most of them were Buddhist (n = 10) and nearly half were married (n = 5).

2.2.2 The Participants in Focus Group Discussion

There were 28 adolescents between the ages of 10 and 19 years and 21 parents, who volunteered to speak out about sexual risk behaviors among adolescents with their peers. The adolescents were divided by gender and age into a total of seven groups for adolescent focus group discussion, including two groups of males and females aged 10-13 years, two groups of males and females aged 14-16 years, two groups of males and females aged 17-19 years, and one group of gays. Meanwhile, a total of six parent groups were divided by gender and age of their children. For adolescents, there were 13 males, 12 females, and 3 transgender females, with the average age of 14.4 years (SD. = 2.6). Most of them were single (n = 27) and practiced Buddhism (n = 23). More than half of them had no boyfriends or girlfriends (n = 17) and no sexual intercourse (n = 26). For parents, there were four males and seventeen females with the average age of 51.2 years (SD = 10.9). Most of them were Buddhist (n = 20) and were married (n = 15).

2.2.3 The Participants in Reliability of An Instrument

There were 20 adolescents and 20 parents, who lived in the areas that were not included in the field study, and were willing to participate in instrument testing. For the demographic data of the adolescents, there were 10 males and 10 females, aged 10-19 years, with the mean age of 15.2 years (SD. = 2.7). Most of them were single (n = 18) and practiced Buddhism (n = 15). More than half of them had a boyfriend or girlfriend (n = 13) but no sexual intercourse (n = 13). For parents, there were four males and sixteen females, aged 30-65 years, with the average age of 49.5 years (SD = 11.1). Most of them were Buddhist (n = 18) and were married (n = 15).

2.2.4 The Participants in Database Evaluation

There were 20 adolescents aged 10-19 years old and 20 parents, who lived in the selected community, and volunteered to participate in this step. For demographic data of the adolescents, there were eight males, one bisexual, one gay, and ten females with the mean age of 14.5 years (SD. = 2.9). Most of them were single (n = 19) and practiced Buddhism (n = 19). More than half (n = 11) studied in a community school and the others (n = 9) studied in an urban school. In addition, most of them (n = 17) had a boyfriend or girlfriend and a quarter (n = 17) had sexual experiences. For parents, there were eight males and twelve females, aged 30-69 years, with the average age of 48.5 years (SD = 11.1).

Most of them were Buddhist (n = 16) and were married (n = 14). Their salary ranged from 3,000 to 25,000 baht per month (US$91 - US$760) with the mean of 10,634.9 baht (SD = 7,605.5).

2.3 Ethical Considerations

This research project obtained approval from the Research Ethical Committee of the Chiang Mai University (Study code: Full-008-2558) and permission from the chief executive of the subdistrict administrative organization. Each participant was informed of the research objectives and the research process. Additionally, the participants were informed that they had rights to refuse to answer questions or withdraw from the study at any time. The information was kept confidential and the identities of the participants were not revealed to others. Each participant signed an informed consent. For the participants who were under 18 years old, their parents signed an informed consent to show agreement that their children could participate in the study.

2.4 Web-based Sexual Risk Behavior Prevention Database Development

The process of the web-based sexual risk behavior prevention database development included five steps (see Figure 1.) as follows:

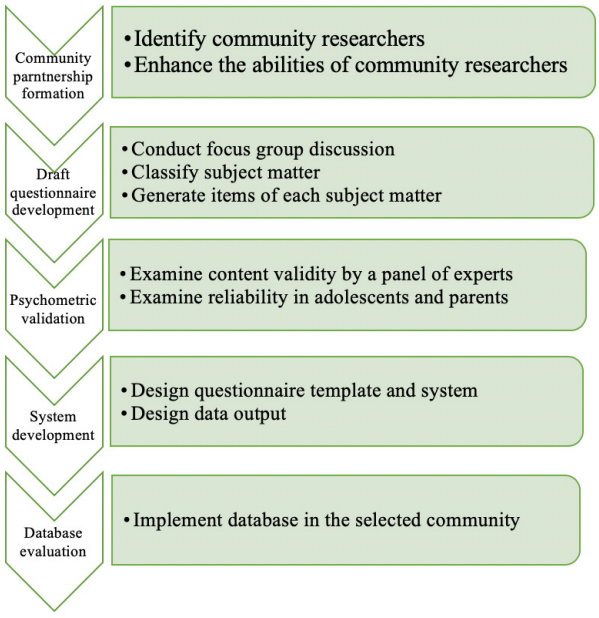

Figure 1. The steps of web-based sexual risk behavior prevention database development

2.4.1 Community Partnership Formation

After permission was received from the chief executive of the subdistrict administrative organization, recruitment flyers were distributed to recruit community researchers, consisting of adolescents, parents, and a foundation staff. The other community researchers were recruited by the executive of the subdistrict administrative organization. In total, twenty-two community researchers, who had been explained about the research goal and the process of community-based participatory research, volunteered to participate until the completion of the study.

Then, all community researchers were trained by the academic researchers and the experts who were knowledgeable about working with adolescents and community. These intensive trainings were held four times in order to establish rapport, enhance knowledge with regard to sexual risk behavior prevention, and strengthen skills for leaderships, teamwork, and conducting a focus group interview following the human subject guideline. After the training, community researchers planned the research process, and identified data collection method and potential informants.

2.4.2 Draft Questionnaire Development

Over the two months, the community researchers and the academic researchers worked together to develop focus group discussion questions, conduct interviews, and develop a draft questionnaire. During interviews, community researchers took role as moderators while the second author acted as a facilitator. After analyzing the data, the community researchers specified main variables, which comprised of adolescent sexual behaviors, factors related to adolescent sexual risk behaviors, including adolescent factors, parent factors, and community factors, and need for sexual risk behavior prevention. A description of adolescent focus group results is published elsewhere [6]. The draft of a sexual risk behavior database in the community was constructed of three domains: (1) household questionnaire, (2) sexual risk behavior prevention questionnaire for adolescents, and (3) sexual risk behavior prevention questionnaire for parents. Then, community researchers generated items of each questionnaire based on review of previous questionnaires and community attitude and context.

2.4.3 Psychometric Validation

At the beginning, a panel of five experts, consisting of three nursing instructors specializing in pediatrics and community health, a HIV/AIDS nurse, and a public health technician officer, checked all self-administered questionnaires for content validity. The content validity index of all questionnaires was greater than 0.8. Then, community and academic researchers revised the questionnaires following experts' suggestions before reliability testing. Cronbach's alpha coefficient and Kuder-Richardson Formula 20 were used to assess the internal consistency reliability of the questionnaires. For each questionnaire, the reliability values ranged from 0.77 to 0.95 (see Table 1 to Table 2).

Table 1. Sexual risk behavior prevention questionnaires for adolescents

Questionnaire	Scale	Higher scores represent	No. of items, reliability
Demographic data	The characteristics of participants, Internet use, and pubertal time	-	23 items
Religious beliefs and practices [12]	Total score	Greater religious beliefs and practices	5 items, $\alpha = 0.78$
Sexual risk behavior prevention knowledge [13]	Total score	Greater knowledge regarding sexual risk behavior prevention	10 items, KR 20 = 0.83
Perception of parenting style [14]	Authoritarian Authoritative Uninvolved Permissive	More parenting style	20 items, $\alpha = 0.77$
Parent-adolescent communication [15]	Perception of sexual communication	Greater parental sexual communication	4 items, $\alpha = 0.81$
	Sexual communication of parent		17-items, $\alpha = 0.88$,
	Comfort to sexual communication with parents		$\alpha = 0.86$
Perception of parental monitoring [16]	Total score	Greater parental monitoring	14 items, $\alpha = 0.87$
Perceived peer norms	Total score	Greater perceived peer norms toward engagement in sexual risk behaviors	12 items, $\alpha = 0.85$
Adolescent perception about approval of sex	Approval of sex from parents and partners	Greater approval of sex from parents or partners	2 items
Sexual self-efficacy [17]	Sexual refusal self-efficacy	Greater self-efficacy in terms of sex refusal and safe sex	3 scenarios with 15 items, $\alpha = 0.90$,
	Safe-sex self-efficacy		$\alpha = 0.95$
Community connectedness	Neighborhood disorganization [18]	More perceived neighborhood disorganization	2 items, $\alpha = 0.93$
	Neighborhood social control [18]	More perceived neighborhood social control	5 items, $\alpha = 0.88$
	Neighborhood social cohesion [18]	More perceived neighborhood social cohesion	5 items, $\alpha = 0.82$
	Community norms	Greater acceptance of the community norms towards sexual risk behaviors	5 items, $\alpha = 0.80$
Needs for sexual risk behavior prevention	The characteristics of activities for preventing sexual risk behaviors	-	8 items
Adolescent sexual risk behavior	Pre-coital behaviors [12]	Greater engagement in sexual risk behavior	9 items, $\alpha = 0.91$
	Sexual behaviors		20 items

Note. *α = Cronbach's alpha coefficient; KR 20 = Kuder-Richardson Formula 20.

Table 2. Sexual risk behavior prevention questionnaires for parents

Questionnaire	Scale	Higher scores represent	No. of items, reliability
Demographic data	The characteristics of informants, Internet use, and education	-	20 items
Religious beliefs and practices [12]	Total score	Greater religious beliefs and practices	5 items, $\alpha = 0.87$
Sexual risk behavior prevention knowledge [13]	Total score	Greater knowledge regarding sexual risk behavior prevention	10 items, KR 20 = 0.80

Table 2. (continue)

Questionnaire	Scale	Higher scores represent	No. of items, reliability
Parenting style [14]	Authoritarian, Authoritative Uninvolved, and Permissive	More parenting style	20 items, $\alpha = 0.79$
Parent-adolescent communication [15]	Perception of sexual communication	Greater parental sexual communication	4 items, $\alpha = 0.84$
	Sexual communication of parent		17-items, $\alpha = 0.92$,
	Comfort to sexual communication with parents		$\alpha = 0.93$
Parental monitoring [16]	Total score	Greater parental monitoring	14 items, $\alpha = 0.81$
Perception about approval of sex	Approval of sex from family members	Greater approval of sex from family members	2 items
Community connectedness	Neighborhood disorganization [18]	More perceived neighborhood disorganization	2 items, $\alpha = 0.97$
	Neighborhood social control [18]	More perceived neighborhood social control	5 items, $\alpha = 0.93$
	Neighborhood social cohesion [18]	More perceived neighborhood social cohesion	5 items, $\alpha = 0.80$
	Community norms	Greater acceptance of the community norms towards sexual risk behaviors	5 items, $\alpha = 0.81$
Needs for sexual risk behavior prevention	The characteristics of activities for preventing sexual risk behaviors	-	8 items

Note. *α = Cronbach's alpha coefficient; KR 20 = Kuder-Richardson Formula 20.

2.4.4 System Development

The community researchers brainstormed to design user interface and sexual risk behavior prevention database on website. Then, the academic researchers held several group meetings to discuss and develop database on the website (www.sexualrisk.com:8080). The sexual risk behavior prevention database comprised two parts: household information and data output. After that, the community and academic researchers examined the data collection and real-time operating system for over three months before the updated version of sexual risk behavior prevention database was uploaded.

2.4.5 Database Evaluation

The community and academic researchers contacted twenty families with adolescents aged 10-19 years to inform them of the research project and invite them to evaluate the sexual risk behavior prevention database via their smartphones or tablet computers. On average, the participants completed the questionnaires within about 15-30 minutes. After completing the questionnaires, the participants received a code number (see Figure 2) for 100 baht (US$3). Then, each participant expressed their satisfaction and gave suggestions about database implementation.

2.5 Mobility and Web Technologies

Our questionnaire system has a dynamic content management so that adaptive questions will be asked according to our sample user's previous answer. This high quality of professional design of our questionnaire system helps reduce the user's stress and boredom which may be caused by a long sequence of questions. Also, with our use of the latest technology, confidential information of each user can be securely stored and protected in our database.

Our remote web services can be considered as a cloud service provided by our web-based system.

Mobility technology is typically considered together with security, analytics, and delivery. Major features of the technology involved in our system include:

(1) *Network capacity plan.* Since our web-based database system requires a real-time network traffic, we thus considered this network capacity in advance during system development to support a larger group of community members.

Figure 2. Sexual risk behavior prevention data among adolescents

(2) *Network operation optimization.* Every informative operation working with our web-based database has been carefully designed in our system to achieve the best performance of our members' experience.

Not only is our web-based system professionally designed with high quality to obtain an impressive feel from our users while providing information to our database system, but we also tried optimizing all of our operations supporting the search feature to find contents according to the given keywords. Surely, confidential information and security from the use of our web-based system are strictly controlled.

Other than many advantages obtaining by 4G technology as explained above, data and memory management is one more issue we can gain from 4G since 4G information technologies also deliver performance-based applications together with proper management techniques such as techniques typically used in business intelligence (BI) applications [26]. It is common for 4G informative technology with web-based database as our system can reduce memory or storage requirements. Such technology improves the performance of systems with high data transmissions. Thus, we are sure that our system will be available for a high degree of scalability and robustness from using 4G informative technologies.

Our database system supports a large amount of data to be stored in so that big data features can be used in terms of analytics. The stored data can be analyzed to gain some insight into information or knowledge of the collected data. The extracted knowledge can then help in leading to better decisions in higher advanced utilization of our system.

The 4G LTE technology promises 100 Mbps of transmission speed on a mobile device and thus it offers a beneficial feature to our web-based database system in that a variety of mobile applications can work perfectly using the 4G LTE cellular technology. Our community members (i.e. our application users) who use a mobile device can participate in our online database system while they are on the go since the recent mobile devices are proposed with 4G speeds. Thus, with a combination of 4G, wireless internet, and cloud, our users can use their handheld devices such as mobile phones or tablets to transfer their information between their devices and our web-based database system easily and comfortably with a high degree of security and performance.

For our developer and administrator side, 4G LTE technology is even suitable for remote backup and recovery from a possible disaster. Thus, we can ensure that our web-based sexual risk behavior prevention database system can be safely, securely, and continuously maintained, comparing to the use of an older generation such as 2G or 3G technology.

2.6 Research Instruments

The instruments of this study consisted of 1) demographic data, including gender, age, marital status, religion, and having a boyfriend/girlfriend, and 2) focus group discussion guides. These guides were used to explore the situation and needs for sexual risk behavior prevention among adolescents in the community in order to establish initial questionnaire content.

2.7 Data Analysis

Content analysis was used to analyze the qualitative data and descriptive statistics, including frequency, percentages, mean, and standard deviations (SD), were used to describe demographic data of the participants. Moreover, Mann-Whitney U tests was used to examine the perception differences between adolescents and parents because the total scores of some variables were not normally distributed.

3 Results

This sexual risk behavior prevention database was developed by adolescents and adults in the community. The aims of database development were to help community leaders and stakeholders access the real time data and could fetch database results to mobilize sexual risk behavior prevention among adolescents in the community. The results were divided into two parts: (1) sexual risk behavior prevention database, and (2) findings from implementation.

3.1 Sexual Risk Behavior Prevention Database

The sexual risk behavior prevention database was comprised of two parts as follows:

(1) *Household information.* This part was designed to collect the data regarding household, sexual risk behavior prevention among adolescents, and sexual risk behavior prevention among parents.

(2) *Data output.* This part emphasized the presentation of the real-time findings. The data output was presented in frequency and percentage in tables, pies, graphs, or charts in order that community leaders and stakeholders could understand easily (see Figure 3). In addition, presenting the answers in Excel based on household data could help the researcher compare perception and attitude between adolescents and their parents.

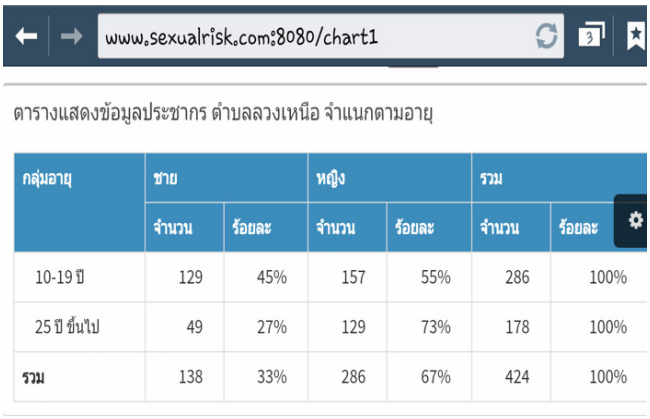

Figure 3. The data output

3.2 Findings from Implementation

As shown in Table 3, there were statistically significant difference in permissive parenting style between adolescents and parents. Parents had higher scores in permissive parenting style than their adolescents. When compared in each question details, we found that adolescents had low scores in freedom of doing following their needs. Similar to the other parenting skills, more parents than adolescents perceived that parents frequently communicated about sexual health and monitored their children.

Table 3. Sexual risk behavior prevention questionnaires for adolescents

Variables	Median Score		Z	p-value
	Adolescent	Parent		
Religious beliefs and practices	6.0	6.5	-.903	.38
Sexual risk behavior prevention knowledge	7.0	7.5	-.041	.96
Parenting style				
Authoritarian	5.0	6.0	-1.855	.06
Authoritative	5.0	6.0	-1.493	.14
Uninvolved	3.0	3.0	-.456	.65
Permissive	7.0	9.0	-2.252	.03
Parent-adolescent communication	13.0	15.5	-.041	.96
Parental monitoring	16.5	22.0	-1.901	.06
Parental approval of sex	2.0	1.0	-.894	.41
Neighborhood disorganization	13.0	5.0	-2.250	.02
Neighborhood social control	6.0	6.0	-.485	.64
Neighborhood social cohesion	15.5	15.0	-.440	.68
Community norms	11.5	10.0	-1.615	.11

For community factors, we found statistically significant difference between adolescents and parents for neighborhood disorganization. More adolescents than parents perceived the problems of substance use, selling alcohol to adolescents, and teenage pregnancy in their community.

Regarding the needs for sexual risk behavior prevention in the community, all of the adolescents and parents agreed with setting up a campaign to change community members' attitudes towards sexual risk behavior among adolescents. In addition, all of the adolescents needed community leaders to re-orient environment towards preventing risk behaviors while all of the parents needed a training to enhance their knowledge and skills for preventing sexual risk behavior (see Table 4).

Table 4. Number and percentages of the need for sexual risk prevention activities among adolescents (N = 20) and parents (N = 20)

Sexual Risk Prevention Activity	Adolescent		Parent	
	N	%	N	%
Providing training to enhance knowledge and skills for preventing sexual risk behaviors (SRB) among adolescents	18	90.0	19	95.0
Providing training to enhance knowledge and skills for preventing SRB among parents who have children	18	90.0	20	100.0
Providing a campaign to change community member's attitudes towards SRB	20	100.0	20	100.0
Providing condoms and contraceptive pills for free	19	95.0	17	85.0
Re-orienting environment towards preventing risk behaviors	20	100.0	18	90.0

For findings regarding the use of web-based sexual risk behavior prevention database, all of the adolescents and half of the parents reflected that the web-based sexual risk behavior prevention questionnaires were comfortable and gave a sense of confidentiality compared to the traditional paper-pencil questionnaire.

"It's handy. In the past, when answering many questions in the paper, my hand felt weak. But I don't feel like that right now… Different colors between questions and answers make it easy to read and answer." (12-year-old female)

"It's more comfortable than paper-based questionnaire. It's easy to change the answer, without an eraser… If village health volunteers give me a paper-based questionnaire with the questions related to sexual behavior like these, I won't feel comfortable to answer with the truth… This questionnaire can keep my answers secret. You don't know my answer, right?" (15-year-old female)

On the other hand, the community researchers revealed that the data output was useful and helpful for presenting sexual risk behavior situation and the needs of the community. The results were also reliable.

"I don't know about statistics. I am just a student. This database can compute the results in real time. It's very useful… Tables in data output help me understand better and I think that community members could understand easily when those tables and charts were presented." (An adolescent community researcher)

"I see that the results from questionnaire can be presented in real time. It makes our results more reliable… That means we didn't make up the data." (An adult community researcher)

4 Discussion

The web-based sexual risk behavior prevention database was designed to facilitate identification of sexual risk behavior prevention situation and the needs of the community. The sexual risk behavior prevention database was comprised of two parts: (1) household information which included household data, sexual risk behavior prevention data among adolescents, and sexual risk behavior prevention data among parents, and (2) data output. Overall, the validity of the questionnaires was proved by a panel of experts and each questionnaire was assessed for the internal consistency reliability. Construct validity and reliability were considered acceptable. In addition, development of the sexual risk behavior prevention database based on creating academic-community partnership was an important implication for mobilizing sexual risk behavior prevention activities in the community. Due to developed questionnaires were specific to community context, the findings could help the community researchers to create an intervention for preventing sexual risk behaviors in the community. This is consistent with a previous study revealing that adolescent engagement through community-based participatory research approach was an important means of developing culturally sensitive digital health intervention [19].

After implementing the sexual risk behavior prevention database in the community, all adolescent participants agreed with the web-based sexual risk behavior prevention questionnaire because they were familiar to fill out via their smartphones compared to paper-pencil questionnaire. Also, using colorful template and gaming to challenge for completing each level made the web-based questionnaire more interesting and reduce their boredom. However, some parent participants preferred paper-pencil questionnaire because they were not familiar to a smartphone or a tablet computer. Therefore, developing questionnaire should consider participants' context. In rural community context of Khon kaen province, nearly half of adults aged 20-60 years did not use an internet in their daily life [20].

In addition, most of the participants reflected that they were comfortable to respond to sensitive questions in the web-based questionnaire because the researchers would not know their answers. The results showed that about 25% of the adolescents reported engaging in sexual intercourse. This is consistent with a study by Spark and colleagues [21] showing that, compared with paper-pencil surveys, computer-assisted surveys could better encourage the participants to answer the questions about how many lifetime sexual partners

they had in the past 12 months and whether they had ever had sex with a same-sex person. Similarly, in comparison with face-to-face interviews or paper-pencil surveys, the results from systematic reviews indicated that vaginal sex, anal sex, and unprotected sex were more likely to be reported through audio computer-assisted surveys [7]. Using internet-based research method enhanced the confidence of participants in anonymous identification [10].

For results from using data output, the community researchers reflected that the results from the sexual risk behavior prevention database were reliable and practical for adoption in their community. The GIS use and the real time result reports in the database could all community stakeholders know the real number of adolescents in the community and their accurate needs for sexual risk behavior prevention activity which could be used in community planning and decision-making for community development. However, this study was limited due to its small sample size (20 adolescents and 20 parents), which may have consequently limited the interpretation of the implementation results.

5 Conclusion and Recommendation

Changing sexual risk behaviors remains a complex challenge. The web-based sexual risk behavior prevention database, developed based on community-based participatory approach, was found to be useful and practical for exploring sexual risk prevention situations and the needs of the community. These findings suggest that developers of clinical practices should consider the cultural differences and usefulness in developing database for community leaders. Specially, the number of questionnaires, the developer and community members have to work together in selecting the important questionnaire specific to develop a sexual risk behavior prevention intervention in the community. Reducing the number of questionnaires could reduce exhaustion of participants from answering the questions and could help community leader to design a practical intervention or strategy to prevent adolescent sexual risk behavior further.

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