

A Study of Educational Materials for the Prevention of Sexually Transmitted Infections That Can Be Used by School Nurses in Sex Education for High School Students: Digital Content Focused on the Relationship between Sexually Transmitted Infections and Pregnancy

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Abstract

Purpose: The purpose of this study was to develop educational materials that can be used in sex education to help high school students prevent sexually transmitted infections and protect their fertility, and to examine their suitability. **Method:** A total of 14 school nurses who had worked in upper secondary schools (response rate: 93.3%) were included in the study. The participants were given educational materials and a self-administered, anonymous questionnaire, and asked to watch the materials and fill out the questionnaire. The responses were collected by mail. The educational materials consisted of digital content using video, audio, and text, incorporating information on types of sexually transmitted infections, the relationship between sexually transmitted infections and pregnancy, HPV/chlamydia infection, prevention methods, and HPV vaccination. Analysis was performed by simple tabulation for each survey item, and free text was coded using KHcoder. This study was conducted with the approval of the research ethics committees of the affiliated universities. **Results:** 64.3% - 78.6% of the school nurses responded that the content was adequate overall in terms of comprehension of content, appropriateness

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of time, audiovisual materials, speed of speech, voice quality, and design. With regard to the introduction of each item, risk of infection, types of infection and their relationship to pregnancy, HPV and chlamydia infections, preventative methods, and vaccination, 57.1% - 85.7% of the respondents were satisfied or very satisfied. Among these, vaccination was the highest and preventative methods was the lowest. Points of improvement regarding the teaching materials included [slide design and flow], [speed of speech], [understanding of HPV & vaccine], [sexually transmitted infections and pregnancy-related diseases], [teaching high school students], and [thorough explanation]. The school nurses wanted digital content on topics such as “emergency contraceptives”, “heat stroke”, “sexually transmitted infections”, as well as “sources of support and counseling”. **Conclusion:** The overall suitability of the video was examined in terms of “comprehension of content”, “appropriateness of time”, “audiovisual materials”, “speed of speech”, “sound quality”, and “clarity”. The teaching materials created in this study were generally adequate, although some modifications were found to be necessary. The teaching materials need to be revised by refining the content, and improving the visuals, audio, length, and design. In addition, school nurses wanted digital content that addresses the issues that young people face in today’s society.

Keywords

Sexually Transmitted Infections, Fertility, High School Students, Digital Content, School Nurses

1. Introduction

Over the past decade (2005-2015), the rates of sexually transmitted infections (STIs) in the age range of 20 - 29 [1] and cervical cancer caused by human papilloma virus (HPV) have increased 2.3-fold [2] over the past decade (2005-2015), making STIs among young people a serious threat to their fertility. For this reason, the United Nations International Technical Guidance on Sexuality Education [3], which serves as a guideline for international sex education, emphasizes the importance of sex education based on the latest scientific evidence. However, Japan’s Courses of Study [4] only includes a section on “the prevention of AIDS and sexually transmitted infections,” lacking specific mention of any sexually transmitted infections other than AIDS, and although many types of sexually transmitted infections are clearly mentioned in textbooks, it is up to teachers to decide whether to cover sexually transmitted infections other than AIDS in their classes. In addition, STI and cancer education are treated separately, and the annual plan for sex education is left to the discretion of each school, which means that the time spent on sexually transmitted infections varies and chlamydia and HPV infections may not be covered. The increase in the incidence of sexually transmitted infections requires educational intervention, but there is currently no systematic approach to sex education, and there is no digital content for efficient, evidence-based

teaching. In parallel with this situation, the number of people in charge of sex education varies from health and physical education teachers, school nurse teachers, homeroom teachers, and external instructors such as doctors and midwives, and the difficulty of sex education is compounded by the lateral positioning of the subject, the fact that sex education is not part of the curriculum, the lack of collaboration with teachers, and the fact that school nurses themselves cannot improve their teaching skills [5]. More than 70% of school nurses have experience being consulted for advice by sexually active students—with their professional knowledge, they are a capable source of education consistently throughout middle and high school [5]. In addition, since the COVID-19 pandemic, the promotion of the use of Information and Communication Technology (ICT) has accelerated, and a diversity of teaching methods is required. Furthermore, increasing visibility of educational materials on the relationship between sexually transmitted infections and fertility will increase interest, lead to knowledge acquisition and understanding, and encourage high school students to take action to prevent sexually transmitted infections in the future.

Based on the above, the purpose of this study was to develop teaching materials that can be used by school nurses in sex education, and to examine their suitability.

2. Methods

2.1. Research Subjects

In order to examine the suitability of the materials, a total of 15 mid-career school nurses who have experience working in high schools were included in the study.

A mid-career school nurse is one who has more than 10 years of experience, has completed training provided by the Ministry of Education, Culture, Sports, Science and Technology, and has been certified as having reached a certain level.

2.2. Data Collection Methods

1) Distribution and collection of questionnaires

The school nurses selected their subjects based the opportunity sampling method and recommendation from the president of the nursing teachers' association. The subjects were given educational materials and an unsigned, self-administered questionnaire, delivered by mail or by hand, and asked to watch the materials and then complete the questionnaire. Collection was done by mail.

2) Survey period

July-September 2024.

2.3. Questionnaire Items

We created our own self-administered, unsigned questionnaire, with reference to prior research [6] [7]. Each subject rated the overall suitability of the video material in the categories of comprehension, appropriateness of time, audiovisual materials, speaking speed, sound quality, clarity, and design using a 5-point scale from “strongly agree” to “strongly disagree”. In addition, respondents were asked

to rate the content (introduction, risks and countermeasures for STIs, types of sexually transmitted infections and their relationship to pregnancy, HPV, chlamydia infections, vaccination, how to prevent STIs,) in terms of design and clarity on a 5-point scale from “very satisfied” to “very dissatisfied”. Subjects were also asked to share their opinions and what they would like to see improved or created in a freeform response.

2.4. Content of the Teaching Materials

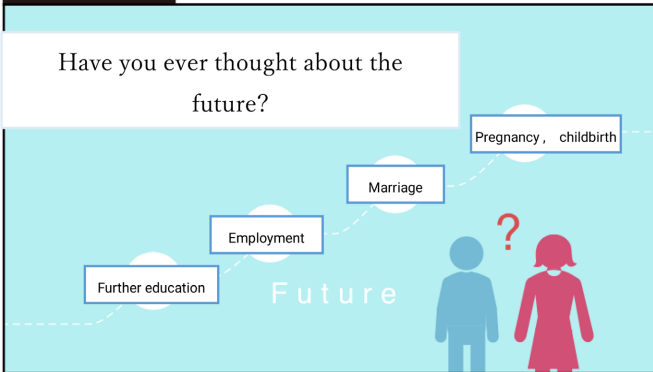
The teaching material was not specific to any one type of sexually transmitted infection, but visualized the relationship between STIs and pregnancy. Chlamydia is the most common STI among young people, and cervical cancer from HPV is also on the rise, which was visualized and explained together with data. The digital video contained audio and text and was kept to approximately 5 minutes in length so that it could be used easily and without placing a burden on students.

Content of teaching materials (Table 1, Figure 1)

Table 1. Contents of the teaching materials.

Title	Contents	Key Points
Introduction		An overview based on a supplementary textbook used by high school students.
Objectives	Risks of sexually transmitted diseases that affect pregnancy and countermeasures.	Related to future fertility.
Types of STIs	Types of sexually transmitted diseases and the risks that affect pregnancy.	Shows risks including chlamydia, HPV, HBs hepatitis, genital herpes, genital warts, gonorrhea, syphilis, AIDS, and trichomoniasis.
Chlamydia	Chlamydia infection.	Data shows that it is more common among young people.
HPV	Causes of cervical cancer and pharyngeal cancer due to HPV.	HPV is a high-risk HPV that can infect anyone and is linked to cancer.
	Effectiveness of HPV vaccination.	Cervical cancer can be prevented by vaccination.
	Types of HPV vaccination. Eligible recipients and subsidies for men at public expense.	Girls from 6th grade of elementary school to 1st year of high school can receive the HPV vaccine at public expense, and men are subsidized for vaccination.
Prevention methods	Preventive methods.	Condom use and vaccination.
Summary	Video footage looking to the future.	Text showing them holding hands with their future partners and children encourages action.

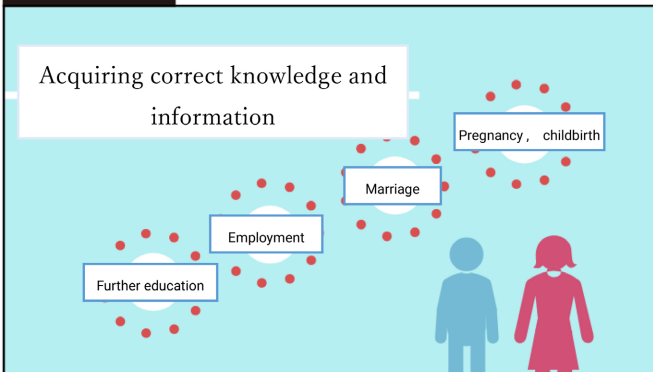
Scene 001



Narration

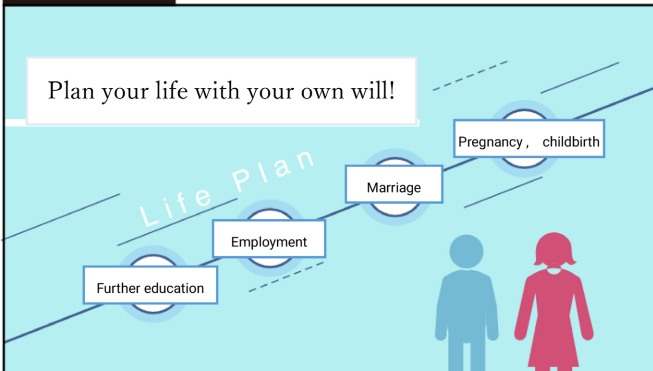
Have you ever thought about your future plans for further education, employment, marriage, pregnancy and childbirth?

Scene 002

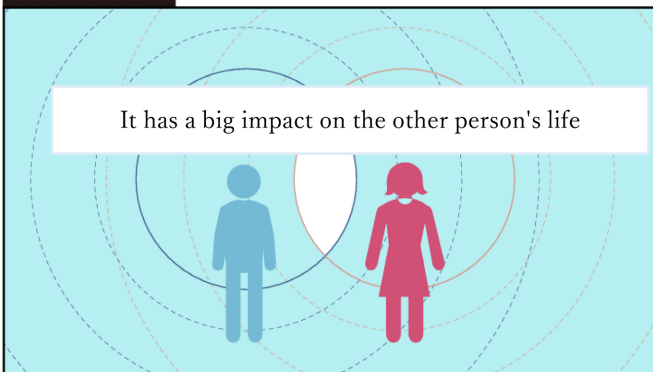


In order to realize your dreams, it is necessary to have the right knowledge and information, and it is very important to think about your life plan with your own will.

Scene 003



Scene 004



Sexual activity has a major impact on not only your life but also the lives of others.

Scene 005



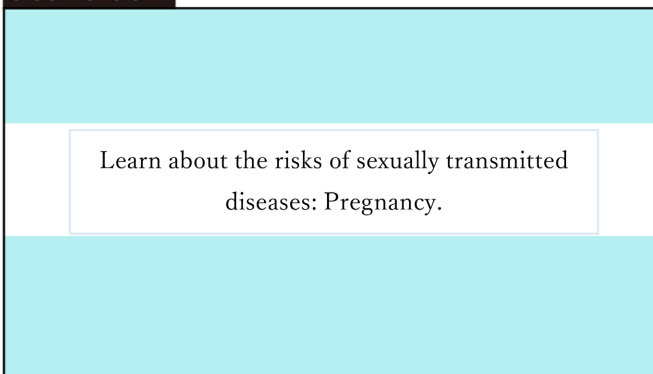
There may be times when you are too embarrassed to speak up about your choices.

Scene 006



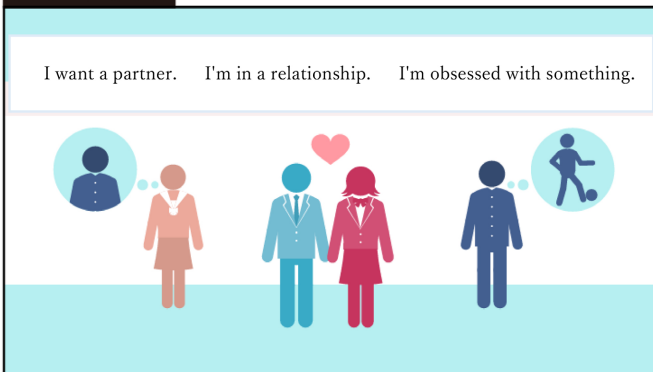
Here you can find answers to your questions about sex and learn that you do not have to deal with physical or mental problems alone.

Scene 007



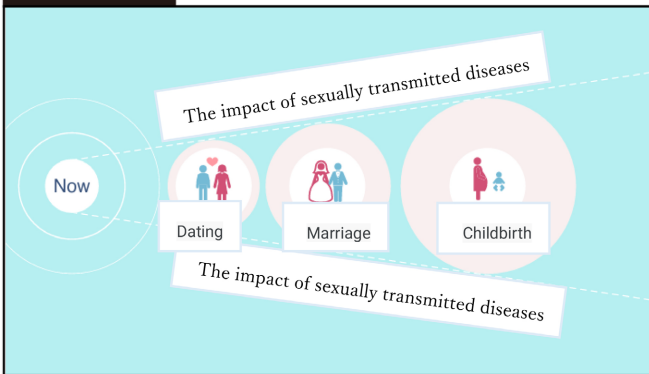
Learn about the risks of sexually transmitted diseases: Pregnancy.

Scene 008



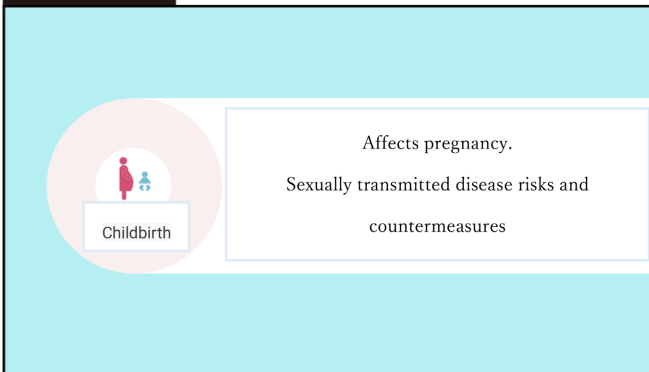
People who are currently in a relationship.
People who want a partner.
People who are obsessed with something right now and can't think about it.
Each person's feelings about relationships may be different.

Scene 009



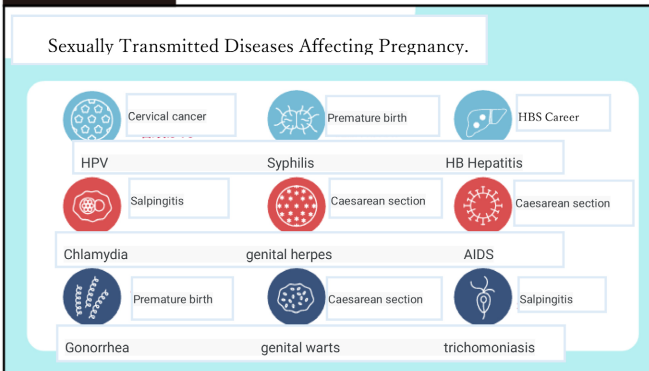
It is very important to know the effects of sexually transmitted diseases now, so that you will be prepared for future opportunities to date, get married, and have children.

Scene 010



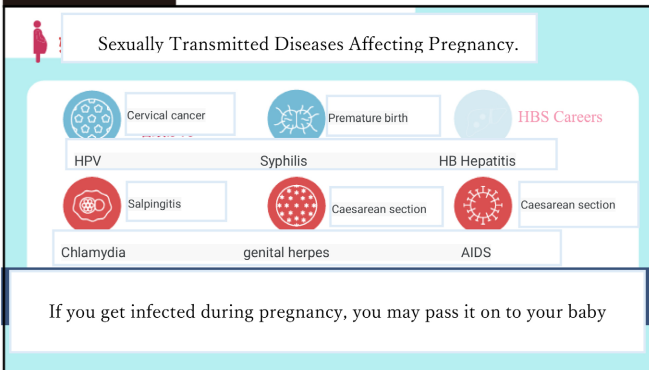
In this video, we will learn about the risks and prevention of sexually transmitted diseases that affect pregnancy.

Scene 011

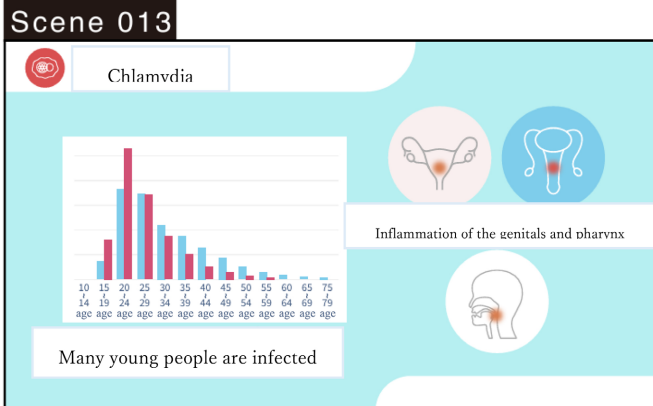


here are many types of sexually transmitted diseases that can affect pregnancy.

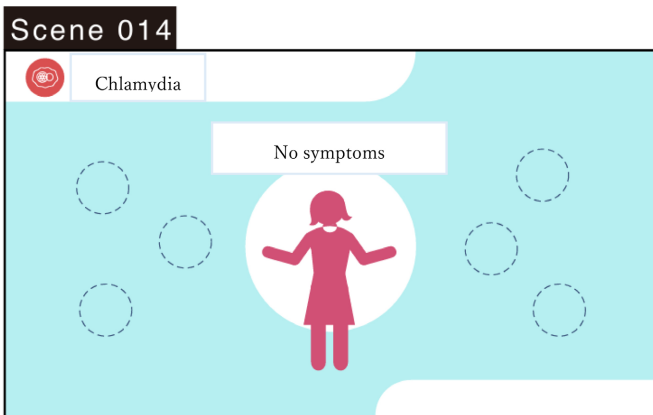
Scene 012



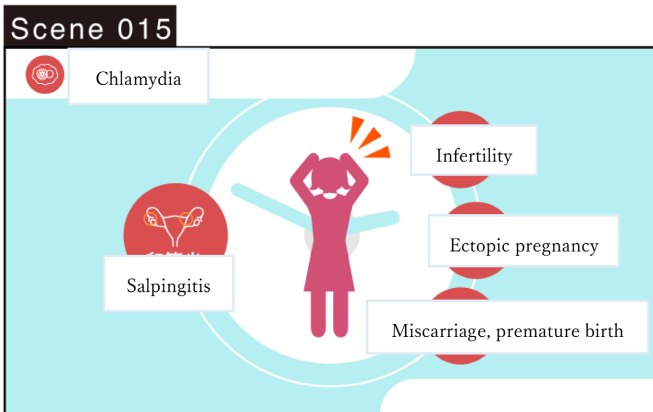
You should be especially careful about chlamydia, HPV, genital herpes, syphilis, and HIV/AIDS, as if you are infected with a sexually transmitted disease while pregnant, it can be passed on to your baby.



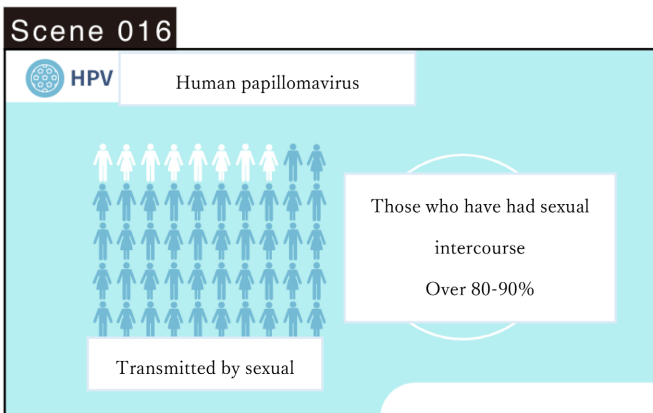
For example, chlamydia is one of the most common sexually transmitted diseases caused by bacteria among young people, and it causes inflammation of the genitals and throat.



Another characteristic is that there are almost no subjective symptoms.

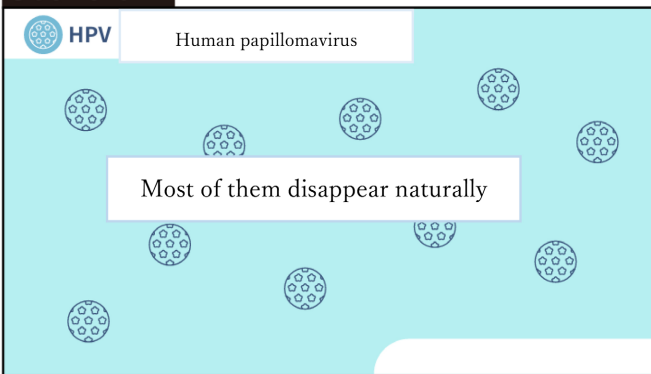


If left untreated, it can cause salpingitis, which can lead to infertility, ectopic pregnancy, miscarriage, and premature birth.



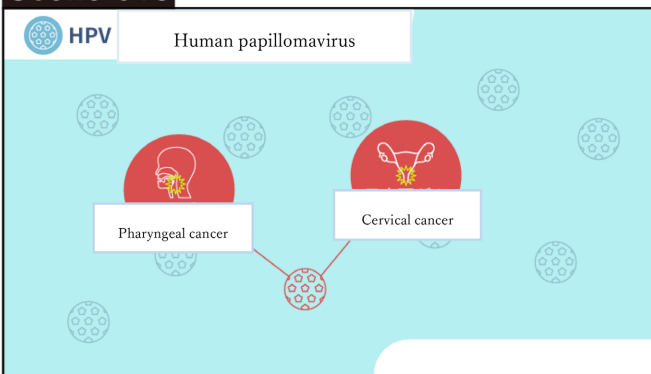
HPV is a virus that is transmitted from person to person primarily through sexual intercourse, and it is said that more than 80-90% of people who have had sexual intercourse will be infected.

Scene 017



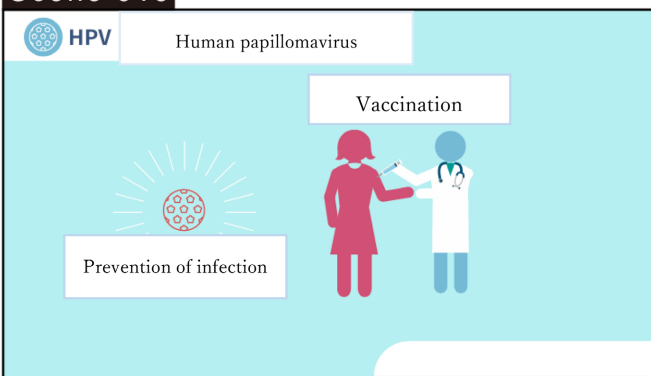
However, most of them are eliminated naturally and do not cause problems.

Scene 018



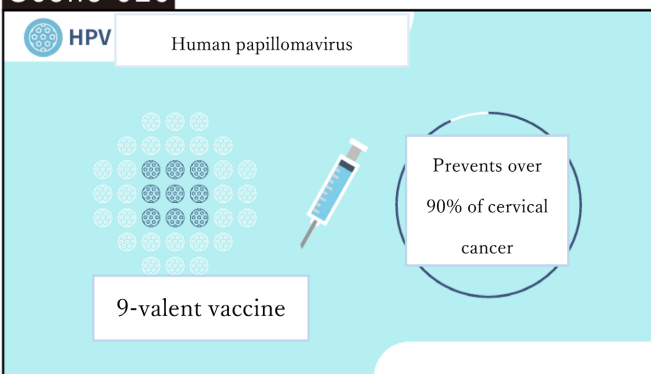
It is known that a limited number of HPV viruses are not eliminated and can cause cervical and pharyngeal cancer.

Scene 019

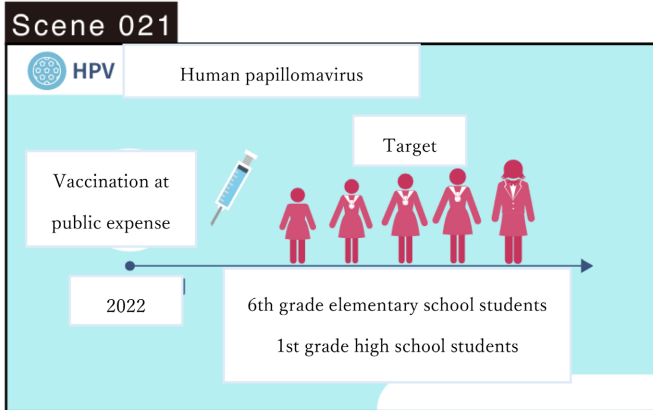


HPV vaccination is an effective means of preventing infection with HPV, which can lead to cancer.

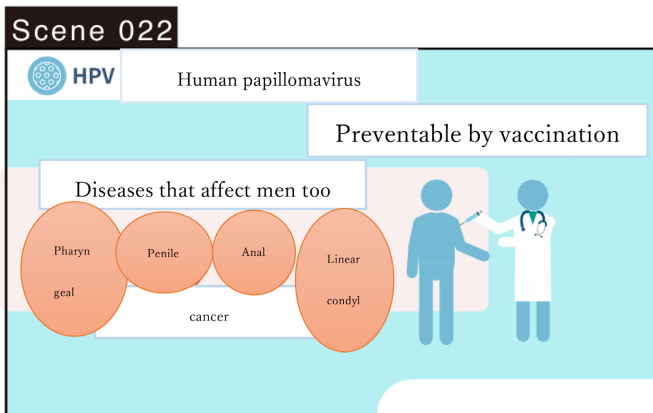
Scene 020



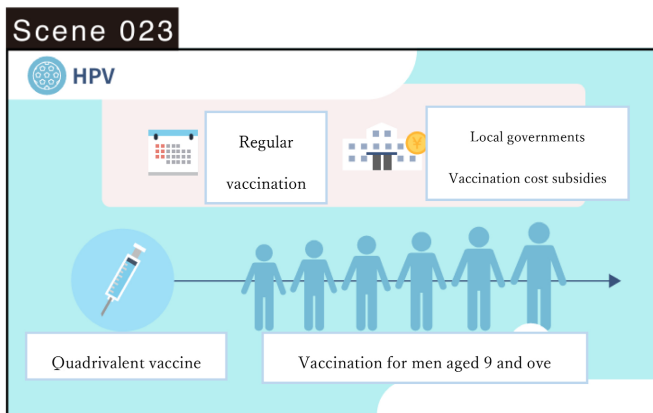
The nine-valent vaccine (Sylgard 9) protects against nine types of HPV and can prevent over 90% of cervical cancer cases.



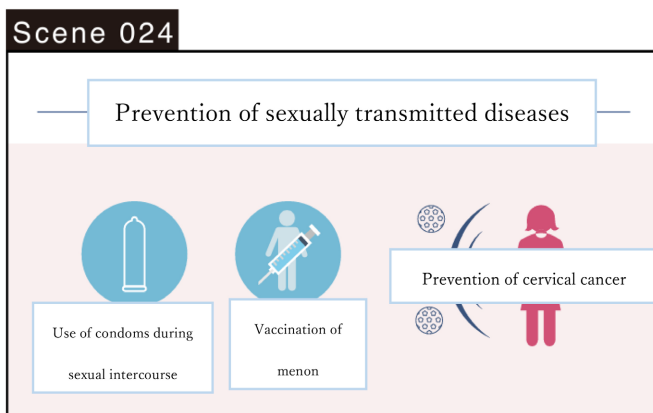
Starting in April 2023, this program will be publicly funded and is available to girls from sixth grade of elementary school to first year of high school.



Since HPV can also cause disease in men, men can also be prevented from getting the HPV vaccine.



In Japan, the quadrivalent vaccine has been approved for use in men aged 9 years and older, and it has been proposed that it be made a part of routine vaccinations, and some local governments are subsidizing the cost of vaccination.



As a method of preventing sexually transmitted diseases, not only should condoms be used during sexual intercourse, but men can also get vaccinated to protect women from sexually transmitted HPV infection and prevent cervical cancer.

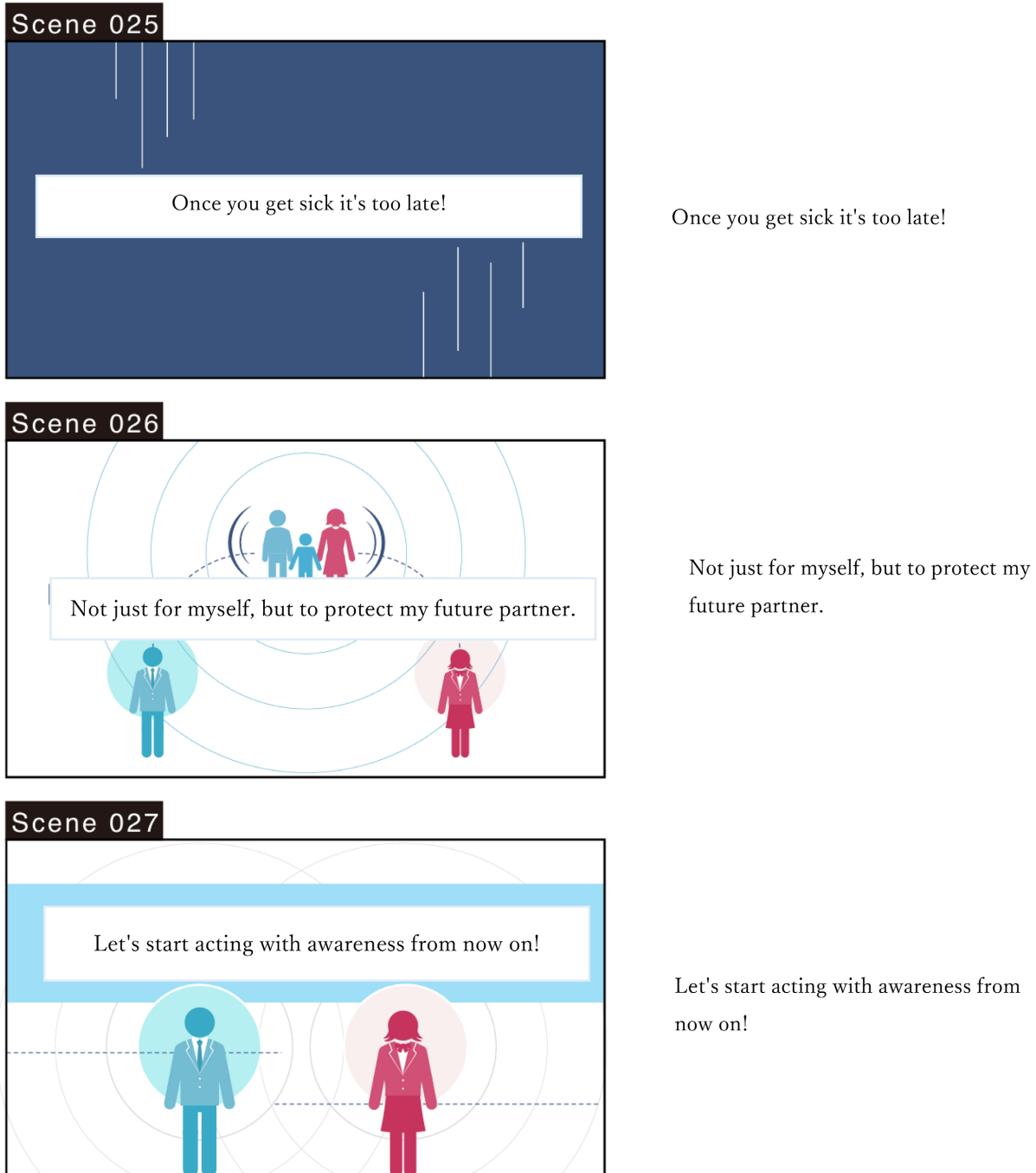


Figure 1. Video slide.

- 1) Introduction (outline based on supplemental reading materials used by high school students [8])
- 2) Risk of sexually transmitted infections
- 3) Types of STIs (chlamydia, HPV, hepatitis B, genital herpes, genital warts, gonorrhea, syphilis, AIDS, trichomonas) and their effects on pregnancy
- 4) Chlamydia infection (risk of infertility, ectopic pregnancy, and premature miscarriage)

- 5) HPV (risk of cervical and pharyngeal cancer development)
- 6) HPV vaccination (vaccine type and effectiveness)
- 7) HPV vaccination (publicly funded vaccine coverage, subsidized vaccination for men)
- 8) Methods of preventing STIs (condom use and vaccination)
- 9) Summary (envisioning the future and encouraging a call to action)

2.5. Preparation of Teaching Materials

- 1) Factors such as the content of study of high school students were sampled among co-researchers from a literature review on sexually transmitted infections and fertility among high school students [9] and a fact-finding survey [10].
- 2) Digital content used infographic-like expressions utilizing motion and numbers to match the scene, with emphasis indicated by the movement of pictograms.
- 3) Medical content was supervised by a physician, and the content was confirmed by a school nurse.
- 4) Creation of the video was commissioned to a vendor.

2.6. Analysis and Evaluation Method

Each survey item was analyzed by simple tabulation. Free-text descriptions were analyzed using the text mining tool KHCoder [11], which is an open-source software program for computer-assisted qualitative data analysis, especially quantitative content analysis and text mining. Co-occurrence networks were created by KHCoder based on the frequency and patterns of the extracted words. Each color represents a cluster of words (topics) that are found in close proximity, with highly related words connected by lines, as shown in the figure. Words used in the co-occurrence network analysis were defined as having a Jaccard coefficient of 0.2 points or higher.

2.7. Ethical Considerations

This study was conducted after receiving approval (22017) from the Research Ethics Committee of each university. The study was explained in writing by the researcher of this study to the subjects, and the subject's free and voluntary consent was confirmed with the return of the consent form and questionnaire. The explanation included the name of the study and the fact that permission to conduct the study had been obtained from the head of the research institution, the name of the research institution and the name of the principal supervisor, the purpose and significance of the study, the method and duration of the study, the reason for their selection as a research subject, the fact that the study would be anonymous to protect personal information, that anonymity would be maintained in the published study, the method of storage and disposal of information, the circumstances regarding conflict of interest for the researchers in association with the study, and support for research subjects and related persons.

3. Results

3.1. Questionnaire Collection Rate

The survey was distributed to 15 respondents. Of these, 14 responses were received, for a response rate of 93.3%. Some blank or inappropriate responses were received; such invalid responses were treated as non-responses for the purpose of the analysis, while the valid responses were included as they were. In addition, since the school nurses who gave harsh evaluations of teaching materials were older and had more years of experience, it was necessary to consider a wide range of age groups.

3.2. Subject Demographics (Table 2)

The age and years of service of the subjects are shown in **Table 2**. Subject age ranged from 34 to 64 years, with an average of 51.4 years. Four (28.6%) of the respondents were aged 60 years or older, five (35.7%) were in their 50s, three (21.4%) were in the 40s, and one (7.1%) was under the age of 40. The number of years worked in high schools ranged from 5 to 42 years, with an average of 20.0 years. Four respondents (28.6%) answered “fewer than 10 years”, four (28.6%) answered “10 - 20 years”, two (14.3%) answered “20 - 30 years”, three (21.4%) answered “30 - 40 years”, and one (7.1%) answered “more than 40 years”.

Table 2. Subject attributes.

		Number of people	%	Average
Age	Under 40	1	7.1	51.4
	40 - 44	3	21.4	
	50 - 59	5	35.7	
	60 or older	4	28.6	
Years of employment	Less than 10 years	4	28.6	20.0
	10 - 20 years	4	28.6	
	20 - 30 years	2	14.3	
	30 - 40 years	3	21.4	
	40 years or more	1	7.1	

3.3. Suitability of Teaching Materials (Figure 2) (Figure 3)

1) Overall suitability of the video as a teaching tool (Figure 2)

The overall suitability of the video in the categories of “comprehension of content”, “appropriateness of time”, “audiovisual materials”, “speaking speed”, “sound quality”, and “clarity” is shown in **Figure 2**. The combined number of “strongly agree” and “agree” responses were 10 (71.4%) for “comprehension of content”, 10

(71.4%) for “appropriateness of time”, and 9 (64.3%) for “audiovisual materials”. Ten respondents (71.4%) “agreed” or “strongly agreed” in the category of “speaking speed”, 11 (78.6%) in “sound quality”, 9 (64.3%) in “clarity”, and 9 (64.3%) in “design”.

On the other hand, 2 - 4 (7.1% - 28.6%) of the respondents chose “neither” regarding the overall suitability of the video, with “clarity” being the most common category for such a response, with 4 respondents. 0 - 2 (0% - 14.3%) of the respondents answered “disagree” or “strongly disagree”, with two respondents each in the categories of “appropriateness of time”, “speaking speed”, and “sound quality”.

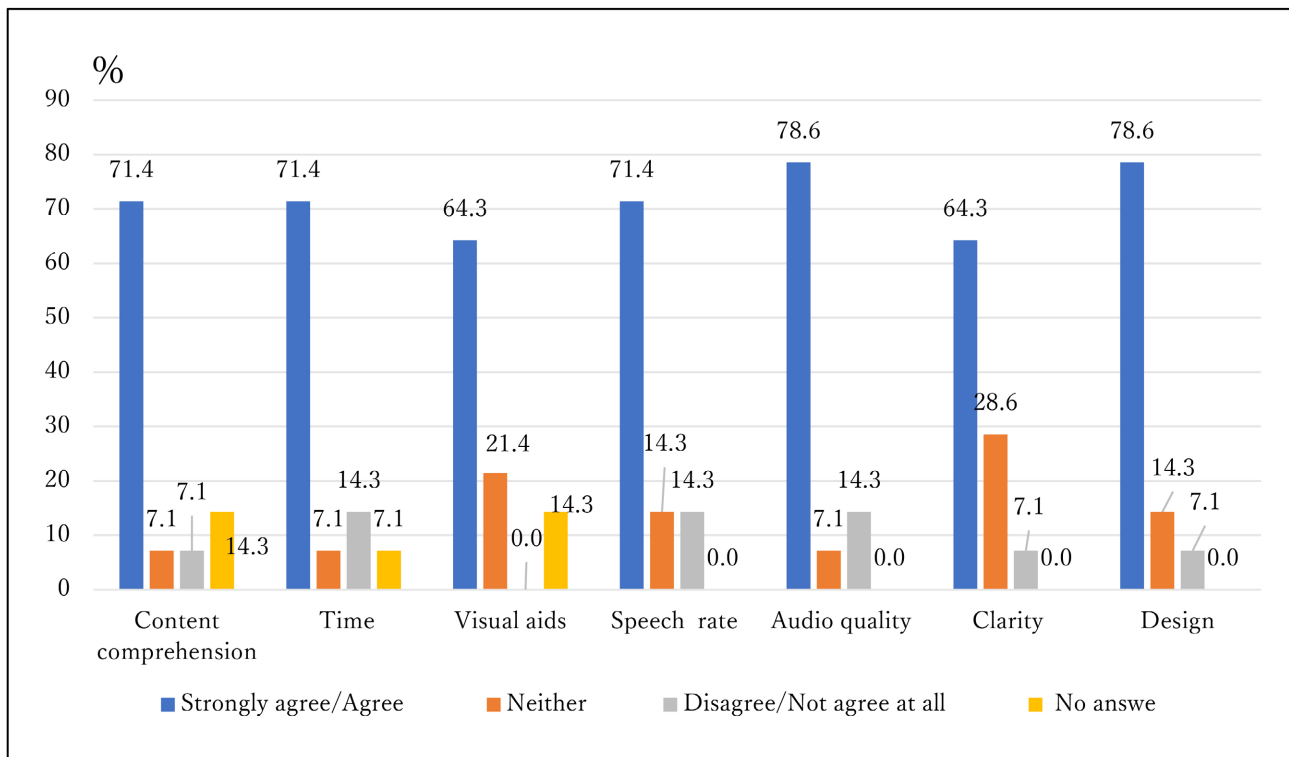


Figure 2. Overall appropriateness.

2) Suitability of teaching materials by category (Figure 3)

Figure 3 shows the “clarity” and “design” categories, which are divided into introduction, risks of STIs, relationship between STI types and pregnancy, sexually transmitted HPV and chlamydia infections, prevention methods, and vaccination. The combined percentage of respondents who were “very satisfied” or “satisfied” with the “clarity” in each category were 10 (71.4%) for “introduction”, 10 (71.4%) for “risk of STIs”, 9 (64.3%) for “relationship between STI types and pregnancy”, 10 (71.4%) for “HPV”, 10 (71.4%) for “chlamydial infections”, 8 (57.1%) for “prevention methods” and 12 (85.7%) for “vaccination”. On the other hand, 0 - 4 (0 - 28.6%) of the respondents answered “neither” and 1 - 4 (14.3% - 42.9%) answered “disagree” or “strongly disagree”. 0 - 4 (0% - 28.6%) of the re-

spondents answered “neither” for the suitability of each category, with design in “HPV”, clarity in “prevention methods” and “design” in “prevention methods” being the most common responses (4 responses each). 2 - 4 (14.3% - 28.6%) of the subjects responded “disagree” or “strongly disagree”, with four of them citing “risk of STIs” and “relationship between STI types and pregnancy”.

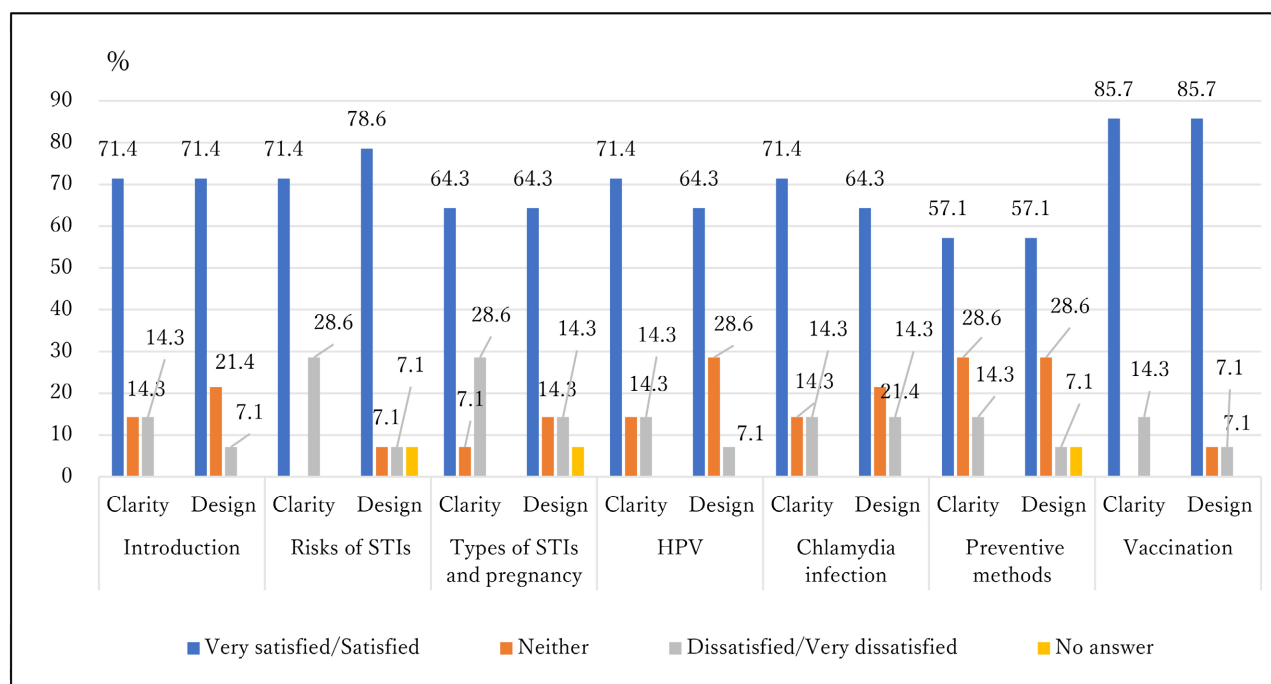


Figure 3. Appropriateness of each item.

The combined number of “very satisfied” and “satisfied” responses was 10 (71.4%) in “design”, 9 (64.3%) in “introduction”, 11 (78.6%) in “relationship between STI types and pregnancy”, 9 (64.3%) in “HPV”, 10 (71.4%) in “chlamydial infection”, 8 (57.1%) in “prevention methods”, and 12 (85.7%) in “vaccination”. On the other hand, 1 - 4 (7.1% - 28.6%) of the subjects responded with “neither” as to the suitability in each category, with “HPV” and “prevention methods” being the most common (4 respondents), while 1 - 2 (7.1% - 14.3%) responded “disagree” or “strongly disagree”, with two being in “relationship between STI types and pregnancy” and two being in “chlamydial infections”.

When the school nurses were assessed on a scale of 1 point for “very satisfied” and 5 points for “strongly disagree”, 11 school nurses scored 1.1 - 2.3, while 3 school nurses scored 3.2 - 3.6. The 3 school nurses who scored harshly had an average age of 59.7 years and 19.3 years of experience as a high school nurse.

3) Points of improvement and opinions regarding teaching materials (Figure 4, Figure 5)

Points of improvement regarding the teaching materials are shown in Figure 4. 13 respondents provided freeform written responses, with a total of 604 extracted words and 31 sentences. A co-occurrence network analysis was performed to

search for connections between the extracted words and similarities in the pattern of word occurrence. The results were divided into six subgraphs: “slide design and flow”, “speaking speed”, “understanding HPV and vaccines”, “ailments related to STIs and pregnancy”, “teaching high school students”, and “thorough explanation”. The words “understanding”, “pregnancy”, “vaccine”, and “thorough” mediated many of the words. Regarding the video’s slide design and flow, there was concern that the large amount of information on each slide would cause them to be passed over without students comprehending it. Regarding the use of colored pictograms to represent gender (light blue for boys, pink for girls), nurses indicated that they wanted coloring that was more conscious of diversity. In addition, the school nurses who received harsh evaluations pointed out that they spoke quickly and had difficulty understanding difficult content such as “understanding HPV and vaccines” and sexually transmitted diseases and pregnancy-related diseases. Furthermore, improvement was needed in the “teaching high school students” category, and subjects expressed a desire for time to be spent on “thorough explanation”.

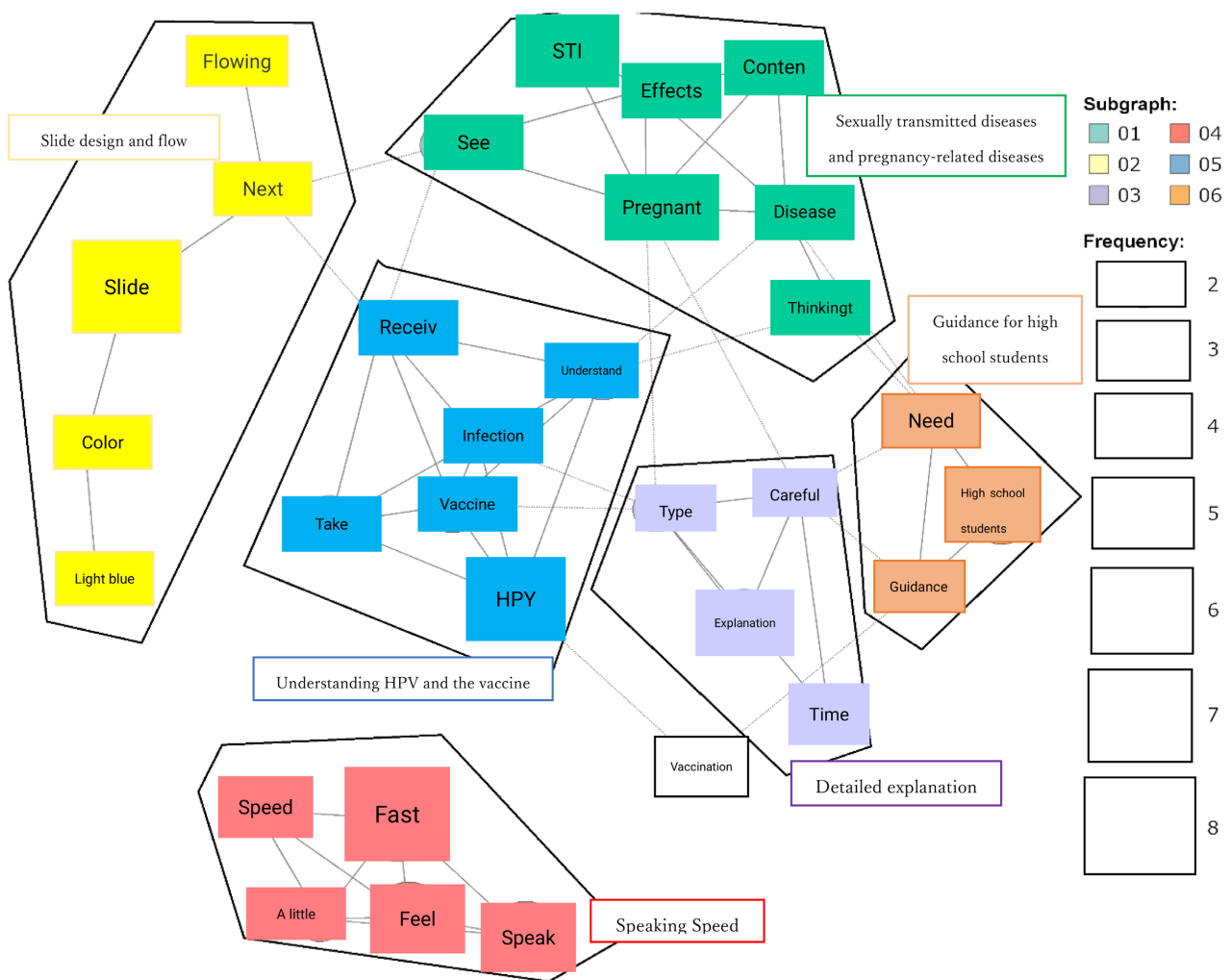


Figure 4. Improvements to teaching materials.

ered large, subjects expressed it was easy to understand and that they will use it in class. While there were “concerns about side effects” and being “unable to recommend the content in school”, there was also praise for the concise content of the video, which left a lasting impression of vaccination. In addition, there were also some opinions against the slide composition, such as “movement of text” and “shape and coloring of the pictograms”, as well as opinions both in agreement with and against the length (“too short, should be around ten minutes”, “short length is good”).

3.4. Digital Content Desired by the Subjects

The video content desired by the school nurses is shown in **Figure 6**. On the physical side, menstruation and emergency contraceptives, as well as heatstroke were mentioned. On the social side, these were information literacy, game addiction, and lifestyle. Sexual abuse, stalking, and voyeurism, as well as domestic violence and sexual harassment were also found. In addition, truancy was mentioned along with depression, eating disorders, suicidal thoughts, self-injury, and other mental health issues. The respondents were looking for video content which enables students to voice their troubles, informs them on how to ask for help and support and where to go for help, and helps them learn how to ask for help and cope with problems.

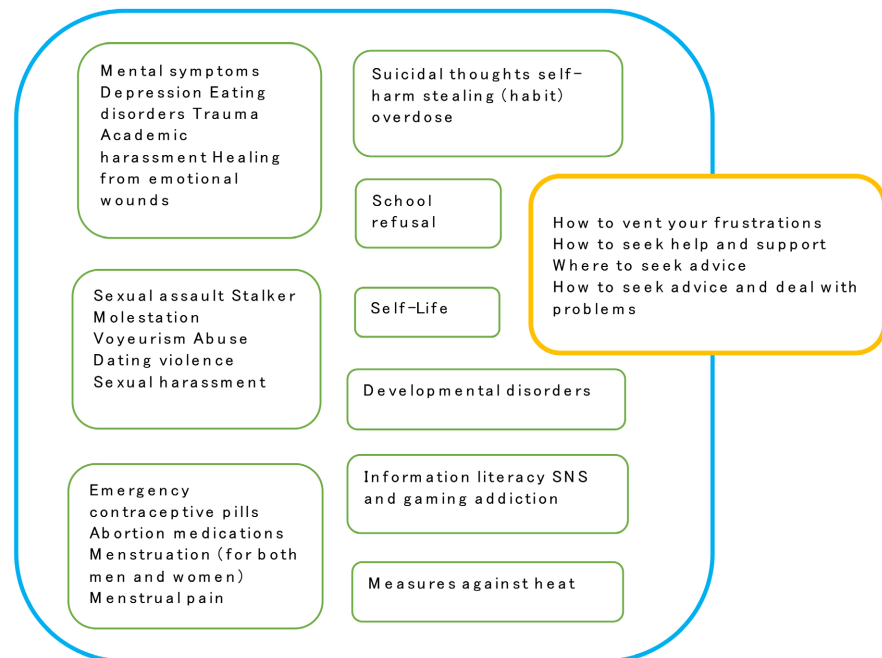


Figure 6. Digital content people would like to see created.

4. Considerations

4.1. Attributes of the Subject

All of the subjects were school nurses with experience in sex education at upper

secondary schools. The breakdown of the subjects' years of service was as follows: 35% for 10 - 14 years, 20% for 20 - 24 years, and 15% for 5 - 9 years. It was possible to examine the suitability of this method for teaching about sexually transmitted infections in high schools because of the subjects' experience as professionals working with high school students. However, the fact that the subjects were recruited partially by the opportunity method may have biased the results.

4.2. Consideration of the Suitability of Teaching Materials

1) Fitness for Purpose

The created teaching materials were videos meant for high school sex education classes, aimed at educating high school students to be able to prevent sexually transmitted infections and protect their fertility. Sex education in Japan is conducted within the educational content of "the prevention of AIDS and sexually transmitted infections" in accordance with the Courses of Study [4], and it is up to the teachers to decide whether or not to cover the various STIs other than AIDS in their classes. In addition, the annual curriculum for sex education is left to the discretion of the schools, which may result in differences in the amount of time spent on learning about STIs. In other words, sex education for high school students aimed at preventing STIs and protecting future fertility is insufficient.

Generation Z (ages 14 - 23) were born into the Internet age and have been surrounded by a digital society their whole lives. As such, they are accustomed to social media and video is an indispensable part of their lives. In addition, a survey on preferences for technology-based learning formats reported that Generation Z tends to prefer learning via online platforms such as YouTube and learning apps/interactive games more than millennials (ages 24 - 40) [12]. Furthermore, school nurses expressed a need for new videos to be used for teaching about STIs, as the videos already in use were outdated and not in line with the current information in areas such as vaccination [10]. Based on the above, we believe that the videos created in this study may help develop sex education classes.

In the introductory section of the teaching materials for this study, we included content related to marriage, pregnancy, and childbirth for the purpose of teaching about sexually transmitted infections in preparation for the future. In response to this, there were concerns about whether high school students would feel STIs, marriage, pregnancy, and childbirth mattered to their lives (categories: timing of education, teaching high school students), as well as differences between individual students and between boys and girls (student feelings). However, according to a survey of high school students, "72% of boys and 81% of girls desired to marry, with the average desired age of marriage being 23.3 years for boys and 22.6 years for girls" [13]. "The most common desired age of childbearing was 25 - 29 years, at 69.7%, with 88.4% of those wishing to have children by age 30" [14]. Furthermore, because just under 80% of boys and over 90% of girls listed "school classes" as the source of information on pregnancy and childbirth [15], it is necessary to teach about STIs in school along with marriage, pregnancy, and childbirth to help

high school students imagine their futures.

2) Difficulty of content (clarity)

The high school students who will view the educational materials have varying degrees of knowledge and interest in STIs, pregnancy, and childbirth. Particularly, in Japan, learning about sex is left to the schools, and parents are unable to teach the subject even if they wish to due to lack of knowledge [16]. In other words, sex education as a part of the school curriculum is an essential part of protecting the fertility of high school students.

Regarding the teaching materials used, 70% rated them adequate in overall content comprehension and over 60% in overall clarity. In terms of the clarity in each category, “relationship between types of STIs and pregnancy” and “prevention methods” were lower than the other items at just under 60%. Comments on areas for improvement were increased in categories concerning side effects related to the HPV vaccine and types of HPV vaccine (“understanding of HPV/vaccine”, “ailments related to STIs and pregnancy”, and “total amount of information”. In addition, the fact that the respondents requested “thorough explanation” shows that these two items are more difficult than the others, indicating a need for “thorough explanation”. However, the other five items ranged from 71.4% - 85.7%, indicating that the content was generally adequate in those categories.

3) Appropriateness of time

The teaching material in this study was a video approximately 5 minutes in length. In the category “appropriateness of time”, which concerned video length, over 70% of the respondents answered that the length was appropriate. However, some subjects responded that it was too short. Since sexually transmitted infections are a part of sex education, it is difficult to devote a long time to it.

WISTIA, a video marketing company, surveyed viewing time in relation to video duration and reported that “about 70% of users will watch a video to the end if it is less than two minutes long, and about 60% will watch it to the end if it is less than five minutes long” [17]. Meanwhile, they also reported that “the more positive the impression the user has of the video, the less likely the user is to rate the subjective viewing time as long” [18]. In other words, it is difficult to evaluate the 5-minute length of the video. For this reason, a length of five minutes is appropriate, but in light of the comments about the overall volume of information and the amount of content, it is necessary to carefully select the content and devise ways to provide the necessary information in a short period of time. solely on external criteria, because internal factors of the caregivers who watched the video are also involved in the evaluation of time appropriateness. Therefore, since learning through video is a significant source of knowledge, it is necessary to determine a time that also considers factors such as impressions and favoring of video content and the influence of psychological characteristics related to time.

4) Suitability of video (audiovisual materials, speaking speed, sound quality)

Educational videos must be easy to watch for high school students to view the material on their own and be interested in it. Based on the responses to the “audi-

ovisual materials, speaking speed, and sound quality” section of the questionnaire, 60% - 70% of the respondents considered the images to be suitable. Factors that affect the suitability of the video include the use of music, text, and sound effects to improve watchability, as well as the per-slide viewing time and information volume.

In our study, respondents shared their suggestions for improving of the materials in the categories of “slide design and flow” and “speaking speed”, as well as their opinions on the overall amount of information and slide composition, such as the movement and color of pictograms.

Foulke *et al.* conducted an experiment on the relationship between playback speed and comprehension of spoken speech and found that “compression of spoken speech in excess of 275 words per minute causes a sharp drop in comprehension, but compression below that level shows no change in comprehension”. The authors reported that “the results of the study were not statistically significant” [19]. In addition, in a study of high school students on the relationship between high-speed presentation of video content and learning effectiveness it was reported that “although the differences in presentation speed between 1×, 1.5×, and 2× presentation speeds did not affect learning effectiveness, 1.5× speed was the most approved presentation speed for learning through video content” [20]. Vemuri *et al.* reported that, in an experiment in which subjects were shown audio transcripts (subtitles) as visual information when playing speech at high speed (using a speech recognizer that instantly recognizes speech) “the speed and accuracy of subjects’ comprehension improved” [21]. In other words, in order to improve the educational effectiveness for high school students, the “speaking speed” category requires adjustment in the number of words per minute, the amount of information on each slide of visual material, and the addition of audio transcripts to the video. It is also necessary to devise ways to get high school students interested so they can view the video on their own.

5) Suitability of expression (design)

The respondents were generally satisfied with the design of the teaching materials in this study, both overall and in each category. Pictograms were used for expression and to indicate areas of emphasis through movement. Pictograms are symbols that effectively convey the meaning of a concept without using letters. Currently, pictograms are attracting attention as a tool that can be used to support nonverbal communication. In their study, Moving Pictograms, Diaz, *et al.* [22] found that “the addition of motion enhances the understanding of the meaning of pictograms in video”. Meanwhile, Ohno [23] states that “it is not necessarily easier to understand the meaning of a moving image. For scenes in which the meaning must be interpreted instantly, still images are more suitable than moving images.” In other words, for slide composition, we should consider whether the pictograms should be still or moving images according to the content.

As for the color scheme of the teaching materials, light blue was used for pictograms indicating boys and pink for girls. It has been shown that colorization of pictograms improves impressions of clarity and eye-catchiness [23]. Meanwhile,

in Japan, people have experienced color-coding by gender since childhood through toys, school bags, and even as adults through bathroom markings. They have internalized stereotypes about gender and colors, such as *male = black, blue, and cold colors*, and *female = red, pink, and warm colors*. Kitagami *et al.* [24] report that “this is particular to Japan, and in fact, this color information is crucial for Japanese people when they recognize toilet pictograms”. In recent years, there has been more sensitivity toward diversity, gender-free, and individual differences. Accordingly, it is necessary to examine the colors used in teaching materials, as the existing gender-based color coding is not in line with contemporary notions of gender. However, since the purpose of teaching materials is first and foremost to be clear and easily understood by high school students, it is necessary to keep that priority in mind when selecting the colors to be used.

6) Digital content school nurses would like to see created

Teenage abortions in Japan are on the rise, increasing 5.1% from 9569 cases in 2022 to 10,053 cases in 2023 [25]. In order to avoid the current situation where emergency contraceptives are not sufficiently used by women who want to prevent unexpected pregnancy, emergency contraceptives have been available for purchase at pharmacies without a doctor’s prescription since November 2023 [26]. It is assumed that school nurses wished for digital content on emergency contraceptives due to this background. In addition, it can be assumed that the need for digital content which covers heat stroke was felt in response to the global warming phenomenon of recent years, which has caused the number of emergency medical evacuations due to heat stroke to increase each year [27], as well as because there have been cases of emergency medical evacuations from schools.

According to the 2023 “Situation Regarding the Sexual Abuse of Children and Youth” report [28], more than one in four (26.4%) young people (16 - 24 years old) have been victims of some form of sexual violence, and the number is increasing every year. Furthermore, more than half of victims do not consult with anyone. Given this critical situation, it is assumed to be the reason that school nurses are in need of digital educational content which covers sexual abuse, as well as how to seek assistance and support and where to go for counseling.

In addition, the social aspects of “information literacy and game addiction” and the mental aspects of “depression, eating disorders, suicidal thoughts, and self-harm” are consistent with the bullying [29], suicide [30], and gender gap [31] issues affecting Generation Z today. In short, school nurses wish to quickly address the issues facing today’s youth and the physical and mental challenges of students in current society.

5. Limitations of the Study and Future Prospects

In this study, we developed and examined the suitability of educational materials to be used by school nurses in teaching sex education in high schools for the prevention of sexually transmitted infections and protection of fertility. One limita-

tion of the study is that the study subjects were school nurse-teachers recruited through the kinship method, and therefore, the study was not sufficient to examine its appropriateness.

As a future task, the teaching materials created will be refined by the school nurse teachers based on the results of this study by conducting intervention studies using the actual teaching materials.

6. Conclusions

The purpose of this study was to develop educational materials that can be used in sex education to help high school students prevent sexually transmitted infections and protect their fertility, and to examine the suitability of the materials. This resulted in the following findings:

1) In examining the materials created for this study as a whole in terms of “comprehension of content”, “appropriateness of time”, “audiovisual materials”, “speaking speed”, “sound quality”, and “clarity”, school nurses found that, although some modifications were necessary, it was generally suitable.

2) In the “prevention methods” category, only 57.1% of the respondents answered that “clarity” and “design” were adequate, but in other categories, 64.3% - 85.7% were satisfied. In order for high school students to prevent sexually transmitted infections on their own and protect their fertility, the teaching materials need to be revised by improving the selection of content, video, audio, time, and design.

3) In terms of improvements that could be made to the teaching materials, the following points were raised: design and flow of slides and speaking speed should be considered, and understanding of HPV/vaccine and diseases related to sexually transmitted infections and pregnancy should be made easier to understand, with careful explanation. There were both assenting and dissenting opinions regarding teaching high school students in relation to marriage, pregnancy, and childbirth and STIs, but since school is the main source of information, students must learn about sexually transmitted infections in conjunction with marriage, pregnancy, and childbirth.

4) The digital content school nurses would like to see created included the content covering the challenges of youth in today’s society and the physical and mental challenges of students.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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