

Enterovirus Knowledge and Handwashing Practices among Nurses in a Hospital in Taipei, Taiwan

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Abstract

Enterovirus outbreaks have occurred in many parts of Asia in recent years, which underscores the need for medical personnel to be knowledgeable about enterovirus infections and prevention methods. A descriptive cross-sectional survey was conducted to examine knowledge of enterovirus, handwashing practices, and sources of information about enterovirus among nurses at a major university hospital in Taipei, Taiwan.

A total of 293 nurses from 18 randomly-selected nursing stations located in a variety of departments throughout the hospital participated in the survey on August 2009. The questionnaire was designed to measure the nurses' knowledge of enterovirus agents, symptoms, treatment, and epidemiology and to assess handwashing frequency and methods. Participants correctly identified many symptoms of enterovirus, but many also incorrectly identified a number of characteristics not associated with enterovirus as being linked to the infection. More than

three-quarters incorrectly said that antibiotics were appropriate for treating enterovirus infections. High levels of compliance with good hand hygiene techniques at work were reported.

Nurses had a much higher level of knowledge than the general population, but the survey identified gaps in knowledge that should be addressed.

Keywords: enterovirus, hand-foot-and-mouth disease, handwashing, nurses, Taiwan

Introduction

The enterovirus genus includes polioviruses, coxsackieviruses, echoviruses, and a variety of other viral agents. While most

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infections with enteroviruses are asymptomatic or mild, symptoms may include fever, lethargy, upper respiratory symptoms, rashes, blisters, and lesions. Enteroviruses infections may lead to pleurodynia, herpangina, and hand, foot and mouth disease (which can be caused by a variety of enteroviruses) [1-2]. A small portion of those infected may develop severe complications such as aseptic or viral meningitis, neurological sequaelae, myocarditis, or even paralysis [3]. Transmission occurs mainly through fecal-oral spread and can also be transmitted via respiratory droplets; body excreta including saliva, sputum, nasal discharge, and feces can carry the virus [4]. Because the infection is spread through touch, frequent and thorough handwashing is essential for the prevention of enterovirus transmissions. Although infections primarily affect young children [5], caregivers can transmit the viruses to children and other susceptible populations. Therefore, it is important for everyone –

children, parents, health care workers, and others – to be vigilant about hand hygiene.

Enterovirus infections are found worldwide, and in the past twenty years outbreaks have occurred in many parts of Asia and Oceania, including Australia [6], Malaysia [7], China [8], and Taiwan [9]. An outbreak in Taiwan during the late 1990s was responsible for 78 deaths, 91% of which were of children less than five years old [9]. Enterovirus infections are now common in Taiwan [10]. In 2008 alone there were 373 confirmed cases of enterovirus infections with severe complications, including 14 fatalities; the majority of cases were children in their first two years of life [11].

A general population survey conducted by the Centers for Disease Control (CDC) of Taiwan in 2008 examined enterovirus knowledge, self-reported handwashing behaviors, and sources of information about enterovirus infection [12]. Caregivers of children under the age of 5 made up 61% of the study population. This survey found that nearly all caregivers of young children with suspected enterovirus infections would bring their ill children to a clinic or hospital, highlighting the need for medical personnel to be alert to enterovirus infections and to have a good attitude toward prevention [12]. In response to this call for improved knowledge and practices of health care workers, we designed and conducted a similar survey of nurses in Taiwan in 2009. The goal of this study was to examine knowledge of enterovirus and reported handwashing practices among nurses in a hospital.

Materials and Methods

A. Study participants

Hospital A is a major teaching hospital located in downtown Taipei, Taiwan, that has 27 medical and surgical departments and 1,933 inpatient beds. In mid-2009, Hospital A employed 1,712 nurses, 806 doctors, and 2,063 other hospital employees. This was a cross-sectional study that invited nurses from 18 randomly selected nursing stations located in a variety of departments throughout the hospital to participate in a self-administered survey of enterovirus knowledge and prevention, and handwashing practices. Nurses that were eligible had to be licensed nurses working full-time at Hospital A. Nurses that did not meet these eligibility requirements were excluded from the study. The 18 nursing stations were selected by drawing at random from a list of ward from the pediatric, neo-natal, emergency rooms, surgical, and general units. The head nurses for each of these units were informed ahead of time about the surveys. If requested by the head nurse, a brief oral presentation in Mandarin was given by the researchers prior to the distribution of the questionnaires. The eligible nurses assigned to these units were asked to complete the surveys immediately after their distribution without assistance from other nurses, and to return the completed survey either to an assigned secure file box designated by the head nurse or to a member of the research team who waited at the nursing station while the surveys were distributed and collected. The surveys did not include any personal identifiers, and to ensure anonymity the survey forms were not linked to the signed informed consent statements. In total, 437

nurses from the randomly-selected nursing stations were asked to participate, and 293 (67%) of these nurses returned completed questionnaires. (The sample size ensured a power of >80 % given a confidence interval of 95 %.) All of these surveys were collected over a two week period in August 2009.

B. Survey instrument

The authors created a structured Knowledge, Attitude, and Practice (KAP) questionnaire that was written in Chinese and revised by Taiwanese culture experts to ensure that the survey was culturally sensitive and appropriate for a Taiwanese study population. The questionnaire consisted of three main sections: demographics, enterovirus knowledge, and handwashing preferences and practices. The section on demographics asked about each participant's age, education level, work ward and unit, and the presence of children living in their home. The knowledge section included a series of 40 yes/no questions about sources of enterovirus knowledge, enterovirus agents and the diseases they cause, common and severe symptoms associated with enterovirus infection, populations at risk, and appropriate practices for caring for a patient with enterovirus infection. To allow for comparison of our results with previous work and provide content validity, several of the questions on enterovirus knowledge and practice were drawn from the general population survey conducted by the CDC of Taiwan in 2008. The study is publicly available on the Taiwan CDC website [12]. Because good hand hygiene is a critical component of enterovirus prevention, the final section contained 18 questions about

handwashing frequency and methods. The questions about frequency asked participants to indicate how often they washed their hands in various circumstances using a 5-point Likert-type scale, with 1 indicating never and 5 indicating always. The remaining questions asked participants to indicate their preferred handwashing methods and the methods they employ at work. For example, participants were asked about duration of handwashing, use of soap, and method of drying their hands. Handwashing questions from the general population survey conducted by the CDC were also incorporated into this section [12].

C. Ethical consideration

This research project was approved by the Human Subjects Review Board of George Mason University (Fairfax, Virginia, USA) and by the Institutional Review Board of National Taiwan University Hospital and National Taiwan University Hospital Nursing Department (Taipei, Taiwan). Participation in the survey was voluntary – the consent statement and instructions emphasized that participation was not a requirement of employment – and all participants provided written informed consent. No compensation or gifts were provided to participants.

D. Statistical analysis

Data were analyzed using SPSS for Windows version 16.0. Each yes/no knowledge question was re-coded into a dichotomous variable for whether the answer was correct or incorrect. Descriptive statistics were used to summarize data. The 2-sided exact p-value for the Chi-square test was used to identify possible variations in the responses provided by participants in

different age groups (nurses <30 years old and nurses \geq 30 years old), working in pediatric wards, or who had children living in their homes, since these three categories represent experiences that might contribute to differential knowledge. We also used the Chi-square test to assess possible differences in knowledge between our nurse participants and the results provided by a government survey of the general population of Taiwan [12]. The p-value was considered to be significant if the p-value was less than 0.05.

Results

Of the 293 participating nurses, 275 (93.9%) were female and 264 (90.1%) had at least a bachelor's degree in nursing. The mean age of participants was 30.0 years (standard deviation: 6.0), with a range from 20 to 49 years. In total, 61 (20.9%) participants had offspring under 18 years of age living in their home and 86 (29.4%) worked in a pediatrics ward.

A. Enterovirus knowledge

Participants had a high level of knowledge about enterovirus infections (Table 1). More than 90% correctly identified fever (99%) and lethargy (99%) as symptoms, EV71 as a type of enterovirus (95%), and hand, foot and mouth disease as being caused by an enterovirus (95%). At least 80% also correctly identified feces (88%), saliva (87%), sputum (80%), and nasal discharge (80%) as possible carriers of the virus, correctly affirmed that enterovirus can cause neurological problems (88%), and identified children less than 4 years old as the population at greatest risk of enteroviral disease (83%).

Table 1. Knowledge of enterovirus among nurses in a hospital in Taiwan

Knowledge of Enterovirus	Nurses % correct of all (n=293)
Is fever a common symptom of enterovirus? (Yes)	99%
Is lethargy a common symptom enterovirus? (Yes)	99%
Is EV71 a type of enterovirus? (Yes)	95%
Can Hand, Foot and Mouth Disease be caused by an enterovirus? (Yes)	95%
Can neurological sequelae be a serious complication of enterovirus? (Yes)	88%
Are feces a common method of enterovirus transmission? (Yes)	88%
Is saliva a common method of enterovirus transmission? (Yes)	87%
Are enterovirus infections most common in children less than 4 years old? (Yes)	83%
Is sputum a common method of enterovirus transmission? (Yes)	80%
Is nasal discharge a common method of enterovirus transmission? (Yes)	80%
Is a blistering rash a symptom of enterovirus? (Yes)	71%
Are spasms (pleurodynia) a symptom of enterovirus? (Yes)	70%
Is jaundice a common symptom of enterovirus? (No)	56%
Is hemorrhagic fever a common symptom of enterovirus? (No)	37%
Are Rhinoviruses a type of enterovirus? (No)	36%
Are enterovirus infections rarely fatal? (Yes)	30%
Are antibiotics recommended to treat enterovirus infections? (No)	24%

There were few differences between population groups within our study population. Nurses age 30 years and older were more likely than younger nurses to correctly note the inappropriateness of antibiotics for enterovirus infections (31.9% vs. 18.7%, $p=0.015$) and nurses less than 30 years old were more likely to correctly identify that hemorrhagic fever is not a symptom of enterovirus (43.2% vs. 28.3%, $p=0.015$). Nurses with children living in their home were more likely to know that young children were most affected by enteroviruses (91.8% vs. 80.2%, $p=0.036$) and that blistering rashes are a symptom (82.0% vs. 68.5%, $p=0.040$). There were no significant

differences between nurses working on pediatric wards and non-pediatric wards. Knowledge was similar for all population groups for the remaining questions.

B. Handwashing

Frequent handwashing is an important step in curbing the spread of enterovirus infections both in hospitals and in other clinical and non-clinical settings. A high proportion of participants in this study said that they always or usually washed their hands after having a bowel movement (98.6%), after handling feces (96.9%), after minimum patient contact (93.2%), before food preparation (92.5%), before eating (90.8%), and after returning home

(88.4%) (Table 2). Washing hands at these times is important for protecting patients, nurses, and nurses' families from infection. Fewer participants reported that they always or usually wash their hands after sneezing or coughing (72.7%), before serving food (63.1%), and after touching office objects (56.7%). This raises concerns about

the possibility of nurses contributing to the transmission of infections like enterovirus.

To assess handwashing knowledge and practices, we asked participants to indicate their personal preference for handwashing technique and the practices they usually follow at work (Table 3). About three-quarters (75.4%) of participants reported a personal

Table 2. Handwashing frequency (usually or always) among nurses in a hospital in Taiwan

Situation	% who say they usually or always wash their hands in this situation
After bowel movement	98.6%
After handling feces	96.9%
After minimal patient contact	93.2%
Before food preparation	92.5%
Before eating	90.8%
After returning home	88.4%
After sneezing or coughing	72.7%
Before serving food	63.1%
After touching office objects	56.7%

Table 3. Handwashing preferences and practices among nurses in a hospital in Taiwan

	Question	% who prefer this option	% who use this option at work	% in this category for whom their preference is what they actually do at work
Soap Use	Soap	75.4%	92.8%	74.4%
	No soap	22.2%	4.8%	
	Missing	2.4%	2.4%	
Duration	20 seconds	67.2%	86.3%	71.7%
	5 seconds	26.3%	4.1%	
	At least a min	3.8%	6.1%	
	Missing	2.7%	3.4%	
Temperature	Warm Water	67.9%	46.4%	70.6%
	Cold Water	27.6%	49.1%	
	Hot Water	2.0%	2.0%	
	Missing	2.4%	2.4%	
Drying	Paper Towel	48.5%	93.2%	52.2%
	Reusable Cloths	20.8%	0.0%	
	Nothing (Air Dry)	13.7%	2.0%	
	Multiple Drying Methods	12.3%	1.7%	
	Hot Air	1.7%	1.0%	
	Handkerchief	1.0%	0.0%	
Hand Sanitizing	Missing	2.0%	2.0%	33.1%
	Soap	76.1%	15.0%	
	Alcohol-based hand sanitizer	18.8%	74.7%	
	Both	2.4%	7.8%	

preference for using soap, but considerably more (92.8%) reported using soap at work. About two-thirds (67.2%) reported preferring to wash hands for about 20 seconds and one-quarter (26.3%) reported preferring to wash for only 5 seconds, but the strong majority (86.3%) reported that they usually washed for about 20 seconds at work. A variety of preferences for hand drying were listed, including using paper towels (48.5%), reusable cloths/handkerchiefs (21.8%), and not drying the hands (13.7%), but the vast majority of respondents (93.2%) reported using paper towels at work. These reports indicate high levels of compliance with good hand hygiene techniques at work and suggest that nurses understand the importance of proper handwashing for minimizing the spread of infections.

The survey identified two areas where nurses may not currently have the option at work of using their preferred method of hand hygiene. First, while 76.1% of participants reported preferring soap and water to alcohol-based rubs for hand sanitizing, 74.7% said that they usually used alcohol rubs at work and only 15.0% reported usually using soap and water. Second, 67.9% of participants preferred using warm water to wash their hands, but half (49.1%) of respondents reported that they usually used cold water at work.

Discussion

A comparison of the results of this survey of 293 nurses to the results of a survey of 911 adults selected from the general population of Taiwan shows that nurses have a very high level of knowledge about enterovirus

symptoms [12]. Nurses were much more likely than the general population to know that fever is a common symptom of enterovirus infection (99% vs. 78%, $p < 0.001$), that lethargy is a common symptom (99% vs. 53%, $p < 0.001$), that neurological sequelae can be a serious complication of enterovirus infection (88% vs. 32%, $p < 0.001$), and that enterovirus can cause spasms (70% vs. 47%, $p < 0.001$). Nurses were as likely as the general population to know that enterovirus infections can cause a blistering rash (71% vs. 70%, $p = 0.664$).

However, a sizeable proportion of nurses also incorrectly identified a number of characteristics not associated with enterovirus as being linked to the infection. Nearly half incorrectly said that jaundice was a common symptom of the disease (44%) and nearly two-thirds incorrectly thought that enterovirus caused hemorrhagic fevers (63%). Nearly two-thirds also incorrectly thought that rhinovirus – the common cold – was a type of enterovirus (64%). Nurses also overestimated the case fatality rate, with only 30% correctly identifying that the disease was rarely fatal. Despite knowing that the infection is caused by a virus, three-quarters (76%) said that antibiotics were recommended for those with enterovirus disease. This suggests that while nurses are very alert to concerns about enterovirus, they may not be receiving adequate information about the defining characteristics of enterovirus disease and appropriate therapies and nursing actions. Participants reported learning about enterovirus from a wide variety of sources, including newspapers or news programs on the radio or TV (97%); medical

journals and professional newsletters (80%); friends, family, and coworkers (78%); public health ads on the television (64%); public health posters (54%); and public health ads on the radio (41%). Most of these sources do not provide the targeted and specific professional information required by practicing nurses.

Based on a comparison of our participants to a survey by the Taiwan CDC, nurses of Hospital A demonstrated a significantly higher level of knowledge about the potential symptoms and severity of enterovirus infections than the general public. There were only a few questions in which responses differed by the nurses' ages, work units, or whether they had children. For the vast majority of questions, no significant differences in knowledge were observed. This suggests that nurses with a range of years of experience and a variety of clinical specialties have all received similar amounts of education about enteroviruses. However, participants also incorrectly attributed a variety of symptoms to enterovirus infections, which highlights the need for additional education about key distinguishing features of enterovirus infections. Continuing education programs that address a wide variety of medical issues have been proven to rapidly increase knowledge and improve practices of nurses [13-15], and educational materials and programs for enterovirus are likely to be equally effective in facilitating the ability of nurses to care for patients and their families and to provide appropriate patient and community health education.

Most participants reported complying with handwashing guidelines that generally suggest washing with warm water, if available,

and soap for a duration of at least 15 seconds then drying hands with an air dryer or a clean towel [16-17]. Water temperature was the one area where nurses reported not being able to practice their preferred handwashing method at work: they preferred warm water but half reported having to use cold water at work. However, while most guidelines do suggest the use of warmer water for handwashing and our participants clearly had a preference for using warm water over cold water, warm or hot water has not been shown to be significantly more effective than cold water at reducing the amount of bacteria on hands [16]. The reported preference for soap and water over alcohol-based disinfectant could be attributable to the common perception that alcohol-based sanitizers are more damaging to the skin than handwashing with soap and water [18]. Common barriers to proper hand hygiene identified in previous studies of health care workers, such as a lack of handwashing supplies [19-20] or the belief that some types of patient contact do not require handwashing [21-22], do not appear to be a hindrance to hygiene in our study population, but handwashing education programs and consistent reinforcement of the importance of handwashing have been shown to be important for increasing and maintaining good practices [23-25].

This study had several potential limitations. First, a great variety of agents are part of the enterovirus genus, which means that the symptoms and potential complications from infection are broad. This could have made it difficult for our participants to correctly identify which symptoms of enterovirus infections frequently

occur with infection and which are rare complications. Second, only about two-thirds of the surveys were returned, which raises the potential of selection bias. However, the answers provided by nurses from wards with high rates of return (about 90% or greater) were not significantly different than the responses from nurses working on wards with low rates of return (with only about half of the surveys returned), which suggests that nurses who participated were not significantly different from nurses who did not participate in the survey. Third, all information about handwashing was by self-report rather than by observation. Previous studies of handwashing practices have shown that data gathered from observations tend to reveal lower compliance with recommended handwashing guidelines than self-reported data about compliance [26]. We attempted to minimize this potential bias by asking about preferences and practices so that we could distinguish between reported ideal behavior and actual behavior. The notable differences between reported preferences and practices support the truthfulness of the answers given.

Conclusion

In 2008, the Minister of the Department of Health of Taiwan called for strengthening health education for target groups and for continuing to promote prevention work [27]. This survey identifies areas where nurses would benefit from additional targeted messages, such as the need for additional information about the defining characteristics of enterovirus infection, including common symptoms and possible complications, and the need to emphasize appropriate use of

antibiotics. Continuing reinforcement of the importance of handwashing should also be emphasized to help prevent the transmission of infections like enterovirus. Continuing education for nurses should aim to fill in these existing gaps in knowledge so as to improve clinical practice.

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AIDS Knowledge Among Arrested Sex Workers and Sex Consumers in Taoyuan, Northern Taiwan

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Abstract

Sex workers or sex consumers who have multiple sexual partners are at a high risk of contracting HIV or venereal diseases. Since July 2006, the Public Health Bureau, Taoyuan County Government, has given a questionnaire to arrested sex workers/consumers to assess their knowledge about AIDS prevention. After filling out questionnaire, sex workers/consumers were given leaflets about AIDS prevention. Since March, 2007, further education about items with incorrect answers was initiated. This study analyzed the answers to a questionnaire given to arrested sex workers/sex consumers in order to assess their knowledge about AIDS prevention and to evaluate the efficacy of the health education leaflets and education counseling.

From July 2006 to January 2008, 467 sex workers/sex consumers were arrested in Taoyuan, Taiwan, and 142 valid questionnaires (30.4%) were used for this study. There were 83.1% sex workers and 16.9% sex consumers. The rate of correct answers about AIDS knowledge was 56.2%. Specifically, 22% wrongly believed they could take medicine to enhance the body's immunity for HIV/AIDS prevention and 24.3% were unaware that HIV/AIDS is a non-curable disease. Only 12.7% knew about the government service for HIV testing, and most sex workers/sex consumers in this study answered incorrectly that blood donation was not an option for HIV/AIDS screening (i.e., they believed it was an option). The rate of correct answers for AIDS knowledge did not increase over the study period, which implies that information about AIDS prevention given to the arrested sex workers/sex consumers were not passed on to their friends.

Keywords: AIDS knowledge, sex workers, sex consumers, health education

Introduction

The major routes of transmission of human immunodeficiency virus (HIV) are unsafe sex, contaminated needles, and transmission from an infected mother to her baby at birth. The majority of HIV infections are acquired through unprotected sexual relations [1]. Since there is currently no vaccine or cure for HIV or acquired immunodeficiency syndrome (AIDS), safe sexual behavior remains the most reliable prevention for HIV infection. However, sex workers and sex

consumers typically have multiple sexual partners and are mostly unwilling to use condoms. These characteristics for both groups lead to a high risk of obtaining HIV or venereal diseases [2-6].

In spite of these well-known, behavior-related characteristics of HIV transmission, sex workers and sex consumers still have considerable misunderstandings about AIDS prevention. For instance, previous studies have found that they often wrongly perceive that HIV/AIDS patients can be recognized by their appearance. They also wrongly think that HIV/AIDS prevention can be achieved by oral or injectable medicine, and they are unaware of early symptoms of AIDS [7-9].

Due to the sensitive characteristics of sex workers and sex consumers, it is difficult to approach these groups. In previous studies, authors have visited a red light district and personally interviewed sex workers or sex consumers [2, 9]. In this study, a questionnaire was given to sex workers/consumers who were arrested by police in order to assess their AIDS prevention knowledge.

Taiwan has several acts or regulations related to AIDS control. In December, 1990, the "AIDS Prevention and Control Act" was issued, stating that arrested sex workers and sex consumers should undergo HIV testing and listen to lectures on prevention of HIV and sexually transmitted diseases (STDs) [10]. In 2007, this act was revised and renamed the "HIV Infection Control and Patient Rights Protection Act." In March 2006, a "Regulations Governing Lecture on the Prevention and Control of HIV and Other Sexually Transmitted Diseases" specified that the lecture should be

within 2 hours [11]. However, no penalty was listed in the regulations for not taking part in the lecture; thus, it has been difficult to fulfill the purpose of the regulation.

From 2004-2006, the HIV/AIDS epidemic in Taiwan dramatically increased among injecting drug users (IDUs) [12]. Since July 2006, the Public Health Bureau, Taoyuan County Government, has given a questionnaire to arrested sex workers/consumers to assess their knowledge about AIDS prevention. After filling out questionnaire, sex workers/consumers were given leaflets about AIDS prevention. Since March, 2007, further education about items with incorrect answers was initiated. This study analyzed the questionnaires to assess the arrested sex workers'/consumers' AIDS knowledge from July 2006 to January 2008 in order to assess their HIV/AIDS knowledge and to evaluate the efficacy of the health education leaflets and education counseling.

Materials and methods

1. Study design and study subjects

All arrested sex workers/consumers in Taoyuan area from July 2006 to January 2008 were included in this study. The Public Health Bureau, Taoyuan County Government, was informed when a sex worker/consumer was arrested. For each arrested worker/consumer, the contracted medical staff drew blood, delivered the AIDS knowledge questionnaire, gave them two condoms and an AIDS education leaflet. Since March 2007, further education has focused on items with incorrect answers in the questionnaire. Those who were HIV positive were also notified, counseled, and

treated.

This study was approved by the Institutional Review Board (IRB), Chang Gung Medical Hospital (file number: 97-1459B) and an informed consent form was exempted due to legal data collected by the government.

2. Measures

Collected information included the date arrested, name, age, gender, AIDS knowledge questionnaire (15 items) and self-reported HIV/AIDS prevention practices. The AIDS knowledge questionnaire consisted of fifteen items (14 four-choice items with one correct answer and 1 item with a yes/no option). Questions included knowledge about AIDS pathogens, transmission routes, the window period, incubation period, clinical signs, treatment, prevention, high-risk groups, punishment and HIV screening test services. The reliability and validity of the AIDS knowledge questionnaire (14 four-choice items) was acceptable. Regarding the content validity, 9 experts rated the AIDS knowledge questionnaire on appropriateness, clarity, and relevance and obtained a mean of 3.2 (range from 1 to 5). Known group differences (school adolescents, arrested drug users, methadone maintenance treatment (MMT) users, and public health workers) in the AIDS knowledge questionnaire were seen. The school adolescents had the lowest correct rate, followed by arrested drug users and MMT users, and the public health workers had the highest correct answers. The Cronbach's α was between 0.60-0.82, indicating good internal consistency. In addition, test-retest reliability was examined for some of the school adolescents and arrested drug users

who filled out the questionnaire twice within two weeks. The correlation coefficient of the two scores was 0.59, indicating a fair amount of stability over time [13].

3. Statistical analysis

The data were analyzed using SAS 9.2 software. The rate of correct answers for single items in the AIDS knowledge questionnaire was presented using both numbers and percentages. The total score for the AIDS knowledge questionnaire was also listed by both mean and standard deviation (SD). The AIDS knowledge score for single items between the sex workers and sex consumers was compared using a chi-square test or Fisher's exact test, where appropriate. The total AIDS knowledge score among groups was also compared by independent t-test, analysis of variance (ANOVA), and Wilcoxon rank sum test, where appropriate. Chi-square test of goodness of fit was used to compare the proportion of study group, age, and HIV statistics between the sample and the population. The significance level in this study was 0.05.

Results

1. Demographic characteristics

From July 2006 to January 2008, the questionnaires were given to 137 sex workers (136 females and 1 male) and 28 sex consumers (all male). A total of 142 valid questionnaires (24 sex consumers, 16.9%, and 118 sex workers, 83.1%) was used for this study after excluding 22 questionnaires (2 or more items missing) and 1 male sex worker.

There were 118 (83.1%) sex workers and 24 sex consumers (16.9%). The mean age was 34.3 years old (SD=9.5). The sex workers

(35.2±9.4 years old) were older than the sex consumers (29.8±8.5 years old) ($p = 0.0056$). Two people tested positive in the HIV screening test.

2. AIDS knowledge

The total score of AIDS knowledge of the sex workers/consumers was 56.2%. About 12.7% of the study subjects recognized the government-provided HIV screening test (#1), while 51.4% were not aware of the anonymous HIV test. 64.5% correctly answered questions about how to prevent HIV infection (#9), but 22% chose the wrong answer about taking medicine to enhance the body's immunity to avoid HIV infection. A surprisingly high number, 88% and 96.4%, respectively, knew about "HIV transmission routes (#13)" and that "HIV can be transmitted by sharing needles, disinfection fluids and dilution fluids (#14)". However, only 32.6% knew the incubation period (#5) and only 33.1% knew the correct window period (#6). Only 25.5% knew that hemophilia patients are not at high risk for AIDS (#2), but 43.3% wrongly believed that injecting drug users (IDUs) are not at high risk for HIV infection (#2). Only 25% were aware of the early symptoms of AIDS (#3) and 25% answered correctly about the treatment of HIV/AIDS (#4). In addition, 61.3% knew about "the punishment for intentionally infecting someone with HIV/AIDS in Taiwan" (#7). Comparing the correct rate of these two groups, the sex worker group had a higher rate of correct answers in item numbers 6, 7, 11, 13, 14 and 15. However, there was no statistically significant difference noted. The sex consumer group had higher correct rates in the other nine questions and a significant difference was found in item numbers 3, 4 and 5 (Table 1).

**Table 1. AIDS knowledge of sex workers and sex consumers in Taoyuan, Taiwan (n=142)
(July 2006-Jan. 2008)**

		%				p
		A	B	C	D	
(1) Which HIV testing service is not currently provided by the Taiwan government?	Sex workers	13.6	57.6	<u>12.7</u>	16.1	1.0000 ¹
A. Free HIV test is available in some medical facilities;	Sex consumers	41.7	20.8	<u>12.5</u>	25.0	
B. An anonymous HIV test is available in some medical facilities;						
C. <u>HIV testing as part of blood donation</u> ;	Total	18.3	51.4	<u>12.7</u>	17.6	
D. The HIV testing with results is available within 5-7 working days						
(2) In Taiwan, which of the following groups is not at high risk for AIDS?	Sex workers	44.4	20.5	<u>23.1</u>	12.0	0.1334 ²
A. IDUs; B. Homosexuals/bisexuals; C. <u>Hemophiliacs</u> ;	Sex consumers	37.5	25.0	<u>37.5</u>	0.0	
D. Newborn of a mother with HIV infection	Total	43.3	21.3	<u>25.5</u>	9.9	
(3) The early symptoms of AIDS are hard to distinguish. Which of the following is not one of them?	Sex workers	<u>22.2</u>	39.3	34.2	71.4	0.0439 ²
A. <u>Blurred vision</u> ; B. Unexplained weight loss;	Sex consumers	<u>41.7</u>	5.8	4.2	8.3	
C. Swollen lymph nodes; D. Weakened immunity	Total	<u>25.5</u>	40.4	29.1	5.0	
(4) Which of the following is not true of HIV/AIDS treatment?	Sex workers	25.9	27.6	25.9	<u>20.7</u>	0.0023 ²
A. There is no vaccine; B. There is no cure;	Sex consumers	20.8	8.3	20.8	<u>50.0</u>	
C. Cocktail therapy has excellent results; D. <u>Radiotherapy is effective</u>	Total	25.0	24.3	25.0	<u>25.7</u>	
(5) After infection with HIV, there are no symptoms during a period of time that is called the "incubation period". How long can this period last?	Sex workers	9.4	27.4	34.2	<u>29.1</u>	0.0432 ²
A. 1-3 years; B. 4-5 years; C. 6-7 years; D. <u>8-10 years</u>	Sex consumers	8.3	16.7	25.0	<u>50.0</u>	
(6) After being infected with the AIDS pathogen, there is a period of time during which blood tests will remain negative but it remains possible to infect others. This is called the "window period." How long can this period last?	Total	9.2	25.5	32.6	<u>32.6</u>	
A. 5-7 days; B. 2-6 weeks; C. <u>1-3 months</u> ; D. 5-7 months	Sex workers	13.6	22.9	<u>35.6</u>	28.0	0.1613 ²
(7) What is the punishment for intentionally infecting someone with HIV/AIDS in Taiwan?	Sex consumers	8.3	20.8	<u>20.8</u>	50.0	
A. No punishment; B. A fine;	Total	12.7	22.5	<u>33.1</u>	31.7	
C. <u>Prison sentence</u> ; D. Lifetime imprisonment	Sex workers	2.6	12.2	<u>62.6</u>	22.6	0.3169 ²
(8) Which of the following is the pathogen for AIDS?	Sex consumers	9.1	9.1	<u>54.6</u>	27.3	
A. Bacteria; B. Fungus;	Total	3.7	11.7	<u>61.3</u>	23.4	
C. Parasites; D. <u>Virus</u>	Sex workers	23.9	14.5	0.9	<u>60.7</u>	0.3266 ²
(9) Which of the following is a correct way to prevent HIV infection?	Sex consumers	4.2	16.7	8.3	<u>70.8</u>	
A. <u>Not sharing needles/syringes, diluents, and wash water with others</u> ;	Total	20.6	14.9	2.1	<u>62.4</u>	
B. Taking medicine to enhance the body's immunity;	Sex workers	<u>62.4</u>	25.6	5.1	6.8	0.2214 ²
C. Having sex and not using a condom with strangers;	Sex consumers	<u>75.0</u>	4.2	12.5	8.3	
D. Using a condom before inserting the penis into the vagina; it is not necessary to wear a condom for genital contact only	Total	<u>64.5</u>	22.0	6.4	7.1	
(10) In 2006, which group that is at risk for AIDS experienced the greatest increase in Taiwan?	Sex workers	<u>66.7</u>	23.9	7.7	1.7	0.7351 ²
A. <u>IDUs</u> ; B. Homosexuals/bisexuals; C. Hemophiliacs;	Sex consumers	<u>68.2</u>	13.6	18.2	0.0	
D. Newborn of a mother with HIV	Total	<u>66.9</u>	22.3	9.4	1.4	
(11) Which body system is destroyed by the AIDS pathogen?	Sex workers	4.3	<u>76.7</u>	15.5	3.5	0.6375 ²
A. Digestive system; B. <u>Immune system</u> ;	Sex consumers	16.7	<u>70.8</u>	12.5	0.0	
C. Endocrine system; D. Respiratory system	Total	6.4	<u>75.7</u>	15.0	2.9	
(12) Which of the following cannot transmit AIDS pathogen?	Sex workers	4.2	0.9	<u>80.5</u>	14.4	0.5676 ¹
A. Blood; B. Semen;	Sex consumers	4.2	0.0	<u>87.5</u>	8.3	
C. <u>Saliva</u> ; D. Vaginal secretion	Total	4.2	0.7	<u>81.7</u>	13.4	
(13) Which of the following is not a route for spreading HIV?	Sex workers	1.7	8.5	<u>89.0</u>	0.9	0.4896 ¹
A. Unprotected sex; B. Needle/syringe sharing;	Sex consumers	4.2	12.5	<u>83.3</u>	0.0	
C. <u>Eating together</u> ; D. Blood transfusion	Total	2.1	9.2	<u>88.0</u>	0.7	
(14) Does sharing needles, disinfectant, or dilution fluid transmit the AIDS pathogen?	Sex workers	<u>97.4</u>	2.6	-	-	0.3369 ¹
A. <u>Yes</u> ; B. No	Sex consumers	<u>91.7</u>	8.3	-	-	
(15) Which of the following is a medium for spreading HIV?	Total	<u>96.4</u>	3.6	-	-	
A. Air B. <u>Body fluids</u>	Sex workers	-	<u>98.3</u>	1.7	-	0.4287 ¹
C. Soil/dirt D. Food	Sex consumers	-	<u>95.8</u>	4.2	-	
Total scores	Total	-	<u>97.9</u>	2.1	-	
	Sex workers	55.4±17.0				0.3344 ³
	Sex consumers	60.0±10.0				
	Total	56.2±17.5				

¹Fisher's exact test; ²Chi-square test; ³independent t-test; *Correct answer is underlined

The rate of correct answers about AIDS knowledge from sex consumers (60.0%) was higher than sex workers (55.4%) , but no statistically significant difference was noted ($p=0.3344$). No significant difference in AIDS knowledge was seen among age groups ($p=0.6523$). The rate of correct answers about AIDS knowledge of HIV+ people (70%) was higher than that of HIV- people (56%). However, no statistical significant difference was noted ($p =0.1425$) (Table 2).

3. Correct rate of AIDS knowledge by duration

The mean rate of correct answers about AIDS knowledge was 71.3% before March

2007 and decreased to 36.7%-65.9% during March 2007 and January 2008 (Figure 1).

4. Representative

Between July 2006 and January 2008, 467 sex workers/consumers were arrested in Taoyuan. Of those arrested, 165 (35.4%) answered questionnaires and 142 valid questionnaire (30.4% response rate) were analyzed for in this study. Sex consumers made up a higher proportion of the sample than that in the total population ($p=0.0022$). The age in the sample was younger than that in the total population ($p=0.0047$). The proportion of HIV+ in the sample was borderline significant compared with that of the total population ($p=0.0569$) (Table 3).

Table 2. AIDS knowledge by study group, age, and HIV status in Taoyuan (July 2006-Jan. 2008)

	n	Correct rate	p
Study group			0.3344 ¹
Sex workers	118	55.4±17.0%	
Sex consumers	24	60.0±10.0%	
Age			0.6523 ²
<20	2	60.0±37.7	
20-29	50	58.9±17.6	
30-39	50	53.7±15.1	
40-49	28	54.0±18.4	
≥50	12	58.9±22.2	
HIV			0.1425 ³
HIV +	2	70.0±4.7%	
HIV -	140	56.0±17.6%	

¹Independent t-test; ²ANOVA; ³Wilcoxon rank sum test

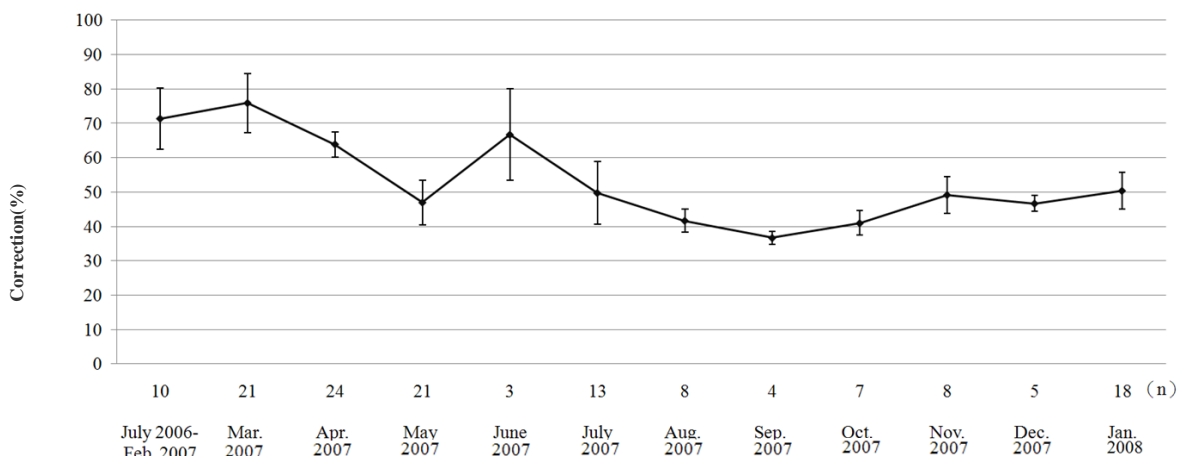


Figure 1. Correct rate of AIDS knowledge: sex workers/consumers in Taoyuan (July 2006-Jan. 2008)

Table 3. Sample representative: sex workers and sex consumers in Taoyuan (July 2006- Jan. 2008)

	Sample (n=142)	Population (n=467)	<i>p</i> ¹
Response rate	30.4%		
Study group			0.0022
Sex workers	118(83.1%)	423 (90.6%)	
Sex consumers	24(16.9%)	44 (9.4%)	
Age			0.0047
<20	2(1.4%)	2(0.4%)	
20-29	50(35.2%)	152(32.5%)	
30-39	50(35.2%)	148(21.6%)	
40-49	28(19.7%)	101(21.6%)	
≥ 50	12(8.5%)	59(12.6%)	
mean ± SD	34.3±9.5	36.5±10.9	
HIV			0.0569
HIV +	2(1.4%)	2(0.4%)	
HIV -	140(98.6%)	465(99.6%)	

¹Chi-square test of goodness of fit

Discussion

Since July 2006, the Public Health Bureau of Taoyuan County Government, Taiwan, has assessed the AIDS knowledge among arrested sex workers/consumers by administering a questionnaire about AIDS knowledge. AIDS education leaflets were also distributed after this group filled out the questionnaire. Since March 2007, further education has focused on the items with incorrect answers in the questionnaire with the hope that accurate information about AIDS prevention would spread among sex workers/consumers and their networks.

1. AIDS knowledge

In our study, the rate of correct answers among sex workers was 55.4%, which was lower than a previous study aimed at sex consumers (69.5%) [2]. However, these two studies were not comparable due to different wording in the questionnaires.

In 2004, for the first time, there was an obvious change in the HIV/AIDS epidemic in Taiwan, among IDUs, the group that

makes up the majority of HIV/AIDS cases [10]. However, our results revealed that only 67% of study subjects answered correctly on “In 2006, which at risk group for AIDS experienced the greatest increase in Taiwan?” (#10). The transmission route of HIV in IDUs was mainly through sharing needles, syringes, and dilution fluid. In contrast, 96.4% correctly answered the question: “Does sharing needle disinfectant or dilution fluid transmit the AIDS pathogen?” (#14), indicating that sex workers/consumers recognized the risk of HIV transmission in IDUs.

Our results show that there are still considerable misunderstandings about HIV/AIDS prevention among sex workers/consumers (#9) even though 64.1% selected the correct answer of “not sharing needles/syringes, diluents, and wash water with others”. However, 22% wrongly believed that “taking medicine to enhance body’s immunity” could prevent HIV/AIDS, which was compatible with previous studies

[7-9]. Only 7% of the sex workers/consumers selected “using a condom before inserting the penis into the vagina; it is not necessary to wear a condom for genital contact only,” indicating that they were aware that condom use was effective, but about 50% of sex consumers in Taiwan [2], sex workers in Thailand [5] and sex workers in Vietnam [6] use condom during sex. This result implies that there is considerable inconsistency between cognition and practice. Hence, it is important to persuade sex workers/consumers to use condoms during the whole process of having sex.

Regarding the treatment of HIV/AIDS (#4), 25.0% of the study subjects misunderstood that there was a vaccine available for HIV infection, and 24.3% wrongly believed that there was medicine to cure HIV/AIDS. These results are compatible with previous studies [7-9] and may imply that sex workers/consumers do not perceive dangers of contracting HIV.

The rate of correct items about the “incubation period” and “window period” was low in our study. The low correct rate of these two questions was not due to the difficulty of the terminology as the definitions of these terms were described in the question. By explaining the definitions of incubation and window period, we tried to accurately evaluate of HIV/AIDS. More importantly, we want to enhance their perceived susceptibility of HIV infection by educating them that after HIV infection there may be no clinical signs and it cannot be recognized by their appearance but is still transmissible during the incubation period.

Only 12.7% realized that the government had facilities for a HIV screening test (#1). Most of the sex workers/consumer also seemed to think that blood donation could be used to find out their HIV status. Another study reported that 51.5% of the sex consumers believed that HIV status could be obtained by blood donation [2] and 16.2% of teenagers had used blood donation as a means to find out their HIV status [14]. A possible approach is to educate the public about the government’s HIV screening service, encourage the public to take this HIV screening test, and not use blood donation to find out their HIV status.

No significant difference in AIDS knowledge was seen in the two study groups (sex workers vs. sex consumers), or according to age, or HIV status. Furthermore, no such analyses have been noted in previous studies, so we cannot compare these findings with the literature.

Comparing the rate of correct answers in these 15 items, sex workers had a higher correct rate in six questions (#6, #7, #11, #13, #14, and #15) than sex consumers did, but there was no statistically significant difference. Sex consumers had a higher correct rate in the other nine questions and a statistically significant difference was found in questions #3, #4 and #5. Hence, we recommend that more efforts to educate sex workers should be made on “early symptoms of AIDS,” “medical treatment of HIV/AIDS,” and the “incubation period.” On the hand, the differences in AIDS knowledge between the two groups may be due to different education levels (sex

consumers typically have higher education levels than sex workers). However, education level was not recorded so this factor could not be analyzed. In future studies, education level should be included in the demographic data.

The rate of correct answers for each item was not consistently higher in sex workers than sex consumers; thus, no significant difference was noted in the total scores between these two study groups. When comparing the correct rate of each item in the AIDS knowledge questionnaire by age group, we noted that the age level of 20-29 years old had a significantly higher correct rate than other age levels in question #4. There was no difference in the correct rate of any question between HIV + and HIV- participants because there were only 2 HIV+ participants in our study (data not shown).

2. Efficacy of the health education

From July 2006, the Public Health Bureau, Taoyuan County Government, distributed the AIDS knowledge questionnaire and then gave the AIDS education leaflet to all arrested sex workers/consumers. Since March 2007, they have also provided further education on items with incorrect answers on the AIDS knowledge questionnaire. However, it was difficult to evaluate the efficacy of these education leaflets and education counseling due to no re-arrested sex workers/consumers in our study. Nevertheless, the results showed that the rate of correct answers on the questionnaire about AIDS knowledge has not increased with time, indicating that these people have

not spread the knowledge gained from the health education leaflets or education counseling to their friends. According to the notes from our contracted medical staff, sex workers/consumers discarded the education materials in the police station, and there was no proper space in the police station for health education. Thus, it is a challenge for public health authorities to educate these high-risk groups about AIDS prevention.

3. Representative

In this study, older people or sex workers who were arrested repeatedly tended to not fill out the questionnaire. Thus, the sample was younger and its rate of sex consumers was higher than the population.

4. Limitations

There are several limitations due to the characteristics of sex workers/consumers and the restriction of gathering data about their AIDS knowledge. The first limitation is that sex workers are marginalized people and are difficult to approach. Buying sex is rarely accepted in our society, and sex consumers generally do not disclose their status. Thus, it is difficult to reach these two groups. We assessed the AIDS knowledge from the arrested sex workers/consumers and our results may not adequately reflect the true AIDS knowledge of the sex workers/consumers. Another limitation is that nationality information was not gathered in this study. In future studies, nationality should be asked in order to study the AIDS knowledge among sex workers with different nationalities. Education level should also be considered

to clarify whether the difference in AIDS knowledge between sex workers and sex consumers was due to the difference of education or not. Another characteristic of sex workers and consumers is that they typically use drugs as well, so it is unclear how this affects their high-risk behaviors related to HIV/AIDS. The data should allow multiple checking of their high-risk status related to drug use in order to carefully calculate what proportion of the sample is a high-risk AIDS group only or what is combined with drug use.

Other than AIDS knowledge, our questionnaire also asked if they "Use condoms or not while having sex with non-stable sex partners? They were further asked to describe reasons for not using condoms. We found that 91% of the arrested sex workers/consumers reported using condoms, which was extraordinarily high. We doubted the validity of the high reported condom use, so we did not report the condom use rate in this study. It is a challenge to know whether or not arrested sex workers/consumers are telling the truth about their practice of condom use. Furthermore, attitudes about condom use were not asked. Hence, we could not study the knowledge, attitudes, or practice (KAP) of condom use among arrested sex workers/consumers in this study.

There were 15 items in the questionnaire, including the knowledge of the AIDS pathogen, transmission route, window period, incubation period, clinical signs and treatment, prevention, high-risk groups, punishment, and the HIV screening service. This questionnaire was also given

to arrested drug users. Recently, this questionnaire was simplified into a 6-item questionnaire. In the future, we recommend that the 6-item questionnaire about AIDS knowledge be used in order to increase the feasibility of the study [13].

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