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Brief communication (Original)

Effectiveness of influenza control using non-pharmaceutical interventions at primary schools in Nakhon Phanom Province, Northeast Thailand

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Background: The world is entering the post-outbreak period of the 2009 A H1N1 strain of the influenza virus. The strain is expected to continue spreading, as seasonal influenza viruses do each year. The majority of children have relatively low immunity and engage in activities at school where opportunities abound for exposure to and spreading of diseases.
Objectives: We compared the effectiveness of influenza prevention by using non-pharmaceutical measures in primary schools.
Methods: This study was conducted at two medium-sized primary schools in Nakhon Phanom province, Thailand. Multistage sampling was used to select students from Grades 4 to 6. The study group consisted of 230 students from the 2 schools and the control group 224 students from the 2 schools. The research included (a) 8 h of instruction on influenza-like illnesses and their prevention integrated into health promotion and physical education classes and (b) building understanding among parents and in the community. Data were analyzed for frequencies, percentages, and multiple logistic regression.
Results: Non-pharmaceutical influenza interventions reduced the rate of influenza-like illnesses by 77% (AOR = 0.23, 95% CI: 0.15"0.36). Students who did not receive the influenza-like prevention and control training had a morbidity of 54.9%; whereas those who received the training had a morbidity of 23.5%. Overall, the group receiving the educational model saw a 57% reduction in its morbidity compared with the control group. The students in the intervention group who washed their hands for 20 seconds three or more times per day had a morbidity of 38.9%, which resulted in an overall reduction in morbidity of 36.4%. The morbidity rate of students who missed school because they were ill was 39.5%. When comparing training methods, the hand-washing group saw morbidity reduced by 34.7%, while simply receiving news and information from public health officials resulted in only a 29.2% reduction in morbidity. Overall, the group receiving the disease prevention and control training was able to reduce morbidity by 58.7%.
Conclusion: Influenza prevention education among students was integrated into the health education curriculum. Children were taught hand-washing and respiratory etiquette (i.e., covering the nose and face when sneezing, coughing, and nose-blowing). Cartoon media were used as visual teaching aids. The results from this program helped to decrease the number of cases of influenza-like illness and morbidity among students and families.

Keywords: Influenza, non-pharmaceutical, prevention program, primary schools

Influenza is a respiratory infection occurring regularly worldwide. The most well-known, major global influenza outbreak was in 1918"1919 and was caused by a then new A H1N1 strain of influenza commonly called the “Spanish Flu”, which caused between 20 and 40 million deaths [1]. The WHO announced a Public Health Emergency of International Concern and set the warning level for influenza A H1N1 strains at Level 6, the highest level, indicating an ongoing multinational situation [2]. On January 19, 2010, there were reports of epidemics in 209 countries with confirmed reports of accumulated incidence rates equal to 58.28 per 100,000 between April 2009 and May 2010 [3]. We are now entering the post-outbreak period with new knowledge from past outbreaks as well as the A H1N1 2009 mutation, which will continue to spread for the next few years as is the pattern with seasonal influenza viruses.

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According to a systematic review of the literature, children who spend most of their daily lives in school participate in activities that clearly put them at risk of catching and spreading disease. Two studies strongly suggest that outbreaks in schools may even hasten and/or exacerbate epidemics. Thus, the benefits of reduced incidence of disease include (a) minimal stress on medical facilities, (b) decreased numbers of days when students are absent from school, and (c) improved community safety and overall public health [4, 5]. The problems of past influenza epidemics in Thailand were found to have been caused by several factors, such as policies set when epidemics had already occurred and prioritization of epidemic periods [6]. Although patients have reduced awareness and anxiety regarding the risks for influenza, infection remains a significant issue. Most patients did not change their lifestyle or risky behaviors, despite receiving information regarding epidemics [7].

Studies in Thailand suggest an escalation in the relapse rates for influenza in the future; therefore, planning and policy guidelines and practicable methods for prevention and disease control are needed. Even though Thailand, a newly industrialized nation, has plans for vaccine production, flu vaccines cannot cover all target groups because of the tremendous budgetary commitment needed. Nonpharmacological preventions consistent with the context of each area need to be considered. In this regard, the knowledge obtained from the current study revealed that communities are able to select measures consistent with, and sustainable in, community settings.

The basic healthcare practice guidelines—which enable improved hygiene by providing health education about various hand-washing methods—have been found to reduce the incidence of influenza by 43% [8]. Studies on the effectiveness of influenza control using such interventions for primary schools in Nakhon Phanom province are needed because schools can follow up at the local level. The aim of this study was to compare the effects of influenza prevention using non-pharmaceutical measures in primary schools. The findings will provide useful information on non-pharmaceutical preventive interventions.

Methods

This study was conducted among students at four medium-sized primary schools in two districts with similar community settings and located in areas with outbreaks of influenza-like illness in more than 10 percent of the population. Multistage sampling was used to select the students from Grades 4 to 6 in two schools. Intervention activities were conducted among the students. The study and control groups consisted of 230 and 224 students respectively, within the two schools.

The diagnosis of influenza-like illness was according to the CDC criteria and based on a physical examination. The rates of influenza-like illness among the students were documented by teachers while nurses recorded symptoms of influenza-like illness among students present in the classroom on a fixed day once a week. The primary outcome measure was clinically diagnosed influenza-like illness (ILI) (by self-report of symptoms), which was defined by fever (≥38°C) with two or more of the following symptoms: cough, sore throat, or rhinorrhea.

The influenza prevention and control models consisted of a Pre-research, Research, and Assessment stages. The Pre-research stage assessed student needs and set guidelines and operation planning. The Research stage included 8 h of instruction on influenza-like illnesses and their prevention; integrated into health promotion and physical education classes. Methods of inculcation included: educational media, cartoons, hand-washing demonstrations, joint production of cartoon media, network building, making pledges to carry handkerchiefs to cover one's mouth and nose while coughing or sneezing, and building understanding among parents and in the community. Assessments of students who contracted influenza-like illness were conducted through follow-up visits at home. The purpose was to evaluate how the family was taking care of the sick person and what measures they were using to prevent the spread of the disease.

Intervention period: group receiving the program

The influenza prevention and control models consisted of:

1. Pre-research stage: to assess student needs and set guidelines and operation planning. Students were given (a) health education and disease prevention training (4 h), (b) systematic self-checking cues if they experience symptoms of influenza-like illnesses, and (c) news and prevention measures for preventing and controlling disease (1–4 months);

2. Skills training stage: to promote (a) wearing surgical masks (4 h), (b) hand-washing, (c) staying home when sick and avoiding community areas (5–6

months), (d) playing a game using cartoon media encouraging a commitment to participate in preventing the spread of pathogens (5–6 months); and, (e) to plan a workshop and draft a joint agreement with the schools and communities to conduct project activities (7–9 months); and,

3. Assessment stage: to do home-evaluation visits of students who contracted influenza-like illness to evaluate how the family was taking care of the sick person and to observe what measures were being used to prevent the spread of disease (9 months).

Educational media and learning activities were designed following guidelines of the Nakhon Phanom Primary Educational Service Area Office; emphasizing easy to understand concepts with clear accompanying images and recommendations from influenza experts. The activities were integrated into Learning Unit 3, Subject 4 under the topic of promoting health, capabilities, and disease prevention.

Performance period: group receiving routine education only

The results were measured by assessing knowledge, attitudes and practices during the first and second semester of academic year 2011.

This study was reviewed and approved by the Ethics Committee for Human Research at Khon Kaen University (HE531376). We obtained written informed consent from teachers, parents, and students for their participation. The intervention was used at the control schools at the conclusion of the study.

Data analysis

Data were analyzed for frequencies, percentages and multiple logistic regression.

Results

The data from respondents in the participatory research group comprised affected students (sampled group, 52.9% girls vs. 47.1% boys). The respective proportion of students receiving routine care from Grades 4, 5, and 6 was 33.0%, 45.5%, and 21.4%. By comparison, the group receiving the education intervention in Grades 4, 5, and 6 was 26.5%, 31.7%, and 41.7%, respectively. The respective proportion of parents with only primary school children in the routine care vs. the intervention group was 64.7% and 82.2%. Most of the parents were agricultural workers (77.7% vs. 86.4%, respectively). Both groups had similarly structured extended families.

Over the three month period preceding the study, both groups roamed within the community and walked home from school (70.7% vs. 78.6%, respectively). Twenty percent of subjects (19.6%) coughed and/or sneezed in the face of classmates, 61.5% washed hands 1–3 times a day, 62.4% seldom or sometimes took cups and spoons for use at school, and 54.6% were absent from school because of influenza.

The variable that correlated with reducing the incidence of influenza-like illnesses was being in the influenza prevention program vs. not being in the program by 77% (95% CI 0.15–0.36, AOR 0.23). Boys were at a 1.52 times greater risk for influenza-like illnesses than girls (95% CI 1.02–2.31, AOR 1.52) and people admitted to hospital for influenza had 44% less occurrence of influenza-like illnesses (95% CI 0.33–0.94 AOR 0.56). People with access to news and information on influenza prevention from just family members—rather than public health officers—were at 2.29 times greater risk of having influenza-like illnesses (95% CI 2.29–4.00, AOR 2.29) (**Table 1**).

Non-pharmaceutical influenza interventions reduced the rate of influenza-like illnesses by 77% (AOR 0.23, 95%CI 0.15–0.36). Students who did not receive the influenza-like prevention and control training had a morbidity of 54.9%; whereas those who received the training had a morbidity of 23.5%. Overall, the group receiving the educational model saw a 57% reduction in its morbidity compared with the control group. The students in the intervention group who washed their hands for 20 seconds three or more times per day had a morbidity of 38.9%, which resulted in an overall reduction in morbidity of 36.4%. The morbidity of students who missed school because they were ill was 39.5%. When comparing training methods, the hand-washing group saw morbidity reduced by 34.7%, while simply receiving news and information from public health officials resulted in only a 29.2% reduction in morbidity. Overall, the group receiving the disease prevention and control training was able to reduce morbidity by 58.7%.

Discussion

This study involved the development of a program for preventing the occurrence of influenza among elementary school students in a rural setting. The program was implemented by promoting hand hygiene and respiratory etiquette via integration into the health education curriculum. Cartoon media were used as the outreach teaching tool. In addition, focus group

Table 1. Influenza-like illnesses by percentage ($N = 454$)

Description (N)	Number (%)		COR	AOR	95% CI for AOR		*P*
	ILI	No ILI			Lower	Upper	
Intervention							
Received (230)	54 (23.47)	176 (76.52)	1.00 (ref.)	0.23	0.15	0.36	<0.001
Did not receive (224)	123 (54.91)	101 (45.09)	0.25				
Sex							
Male (216)	103 (43.27)	135 (56.72)	1.00 (ref.)	1.52	1.52	1.00	0.049
Female (238)	74 (34.37)	142 (65.74)	0.68				
Inpatient had illness from influenza							
Yes (90)	41 (45.56)	49 (54.44)	1.00 (ref.)	0.56	0.33	0.94	0.027
No (364)	136 (37.36)	228 (62.64)	0.71				
Familial							
Single family (203)	68 (33.49)	135 (66.50)	1.00 (ref.)	1.39	0.92	2.11	0.120
Extended family (251)	109 (43.26)	142 (56.57)	1.52				
Hand-washing per day							
<3 times (279)	109 (39.07)	170 (60.93)	1.00 (ref.)	1.01	0.66	1.53	0.972
>3 times (175)	68 (38.86)	107 (61.14)	0.99				
Absence from school because of influenza							
Absences (206)	79 (38.34)	127 (61.65)	1.00 (ref.)	0.89	0.59	1.35	0.578
No absences (248)	98 (39.52)	150 (60.48)	1.05				
Walked home in rain during 3 months preceding study							
No (97)	35 (36.08)	62 (63.92)	1.00 (ref.)	1.01	0.61	1.68	0.965
Yes (357)	142 (39.77)	215 (60.22)	0.99				
Learning of self-care for prevention of influenza							
Public health officials (106)	31 (29.24)	75 (70.75)	1.00 (ref.)	1.47	1.46	2.76	0.031
Radio, television, newspapers (96)	36 (37.50)	60 (62.50)	0.17				0.232
Family members (177)	79(44.63)	98 (55.37)	0.31	2.29	2.29	4.00	0.004
Experience, personal beliefs (75)	31(41.33)	44 (58.67)	0.18	1.01	1.76	3.40	0.102

discussions revealed: the need (1) for local resource persons; (2) clear communication; (3) access to health services and (4) households. These findings agree with other studies on reducing the risk of pandemic influenza [9].

The program proved appropriate for preventing influenza among students, teachers, and parents by promoting (a) the use of handkerchiefs to cover the mouth and nose when sneezing or coughing, (b) frequent hand-washing, and (c) staying home from school when sick. When students received news and information at school, they shared it at home. Importantly, the program was associated with a clear reduction in the number of influenza-like illnesses among students; as evidenced by the serial interval—i.e., the mean interval between onset in 2 successive patients in a chain of transmission—being 2–4.

The study findings indicate that children in the group who received the influenza prevention program had 77% lower incidence of influenza-like symptoms than the group that did not receive the program (95%CI 0.15–0.36, $P < 0.001$). The infection rate in the year of this intervention was significantly lower than that the previous 3 years, (14.5, 12.8, and 10.4/100 person-months). In the final year of the intervention, the infection rate fell to 5.7 per 100 persons per month.

Boys had a 1.52 times greater risk for having influenza-like symptoms than girls (95%CI 1.02–2.31, $P < 0.049$), which is consistent with a study of the perceptions and behaviors related to hand hygiene for the prevention of H1N1 influenza transmission among Korean university students during a peak pandemic period. Korean students increased their frequency of hand hygiene practices during the pandemic and female students were more likely to practice more frequent hand washing. Students who perceived a lower effectiveness of hand-washing, perceived a higher severity of H1N1 and greater personal susceptibility. Persons who perceived a greater

severity of illness (OR 1.00-3.12) washed their hands more frequently [5].

It was also found that receiving news and information on the prevention of influenza from family (as distinct from public health officials) is associated with a 2.29 times higher risk for having influenza (95% CI 2.29–4.00, AOR 2.29). Healthcare staff are evidently considered a more credible source of information possibly because of their work-related experience, and their access to timely and geographically relevant information, recommendations, and practice guidelines. Chedsada found that social support, participation, and coordination were the most influential variables vis-□-vis ensuring the effectiveness of influenza control and preventive measures against avian flu in poultry. Public health officers must therefore be prepared to provide correct advice [6].

A review of the behaviors of teaching staff on the transmission of the "common cold" revealed that frequent hand-washing can help to limit the spread of sickness [10]. Similarly, a large study of military recruits found that a structured top-down program of hand-washing at least five times daily nearly halved the incidence of acute respiratory illnesses, while recruits who washed hands less frequently reported more episodes of acute respiratory illnesses (OR 1.5, 95% CI 1.2 to 1.8) [11]. Interestingly, promoting hand-washing and using soap to wash hands were both associated with significantly reduced school absenteeism [12]. Teachers generally agree that a hand-washing program is easy to implement among primary students: step (1) wet hands, (2) lather fingers, (3) lather palms and backs of hands, (4) rinse, and (5) dry with a clean towel [13].

Walking home in the rain during the three months preceding the study was a risk for illness. Similarly, an Israeli study of 186,094 children (between six and twelve years of age) reported temporary, preventative school closures resulted in a (a) 42% decreased morbidity from respiratory tract infections, (b) 28% decrease in visits to physicians and/or emergency department, and (c) 35% reduction in the purchase of medications [12].

A WHO consultation in 1959 concluded that the 1957 influenza pandemic tended to appear first in army units, schools and other groups where there was relatively close contact among people. Noting the reduced incidence in rural areas, the consultation suggested that avoiding crowding could reduce the peak incidence in an epidemic [14]. Children can be important agents of change in health behavior, particularly of hand-washing [15].

One of the limitations to this research was that the number of students registered in school did not match the numbers present in the classroom so we had a smaller sample than we had calculated. We, therefore, increased the number of schools in both the study and control group, which resulted in delays and/or asynchronous activities.

Conclusions

Influenza prevention education among students was integrated into the health education curriculum. Children were taught hand-washing and respiratory etiquette (i.e., covering the nose and face when sneezing, coughing and nose-blowing). Cartoon media were used as visual teaching aids. The results from this program helped to decrease the number of cases of influenza-like illness and morbidity among students and families.

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