Cluster-Randomized Controlled Trial of a Brief Theory-Based Avian Influenza Prevention Program for Poultry Workers in Taiwan

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Abstract. ***Objective:*** To test the effectiveness of an intervention program based on the Health Belief Model, which aimed to promote preventive behaviors against avian influenza among poultry workers. ***Methods:*** A cluster-randomized controlled trial was conducted, with poultry farms as clusters. Thirty-four participants were recruited at pretest. Pretest and immediate posttest data were collected before and immediately after the intervention, respectively. In addition, a follow-up posttest was conducted 3 months after the intervention was implemented. ***Results:*** Participants in the control group reported higher prevalence of handwashing with soap (86.7%) than those in the intervention group (52.6%) at pretest. However, this difference was not significant at 3-month follow-up (80.0% vs. 68.8%). Furthermore, perceived effectiveness of handwashing in preventing avian influenza did not differ between the intervention group and the control group at pretest (89.5% and 86.7%, respectively). However, at 3-month follow-up, the intervention group had a significantly higher proportion of perceiving handwashing to be effective (93.8%) than did the control group (60.0%). ***Conclusion:*** These findings suggest that the intervention program may have a sustainable long-term effect on participants' handwashing behavior as well as perception regarding the effectiveness of the preventive behavior. The results of this study could inform future pandemic control and prevention initiatives for avian influenza outbreaks.

Keywords: avian influenza, cluster-randomized controlled trial, poultry worker, Health Belief Model, handwashing with soap, intervention, Taiwan

1. Introduction

Avian influenza (AI) can be highly pathogenic and fatal: at least 598 cases of AI had been reported around the world, resulting in 352 deaths, with a case fatality rate of 58.9% [1]. The AI virus has been found in domestic poultry (e.g., chickens, geese, ducks, etc.), wild birds [2], waterfowl and shorebirds [3]. An extensive review indicated that the AI virus could be transmitted through direct contact with infected poultry, including holding diseased or dead poultry, defeathering, slaughtering, or preparing sick poultry for cooking [4]. These properties of AI virus place poultry workers at risk for contracting AI.

Taiwan experienced sporadic AI outbreaks in 2004 and most recently in 2011, including major local outbreaks in Kaohsiung (a region located in southern Taiwan) in 2008. Information released in government reports [5] confirmed that these outbreaks were caused by H5N2 virus. Although no highly pathogenic avian influenza (HPAI) H5N1 cases had been reported in Taiwan, yet considering its geographical location being an important stopover for migrating birds [6] and previous H5N1 outbreaks in neighboring Asian countries such as Thailand and China [7], plus increasing travel and direct transportation links with other countries, Taiwan is still at risk for HPAI outbreaks. A catastrophic scenario is that human-to-human transmissions may occur if there is a change in the viral genome [8], and according to a relatively conservative estimate by the World Health Organization (WHO), such transmissions may cause 2 million to 7.4 million deaths [9].

Since the Health Belief Model (HBM) [10] has been commonly used to examine preventive health behaviors [11], HBM was employed as an overarching theoretical framework in the current study to investigate the effectiveness of a theory-based intervention program, which aimed to promote AI preventive behaviors among poultry workers. Findings from this study could inform future pandemic control and prevention initiatives for AI outbreaks.

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2. Methods

2.1. Study design and procedure

A cluster-randomized controlled trial was conducted in central Taiwan from September 2011 to January 2012, with poultry farms as clusters. Poultry farms were randomly assigned to the intervention group or the control group. A proportionate number of the participants were recruited from each poultry farm, resulting in a total sample of 34 participants from 10 small poultry farms. Pretest and immediate posttest data were collected before and immediately after the intervention, respectively. Follow-up data were also collected 3 months after the implementation of the intervention. The study protocol was reviewed and approved by the Institutional Review Board of the National Taiwan University College of Public Health.

2.2. Participants

At pretest, 34 participants were recruited, with 19 (55.9%) being assigned to the intervention group. At 3-month follow-up, 31 participants remained in the study, with 16 being in the intervention group.

2.3. Intervention

For the intervention group, a 15-minute AI prevention program was conducted by trained personnel, aimed to promote handwashing with soap and facemask wearing when in contact with chickens. Based on the Health Belief Model, the intervention consisted of components to enhance perceived susceptibility, perceived severity, perceived effectiveness, and perceived severity (Table 1). By contrast, the control group was provided with an information session on AI (e.g., virus types, symptoms).

Table 1. Application of Health Belief Model (HBM) constructs to the avian influenza prevention program

HBM constructs	Translating constructs to the intervention
Perceived susceptibility	Information about how avian influenza is spread - How avian influenza can be spread through direct contact with infected poultry - Who is at risk of contracting avian influenza - The previous outbreak of avian influenza in the neighbouring area
Perceived severity	Information about the seriousness of the avian influenza - The avian influenza is a serious disease for both chickens and humans - Avian influenza can lead to deaths - How contracting avian influenza can affect the business
Perceived benefits	Information about how handwashing with soap can be effective in preventing avian influenza - Handwashing with soap is an effective and easy way to protect against avian influenza Information about how wearing facemasks when in contact with chickens can be effective in preventing avian influenza - Wearing facemasks when in contact with chickens is an effective and inexpensive way to protect against avian influenza
Perceived barriers	Information aimed to lower the perceived barriers of handwashing with soap - Handwashing is still necessary even when one already wears gloves - Correct ways to wash hands with soap Information aimed to lower the perceived barriers of facemask wearing when in contact with chickens - Though it can uncomfortable to wear facemasks, one will get used to it eventually - How to choose from different types of facemasks
Cues to action	Liquid soap and facemasks were given to the participants, which serves as a cue to action to wash hands with soap and wear facemasks when in contact with chickens

2.4. Measures

Primary outcomes were handwashing with soap and wearing facemasks when in contact with chickens in the past 3 months, which were assessed at pretest and 3-month follow-up. Secondary outcomes included intention to wash hands with soap, wear facemasks when in contact with chickens, and other HBM constructs (as listed in Table 3), which were assessed at pretest, immediate posttest, and 3-month follow-up.

The questionnaire used in this study was modified from survey questionnaires used in a previous AI study [12] and H1N1 studies [13, 14].

2.5. Analyses

First, the differences in sociodemographic characteristics between the intervention and control groups were examined to ensure comparability of the two groups. Primary outcome measures of the intervention group, compared with the control group, were examined separately at pretest and 3-month follow-up using chi-square test. Differences in secondary outcome measures between the intervention group and control group were also examined separately at pretest, immediate posttest, and 3-month follow-up using chi-square test.

3. Results

The control group and the intervention group did not differ significantly in age, gender, education level, or marital status (Table 2). Table 3 shows that, at pretest, participants in the control group reported significantly higher prevalence of handwashing with soap (86.7%) than those in the intervention group (52.6%). However, this significant difference disappeared at 3-month follow-up (80.0% vs. 68.8%). In addition, proportion of the participants who perceived handwashing to be effective in preventing AI did not differ between the intervention group and the control group at pretest (89.5% and 86.7%, respectively). However, at 3-month follow-up, the intervention group had a significantly higher proportion of perceiving handwashing to be effective (93.8%) than did the control group (60.0%).

Table 2. Sociodemographic characteristics of the control and intervention groups at pretest

	Control (n=15)	**Intervention (n=19)**	**x^2 (df), p-value**
Male	40.0%	47.4%	0.185 (1), 0.74
Education level of high school or above	40.0%	42.1%	0.015 (1), 1.00
Married	73.3%	84.2%	0.61 (1), 0.67
	mean (SD)	**mean (SD)**	**t (df), p-value**
Age	46.8 (12.99)	52.1 (11.86)	1.24 (32), 0.223

Table 3. Comparisons between control and intervention groups in the percentages of primary and secondary outcome measures at pretest, immediate posttest, and 3-month follow-up

	Pretest		Immediate Posttest		3-Month Follow-Up	
	Ctrl	Ix	Ctrl	Ix	Ctrl	Ix
Variable	n=15	n=19	n=15	n=19	n=15	n=16
Handwashing with soap	**86.7**[a]	**52.6**[a]	-	-	80.0	68.8
Facemask wearing when in contact with chickens	80.0	68.8	-	-	53.3	62.5
Intention to wash hands with soap	86.7	84.2	93.3	100.0	93.3	100.0
Intention to wear facemasks when in contact with chickens	80.0	73.7	86.7	78.9	86.7	81.3
Perceived likelihood of contracting AI	26.7	15.8	46.7	21.1	33.3	37.5
Contracting AI would have a great impact on health	80.0	68.4	86.7	89.5	93.3	87.5
Contracting AI would have a great impact on daily life	80.0	73.7	93.3	89.5	73.3	93.8
Perceived effectiveness of handwashing in preventing AI	86.7	89.5	93.3	94.7	**60.0**[b]	**93.8**[b]
Perceived effectiveness of facemask wearing in preventing AI	86.7	84.2	86.7	84.2	60.0	87.5
Self efficacy of handwashing with soap	86.7	63.2	86.7	73.7	80.0	87.5
Self efficacy of wearing facemasks when in contact with chicken	86.7	84.2	86.7	84.2	60.0	87.5

Ctrl, control group; Ix, intervention group; AI, avian influenza

[a]Chi-squared $\chi^2 = 4.44$, p-value=.035 [b]Chi-squared $\chi^2 = 5.04$, p-value=.037

4. Discussion

This study intended to test the effectiveness of a brief theory-based intervention, which aimed to promote AI preventive behaviors among poultry workers, including handwashing with soap and wearing facemasks

when in contact with chickens. Interestingly, participants in the control group reported higher prevalence of handwashing with soap than those in the intervention group at pretest; however, at 3-month follow-up, there existed no significant difference between the control group and the intervention group, as participants in the intervention group increased their handwashing behavior while those in the control group decreased this preventive behavior. This finding suggests that the intervention program may yield some effect on participants' handwashing behavior in the long run.

As regards perceived effectiveness of handwashing in preventing AI, there was no significant difference between the control group and the intervention group at pretest. At immediate posttest, both groups showed increased proportions of participants who perceived handwashing to be effective in preventing AI (from 86.7% to 93.3% in the control group; from 89.5% to 94.7% in the intervention group). However, at 3-month follow-up, the intervention group had a significantly higher proportion of participants who perceived handwashing to be effective. This finding suggests that the intervention program has a sustainable long-term effect on participants' perception regarding the effectiveness of the preventive behavior, which may lead to better practice of AI preventive behaviors.

In conclusion, the intervention based on the Health Belief Model can have some long-term effect on poultry workers' preventive behavior as well as perceptions regarding AI. This study provides empirical evidence of the effectiveness of a brief theory-based intervention. Further studies are needed to examine which components of the intervention may be the most effective in the behavior change process.

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