博士論文

論文題目　Long-term impact of community-based information, education and communication activities on food hygiene and food safety behaviors in Vietnam

（ベトナムにおける食品衛生・安全行動に対する
地域に根ざした教育・啓発活動の長期的効果）

氏　名　　髙梨　久美子

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Kumiko Takanashi

髙梨　久美子

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Department of Community and Global Health
School of International Health
Graduate School of Medicine
The University of Tokyo

東京大学大学院　医学系研究科
国際保健学専攻
国際地域保健学教室

Academic Supervisor **Professor Masamine Jimba**
Applicant **Kumiko Takanashi**

指導教員　神馬　征峰
申請者　髙梨　久美子

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Abbreviations

AOR	Adjusted odds ratio
CI	Confidence interval
FHFS	Food hygiene and food safety
IEC	Information, Education and Communication
ILSI Japan CHP	International Life Sciences Institute Japan Center for Health Promotion
MOH	Ministry of Health
NIN	National Institute of Nutrition
SD	Standard Deviation
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization
WMU	Water Management Union
WTF	Water Treatment Facility

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Abstract

Background: Community-based information, education and communication (IEC) activities are thought to be a sustainable strategy to increase the frequency of multiple food hygiene and food safety (FHHS) behaviors. This study examined i) the changes in practices of multiple FHFS behaviors from baseline to the 1st evaluation, ii) the sustainability of these multiple FHFS behaviors from the 1st evaluation to the 2nd evaluation, and iii) IEC activities associated with the practice of these multiple FHFS behaviors at the 2nd evaluation.

Methods: A repeated cross-sectional study was conducted in Hanoi, Vietnam. After the baseline survey, a participatory program and an IEC intervention program were conducted and a 1st set of evaluation data was collected. One additional year of the self-sustaining IEC program was conducted, and a 2nd set of evaluation data was collected.

Results: Among 17 FHFS behaviors measured, the practice rates of four FHFS behaviors and eight FHFS behaviors significantly increased by the 1st and 2nd evaluations, respectively. The mean FHFS scores of a 14 item-scale significantly increased from 4.96 items at baseline to 5.50 items at the 1st evaluation and 7.23 items at the 2nd evaluation. At the end of the self-sustaining IEC program, flip chart communication showed an association with a greater number of FHFS behaviors.

Discussion and Conclusions: This study has limitations related to social desirability bias, no-setting of control villages, and the interrelationship of FHFS behaviors. However, this study suggests inclusion of interpersonal communication such as flip chart communication

would benefit existing IEC activities.

Key words: Information, education and communication; health education; health knowledge, attitudes, practice; hygiene; food safety; community-based approach; program evaluation

1. Introduction

1.1 Global positioning of food hygiene and food safety (FHFS)

Proper food hygiene and food safety (FHFS) behaviors play a critical role to reduce the risk of various health problems including diarrheal diseases. In this light, “food hygiene” refers to personal hygiene, especially in the form of handwashing with soap at critical points [1]. “Food safety”, meanwhile, refers to assure food that does not cause harm when eaten [2]. However, globally, caregivers’ improper FHFS put children at great risk of diarrhea [3]. Over 70% of biological causes of childhood diarrhea are estimated to derive from i) ingesting contaminated water or food, and ii) transmission of pathogens from contaminated hands [4, 5]. Improper FHFS behaviors of caregivers can easily result in childhood diarrhea. It remains as immediate health threats in both developed and developing countries [6]. To prevent such ubiquitous diarrheal diseases, effective preventive measures rarely require advanced technologies [7, 8]. Improving caregivers’ FHFS behaviors is a basic, well-known, and simple preventive measure against of childhood diarrhea.

1.2 Childhood diarrhea

Diarrheal disease is a priority issue on the list of global infectious diseases which need to be controlled [8, 9]. It is the second leading cause of preventable death among children under five in low-and-middle income countries [10]. Among children under five, annual

diarrhea cases have been slightly declined over the last 20 years from 1.9 billion to 1.7 billion cases [11]. Yet in 2011, an estimated 700,000 children died due to diarrhea [12]. Additionally, diarrhea has been identified as both a risk factor and a consequence of childhood malnutrition [13]. For example, repeated diarrhea episodes are known to decrease nutrient absorption, and malnourished children are more likely to suffer from diarrhea [14].

Diarrhea also is a common symptom of gastrointestinal infections. A wide range of pathogens, including *E. coli* bacteria, *bacterium vibrio cholera* and rotavirus, are responsible for most acute and severe cases of childhood diarrhea [10, 12]. Among children, *E.coli* related diarrhea episodes are considerably more common than those of rotavirus diarrhea. However, rotavirus related diarrhea episodes account for more hospital admissions due to severe dehydration [15]. Those pathogens commonly originate from human and animal feces, and are transmitted through multiple routes until ingested by humans (fecal-oral pathogen transmission). During the transmission, bacteria can multiply in environments such as water, food or hands [16]. For viruses, they do not multiply in the environments, the environments serve as vehicles for virus transmission [4]. Thus, improper FHFS behaviors are mostly mentioned as critical underlying factors related to fecal-oral pathogen transmission as well as low water quality, insufficient water quantity, and inadequate sanitation facilities [10].

1.2 Food hygiene interventions

Simple hygiene behaviors such as handwashing are the most recommended

interventions worldwide to reduce the risk of diarrheal diseases. Systematic reviews have demonstrated strong evidence that handwashing with soap is the most effective method to reduce the risk of diarrhea (44% [17] and 47% [18]). Further, a case-study conducted in Burkina Faso demonstrated the cost-effectiveness of handwashing with soap against childhood diarrhea [19].

Specifically, five critical handwashing points or times for hadwashing are commonly cited to reduce pathogens: 1) *before eating*, 2) *before feeding children*, 3) *when preparing food*, 4) *after using the toilet,* and 5) *after cleaning a child's bottom* [1, 20]. These critical times for handwashing are further categorized into two based on pathogen removal points [4]. The primary points for removal of pathogens after fecal contact are handwashing with soap after 1) using the toilet and 2) cleaning a child's bottom. Secondary points for removal of pathogens before ingestion are handwashing with soap before 1) eating, 2) feeding children, and 3) preparing food. However, it remains controversial about which handwashing points are most important for reducing childhood diarrhea [21].

1.3. Food safety interventions

Basic food safety interventions are also important measures for disrupting gastrointestinal pathogen transmission and growth in food [22]. Unlike handwashing interventions, food safety interventions have not been systematically studied in order to determine a magnitude of diarrhea risk reduction [23]. However, child food prepared at home

(e.g. porridge, soup, mashed meat and vegetables) is associated with a higher risk of contamination by pathogens than does household drinking water [5, 22, 24]. Thus, food safety interventions on children's food are more important for the reduction of the risk of diarrhea.

According to the WHO's five keys to safer food manual, the five major control factors are identified as follows: 1) *personal hygiene:* handwashing with soap at critical points to prevent pathogen transmission from hand to food or hand to mouth, 2) *avoiding cross-contamination:* separating raw and cooked food or cooking utensils to avoid pathogens from raw food to transmit to cooked food or cooking utensils, 3) *adequate cooking:* cooking food at 70℃ to kill almost all pathogens, 4) *keeping food at a safe temperature:* keeping food at below 5℃ or above 60℃ to avoid the growth of pathogens at this range of temperature and 5) *avoiding water and foods from unsafe sources:* using safe water and washing vegetables and fruits if they are eaten raw [6]. These control factors are important because most of pathogens multiply to 10^6 per cm^3 within 3 hours when the temperature is between 20℃ and 40℃. At this level, pathogens are known to cause diarrhea in susceptible individuals [22].

1.4 Information, education and communication (IEC) approach

Although FHFS interventions deal with very simple and basic behaviors, changing these FHFS behaviors is a very complex and a challenging health issue globally [4]. To improve FHFS behaviors, information, education and communication (IEC) approaches have been employed using various methods and strategies to deliver health education messages in

many parts of the world since the mid-1990s [25]. IEC approaches have been highlighted because such approaches enable the modification of behavior and result in changes in social conditions [26]. Further, the learning process is designed to empower people to make wise decisions. Moreover, the principles of the IEC approach include needs assessment, planning and evaluation [26].

Depending on the characteristics of the IEC channels, IEC can be categorized into four methods [27]: 1) *interpersonal IEC* that employs direct communication with the target audiences and exchange of information between the communicators and the audiences (e.g. counseling sessions, group discussions and community meetings), 2) *one-way IEC* that employs indirect communication between the communicators and the audiences (e.g. loudspeaker announcements, newsletters, bulletin boards, leaflets, and posters), 3) *opportunistic IEC* that employs communication with the audiences through occasional events (e.g. health day events, and poems, drawings and cooking contests), 4) *mass media IEC* that uses media technologies to reach large audiences (e.g. television, radio and newspapers). Traditionally, IEC strategies involve targeting a small number of behaviors using only a few core messages, and repeating those messages through several information channels [28] in order to overcome the weaknesses inherent in a single information channel [29]. This strategy tends to achieve higher rates of practice to targeted behaviors in a short period of time [30]. In contrast to the above, some community-based studies adopt another important IEC strategy that targets multiple behaviors using many messages. These studies have been demonstrated

to achieve similar practice rates [31, 32]. When considering the different IEC strategies, an appropriate strategy always needs to be developed in light of the timeframe and the local context.

1.5 Community-based participatory approach

Since the mid-1990s, donor policies for the water and health sector have drastically shifted from hardware-type investments to community-based approaches [33]. This drastic shift resulted from low water supplies and low health education coverage that had resulted in poor health impacts [34]. Learning from past experience, community participation has received increasing attention [35]. Likewise a number of other approaches that considered community as a central focus, the community-based participatory research (CBPR) is thought to result in the long-term sustainability of health education programs which in turn can reduce health disparities [36, 37]. CBPR is based on the following principles: i) empowering community members through collaborative and equitable partnership and ii) utilizing community resources. PRECEDE-PROCEED is another model for health education planning to provide a framework for identifying health education program strategies [38]. This model enhances to look at health issues in the context of community in order to attain effective implementation of health education programs. Therefore, there are challenges which must be met with the creative use of these approaches and models to promote healthy behaviors for attaining better health [39].

1.6 Community-based IEC activities and FHFS behaviors

Sustainable IEC activities are known to improve FHFS behaviors in community settings [25], but little research have been conducted on the long-term effectiveness of IEC activities on multiple FHFS behaviors [23, 40]. The long-term sustainability of improved behaviors has only been demonstrated for interventions targeting only a limited number of handwashing behaviors [41, 42]. A few studies have targeted FHFS behaviors, but have only focused on a limited range of behaviors and examined only medium-term sustainability (3-5 months) [43, 44]. Only one study has demonstrated the long-term effectiveness (2-year) of community-based IEC interventions on multiple behaviors – but it did not cover food safety behaviors [32]. Notably, the practice rates in this study was comparable to studies targeting only a small number of behaviors. To date, no studies have aimed to improve a large number of FHFS behaviors while also examining the long-term effectiveness of IEC interventions. The main barriers include the lack of human resources, limited fund allocation and the long period of time necessary to build IEC activities in communities [25].

1.7 Vietnam: country profile

The Socialist Republic of Vietnam (Vietnam) is located in Southeast Asia with a long S-shaped landform extending from the north to the south (1650km). The population was 88.7 million in 2011 [45] of which 86% were the Kinh people and the remaining a mixture of 53 different minorities [46]. Most of central government offices are stationed in Hanoi (the

capital), in the Red River Delta Region, in the northern part of Vietnam.

The climate varies between the northern to southern parts of the country, and between the delta and mountainous regions. In the Red River Delta Region where this study was conducted, the hottest months are from June to August with an average monthly temperature of 28℃, and the coldest months are from December to February with an average monthly temperature ranging from 15 to 20℃ [47]. The rainy season starts roughly from May and lasts till September with an average monthly rainfall ranging from 162mm to 360mm.

Vietnam reached lower middle-income status in 2009 as a result of political and economic reforms (Doi Moi) launched in 1986 [48]. Vietnam has made many commitments to improve social issues (health, education and poverty) that have been backed up by allocating funds to these sectors and by developing legislation and policies [49]. The Communist Party of Vietnam (CPV) is the unique central government body which decides national development policies. These policies are usually proceed through four hierarchal administrative structures (national, provincial, district and commune) [50]. This government structure plays an important role in the lives of local people and international developmental projects.

In 2000, the Vietnamese government established the program "National Rural Clean Water Supply and Sanitation Strategy up to the year 2020" [51]. This program is an important on-going government program to influence FHFS issues. As the government has begun to give priority to rural water supplies and sanitation development, Vietnam has a relatively high

coverage of improved drinking water (77% in 2000 and 95% in 2010) [52]. However, this high coverage is measured by the indicator "improved drinking water". This indicator was established as a proxy indicator for monitoring the access to safe drinking water within the United Nations Millennium Development Goals set in 2000. However, this indicator is based on drinking water sources regardless of water quality. Therefore, a gap exists when the Vietnamese drinking water quality standards established by the Ministry of Health is used to express water quality. According to the Center for Rural Water Supply and Sanitation under the Vietnamese Ministry of Agriculture and Rural Development, less than 30% of "improved drinking water" meets the water quality standards [53].

1.8 FHFS and childhood diarrhea in Vietnam

In Vietnam, caregivers are most likely handle the water and food that consumed by children. Thus, caregivers play an important role in reducing the risk of childhood diarrhea. Diarrhea remains as a common communicable illness among children under five in Vietnam [49]. In 2010, more than 500,000 cases of diarrhea were estimated to occur among children under five [54, 55]. A study conducted in Hanoi shows that rotavirus and *E. coli* are the most frequently identified diarrheal pathogens among children under five who visit hospitals [56]. Cholera is a re-emerging communicable illness that affects all age groups in Vietnam. Between 2007 and 2010, over 200 to 800 cases with V. cholera positive were reported [57, 58].

In Vietnam, potential contributing factors to childhood diarrhea are considered to be similar to the global trend. Such factors includes low socioeconomic status, lack of piped water and latrines, less frequent handwashing [56], contaminated food [59] and lack of information about health and sanitation [56]. Moreover, as I reported in my previous study conducted in 2006, caregivers' improper FHFS behaviors were important factors of the occurrence of childhood diarrhea [60]. In particular, the risk of diarrhea was higher among children whose caregivers did not separate utensils for raw and cooked food, and whose caregivers prepared food on the ground rather than on tables.

When developing a program to change caregivers' FHFS behaviors, two particular features of Vietnam need to be considered; i) understanding the local context is crucial because FHFS behaviors are strongly influenced by Vietnamese customs and traditions (Vietnamese people have managed to retain these customs despite foreign influence in the history of Vietnam [49]), and ii) realizing the importance of enabling factors, because water and soap availabilities are generally high in Vietnam (soap availability is 94%) [61].

1.9 IEC approach in Vietnam

IEC approaches are thought to have the potential to improve water- and health-related awareness and behaviors. These improvements are expected to contribute to better long-term public health conditions in Vietnam [62]. The most common IEC approaches include health day events (e.g. micronutrients day) and the utilization of traditional communication channels

such as music, poetry and theater [62].

In line with the National Rural Clean Water Supply and Sanitation Strategy, several different government institutions within the country (Center for Rural Water Supply and Sanitation, Ministry of Agriculture and Rural Development, National Institute of Nutrition, Ministry of Health and Ministry of Education) address FHFS issues collaboratively using IEC strategies and community participation [63].

However, these common IEC approaches have several shortcomings [50]. First, didactic IEC approaches promote information and education through a single channel. For example, loudspeaker announcements are commonly used as a single channel. The use of several channels is suggested in order to increase the chances of reaching target audiences [29]. Second, IEC messages and materials do not adequately reach community members due to their inherently top-down approach. Usually, the quantity of IEC materials is sufficient in reaching key people at the province and district levels, but is insufficient in reaching the grassroots target audiences at the commune and village levels [64]. Finally, even IEC approaches which succeed in improving the knowledge of water- and health-related subjects, do not always change the associated behaviors. The gap between knowledge and behavior is mainly attributed to: i) a lack in understanding of local context, and ii) target behaviors which are not based on the needs of the target audiences. Therefore health messages have not sufficiently convinced audiences to actually change behaviors [62]. Considering this state of affairs in Vietnam, how to improve actual behaviors could be a priority issue. Therefore, an

innovative approach is needed for community-based IEC activities in order to promote and maintain FHFS behaviors in Vietnam.

2. Objectives and hypotheses

This study had three specific objectives.

i) To examine whether the multiple FHFS behaviors of caregivers can be increased by the programs conducted during the first year (the participatory program and the IEC intervention program). I hypothesized that the IEC intervention program which is built on the participatory program contributes to more frequent FHFS behaviors. Thus, the frequency of multiple FHFS behaviors may have increased by the 1st evaluation.

ii) To examine whether the increased frequency of behaviors at the 1st evaluation can be sustained during the second year of the self-sustaining IEC program. I hypothesized that if the self-sustaining IEC program were led by a community group, this would contribute to the sustainability of multiple FHFS behaviors. Thus, the practice of multiple FHFS behaviors would be sustained up to the 2nd evaluation.

iii) To examine whether the highly covered IEC channels and/or exposed to multiple IEC channels are associated with the frequency of multiple FHFS behaviors by the end of the self-sustaining IEC program (two years after baseline survey). I hypothesized that it is necessary to implement sustainable IEC activities to maintain the practice of FHFS

behaviors. Thus, receiving IEC from one highly covered IEC channel and/or multiple channels should be associated with the frequency of multiple FHFS behaviors.

3. Methods

3.1 Study context

This study was designed within the Safe Water and Nutrition (SWAN) project run by the International Life Sciences Institute Japan Center for Health Promotion (ILSI Japan CHP) and the National Institute of Nutrition (NIN) under the Vietnamese Ministry of Health in Hanoi from November 2005 to November 2008. A Vietnamese and Japanese research team was formed and worked on the project. This community-based project renovated the infrastructure of the water treatment facilities (WTF) to improve water quality and quantity, and conducted training for the water management union (WMU) about operations and maintenance. Within this project, an IEC program was implemented toward improving behaviors related to drinking water, FHFS and nutrition. The SWAN project was implemented in a total of 3 sites (at the village or commune level) with 2 control sites in Hanoi and Nam Dinh Province. In this study, one village in Hanoi was chosen as a study site and investigated from January 2006 to January 2008.

3.2 Study design

This longitudinal study was designed using a repeated cross-sectional design. The repeated cross-sectional design is widely used in the field of evaluation research and implementation research [65, 66]. The study design is suitable to reflect the real community context and to evaluate behavioural changes of whole communities [67, 68].

3.3 Study site

This study was conducted in Huynh Cung Village, Tam Hiep Commune in the Thanh Tri District of Hanoi, Vietnam – home to 3,900 people in 2006 [60] (Appendix 1). This village was chosen because: i) chemical and microbiological contaminations were emerging health risks, ii) this area was considered to be socially and economically deprived area by the central government agencies, iii) the leaders of the study site was willing to collaborate.

The study site is located immediately south of Hanoi. This location is an outlet for accumulated urban waste carried by water flowing in streams and canals from Hanoi [69]. A WTF was established in the village in 1996 by the Vietnamese Ministry of Agriculture and Rural Development. This WTF had two major problems before the baseline survey in January 2006. The first problem was related to water quantity: only two-thirds of community members used WTF water through piped supplies. The second problem was related to water quality: the concentrations of some of chemical and microbiological indicators did not meet the drinking water quality standards of Vietnamese government [70]. Those contaminants include iron,

arsenic, and ammonium, coliforms and *Clostridium perfringens.*

Prior to the baseline survey, preliminary observations were conducted to understand the situation of the study site. Due to water quantity and quality problems, community members made various efforts to obtain cleaner water. The efforts included the use of rain water and tube well water in addition to WTF water, and the use of household filtration equipment. Moreover, caregivers' FHFS behaviors posed health risks which could result in childhood diarrhea. Nevertheless, close relationships were observed among relatives and neighbors at the community level. Such an environment enables caregivers to discuss FHFS issues without any negative social repercussions.

3.4 Study population

This study targeted all caregivers and their children aged 6 months to 4 years lived in the study village. The term "caregivers" is used throughout this study to refer collectively to parents or other family members who are responsible for a child's day-to-day primary care (12 hours or more) and upbringing. For children, in case one household had more than two children within this study's target age-group, younger child was included in this study.

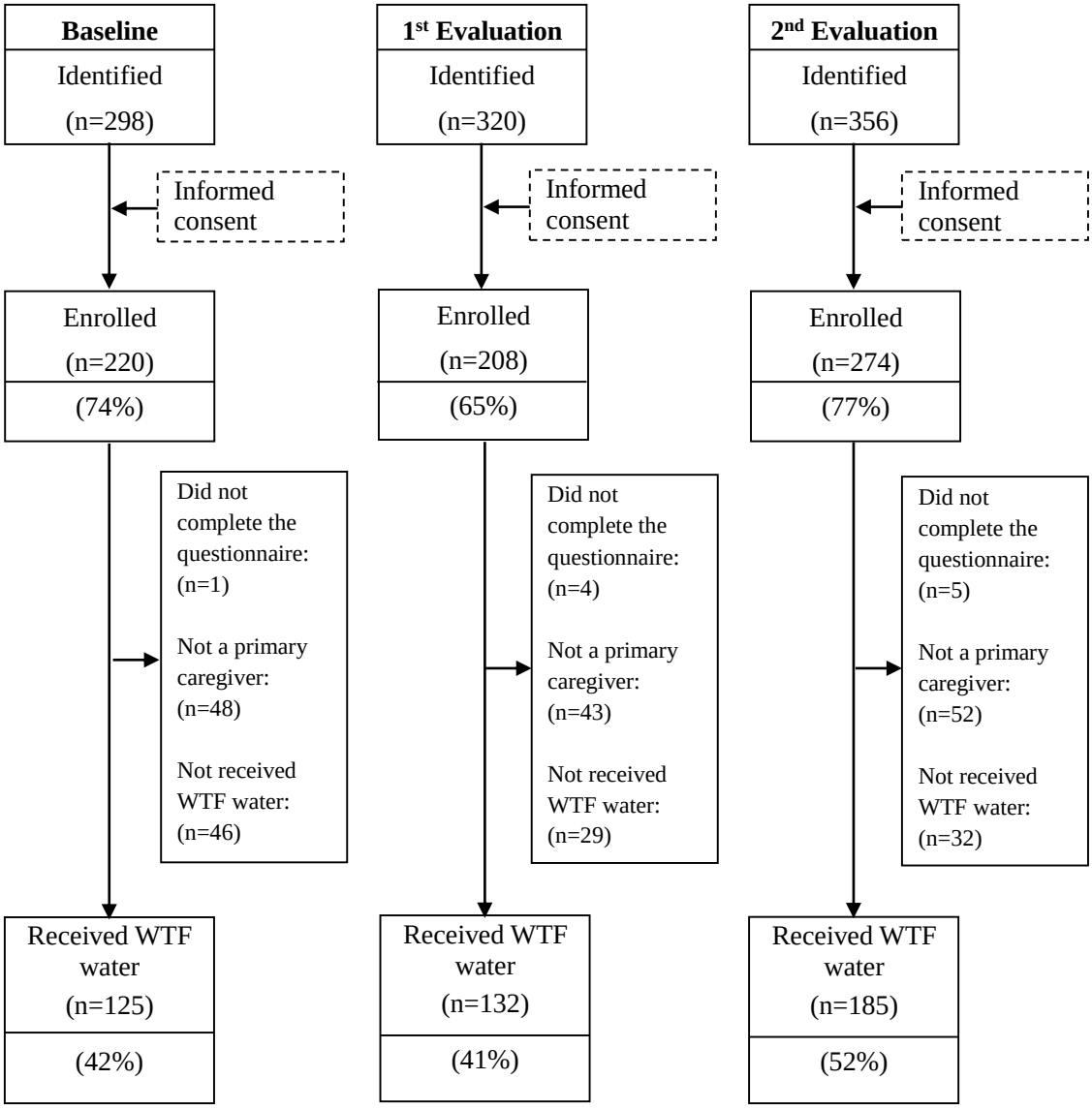
To identify caregiver-child pairs for three surveys (baseline, the 1st evaluation and the 2nd evaluation), the list of children under five was used. The list was renewing every year by the commune health station. From the list, 298 caregiver-child pairs were identified as this study's population for the baseline survey, 320 for the 1st evaluation survey and 356 for the

2nd evaluation survey (Figure1). Among these, 220 (74%) caregiver-child pairs were enrolled at the time of the baseline survey, 208 (65%) at the time of the 1st evaluation survey and 274 (77%) at the time of the 2nd evaluation survey. I confirmed the reasons of non-participation through the village health workers. The main reasons for non-participation were family obligations and sudden illness.

From the enrolled caregiver-child pairs, I excluded the following caregivers from the statistical analyses: i) caregivers who were not the children's primary caregivers (it was assumed that primary caregivers' FHFS behaviors mostly affected childhood diarrhea incidence), and ii) those who did not receive water treatment facility (WTF) water. The IEC provider of this study reported that those who did not receive WTF water may not have received IEC equivalent to those who did receive WTF water.

The final analysis was based on 125 (42%) caregiver-child pairs at baseline, 132 (41%) at the 1st evaluation and 185 (52%) at the 2nd evaluation. Among the caregivers included in the final analysis, 21 caregivers participated in all three surveys. The data from three-survey participants were also analyzed and reported separately.

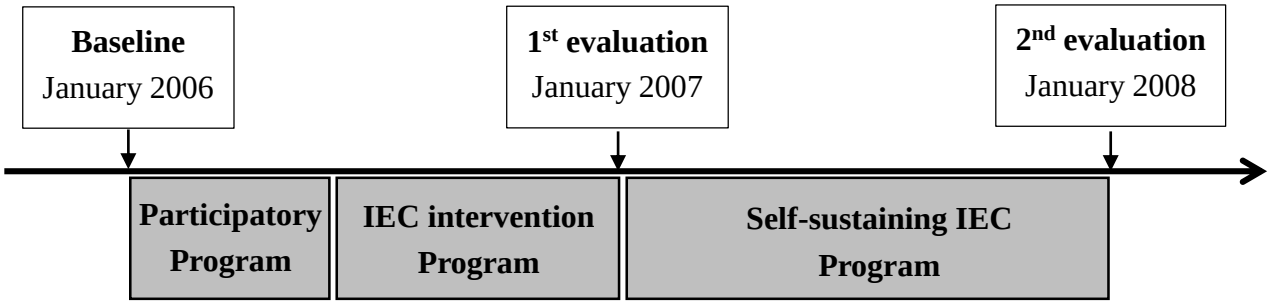
Figure 1. Survey profile and participant flow



3.5 Community-based programs

The community-based programs are described in the following diagram (Figure 2). I referred PRECEDE-PROCEED model and CBPR to plan the overall community-based programs. For the first year, I planned a five-month participatory program and a seven-month IEC intervention program in order to increase the caregiver's multiple FHFS behaviors. I thought that the participatory program was necessary in order to understand the situation related to FHFH behaviors and to identify necessary IEC activities in the study village. In addition, I thought that incorporating the outcomes of the participatory program into the IEC intervention program should contribute to more frequent FHFS behaviors. As the program for the second year, I planned a one-year self-sustaining IEC program in order for the community group to oversee the IEC activities and to help the caregivers continue their practice of multiple FHFS behaviors. I thought that the self-sustaining IEC program was important in order to confirm the sustainability of IEC activities and the practice of FHFS behaviors.

Figure 2. Community-based programs



3.5.1 Participatory program (January to May 2006)

I designed a five-month participatory program to involve caregivers for identifying their needs to construct the contents of the following IEC intervention program.

First, the research team identified a group of personnel who was appropriate for leading the community-based IEC activities. A group included personnel worked for WTF water supply and personnel worked as village health worker. Based on this group, the official formation of the WMU was assisted at the beginning of the participatory program. This WMU consisted of 10 community members: the village leader, sub-group leaders, WTF operators, the first secretaries of the village's communist party, the leader of the health station and village health workers (one sub-group leader serves concurrently as a village health worker and one village health worker serves concurrently as a Women's Union member).

The target FHFS behaviors and the IEC messages were decided based on group discussions with caregivers and the results of the baseline survey. I developed the agenda and the flow of the group discussions. The selection criteria for target FHFS behaviors were: i) some of the caregivers already practiced proper FHFS behaviors so that inexperienced caregivers could change their FHFS behaviors with only minimal effort, and ii) FHFS behaviors that were associated with childhood diarrhea in my previous study. Caregivers understood that those FHFS behaviors were important and needed to be changed (Figure 3). The points of the IEC messages were: practical advices on FHFS customs and traditions, and easy to understand advice for the caregivers. Finally, five IEC channels were selected taking into account the use

of community's human resources and materials through group discussions with WMU and caregivers.

Figure 3. Example photos of FHFS behaviors

Photo1: Example of caregiver's handwashing with soap

Photo 2: Example of separating cutting board and knife for raw food and cooked food

3.5.2 IEC intervention program (June to December 2006)

Based on the preceded program, I designed the contents of a seven-month intervention program to promote behavior change through educational messages linking FHFS behaviors to diarrhea. The main message was "Both handwashing with soap and proper food handling practices contribute to protecting your child from developing diarrhea." Much practical advice was provided in order to present a clear direction for action (Figure 4).

Figure 4. IEC messages

Practical advices		
		Caregivers' food hygiene (FH) behaviors
		Handwashing with soap at food eating and handling-related points
1	FH_1	- Wash your hands before eating
2	FH_2	- Wash your hands before feeding to child
3	FH_3	- Wash your hands before food preparation
4	FH_4	- Wash your hands after handling raw food
		Handwashing with soap at sanitation-related points
5	FH_5	- Wash your hands after using the toilet
6	FH_6	- Wash your hands after cleaning child's bottom
7	FH_7	- Wash your hands after handling garbage
8	FH_8	- Wash your hands when hands look dirty
		Children's food hygiene (FH) behaviors
9	FH_9	- Washing child's hands with soap before eating
10	FH_{10}	- Washing child's hands with soap after toilet use

Figure 4 (continued). IEC messages

		Practical advices
11	FH_{11}	**Six steps of handwashing process** Step 1) Wet hands thoroughly with water Step 2) Apply soap generously till having bubble Step 3) Scrub under nail Step 4) Rub hands vigorously Step 5) Rinse hands thoroughly with water Step 6) Dry hands using clean towel
		Caregivers' food safety (FS) behaviors
		Avoiding cross-contamination
12	FS_1	- Using separate utensils (cutting board and knife) for raw food and cooked food
13	FS_2	- Washing child's utensils (cup, bowl and spoon) with soap
14	FS_3	- Preparing food on tables which is at least 60cm high, not on the ground
		Food at safe temperature
15	FS_4	- Avoid laying cooked food long (more than two hours) in room temperature
16	FS_5	- Food after cooking should be eaten immediately
17	FS_6	- Raw food after purchasing should be washed off then packed thoroughly and keep in the refrigerator
		Adequate cooking
18	FS_7	- Leftovers stored more than two hours should be reheated at over 60℃ (until piping hot) before serving
		Use safe water and raw materials
19	FS_8	- Use safe water for drinking and washing vegetables
		Diarrhea care and nutritional advice
20	FS_9	- Feed the child more fluids to compensate water loss

The WMU played a central role with the support of the research team to provide FHFS messages through five IEC channels: 1) workshops, 2) newsletter distribution, 3) loudspeaker announcements, 4) bulletin boards, and 5) flip chart communication (Figure 5).

First, two workshops was organized to communicate FHFS issues directly to the caregivers. Since Vietnamese researcher from central government (NIN) undertook the lectures using PowerPoint material projected on a screen, an estimated 240 caregivers (80 caregivers x 3 days) voluntary attended each workshop. Second, a research team issued three newsletters to communicate FHFS-related information. To this end, a professional Vietnamese journalist was hired to interview caregivers, local authorities and research team to select important topics for caregivers to learn. I developed educational contents related to FHFS for the newsletters. WMU distributed the newsletters to caregivers so that caregivers could read them anytime at home if they wanted to recall FHFS related information. Third, village health workers wrote articles about FHFS issues and broadcast their messages twice weekly for 15 minutes each using public loudspeakers fixed to poles on streets. Fourth, we installed a bulletin board (1m x 1.5m board covered by glass) in front of the village cultural center, located on the village's main street, upon which the WMU posted the program's FHFS-themed newsletters. Fifth, two different flip chart types (6 pages, picture-story style, and A3-size in full color) were developed for dealing with FHFS issues and water-borne diseases, respectively. I developed the educational contents of the flip charts and the contents of the training. For each flip chart, a Vietnamese researcher conducted a two-day training session, in which the WMU learned how to deliver the main messages effectively using the flip charts and practiced the necessary communication skills through role-play.

Figure 5. Profile of community-based IEC activities

Channels

1. Workshop (Interpersonal IEC)

2. Newsletter distribution (One-way IEC)

3. Loudspeaker announcements (One-way IEC)

4. Bulletin board (One-way IEC)

5. Flip chart communication (Interpersonal IEC)

3.5.3 Self-sustaining IEC program (January 2007 to January 2008)

As the last step of the community-based programs, I designed the contents of a one-year self-sustaining IEC program to maintain the WMU's IEC activities and strengthen caregivers' proper FHFS behaviors. The village health workers continued delivering the loudspeaker announcements twice a week. Similarly, the WMU replaced the materials posted on the bulletin boards periodically. Moreover, WMU used nine pairs of flip charts to communicate with caregivers during village gatherings held in the village cultural center and

during home visits. The WMU communicated with an average of 35 households every month. Targeted households were exposed to flip chart communication a maximum of two times during this period. One village health worker reported all activities to the research team in the form of a monthly monitoring report. Additionally, research team visited the village to observe on-going activities every two to three months.

3.6 Questionnaire development

I developed a structured questionnaire for this study to assess caregivers' FHFS behaviors, coverage of IEC activities and relative information (Appendix 2). First, I adopted a questionnaire used by Vietnam's Ministry of Health [71]. Second, FHFS questions were added based on the recommendations of WHO and Vietnam's Ministry of Health [6, 72, 73]. Third, ideas gathered during group discussions with the caregivers were incorporated. Finally, questions about IEC channels were added to both the 1st and 2nd evaluation surveys. The final questionnaire covered: 1) socio-demographic characteristics, 2) water use details, 3) childhood diarrhea, 4) FHFS behaviors and 5) IEC activities. The questionnaire was first developed in English and then translated into Vietnamese by local experts. This version was translated back into English to confirm the accuracy of the original translation. Finally, the Vietnamese questionnaire was tested using 25 caregivers from a different village in the same district to confirm whether the flow of questions was appropriate for caregivers.

3.7 Data collection

Data were collected in January 2006 (baseline), January 2007 (the 1st evaluation) and January 2008 (the 2nd evaluation) by conducting interviews with caregivers using the developed structured questionnaire at the commune health center. The interviews took about 30 minutes. NIN staff members (Vietnamese) were recruited to serve as interviewers. Before each of the three survey waves, I confirmed the meaning of each question with the Vietnamese researcher to prepare half-day training sessions. In these sessions, the same Vietnamese researcher from NIN explained the details of each question to a selected group of eight to ten interviewers to ensure accurate data collection.

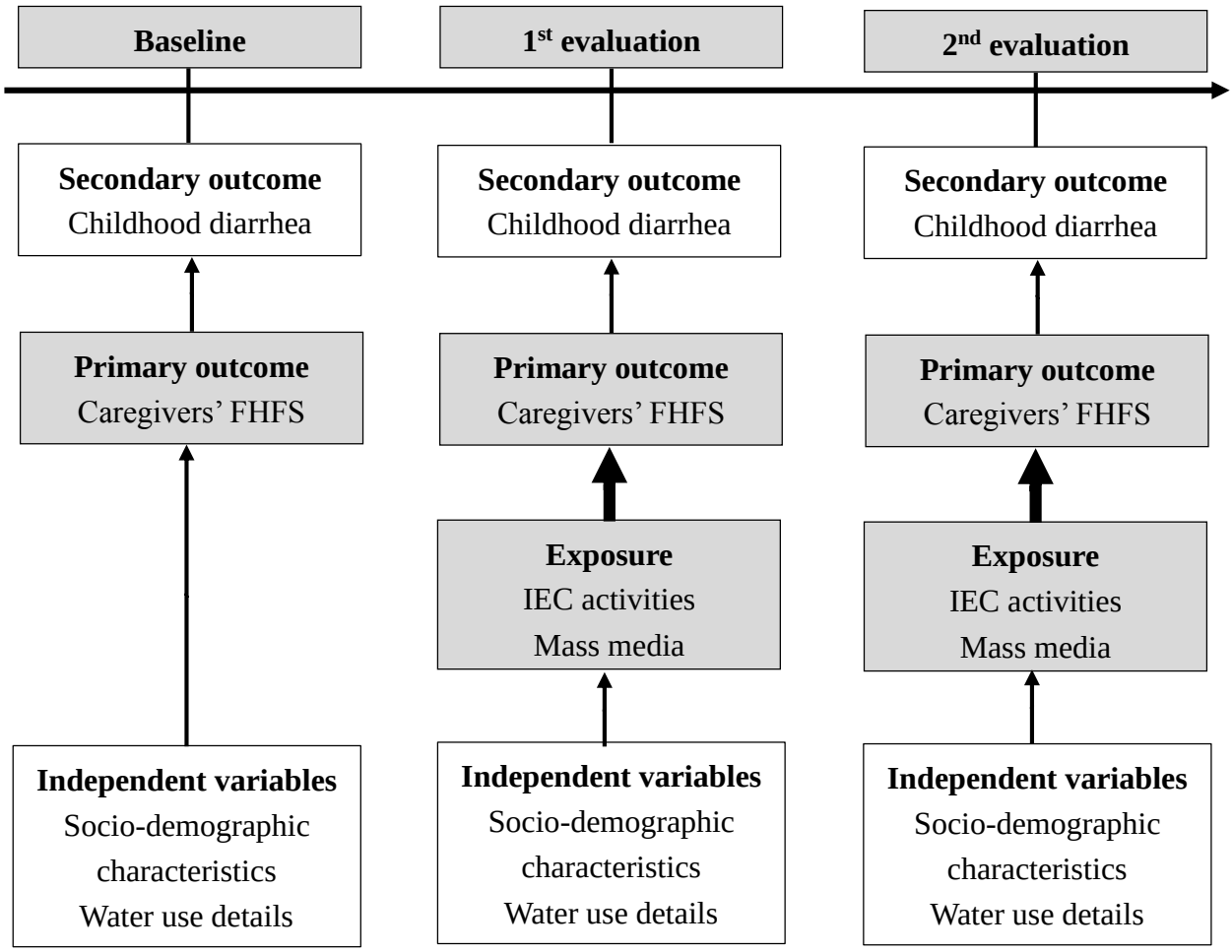
3.8 Measurements

3.8.1 Outcome variables

The primary outcome variable was caregivers' FHFS behaviors (Figure 6). A total of 17 FHFS behaviors were measured, which related to food hygiene, 10 critical handwashing time points were assessed included four during eating and food handling-related activities, four during sanitation-related activities, and children's handwashing before eating and after using the toilet. Related food safety, seven proper food handling practices assessed consisted of three related to avoiding cross-contamination, three related to keeping food at a safe temperature, and one related to adequate cooking. Compared to 20 practical IEC messages provided, three FHFS behaviors were not included in the outcome measurements based on the

discussion with WMU, caregivers and Vietnamese researchers. The reasons of exclusions were; “six steps of handwashing process” was not easy to measure within the short interview time, “use safe water for drinking and washing vegetables” was measured as an independent variable (water use details), and “diarrhea care and nutritional advice” were considered as treatment measures.

Figure 6. Conceptual framework of the study



To evaluate these behaviors as a whole, a scoring system was developed. One point was awarded for “proper behavior” and 0 points for “wrong behavior” on each measured FHFS

item (Figure 7). For 10 food hygiene behaviors, proper behavior was determined if caregivers reported that they washed their hands with soap: before eating / before feeding to child / before food preparation / after handling raw food / after using the toilet / after cleaning child's bottom / after handling garbage / when hands look dirty, and that they washed child hands with soap: before eating / after toilet use. Proper handwashing behaviors related to child, caregivers washed children's hands before eating and after toilet use.

For seven food safety behaviors, proper behavior was determined if caregivers reported that they used separate utensils for raw food and cooked food / washed children's utensils with soap / prepared food on tables and not the ground / stored cooked food in refrigerators or fed immediately if more than two hours after cooking / stored cooked food in the refrigerator, or covered it at room temperature, or fed immediately if less than two hours after cooking / stored raw food in the refrigerator or cooked raw food immediately / reheated leftovers before eating.

However, three items were excluded from the scoring– "whether or not to reheat leftovers", "raw food storage" and "cooked food storage less than two hours". For the item "whether or not to reheat leftovers", it appeared to be a common practice for caregivers beginning with the baseline survey and therefore was included only in the 1st and 2nd evaluations. For the item "raw food storage", none of the caregivers answered incorrectly at baseline or at the 2nd evaluation. For the item "cooked food storage less than two hours", none of the caregivers answered incorrectly at the 2nd evaluation.

Final, total scores ranged from 0 to 14. The internal consistency of the 14-item scale was statistically tested using Cronbach's α and obtained moderate to high values; 0.78 at baseline, 0.64 at the 1st evaluation and 0.59 at the 2nd evaluation.

Figure 7. Coding of food hygiene and food safety score

Food hygiene and food safety behaviors			Coding
		Caregivers' food hygiene (FH) behaviors	
		Handwashing with soap at food eating and handling-related points	
1	FH_1	- Before eating	1=Water with soap
2	FH_2	- Before feeding to child	0=Only water / wet towel / water with salt / boiled water
3	FH_3	- Before food preparation	
4	FH_4	- After handling raw food	
		Handwashing with soap at sanitation-related points	
5	FH_5	- After using the toilet	
6	FH_6	- After cleaning child's bottom	
7	FH_7	- After handling garbage	
8	FH_8	- When hands look dirty	
		Children's food hygiene (FH) behaviors	
9	FH_9	- Washing child's hands with soap before eating	
10	FH_{10}	- Washing child's hands with soap after toilet use	
		Caregivers' food safety (FS) behaviors	
		Cross-contamination	
11	FS_1	- Using separate utensils (cutting board and knife) for raw food and cooked food	1=Yes 0=No

Figure 7 (continued). Coding of food hygiene and food safety score

Food hygiene and food safety behaviors			Coding
12	FS_2	- Washing child's utensils (cup, bowl and spoon) with soap	1=Water with soap / water with soap and then boil water 0=Only water / boiled water
13	FS_3	Food preparation on tables	1=On tables 0=On ground
14	FS_4	Food at safe temperature - Cooked food storage if more than two hours	1=Refrigerator / feed immediately after cooking 0=With cover in room temperature / without cover in room temperature
15	FS_5	- Cooked food storage if less than two hours	1=Refrigerator / feed immediately after cooking / with cover in room temperature 0=Without cover in room temperature
16	FS_6	- Raw food storage	1=Refrigerator / cook immediately 0=Screened or enclosed cabinet / on the table with cover / on the table without cover
17	FS_7	Adequate cooking - Reheat leftovers of whole family before eating	1=Yes 0=No

Aside the primary outcome of the study – assessing the FHFS behaviors of caregivers – a secondary outcome variable was childhood diarrhea prevalence. This variable was monitored to observe its change with respect to changing caregivers' FHFS behaviors. The

form of diarrhea of our study's interest was "acute watery diarrhea" – a life-threating form of diarrhea among children [15]. Therefore, this study used the definition of diarrhea as watery stool occurring more than three times per day in the two weeks prior to the survey [17]. The caregivers were asked if the child suffered from diarrhea in the past two weeks. Those who reported "yes" were coded as 1 and those reported "no" were coded as 0.

3.8.2 Exposure variable

Exposure variable of this study was IEC activities of the program and mass media influence. Caregivers were asked if they received IEC related to FHFS from any of the IEC channels of the program such as workshops, newsletters, loudspeaker announcements, bulletin boards, and flip chart communication. If caregivers reported that they received IEC related to FHFS from any of the IEC channels, 1 point was given for each. Those who reported "not receiving IEC related to FHFS" received 0 points. Possible scores ranged from 0 to 5. This score was used to examine the effect of multiple IEC channels in this program.

In a parallel way, mass media channels (TV, radio and newspaper) were measured to monitor if those channels provided any FHFS related information and influenced to caregivers FHFS behaviors.

3.8.3 Independent variables

Independent variables include water use details and socio-demographic characteristics. Information about water use details was collected to assess the quantity of WTF water avails per capita per day and to determine the main water source used for different purposes in the

course of a day. The water use details were measured because they were considered as enabling factors for practicing proper FHFS behaviors. The accessibility of quantity clean water (WTF water) was reported and associated with more frequent handwashing [74]. The use of clean water for different domestic purposes was reported as an important predictor for ensuring safe water and food resources [3, 75]. At my study site, flow-meters were installed on the premises of the caregivers if they received WTF water and they paid the water fee based on the quantity of water they used. Therefore, the quantity of WTF water was calculated as per capita per day using the following formula: the quantity of WTF water that a family of caregiver consumed per month (cubic meter) was divided by number of family members who used this water, and again divided by 30 days, then multiplied with 1,000 (convert the unit to liter). Then, according to the WHO and Vietnamese standards, the quantity of WTF water was categorized into two categories of WTF water access level; basic (0-19L/c/d) to intermediate (20-59L/c/d) and optimal access (more than 60L/c/d) [51, 76].

In Vietnam, since clean water (commonly referred as water that meets the Vietnamese government standards [70]) is limited, traditionally caregivers set the following priority on water use; drinking water > cooking water (use for soup and rice) > food preparation water (washing rice and vegetables) > laundry and bathing water [51]. Then, caregivers select the water source according to what caregivers think is cleaner or is most suitable for a particular purpose depending on their priorities and preferences. In my study, I categorized water sources as “WTF water or purified bottled water” and “other water sources (rain water, drilled

well or dug well)".

Second, socio-demographic characteristics of caregivers and their children were obtained because caregivers are often in charge of handling children's water and food [77]. Caregivers' characteristics include type of relationship with the child, age, occupation, education, number of people in household, and refrigerator possession. Relationship with the child was categorized into "other (grandmother, father, aunt and grandfather)" and "mother" because usually mothers are in charge of preparing food in the home [78]. Age was classified as "29 or younger", "30 -34" and "35 or older" to have balanced distribution. The younger caregivers tended to practice inappropriate FHFS behaviors [79]. In Vietnam, the FHFS behaviors of older caregivers were found to be difficult to change [49]. Occupation was classified as "farmer", factory worker", "housework / retired", "civil servant / company employee" and "home-based business". Occupation was considered to represent the economic status of the caregivers. The better economic status was reported to provide a better environment for practicing proper FHFS behaviors [56]. Education was categorized as "secondary school or less" and "high school or more" because higher education level of the caregivers was associated with the better practice of FHFS behaviors [80]. Number of people in household was classified as "4 or fewer" and "5 or more" to obtain balanced distribution. Larger household size was considered to be a predictor of the childhood diarrhea because large family size tended to limit the use of water [81]. Refrigerator possession was reported as "yes" and "no". Refrigerator possession represented the living standard of the caregivers.

Also the refrigerator possession was considered to be an enabling factor for keeping food at a safe temperature [6].

The children's characteristics include number of children under five, birth order of child, child's age (months) and child's sex. Number of children under five was categorized into "1 child" and "2 or more" to obtain a balanced distribution. Shorter birth spacing (less than 2 years) was reported as a risk factor for infectious diseases which could be contracted from older siblings [82]. Birth order of the children was categorized into "second or higher" and "first". Birth order of child was reported to be associated with child morbidity. The health of younger siblings has been shown to be affected by older siblings under five years old [82]. The child's age (months) was classified as "6-11", "12-23", "24-35", "36-47" and "48-59". Children during the first two years of life were reported to be most susceptible to diarrheal diseases [83]. The child's sex was categorized into "male" and "female". Higher incidences of diarrheal diseases were reported among boys than girls due to greater mobility [84].

The questions of "whether boil water for drinking" and "type of latrine" were asked only at baseline because none of caregivers reported that they don't boil water for drinking, and all of caregivers except one use hygienic latrines including water-flush latrines [85]. It was presumed that the influence of these two basic characteristics were very minimal in my study since they seemed well established characteristics in my study site.

3.9 Sample size estimation

The required sample size was calculated using following parameters. I assumed that the proportion of caregivers who practiced proper FHFS behavior at baseline was 60% and this would increase to 85% at the 1st evaluation [30]. To detect a 25% difference with a confidence interval of 95% and a power of 80% (Epi Info 3.5.3.), it entailed a minimum of 120 caregiver-child pairs in each survey.

3.10 Statistical analysis

The changes of variables from baseline to the 1st evaluation, and from the 1st to the 2nd evaluation were separately assessed to examine the impact of IEC intervention program and self-sustaining IEC program on FHFS behaviors. First, proportions for socio-demographic characteristics, water use details, coverage of mass media and IEC activities of the program, childhood diarrhea, FHFS behaviors were described. The changes of variables were tested using the Chi-square test or the Fisher's exact test for all categorical variables, and using the Student's t-test for all continuous variables. Second, multicollinearity was checked by performing the collinearity diagnostics in the SPSS. If the VIF (variance inflation factor) indicated less than 10, multicollinearity among variables were not found in this study. The results of the collinearity diagnostics showed that 15 independent variables of this study did not indicate any multicollinearity. Therefore, all the independent variables of the study were included in the subsequent statistical analysis. Third, the changes of coverage of mass media

and IEC activities of the program, childhood diarrhea prevalence and the practice rates of FHFS behaviors were analyzed using hierarchical logistic regression analysis while adjusting for confounding variables. The confounding variables that entered in the first hierarchy were; caregiver type, age, occupation, and education level; number of people in household; refrigerator possession; number of children under five years; child's birth order, age and sex; WTF water access level; and main water source for drinking, cooking, food preparation, and laundry and bathing. In logistic regression analysis, every independent variable requires ten to twenty outcome cases to obtain adequate model fitness [86]. In this study 15 independent variables were entered because I chose to include all relevant independent variables in the model. In the second hierarchy, survey waves (baseline and the 1st evaluation, or the 1st evaluation and the 2nd evaluation) were entered. Then the adjusted odds ratio (AOR), 95% confidence intervals (C.I.) and adjusted P value were reported respectively. Fourth, hierarchical multiple regression analysis was performed to examine the changes of number of IEC channels and FHFS behavior scores. In this analysis, same confounding variables were adjusted with hierarchical logistic regression analysis. Finally, multiple linear regression with backward elimination procedures were performed to determine the factors affecting a greater number of proper FHFS behaviors. In this analysis, two models were tested. The first model was aimed to examine if any of the single IEC channels were associated with the multiple FHFS behaviors. The second model was aimed to examine if receiving multiple IEC channels was associated with the practice of multiple FHFS behaviors.

In all the analyses of this study, missing data were excluded from the analysis. A P value of < 0.05 was considered to indicate statistical significance. All statistical analyses were performed using SPSS, version 13.0 (SPSS Inc., Chicago, IL, USA).

3.11 Ethics statement

The Research Ethics Committee of the Graduate School of Medicine of the University of Tokyo, Japan (approval No. 1329) (Appendix 3) and the Scientific Committee of the NIN, Vietnam, (Appendix 4) reviewed and approved the study protocol. All the caregivers were informed of the study procedures and voluntarily took part in the study. After explaining the confidentiality of the study, written informed consent was obtained from all caregivers for their participation and that of their children (Appendix 5).

4. Results

4.1 Socio-demographic characteristics of all caregivers

Most of the caregivers' socio-demographic characteristics were similar between baseline and the 1st evaluation, and between the 1st and 2nd evaluations (Table 1). Such variables include age, education, refrigerator possession, number of children under five, birth order of child, child's age and child's sex.

Only a few of the caregivers' socio-demographic characteristics were statistically different between baseline and the 1st evaluation, and between the 1st and 2nd evaluations. Between baseline and the 1st evaluation, caregiver type and family size differed significantly. In the baseline survey, 96.8% of caregivers were mothers, whereas 77.3% were mothers in the 1st evaluation survey ($P<0.001$). The percentage of caregivers who had large families (5 people or more) significantly increased from 35.2% at baseline to 56.1% at the 1st evaluation ($P=0.001$).

Between the 1st evaluation and the 2nd evaluation, occupation and family size differed significantly. Occupations were significantly different largely due to an increase in the number of caregivers engaging in home-based businesses in the 2nd evaluation ($P=0.011$). The percentage of caregivers who had large families (5 people or more) significantly decreased by the 2nd evaluation ($P=0.005$).

Table 1. Socio-demographic characteristics of all caregivers

	Baseline (n=125)		1st evaluation (n=132)		2nd evaluation (n=185)		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n	(%)	n	(%)	n	(%)	P value[*1]	P value[*1]
Caregiver type							**<0.001**	0.230
Other	4	(3.2)	30	(22.7)	32	(17.3)		
Mother	121	(96.8)	102	(77.3)	153	(82.7)		
Age (years)							0.077	0.681
29 or younger	49	(39.2)	41	(31.1)	60	(32.4)		
30-34	49	(39.2)	46	(34.8)	56	(30.3)		
35 or older	27	(21.6)	45	(34.1)	69	(37.3)		
Occupation							0.123	**0.011**
Farmer	47	(37.6)	46	(34.8)	44	(23.8)		
Factory worker	24	(19.2)	19	(14.4)	27	(14.6)		
Housework / retired	20	(16.0)	37	(28.0)	39	(21.1)		
Civil servant / company employee	14	(11.2)	17	(12.9)	35	(18.9)		
Home-based business[*2]	20	(16.0)	13	(9.8)	40	(21.6)		
Education							0.622	0.696
Secondary school or less[*3]	53	(42.4)	60	(45.5)	80	(43.2)		
High school or more[*4]	72	(57.6)	72	(54.5)	105	(56.8)		
Number of people in household								
4 or fewer	81	(64.8)	58	(43.9)	111	(60.0)	**0.001**	**0.005**
5 or more	44	(35.2)	74	(56.1)	74	(40.0)		
Refrigerator possession							0.217	0.061
No	47	(37.6)	40	(30.3)	39	(21.1)		
Yes	78	(62.4)	92	(69.7)	146	(78.9)		
Boil water for drinking								
Yes	124	(99.2)	-	-	-	-		
Sometimes	1	(0.8)	-	-	-	-		
Type of latrine								
No latrine	1	(0.8)	-	-	-	-		
Other type of hygienic latrines[*5]	23	(18.4)	-	-	-	-		
Water-flush latrine	101	(80.8)	-	-	-	-		

*1: Chi-square test; Fisher's exact test
*2: Those with a home-based business include seller, hairdressers, tailors, etc.
*3: *Secondary school or less* includes not being able to read and write, only being able to read and write, primary school attendance only, and up to secondary school attendance only.
*4: *High school or more* includes high school and higher education.
*5: *Other type of hygienic latrines* includes single-vault latrines, double-vault latrines, septic tanks, and biogas-vault latrines (MOH 2005).

Table 1 (continued). Socio-demographic characteristics of all caregivers

	Baseline (n=125)		1st evaluation (n=132)		2nd evaluation (n=185)		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n	(%)	n	(%)	n	(%)	P value*1	P value*1
Number of children under five years							0.054	0.446
1	112	(89.6)	107	(81.1)	156	(84.3)		
2 or more	13	(10.4)	25	(18.9)	29	(15.7)		
Birth order of child							0.968	0.542
Second or higher	59	(47.6)	62	(47.3)	93	(50.8)		
First	65	(52.4)	69	(52.7)	90	(49.2)		
Child's age (months)							0.491	0.084
6-11	18	(14.4)	13	(9.8)	21	(11.4)		
12-23	35	(28.0)	39	(29.5)	38	(20.5)		
24-35	27	(21.6)	39	(29.5)	42	(22.7)		
36-47	23	(18.4)	23	(17.4)	49	(26.5)		
48-59	22	(17.6)	18	(13.6)	35	(18.9)		
Child's sex								
Male	69	(55.2)	69	(52.3)	103	(55.7)	0.638	0.549
Female	56	(44.8)	63	(47.7)	82	(44.3)		

*1: Chi-square test
Baseline (n=124), 1st evaluation (n=131) and 2nd evaluation (n=183)

4.2 Socio-demographic characteristics of three-survey participants

None of the caregiver's socio-demographic characteristics were differed between baseline and the 1st evaluation, or between the 1st evaluation and the 2nd evaluation (Table 2).

Table 2. Socio-demographic characteristics of three-survey participants

	Baseline (n=21)		1st evaluation (n=21)		2nd evaluation (n=21)		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n	(%)	n	(%)	n	(%)	P value[*1]	P value[*1]
Caregiver type							0.500	1.000
Other	0	(0.0)	1	(4.8)	0	(0.0)		
Mother	21	(100.0)	20	(95.2)	21	(100.0)		
Age (years)							0.887	0.651
29 or younger	13	(61.9)	12	(57.1)	9	(42.9)		
30-34	6	(28.6)	6	(28.6)	8	(38.1)		
35 or older	2	(9.5)	3	(14.3)	4	(19.0)		
Occupation							0.992	0.887
Farmer	9	(42.9)	8	(38.1)	5	(23.8)		
Factory worker	2	(9.5)	2	(9.5)	3	(14.3)		
Housework / retired	4	(19.0)	4	(19.0)	4	(19.0)		
Civil servant / company employee	2	(9.5)	3	(14.3)	4	(19.0)		
Home-based business[*2]	4	(19.0)	4	(19.0)	5	(23.8)		
Education							0.513	0.726
Secondary school or less[*3]	8	(38.1)	6	(28.6)	5	(23.8)		
High school or more[*4]	13	(61.9)	15	(71.4)	16	(76.2)		
Number of people in household							0.346	0.533
4 or fewer	14	(66.7)	11	(52.4)	13	(61.9)		
5 or more	7	(33.3)	10	(47.6)	8	(38.1)		
Refrigerator possession							0.190	1.000
No	9	(42.9)	5	(23.8)	5	(23.8)		
Yes	12	(57.1)	16	(76.2)	16	(76.2)		

*1: Chi-square test; Fisher's exact test
*2: Those with a home-based business include seller, hairdressers, tailors, etc.
*3: *Secondary school or less* includes not being able to read and write, only being able to read and write, primary school attendance only, and up to secondary school attendance only.
*4: *High school or more* includes high school and higher education.

Table 2 (continued). Socio-demographic characteristics of three-survey participants

	Baseline (n=21)		1st evaluation (n=21)		2nd evaluation (n=21)		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n	(%)	n	(%)	n	(%)	P value*1	P value*1
Number of children under five years							0.093	1.000
1	20	(95.2)	15	(71.4)	16	(76.2)		
2 or more	1	(4.8)	6	(28.6)	5	(23.8)		
Birth order of child							0.537	0.758
Second or higher	12	(57.1)	10	(47.6)	11	(52.4)		
First	9	(42.9)	11	(52.4)	10	(47.6)		
Child's age (months)							0.109	0.100
6-11	7	(33.3)	1	(4.8)	0	(0.0)		
12-23	8	(38.1)	7	(33.3)	2	(9.5)		
24-35	4	(19.0)	8	(38.1)	6	(28.6)		
36-47	2	(9.5)	4	(19.0)	9	(42.9)		
48-59	0	(0)	1	(4.8)	4	(19.0)		
Child's sex							1.000	1.000
Male	12	(57.1)	12	(57.1)	12	(57.1)		
Female	9	(42.9)	9	(42.9)	9	(42.9)		

*1: Chi-square test; Fisher's exact test

4.3 Water use details of all caregivers

None of the water use details were differed between baseline and the 1st evaluation, and between the 1st evaluation and the 2nd evaluation (Table 3). More than 70% of the caregivers had optimal access to WTF water (more than 60 lit/capita/day) in all three survey waves. Further, more than 80% of the caregivers used WTF water for drinking, cooking, food preparation and washing in all three survey waves. Among them, a slightly higher percentage of caregivers tended to use WTF water for food preparation. One reason could be that vegetables were eaten raw after being washed with water, therefore, caregivers tended to choose cleaner water sources. The percentage of caregivers who used WTF water as their main source of cooking water remained constant between baseline and the 1st evaluation, but slightly increased from 85.6% in the 1st evaluation to 92.4% in the 2nd evaluation. This was because caregivers shifted to give more priority to cooking water (use for soup and rice). Constantly among three surveys, 10.3% to 16.7% of caregivers used other water sources, particularly rain water, for main drinking water, because in Vietnamese tradition, caregivers preferred to make tea with rain water.

Table 3. Water use details of all caregivers

	Baseline (n=125)		1st evaluation (n=132)		2nd evaluation (n=185)		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n	(%)	n	(%)	n	(%)	P value*1	P value*1
WTF water access level							0.148	0.471
Basic - Intermediate (0-59L/c/d)	22	(17.6)	33	(25.0)	53	(28.6)		
Optimal (More than 60L/c/d)	103	(82.4)	99	(75.0)	132	(71.4)		
Main drinking water source							0.383	0.094
Other water sources*2	16	(12.8)	22	(16.7)	19	(10.3)		
WTF water or Purified bottled water	109	(87.2)	110	(83.2)	166	(89.7)		
Main cooking water source							0.999	0.050
Other water sources*2	18	(14.4)	19	(14.4)	14	(7.6)		
WTF water	107	(85.6)	113	(85.6)	171	(92.4)		
Main food preparation water source							0.735	0.791
Other water sources*3	9	(7.2)	11	(8.3)	17	(9.2)		
WTF water or Purified bottled water	116	(92.8)	121	(91.7)	168	(90.8)		
Main laundry and bathing water source							0.616	0.883
Other water sources*3	18	(14.4)	22	(16.7)	32	(17.3)		
WTF water	107	(85.6)	110	(83.3)	153	(82.7)		

Table 3 (continued). Water use details of all caregivers

	Baseline (n=125)		1st evaluation (n=132)		2nd evaluation (n=185)		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n	(%)	n	(%)	n	(%)	P value*1	P value*1
Average of water use details								
Basic-intermediate access and use of other water sources*3	17	(13.3)	21	(16.2)	27	(14.6)		
Optimal water access and use of WTF water	108	(86.7)	111	(83.8)	158	(85.4)		

*1: Chi-square test
*2: Rain water or drilled well
*3: Rain water, drilled well or dug well

4.4 Water use details of three-survey participants

None of the water use details were differed between baseline and the 1st evaluation, and between the 1st evaluation and the 2nd evaluation (Table 4).

Table 4. Water use details of three-survey participants

	Baseline (n=21)		1st evaluation (n=21)		2nd evaluation (n=21)		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n	(%)	n	(%)	n	(%)	P value*1	P value*1
WTF water access level							0.410	0.734
Basic - Intermediate (0-59L/c/d)	2	(9.5)	5	(23.8)	7	(33.3)		
Optimal (More than 60L/c/d)	19	(90.5)	16	(76.2)	14	(66.7)		
Main drinking water source							0.606	1.000
Other water sources*2	1	(4.8)	3	(14.3)	3	(14.3)		
WTF water or Purified bottled water	20	(95.2)	18	(85.7)	18	(85.7)		
Main cooking water source							0.488	1.000
Other water sources*2	0	(0)	2	(9.5)	1	(4.8)		
WTF water	21	(100)	19	(90.5)	20	(95.2)		
Main food preparation water source							0.488	0.488
Other water sources*3	0	(0)	2	(9.5)	0	(0.0)		
WTF water or Purified bottled water	21	(100)	19	(90.5)	21	(100.0)		
Main laundry and bathing water source							1.000	1.000
Other water sources*3	3	(14.3)	4	(19.0)	3	(14.3)		
WTF water	18	(85.7)	17	(81.0)	18	(85.7)		

*1: Chi-square test; Fisher's exact test
*2: Rain water or drilled well
*3: Rain water, drilled well or dug well

4.5 Coverage of mass media and IEC activities of the program (all caregivers)

As for the coverage of mass media channels, between the 1st evaluation and the 2nd evaluation, the proportion of caregivers who were exposed to radio messages significantly increased from 9.8% in the 1st evaluation to 23.2% in the 2nd evaluation (P=0.006) (Table 5, Figure 8). The coverage of mass media channels ranged from 3.8% to 28.0% at the 1st evaluation and from 10.8% to 28.1% at the 2nd evaluation.

As for the coverage of IEC activities of the program, as predicted, coverage of workshops and newsletters, meanwhile, decreased significantly from the 1st evaluation to the 2nd evaluation because such channels were mainly used prior to the 1st evaluation. The coverage of loudspeaker announcement and bulletin board communication remained statistically similar between the 1st evaluation and the 2nd evaluation (loudspeaker: 87.1% to 86.1%, bulletin board: 67.4% to 60.5%). Compared to the above two IEC channels, flip chart communication showed moderate coverage (57.8%) at the 2nd evaluation. The coverage of IEC activities of the program ranged from 67.4% to 87.1% at the 1st evaluation and from 53.0% to 86.1% at the 2nd evaluation.

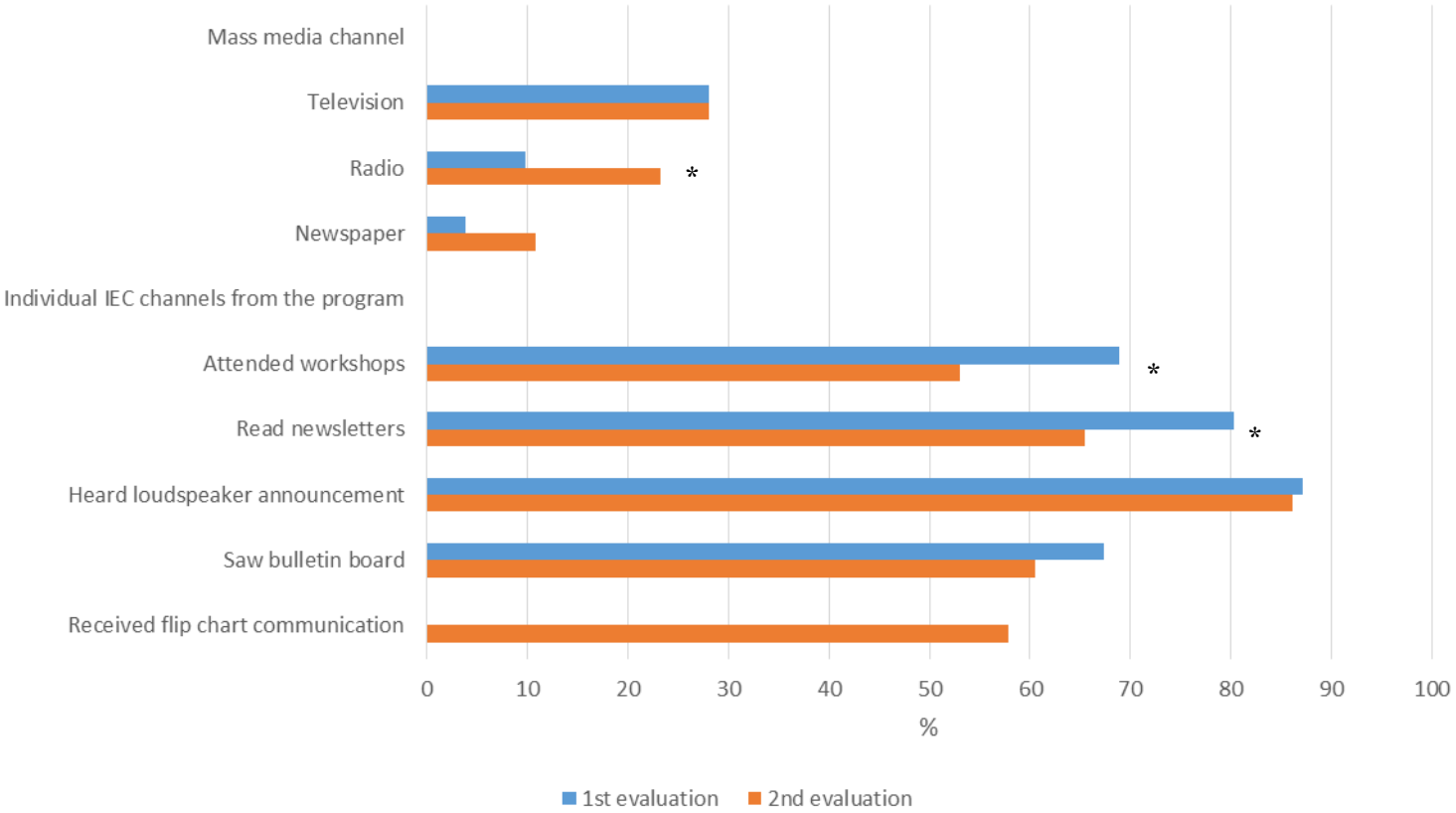
Among 4 IEC channels provided, caregivers were exposed to 3.04 (1.2) channels at the 1st evaluation. By the 2nd evaluation, although 5 IEC channels were provided, the exposed number of IEC channels remained unchanged (3.25 (1.6) channels, P=0.164).

Table 5. Coverage of mass media and IEC activities of the program (all caregivers)

	1st evaluation (n=132)		2nd evaluation (n=185)					
	n	(%)	n	(%)	P value*1	AOR	(95% C.I.)	Adjusted P value*2
Mass media channels								
Television	37	(28.0)	52	(28.1)	0.988	0.93	(0.53-1.65)	0.810
Radio	13	(9.8)	43	(23.2)	**0.002**	2.86	(1.31-6.03)	**0.006**
Newspaper	5	(3.8)	20	(10.8)	**0.022**	2.90	(0.91-9.20)	0.071
Mean	18	(13.9)	38	(20.7)				
Individual IEC channels of the program								
Attended workshops	91	(68.9)	98	(53.0)	**0.004**	0.50	(0.29-0.85)	**0.010**
Read newsletters	106	(80.3)	121	(65.4)	**0.004**	0.42	(0.23-0.76)	**0.004**
Heard loudspeaker announcement	115	(87.1)	163	(86.1)	0.792	1.49	(0.68-3.27)	0.324
Saw bulletin board	89	(67.4)	112	(60.5)	0.210	0.73	(0.43-1.24)	0.246
Received flip chart communication	--	-	107	(57.8)	-	-	-	-
Mean	100	(75.9)	120	(64.6)				
Multiple IEC channels of the program	Mean	(SD)	Mean	(SD)				
Mean IEC channels received from the program	3.04	(1.2)	3.25	(1.6)	0.179*3			0.164*4

*1: Chi-square test; Fisher's exact test
*2: Hierarchical logistic regression analysis
*3: Independent-sample t-test
*4: Hierarchical multiple regression analysis
Adjusted for caregiver type, age, occupation, and education level; number of people in household; refrigerator possession; number of children under five years; child's birth order, age and sex; WTF water access level; and main water source for drinking, cooking, food preparation, and laundry and bathing.

Figure 8. Coverage of mass media and IEC activities of the program (all caregivers)



*Adjusted P<0.05; Hierarchical logistic regression analysis: Adjusted for caregiver type, age, occupation, and education level; number of people in household; refrigerator possession; number of children under five years; child's birth order, age and sex; WTF water access level; and main water source for drinking, cooking, food preparation, and laundry and bathing.

4.6 Coverage of mass media and IEC activities of the program (three-survey participants)

None of the coverage of mass media differed between the 1st evaluation and the 2nd evaluation (Table 6). None of the coverage of IEC activities of the program differed between the 1st evaluation and the 2nd evaluation. Among 4 IEC channels provided, caregivers received 3.29 (0.85) channels from the program at the 1st evaluation. The number of channels significantly increased to 4.19 (1.3) channels at the 2nd evaluation when 5 IEC channels were provided (P=0.009).

Table 6. Coverage of mass media and IEC activities of the program (three-survey participants)

	1st evaluation (n=21)		2nd evaluation (n=21)		
	n	(%)	n	(%)	P value*1
Mass media channel					
Television	3	(14.3)	2	(9.5)	0.500
Radio	2	(9.5)	7	(33.3)	0.065
Newspaper	0	(0.0)	2	(9.5)	0.244
Mean		(7.9)		(17.4)	
Individual IEC channels of the program					
Attended workshops	19	(90.5)	16	(76.2)	0.205
Read newsletters	17	(81.0)	20	(95.2)	0.343
Heard loudspeaker announcement	20	(95.2)	18	(85.7)	0.606
Saw bulletin board	13	(61.9)	19	(90.5)	0.067
Received flip chart communication	--	--	15	(71.4)	--
Mean		(82.2)		(83.8)	
Multiple IEC channels of the program	Mean	(SD)	Mean	(SD)	
Mean number of IEC channels received from the program	3.29	(0.85)	4.19	(1.3)	**0.009***2

*1: Chi-square test; Fisher's exact test

*2: Independent-sample t-test

4.7 Diarrhea prevalence among children under five (all children)

In the baseline survey, 21.6% of caregivers reported that their child had experienced diarrhea during the previous two weeks (Table 7, Figure 9). The childhood diarrhea prevalence was significantly reduced to 7.6% at the 1st evaluation (P=0.002) – a reduction that was maintained through the 2nd evaluation (5.9%).

Stratifying diarrhea prevalence by monthly categories showed that diarrhea tended to be more prevalent among children under 24 months than among older children (Figure 10). Prevalence of diarrhea was largely reduced, particularly among children older than 24 months, by the 2nd evaluation. Considering the highest proportion of children was under 24 months at baseline and at the 1st evaluation relative to the 2nd evaluation, we adjusted for child's age along with other confounding factors, but the results were essentially the same as in the unadjusted analysis.

Table 7. Diarrhea prevalence among children under five (all children)

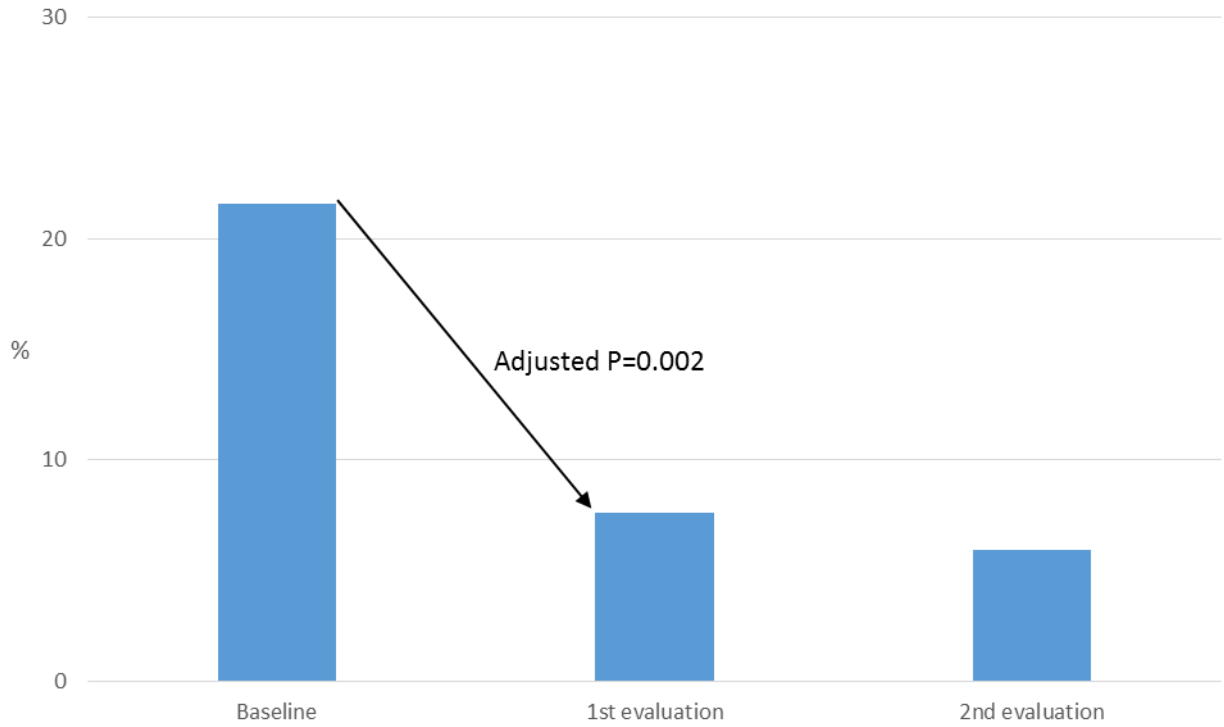
	Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation				1st evaluation to 2nd evaluation			
	n/N	(%)	n/N	(%)	n/N	(%)	P value*1	AOR	(95% C.I.)	Adjusted P value*2	P value*1	AOR	(95% C.I.)	Adjusted P value*2
Diarrhea prevalence in the past two weeks														
Under five	27/125	(21.6)	10/132	(7.6)	11/185	(5.9)	**0.001**	0.22	(0.08-0.57)	**0.002**	0.565	1.26	(0.38-4.19)	0.701
Stratified by month category														
6-11 months	4/18	(22.2)	2/13	(15.4)	2/21	(9.5)								
12-23 months	10/35	(28.6)	5/39	(12.8)	8/38	(21.1)								
24-35 months	7/27	(25.9)	1/39	(2.6)	0/42	(0.0)								
36-47 months	4/23	(17.4)	2/23	(8.7)	1/49	(2.0)								
48-59 months	2/22	(9.1)	0/18	(0.0)	0/35	(0.0)								

*1: Chi-square test

*2: Hierarchical logistic regression analysis

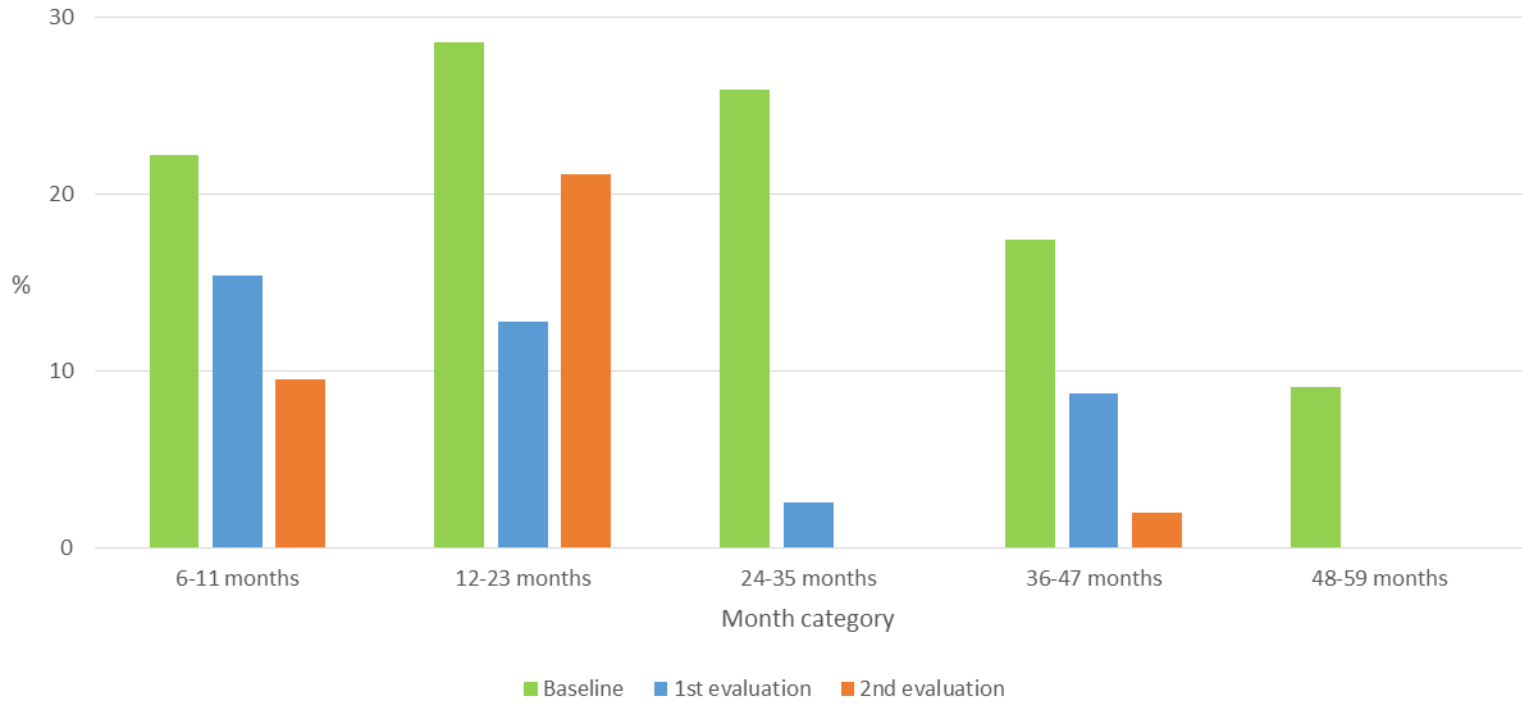
Adjusted for caregiver type, age, occupation, and education level; number of people in household; refrigerator possession; number of children under five years; child's birth order, age, and sex; WTF water access level; and main water source for drinking, cooking, food preparation, and laundry and bathing.

Figure 9. Diarrhea prevalence among children under five



Hierarchical logistic regression analysis: Adjusted for caregiver type, age, occupation, and education level; number of people in household; refrigerator possession; number of children under five years; child's birth order, age and sex; WTF water access level; and main water source for drinking, cooking, food preparation, and laundry and bathing.

Figure 10. Diarrhea prevalence stratified by month category



4.8 Diarrhea prevalence among children under five (21 children who participated in three surveys)

Diarrhea prevalence among children under five significantly decreased from baseline to the 1st evaluation (from 47.6% to 9.5%, P=0.015) (Table 8). This prevalence remained unchanged at the 2nd evaluation.

Table 8. Diarrhea prevalence among children under five (21 children who participated in three surveys)

	Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
	n/N	(%)	n/N	(%)	n/N	(%)	P value*1	P value*1
Diarrhea prevalence in the past two weeks								
	10/21	(47.6)	2/21	(9.5)	0/21	(0.0)	**0.015**	0.488

*1: Fisher's exact test

4.9 Changes in the practice rates of FHFS behaviors (all caregivers)

From baseline to the 1st evaluation, the practice rates of "handwashing after toilet use" and three food safety behaviors were significantly increased (Table 9, Figure 11). The practice rates of "handwashing after using the toilet" significantly increased from 22.0% at baseline to 33.3% at the 1st evaluation (P=0.001). The three food safety behaviors included: using separate utensils for raw food and cooked food / washing child's utensils with soap / and proper cooked food storage (less than 2 hours). Practice rates of the measured seven food safety behaviors ranged from 61.6% to 87.9% at baseline, and showed an absolute change of 9.1% to 35.3% during the programs of the first year.

From the 1st evaluation to the 2nd evaluation, the practice rates of "handwashing after toilet use" and seven food hygiene behaviors significantly increased. Three food safety behaviors that increased by the 1st evaluation were maintained from the 1st evaluation to the 2nd evaluation. "Handwashing after using the toilet" significantly increased from 33.3% at the 1st evaluation to 53.8% at the 2nd evaluation (P=0.002). The seven food hygiene behaviors included handwashing with soap: before eating / before feeding / before food preparation / after handling raw food / when hands look dirty / child handwashing before eating / and after toilet use. Practice rates of measured ten food hygiene behaviors were lower (8.1% to 42.0%) than food safety behaviors at baseline, but significant increases (12.0% to 25.5%) were observed from the 1st evaluation to the 2nd evaluation.

Five FHFS behaviors did not significantly change either between baseline and the 1st evaluation or between the 1st and the 2nd evaluation. However, four of these behaviors showed an absolute change from 4.5% to 11.0%, and one reached 100% practice by the 2nd evaluation.

Table 9. Changes in the practice rates of FHFS behaviors (all caregivers)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation			1st evaluation to 2nd evaluation		
n/N	(%)	n/N	(%)	n/N	(%)	Absolute change %	P value*1	Adjusted P value*2	Absolute change %	P value*1	Adjusted P value*2
Caregivers' food hygiene behaviors											
Handwashing with soap at food eating and handling-related points											
Before eating											
34/125	(27.2)	33/132	(25.0)	93/184	(50.5)	-2.2	0.688	0.762	25.5	**P<0.001**	**P<0.001**
Before feeding											
26/125	(20.8)	27/132	(20.5)	84/184	(45.7)	-0.3	0.945	0.718	25.2	**P<0.001**	**P<0.001**
Before food preparation											
24/112	(19.2)	25/132	(18.9)	67/184	(36.4)	-0.3	0.958	0.131	17.5	**0.001**	**0.001**
After handling raw food											
10/124	(8.1)	12/132	(9.1)	39/185	(21.1)	1.0	0.770	0.632	12.0	**0.004**	**0.005**
Handwashing with soap at sanitation-related points											
After using the toilet											
27/123	(22.0)	44/132	(33.3)	99/184	(53.8)	11.3	**0.043**	**0.001**	20.5	**P<0.001**	**0.002**
After cleaning child's bottom											
21/124	(16.9)	24/132	(18.2)	42/185	(22.7)	1.3	0.793	0.536	4.5	0.328	0.290
After handling garbage											
13/124	(10.5)	16/132	(12.1)	13/184	(7.1)	1.6	0.680	0.532	-5.0	0.125	**0.015**
When hands look dirty											
15/122	(12.3)	22/132	(16.7)	70/184	(38.0)	4.4	0.324	0.552	21.3	**P<0.001**	**P<0.001**

Table 9 (continued). Changes in the practice rates of FHFS behaviors (all caregivers)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation			1st evaluation to 2nd evaluation		
n/N	(%)	n/N	(%)	n/N	(%)	Absolute change %	P value*1	Adjusted P value*2	Absolute change %	P value*1	Adjusted P value*2
Children's food hygiene behaviors											
Handwashing with soap before eating											
40/119	(33.6)	44/132	(33.3)	90/185	(48.6)	-0.3	0.963	0.881	15.3	**0.007**	**0.020**
Handwashing with soap after toilet use											
47/112	(42.0)	51/123	(41.5)	102/184	(55.4)	-0.5	0.938	0.984	13.9	**0.016**	**0.037**

Mean practice rate of food hygiene behaviors						Absolute change % from baseline to the 1st evaluation		Absolute change % from the 1st evaluation to the 2nd evaluation		Absolute change % from baseline to the 2nd evaluation	
	(21.3)		(22.9)		(37.9)	(1.6)		(15.1)		(16.7)	
						% increase from baseline to the 1st evaluation		% increase from the 1st evaluation to the 2nd evaluation		% increase from baseline to the 2nd evaluation	
						(7.5)		(65.9)		(78.4)	

Table 9 (continued). Changes in the practice rates of FHFS behaviors (all caregivers)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation			1st evaluation to 2nd evaluation		
n/N	(%)	n/N	(%)	n/N	(%)	Absolute change %	P value[*1]	Adjusted P value[*2]	Absolute change %	P value[*1]	Adjusted P value[*2]
Caregivers' food safety behaviors											
Cross-contamination											
Using separate utensils (cutting board and knife) for raw food and cooked food											
77/125	(61.6)	110/132	(83.3)	152/185	(82.2)	21.7	**<0.001**	**<0.001**	-1.1	0.786	0.682
Washing child's utensils (cup, bowl and spoon) with soap											
109/124	(87.9)	128/132	(97.0)	181/185	(97.8)	9.1	**0.006**	**0.008**	0.8	0.627	0.718
Food preparation on tables											
87/125	(69.6)	86/132	(65.2)	141/185	(76.2)	-4.4	0.447	0.618	11.0	**0.031**	0.096
Food at safe temperature											
Proper cooked food storage behavior (food for child in summer, more than 2 hours)											
88/125	(70.4)	107/132	(81.1)	162/185	(87.6)	10.7	**0.046**	0.125	6.5	0.111	0.317
Proper cooked food storage behavior (food for child in summer, less than 2 hours)[*3]											
79/125	(63.2)	130/132	(98.5)	185/185	(100.0)	35.3	**<0.001**	**<0.001**	1.5	0.093	0.999
Proper raw food storage behavior (food for child in summer)[*4]											
125/125	(100.0)	129/130	(99.2)	183/183	(100.0)	-0.8	0.326	0.999	0.8	0.235	1.000
Adequate cooking											
Reheat leftovers of whole family before eating (food for whole family)[*5]											
--	--	121/128	(94.5)	179/182	(98.4)		---	---	3.9	0.061	0.068

Table 9 (continued). Changes in the practice rates of FHFS behaviors (all caregivers)

Baseline		1st evaluation		2nd evaluation				
n/N	(%)	n/N	(%)	n/N	(%)			
Mean practice rate of food safety behaviors						Absolute change % from baseline to the 1st evaluation	Absolute change % from the 1st evaluation to the 2nd evaluation	Absolute change % from baseline to the 2nd evaluation
	(75.5)		(88.4)		(91.7)	(13.0)	(3.3)	(16.3)
						% increase from baseline to the 1st evaluation	% increase from 1st evaluation to the 2nd evaluation	% increase from baseline to the 2nd evaluation
						(17.2)	(3.8)	(21.6)

*1: Chi-square test; Fisher's exact test
*2: Hierarchical logistic regression analysis
*3: Excluded from the FHFS score because none of the caregivers reported wrong cooked food storage behavior at the 2nd evaluation.
*4: Excluded from the FHFS score because none of the caregivers reported wrong raw food storage at baseline and at the 2nd evaluation.
*5: Excluded from the FHFS score because we did not measure this indicator in the baseline survey.

Figure 11. Changes in the practice rates of FHFS behaviors (all caregivers)

*1: Adjusted P<0.05: Form baseline to the 1st evaluation

*2: Adjusted P<0.05: From the 1st evaluation to the 2nd evaluation

Hierarchical logistic regression analysis: Adjusted for caregiver type, age, occupation, and education level; number of people in household; refrigerator possession; number of children under five years; child's birth order, age and sex; WTF water access level; and main water source for drinking, cooking, food preparation, and laundry and bathing.

4.10 Changes in the practice rates of FHFS behaviors (three-survey participants)

From baseline to the 1st evaluation, the rate of proper cooked food storage behavior (less than 2 hours) significantly increased from 76.2% to 100.0% (P=0.048) (Table 10). From the 1st evaluation to the 2nd evaluation, the rates of handwashing with soap before eating and children's handwashing with soap before eating significantly increased from 23.8% to 61.9% (P=0.028) and from 28.6% to 66.7% (P=0.013) , respectively.

Table 10. Changes in the practice rates of FHFS behaviors (three-survey participants)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation		1st evaluation to 2nd evaluation	
n/N	(%)	n/N	(%)	n/N	(%)	Absolute change %	P value*1	Absolute change %	P value*1
Caregivers' food hygiene behaviors									
Handwashing with soap at food eating and handling-related points									
Before eating									
3/12	(14.3)	5/21	(23.8)	13/21	(61.9)	9.5	0.697	38.1	**0.028**
Before feeding									
3/21	(14.3)	3/21	(14.3)	8/21	(38.1)	0	1.000	23.8	0.159
Before food preparation									
3/21	(14.3)	5/21	(23.8)	6/21	(28.6)	9.5	0.697	4.8	1.000
After handling raw food									
2/21	(9.5)	4/21	(19.0)	5/21	(23.8)	9.5	0.663	4.8	1.000
Handwashing with soap at sanitation-related points									
After using the toilet									
3/21	(14.3)	8/21	(38.1)	14/21	(66.7)	23.8	0.159	28.6	0.064
After cleaning child's bottom									
2/21	(9.5)	1/21	(4.8)	4/21	(19.0)	4.7	1.000	14.2	0.343
After handling garbage									
1/21	(4.8)	2/21	(9.5)	0/21	(0.0)	4.7	1.000	9.5	0.488
When hands look dirty									
0/21	(0.0)	2/21	(9.5)	4/21	(19.0)	9.5	0.488	9.5	0.663

Table 10 (continued). Changes in the practice rates of FHFS behaviors (three-survey participants)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation		1st evaluation to 2nd evaluation	
n/N	(%)	n/N	(%)	n/N	(%)	Absolute change %	P value*1	Absolute change %	P value*1
Children's food hygiene behaviors									
Handwashing with soap before eating									
4/18	(22.2)	6/21	(28.6)	14/21	(66.7)	6.4	0.726	38.1	**0.013**
Handwashing with soap after toilet use									
3/18	(16.7)	10/21	(47.6)	14/20	(70.0)	30.9	0.051	22.4	0.146
Mean practice rate of food hygiene									
	(12.0)		(21.9)		(39.4)				

Table 10 (continued). Changes in the practice rates of FHFS behaviors (three-survey participants)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation		1st evaluation to 2nd evaluation	
n/N	(%)	n/N	(%)	n/N	(%)	Absolute change %	P value*1	Absolute change %	P value*1
Caregivers' food safety behaviors									
Cross-contamination									
Using separate utensils (cutting board and knife) for raw food and cooked food									
12/21	(57.1)	18/21	(85.7)	18/21	(85.7)	28.6	0.085	0	1.000
Washing child's utensils (cup, bowl and spoon) with soap									
19/21	(90.5)	21/21	(100.0)	21/21	(100.0)	9.5	0.488	0	---
Food preparation on tables									
15/21	(71.4)	16/21	(76.2)	16/21	(76.2)	4.8	1.000	0	1.000
Food at safe temperature									
Proper cooked food storage behavior (food for child in summer, more than 2 hours)									
16/21	(76.2)	17/21	(81.0)	17/21	(81.0)	4.8	1.000	0	1.000
Proper cooked food storage behavior (food for child in summer, less than 2 hours)									
16/21	(76.2)	21/21	(100.0)	21/21	(100.0)	23.8	0.048	0	---
Proper raw food storage behavior (food for child in summer)									
21/21	(100.0)	20/20	(100.0)	21/21	(100.0)	0	---	0	---
Adequate cooking									
Reheat leftovers of whole family before eating (food for whole family)									
--	--	18/21	(85.7)	21/21	(100.0)	---	---	14.3	0.232
Mean practice rate of food safety									
	(78.6)		(89.8)		(91.8)				

*1: Chi-square test; Fisher's exact test

4.11 FHFS score changes (all caregivers)

From baseline to the 1st evaluation, the mean FHFS scores of 14 item-scale significantly increased from 4.96 items to 5.50 items (P=0.047) (Table 11). From the 1st evaluation to the 2nd evaluation, the mean score significantly increased from 5.50 items to 7.23 items (P<0.001).

Table 11. FHFS score changes (all caregivers)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation		1st evaluation to 2nd evaluation	
N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	P value*1	Adjusted P value*2	P value*1	Adjusted P value*2
107	4.96 (2.91)	123	5.50 (2.31)	183	7.23 (2.39)	0.129	**0.047**	**<0.001**	**<0.001**

*1: Independent-sample t-test
*2: Hierarchical multiple regression analysis
Adjusted for caregiver type, age, occupation, and education level; number of people in household; refrigerator possession; number of children under five years; child's birth order, age, and sex; WTF water access level; and main water source for drinking, cooking, food preparation, and laundry and bathing.

4.12 FHFS score changes (three-survey participants)

From baseline to the 1st evaluation, the mean FHFS scores of 14 item-scale did not increase significantly (Table 12). However, from the 1st evaluation to the 2nd evaluation, the mean score increased from 5.62 items to 7.30 items (P=0.024).

Table 12. FHFS score changes (three-survey participants)

Baseline		1st evaluation		2nd evaluation		Baseline to 1st evaluation	1st evaluation to 2nd evaluation
N	Mean (SD)	N	Mean (SD)	N	Mean (SD)	P value*1	P value*1
18	4.22 (2.6)	21	5.62 (1.8)	20	7.30 (2.7)	0.055	**0.024**

*1: Independent-sample t-test

4.13 Factors linked to having a greater number of proper FHFS behaviors at the 2nd evaluation

In the first model, the flipchart communication by a community group was significantly associated with a greater number of proper FHFS behaviors (Beta=0.174, P=0.018) (Table 13). Also, optimal access to WTF water (60L/c/d or more) was significantly associated with a greater number of proper FHFS behaviors (Beta=0. 172, P=0.019).

In the second model, receiving multiple IEC channels did not indicate an association with a greater number of proper FHFS behaviors (Beta=0.131, P=0.072). Other important factors found to be related to having a greater number of proper FHFS behaviors were the following: having a refrigerator (Beta=0.147, P=0.046), and optimal access to the WTF water (60L/c/d or more) (Beta=0.149, P=0.041).

Table 13. Determinants of the number of proper FHFS behaviors at the 2nd evaluation

	Beta coefficient	SE	P value[*1]
Effective IEC channel (n=183)[*2]			
Refrigerator possession	0.127	0.422	0.081
Optimal access to the WTF water (60L/c/d or more)	0.172	0.385	**0.019**
Received flip chart communication	0.174	0.352	**0.018**
Use of multiple IEC channels (n=183)[*2]			
Refrigerator possession	0.147	0.427	**0.046**
Having more than 2 children under five	0.121	0.479	0.099
Optimal access to the WTF water (60L/c/d or more)	0.149	0.382	**0.041**
Multiple IEC channels of the program (scored from 1 to 5)[*3]	0.131	0.109	0.072

*1: Multiple linear regression with backward elimination procedures
*2: The first model included 10 socio-demographic factors, 5 water use factors and multiple IEC channels of the program. The final model included variables for which P values were less than 0.1.
*3: Continuous variable

5. Discussion

In this study site, more than 70% of the caregivers had optimal access to safe water sources and more than 80% of the caregivers used safe water sources for daily domestic purposes. The coverage of mass media was limited but the mean coverage of IEC activities of the program reached over 60%. This study clearly demonstrates that, of 17 measured FHFS behaviors, the practice rates of four FHFS behaviors significantly increased during the program's first year (the participatory program and the IEC intervention program). Moreover, the practice rates of eight FHFS behaviors significantly increased during the self-sustaining IEC program of the second year. The mean FHFS scores of 14 item-scale significantly increased from 4.96 items at baseline to 5.50 items at the 1st evaluation and to 7.23 items at the 2nd evaluation. At the end of self-sustaining IEC program, WMU-administered flip chart communication emerged as an variable associated with a greater number of FHFS behaviors.

5.1 Multiple FHFS behavioral change

This study demonstrated that the practice rates of four FHFS behaviors increased during the program's first year. Moreover, caregivers practiced 4.96 items (FHFS behaviors) at baseline and this increased to 5.50 items at the 1st evaluation. Twenty-one caregivers who participated in three surveys showed similar increase from baseline to the 1st evaluation.

These results should be considered in terms of the consistency of the study population and the external factors. First, in terms of the consistency of the study population, although

twenty-one caregivers participated in all three surveys, most of the caregivers differed in each survey. On the other hand, it was observed that the number of children under five in this village increased with each survey. Therefore, the consistency of the study population should be carefully considered because better FHFS behaviours could be introduced by immigrants who already have proper FHFS behaviours in the 1st evaluation or 2nd evaluation. The population data of the study village showed that the population of the village increased due to natural population increases (from 14.1 ‰ in 2006 to 15.2 ‰ in 2008). The rate of immigration tended to be small (from 5 ‰ in 2006 to 4 ‰ in 2008). In this regard, the number of children under five increased as a result of babies born to indigenous families in the village. It is reasonable to conclude that the caregivers who participated in the three surveys were indigenous people rather than immigrants.

Second, in terms of the external factors, the results obtained in Ngoc Truc Village could be referred to back up the changes of the FHFS behaviors observed in the study site (Appendix 6). The community-based IEC program was not implemented in Ngoc Truc Village. Ngoc Truc Village is located in Tu Liem District of Hanoi. A repeated cross-sectional study was also applied to collect data in January 2007 for use as baseline and in August 2008 for evaluation. The changes of the same 17 FHFS behaviors were measured in this village. The results showed that the practice rates of 11 items did not change from baseline to evaluation. The practice rates of three items increased (children's handwashing with soap before eating / children's handwashing with soap after toilet / using separate utensils for raw and cooked

food) and another three items decreased (handwashing with soap after handling raw food / handwashing with soap after handling garbage / handwashing with soap when hands look dirty) from baseline to evaluation. The mean FHFS score of 14 item-scale did not show any changes from baseline to evaluation (from 7.62 items to 7.44 items, P=0.716).

However, to interpret the results from Ngoc Truc Village, it should be noted that the practice rates of FHFS behaviors were high at baseline. For example, the mean practice rate of food hygiene was 41.8% and the mean practice rate of food safety was 88.0% at baseline. High practice rates of FHFS behaviors can be explained by the fact that more than 60% of caregivers reported that they had received FHFS related information from TV at baseline. Therefore, direct comparison of this village as a control was considered as inappropriate.

From above two points, it is plausible to conclude that the IEC intervention program contributed to increase the practice of multiple FHFS behaviors in this study.

Multiple FHFS behavioral change in this study is supported by a two-year intervention study conducted in Zimbabwe, which demonstrates that 17 behaviors shows an improvements among 20 measured handwashing, sanitation and drinking water related behaviors [32]. Studies in Zimbabwe and Thailand indicate that behavioral changes can be produced by altering social norms in communities [32, 87]. As the previous studies indicate, alteration of social norms related FHFS behavior may contribute to the changes in FHFS behaviors found in this study.

In this study, caregivers were provided with many messages related to each targeted

behavior in order to promote multiple FHFS behaviors. Even though many messages were provided, caregivers might have only selected and acted upon behaviors that had not been practiced previously. This messaging strategy is supported by the results of a community-based behavioral change intervention program conducted in Bangladesh [31].

In this study, multiple targeted FHFS behaviors were selected based on group discussions with caregivers during the participatory phase of the program. As the studies in Bangladesh and Thailand demonstrate, a participatory approach may contribute to changes in multiple FHFS behaviors [43, 31].

5.2 Long-term sustainability of FHFS behaviors

This study demonstrated that the practice rates of eight FHFS behaviors increased during the second year of the self-sustaining IEC program. Moreover, caregivers practiced 5.50 items (FHFS behaviors) at the 1st evaluation, but this significantly increased to 7.23 items at the 2nd evaluation. Twenty-one caregivers who participated in three surveys showed similar increases from the 1st evaluation to the 2nd evaluation. Referring to the results obtained in Ngoc Truc Village, the mean FHFS score did not change during the 20 months between baseline and evaluation. In this regard, it is plausible to consider that multiple FHFS behaviors were not only sustained but also increased because of the self-sustaining IEC program in this study.

The long-term sustainability of handwashing related behaviors are indicated by

adaptation rates of behaviors in a study in Pakistan that evaluated the sustainability of handwashing behaviors 5 years after the program's termination [88]. Moreover, studies in Indonesia and India demonstrate the sustainability of handwashing behaviors 2 years and 9 years after the program's termination [41, 42]. These previous studies report that IEC activities such as face-to-face health education and home visits by community groups contribute to the sustainability of FHFS behaviors.

Furthermore, previous studies report that acceptability and affordability related to FHFS behaviors are enabling factors for the sustainability of behaviors. A study conducted in Thailand indicates that behavior change can be easily realized: i) if community members practice at least some target behaviors, and ii) if the behavior change requires a very little extra effort or cost [87]. In this study, several behaviors were found to be practiced at slightly higher frequencies than the national average presumably because the study site was suburban area close to the capital city of Hanoi [89]. Furthermore, affordability was another important factor to sustain proper FHFS behaviors [30]. In this study, an increase in the number of households engaging in home-based businesses may lead to better financial situations. Thus improved economic status may provide better opportunities to purchase cooking equipment and soap that are necessary materials for proper FHFS behaviors.

5.3 Flip chart communication

Flip chart communication showed an association with a greater number of FHFS

behaviors in a multiple regression analysis. Despite the moderate coverage of flip chart communication (57.8%), this channel contributed toward changing FHFS behaviors.

However, when interpreting this result, it should be noted that the internal consistency of the FHFS score at the 2nd evaluation showed a slightly lower value. This variable was used as the outcome variable of the multiple regression and drew the results that showed an association with flip chart communication. The lower internal consistency of the FHFS score may affect the results to some extent as multiple regression analysis. However, the lowered trend of Cronbach's α value in each survey could be explained that the internal consistency became lower due to increased item variance in the 2nd evaluation. In this study, by the 2nd evaluation, of 17 measured FHFS behaviors, the practice rates of 11 FHFS behaviors significantly increased compared to baseline. The increased item variance of the Cronbach's α by the 2nd evaluation would suggest that the community-based programs in this study resulted the increased practice rates of FHFS behaviors.

In this study, WMU communicated with caregivers using flip charts through village gatherings and household visits. This finding is consistent with a study in Thailand that suggests interpersonal IEC plays an important role when the close relationship with others is strong in the community [87]. Moreover, interpersonal IEC allows for questions and answers, and deepens caregivers' understanding of the benefits of proper FHFS behaviors in accordance with their preparedness [87].

Studies suggest that home visits or community organizations affect changing health

related behaviors in India, Myanmar and Pakistan [42, 90, 91]. A study in the U.S. also indicates that interpersonal communication is associated with adaptation of health behaviors [92].

Demonstrated advantages notwithstanding, our study also indicates that careful consideration is needed to overcome the disadvantages of flip chart communication. Household visits entail continuous effort and manpower in areas where population density is low [42, 90]. This burden may be reduced if several households could be gathered in one place to conduct the flip chart communication. Additionally, the training of IEC providers may influence the effectiveness of this channel. This dimension can be improved by including role-play sessions in the training [87].

5.4 Reduction in childhood diarrhea

This study demonstrated that childhood diarrhea was significantly reduced during the programs of the first year and the reduced level was maintained during the self-sustaining IEC program. Twenty-one children who participated in three surveys showed similar reductions in the occurrence of childhood diarrhea. Referring to the results of Ngoc Truc Village, similar reduction trend of childhood diarrhea was observed from baseline to evaluation (20.1% at baseline to 3.1% at evaluation). Therefore, it is to conclude that childhood diarrhea reduction in the study site may result from other factors in addition to FHFS behavioral changes.

5.5 Limitations

These findings should be considered in the context of several study limitations. First, this study did not include objective measurements when the caregiver's FHFS behaviors were investigated. Self-reporting measurements may come with an overestimate of health outcomes and behaviors due to social desirability bias and recall bias [93]. Objective measurements such as direct observation and recording methods could conceivably have been combined to investigate the caregiver's FHFS behaviors to validate the caregiver's self-reporting. However, it was concluded that considerations such as the potential intrusiveness and inconvenience of such methods were more important, especially in a long-term community-based study [23]. Therefore, it relied solely on a follow-up focus group discussion to retrospectively analyze how the behavior change had occurred at both the individual and societal levels. In Vietnam, although a difference between knowledge and practice has been noted in a previous handwashing program [61], reliable and feasible data collection tools are not currently available. More research is thus needed to develop innovative tools to minimize bias in measuring FHFS behaviors [23].

Second, this study did not employ control village, which would have made the program's effects on the behavioral change clearer. However, the use of control village was not applied due to the following major limitations. Randomized controlled trial design was considered to be inappropriate. Since the IEC program was deployed to the whole community,

I was not able to allocate target and control individuals randomly within the same village. Cluster randomized controlled trial design may have been possible, but leakage of the IEC program's details to any control village would have been a concern due to long study period.

Third, this study did not apply factor analysis to confirm the interrelationship between 14 FHFS behaviors before combining these behaviors. Factor analysis would have made the logic behind combining food hygiene behaviors and food safety behaviors clearer. However, this study calculated Cronbach's α based on the dichotomous variables to confirm that all the items in a score measure the same concept at baseline.

6. Conclusions

This study demonstrated that, where mass media information sources are limited, and when access to safe water was ensured, and the mean coverage of IEC activities reached over 60%, the practice rates and the mean score of multiple FHFS behaviors increased and these increases were sustained. At the end of the self-sustaining IEC program, flip chart communication by a community group showed an association with a greater number of FHFS behaviors. This study indicates that flip chart communication can be sustainably used by community groups after external support has been terminated. For water and health programs in Vietnam and other similar developing countries, this study suggests inclusion of interpersonal communications such as the flip chart communication would support and benefit existing IEC activities.

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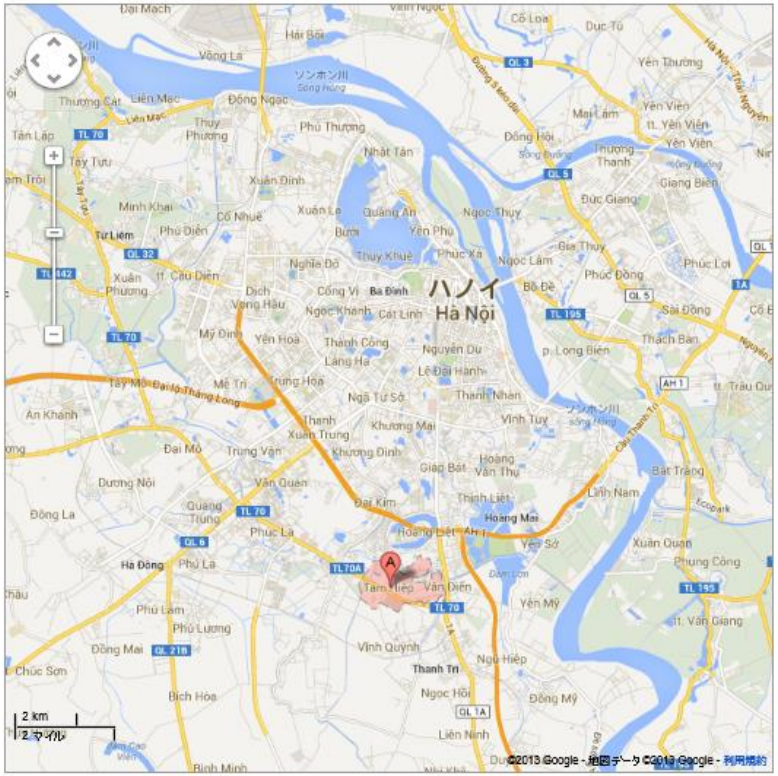
Appendix 1. Map of Vietnam and the location of Tam Hiep Commune

Map of Vietnam

Source: CIA World Factbook

The location of Tam Hiep Commune, Thanh Tri District, Hanoi



Source: Google map

Code: _____
Date of survey: / /
Name of interviewer:
_____

Appendix 2

Questionnaire

Province: Hanoi District: Thanh Tri Commune: Tam Hiep Village: Huynh Cung

I. General Information

1. Name of interviewee: _____

2. Year of birth: _____

3. Education:
   1. Can't read and write (no school education) 2. Only read and write (no school education)
   3. Primary school 4. Secondary school 5. High school
   6. Higher education 7. Don't know 8. No answer

4. Occupation:
   1. Farmer 2. Worker (in factory) 3. Housework 4. Teacher or administration
   5. Seller 7. Others, specify 8. Don't know 9. No answer

5. Name of the husband or leader of HH (who register the name to the WTF)

_____

6. Number of people in household: _____ *people*

7. Number of children < 5 years old: _____ *children*

8. Name of the child: _____

9. Sex: *1. Boy 2. Girl*

10. Date of birth: / / *1. Lunar calendar 2. Solar calendar*

11. Birth weight: _____ *g*

12. Order of the child:
    1. First 2. Second 3. Third 4.Fourth 7.Others, specify 9. No answer

13. Who takes care of the child most frequently? (over 12hr/day)
    1. Mother 2. Grandmother 3. Child's Sister or Brother
    4. House-maid 5. Father 7. Others, specify

14. What is the relationship interviewee and child?
    1. Mother 2. Grandmother 3. Child's Sister or Brother
    4. House-maid 5. Father 7. Others, specify

II. Nutrition and Health

15. Has he/she suffered from diarrhea in the past two weeks? (Watery stool more than 3 times per day)
    1. Yes 2. No 8. Don't remember 9. No answer
    If yes, go to Q18

16. If no, has he/she suffered from diarrhea in the past three months? (Watery stool more than 3 times per day)
    1. Yes 2. No 8. Don't remember 9. No answer
    If yes, go to Q18

17. If no, has he/she ever suffered from diarrhea before? (Watery stool more than 3 times per day)

1. Yes *2. No* *8. Don't remember* *9. No answer*

If no/don't remember/no answer go to Q19

18. When your child has diarrhea, how did you feed your child (Multiple-choice)?

1. Ordinary meal *2. Stop breastfeeding* *3. Increase frequency of breastfeeding*
4. Reduce vegetables *5. Avoid fat/Oil* *6. Increase meal* *7. Reduce meal*
8. Reduce amount of meal but increase frequency of meal
9. Increase fluid (water, juice or liquid of porridge)
10. Give fluids for the oral dehydration therapy *11. Do not give fish*
12. Others specify *13. Don't know* *14. No answer*

After answer, go to Q20

19. If your child has diarrhea, how will you feed your child (Multiple-choice)?

1. Ordinary meal *2. Stop breastfeeding* *3. Increase frequency of breastfeeding*
4. Reduce vegetables *5. Avoid fat/Oil* *6. Increase meal* *7. Reduce meal*
8. Reduce amount of meal but increase frequency of meal
9. Increase fluid (water, juice or liquid of porridge)
10. Give fluids for the oral dehydration therapy *11. Do not give fish*
12. Others specify *13. Don't know* *14. No answer*

III. Food hygiene and safety

20. If your child uses a toilet, are your child's hands washed after the toilet?

1. Always *2. Sometimes* *3. Never* *8.No answer*

If no/no answer, go to Q22

21. If yes, how are they often washed?

1. Only water *2. Water with soap* *3. Wet towel* *4. Water with salt*
5. Boiled water *7. Others, specify* *8. No answer*

22. Are your child's hands washed before eating?

1. Always *2.Sometimes* *3. Never* *8.No answer*

If no/no answer, go to Q24

23. If yes, how are they often washed?

1. Only water *2. Water with soap* *3. Wet towel* *4. Water with salt*
5. Boiled water *7. Others, specify* *8. No answer*

24. When do you wash your hands? (multiple choice)

1. Before eating *2. Before letting child eat* *3. After leaving toilet*
4. Before preparing food (cooking) *5. After handling garbage* *6. After cleaning the baby's bottom*
7. After handling raw food *8. When hands look dirty* *9. All above*
10. Others, specify *11. Don't remember* *12. No answer*

25. How do you often wash your hands? By:

1. Only water *2. Water with soap* *3. Wet towel* *4. Water with salt*
5. Boiled water *7. Others, specify* *8.No answer*

26. What kind of water do you mainly use for drinking?

1. WTF water *2. Rain water stored in containers* *3. Drilled well* *4. Dug well*
5. Pond, Lake, River, Canal *6. Purified bottled water* *7. Others, specify* *8. No answer*

27. What kind of water do you mainly use for cooking (soup, rice)?

1. WTF water *2. Rain water stored in containers* *3. Drilled well* *4. Dug well*
5. Pond, Lake, River, Canal *6. Purified bottled water* *7. Others, specify* *8. No answer*

28. What kind of water do you mainly use for food preparation (washing rice & vegetables)?
1. WTF water *2. Rain water stored in containers* *3. Drilled well* *4. Dug well*
5. Pond, Lake, River, Canal *6. Purified bottled water* *7. Others, specify* *8. No answer*

29. What kind of water do you mainly use for cloth washing & bathing?
1. WTF water *2. Rain water stored in containers* *3. Drilled well* *4. Dug well*
5. Pond, Lake, River, Canal *6. Purified bottled water* *7. Others, specify* *8. No answer*

30. Do you have a refrigerator? *1. Yes* *2. No* *9. No answer*

31. What is the main type of raw food storage you use for your child in summer?
1. Refrigerator *2. Screened/Enclosed cabinet* *3. On the table with cover*
4. On the table without cover *5. Cook immediately* *7. Others, specify*
8. Don't know *9. No answer*

32. How do you keep cooked food of your child in summer for less than 2 hours? (Multiple choice)
1. Refrigerator *2. With cover in room temperature*
3. Without cover in room temperature *4. Feed immediately after cooking*
7. Others, specify *8. Don't know* *9. No answer*

33. How do you keep cooked food of your child in summer for more than 2 hours? (Multiple choice)
1. Refrigerator *2. With cover in room temperature*
3. Without cover in room temperature *4. Feed immediately after cooking*
7. Others, specify *8. Don't know* *9. No answer*

34. Do you reheat leftover of whole family before eating?
1. Yes *2. No* *9. No answer*

35. How do you wash utensils (cup, bowl and spoon) of child? By:
1. Only water *2. Water with soap* *3. Boiled water*
4. All above (water with soap and then boiled water)
7. Others, specify *8.No answer*

36. Do you separate the utensils (cutting board & knife) for raw foods and cooked foods?
1. Yes *2. No* *9. No answer*

37. Where do you often prepare the food for cooking?
1. On table *2. On ground* *7. Others, specify* *8.Don't know* *9 No answer*

38. What is clean water? (Multiple choice)
1. No-turbidity *2. Colorless* *3. Smell-less* *4. Tasteless*
5. No toxic chemicals *6. Without pathogenic bacteria* *7. Others, specify*
8. Don't know *9. No answer*

39. Which can cause water pollution? (Multiple choice)
1. Latrine closing to water source *2. Close to breeding facility*
3. Close to cemetery *4. Broken pipe*
5. Drains *6. Penetration of pond's water*
7. Penetration of polluted river *8. Dirty bucket*
9. Dusty & dirty house's roof *10. Waste disposal from factories*
11. Chemical in Roof paints *12. Others, specify*
13. Don't know *14. No answer*

40. What kind of diseases you may suffer from if unhygienic water is used for drinking? (Multiple choice)

1. Diarrhea	*2. Worms*	*3. Eye sore*	*4. Skin disease*
5. Bird flu	*6. Female disease*	*7. Cancer*	*8. Others, specify*
9. Don't know	*10. No answer*		

41. What kind of diseases you may suffer from if unhygienic water is used for bathing & washing? (Multiple choice)

1. Diarrhea	*2. Worms*	*3. Eye sore*	*4. Skin disease*
5. Bird flu	*6. Female disease*	*7. Cancer*	*8. Others, specify*
9. Don't know	*10. No answer*		

42. What kind of diseases you may suffer from if you do not wash your hands before meal and after defecation? (Multiple choice)

1. Diarrhea	*2. Worms*	*3. Eye sore*	*4. Skin disease*
5. Bird flu	*6. Female disease*	*7. Cancer*	*8. Others, specify*
9. Don't know	*10. No answer*		

43. What are you doing to prevent your family from diseases due to usage of unhygienic water for drinking, cooking, washing & bathing? (Multiple choice)

1. Find another cleaner water	*2. Build or rebuild the filter*
3. Make the water tank capped	*4. Boil water*
5. Mix water with alum	*6.Locate breeding facilities far from water sources*
7. Others, specify	*8. Do nothing*
9. Don't know	*10. No answer*

44. Do you have any container for water storage?

1. Yes *2. No* *8. Don't know* *9. No answer*

If no/don't know/no answer, go to q47

45. If yes (Q44), do you keep fish in the container?

1. Yes *2. No* *8. Don't know* *9. No answer*

If no/don't know/no answer, go to q47

46. If yes, why do you keep fish? (Open answer)

_____

_____

IV. Water and Health

A. Water quantity

47. Do you have enough water for drinking & cooking during the year?

1. Yes *2. No* *8. Don't know* *9. No answer*

If yes/don't know/no answer, go to Q49

48. If not, how many months per year did you lack of drinking & cooking water? ____ months

49. Do you have enough water for bathing & washing during the year?

1. Yes *2. No* *8. Don't know* *9. No answer*

If yes/don't know/no answer, go to Q51

50. If not, how many months per year did you lack of bathing & washing water? ___ months

51. Do you receive water from WTF?

1. Yes *2. No* *8. Don't know* *9. No answer*

If yes, go to Q52 & Q53. If no, go to Q54 If don't know/No answer, go to Q55

52. If yes, how much m3 of water do you receive from WTF every month? _____ m3/ month

53. For the water from WTF, with how many people do you share it in your family? _____ *people*
(After answer, go to Q55)

54. If no for Q51 or if you do not receive water from WTF, please state one most important reason.
1. Because my house is far from WTF, I can not receive the water.
2. Because water from WTF is not clean, I can receive it, but I refuse to receive it.
3. Because I receive only a little amount of water from WTF, and I have to share the water with many people, I refuse to receive it.
4. Because I do not have enough money, I can't receive the water.
7. Others, specify……..
8. Don't know
9. No answer

B. Water quality

55. Which water source is cleaner than others?
(Rank the following sources: Drilled well, WTF, Dug well, and Rain water)
1. 2. 3. 4.

56. Do you have a sand filtration system in your house?
1. Yes *2. No* *8. Don't know* *9. No answer*
If no/don't know/no answer, go to Q60

57. If yes, how often do you wash the sand filtration system?
1. Once a week *2. Once or twice per month* *3. Once per 3 months*
4. Once per 6 months *5. Once per 12 months* *7. Others, specify*
8. Don't know *9. No answer*

58. If yes, which source do you use at the sand filtration system?(Multiple choice)
1. WTF water *2. Drilled well* *3. Private dug well* *4. Rain water*
7. Other specify *8. Don't know* *9. No answer*

59. If yes, for what purpose do you use the filtered water? (Multiple choice)
1. Drinking *2. Cooking* *3. Preparing food* *4. Washing and bathing*
7. Others specify *8. Don't know* *9. No answer*

60. Do you have a private ceramic filtration system?
1. Yes *2. No* *8. Don't know* *9. No answer*
If no/don't know/no answer, go to Q64

61. If yes, how often do you wash the ceramic filtration system?
1. Once a week *2. Once or twice per month* *3. Once per 3 months*
4. Once per 6 months *5. Once per 12 months* *7. Others, specify*
8. Don't know *9. No answer*

62. If yes, which source do you use at the ceramic filtration system? (Multiple choice)
1. WTF water *2. Drilled well water* *3. Dug well water* *4. Rain water*
7. Others, specify *8. Don't know* *9. No answer*

63. If yes, for what purpose do you use the filtered water? (Multiple choice)
1. Drinking *2. Cooking* *3. Preparing food* *4. Washing and bathing*
7. Others specify *8. Don't know* *9. No answer*

64. How do you store boiled water for drinking purposes? (Multiple choice)
1. Thermos bottle *2. Un-thermos bottle* *3. Bowl without cover* *7. Other, specify*
8. Don't know *9. No answer*

65. How often do you wash the utensils you use to store water for drinking (after boiling)?

1. Every day *2. Every 2-3 days* *3. Every 4-6 days* *4. Once a week*
5. One to two times per month *6. Never wash* *7. Others, specify*
8. Don't know *9. No answer*

66. How do you store water for cooking?

1. Water is taken directly from tap *2. Stored in stainless steel container*
3. Stored in capped concrete tank *4. Stored in container under ground*
5. Stored in plastic bucket, pot with cover *7. Others, specify*
8. Don't know *9. No answer*

67. How often do you wash the containers you use to store water for cooking?

1. Once a week *2. Once or twice per month* *3. Once per 3 months* *4. Once per 6 months*
5. Once per 12 months *7. Others, specify* *8. Don't know* *9. No answer*

68. Do you check water quality?

1. Yes *2. No* *8. Don't know* *9. No answer*
If no/don't know/no answer, go to Q70

69. If yes, how do you check water quality? (Multiple choice)

1. Outlook (Turbidity, Color) *2. Taste* *3. Smell* *4. Tea*
7. Others, specify *8. Don't know* *9. No answer*

70. Do you accept chlorine smell in piped water?

1. Yes *2. No* *8. Don't know about chlorine smell* *9. No answer*

C. Water management

71. Are you satisfied with current activities of the water management union?

1. Yes *2. No* *8. Don't know* *9. No answer*
If yes, go to q72 If no, go to Q73 If don't know/no answer, go to Q74

72. If yes, why? (Open answer)

_____

_____

73. If no, why? (Open answer)

_____

_____

74. After WTF renovation, are you satisfied with buying water from it?

1. Yes *2. No* *8. Don't know* *9. No answer*

75. Do you pay for monthly water bill in time?

1. Yes *2. No* *8. Don't know* *9. No answer*
If yes/don't know/no answer, go to Q77

76. If No, please state reasons?

1. Lack of money *2. Not familiar with this water* *7. Others, specify*
8. Don't know *9. No answer*

77. When you detect a leakage or break in the network, you will:

1. Ignore *2. Fill up the break/ leakage by soil* *3. Inform WTP staff*
4. Inform local authority *7. Other specify*
8. Don't know *9. No answer*

78. Has any health staff (including collaborators) come to your house to inspect domestic water and during the last one year?

1. Yes *2. No* *8. Don't know* *9. No answer*

If no/don't know/no answer, go to Q80

79. If yes, how many times?

1. No. of times:_____ times *99. Don't remember*

80. Is there anything that you can do for improving water management in the hamlet? (Open answer)

_____

_____

81. Please describe the differences of WMU before and after the renovation. (Open answer)

_____

_____

D. IEC activity

82. Have you ever received any information about safe water, safe food and nutrition from mass media during the last one year?

1. Yes *2. No* *8. Don't know* *9. No answer*

If no/don't know/no answer, go to Q84

83. If yes, how did you get the information? (Multiple choice)

1. Television *2. Radio* *3. Newspaper* *7. Others, specify*
8. Don't know *9. No answer*

84. Have you attended workshops about safe water?

1. Yes *2. No* *8. Don't know* *9. No answer*

85. Have you attended workshops about safe food and nutrition?

1. Yes *2. No* *8. Don't know* *9. No answer*

86. Have you read newsletters from project SWAN?

1. Yes *2. No* *8. Don't know* *9. No answer*

87. Have you heard information about safe water by loudspeaker?

1. Yes *2. No* *8. Don't know* *9. No answer*

88. Have you heard information about safe food and nutrition by loudspeaker?

1. Yes *2. No* *8. Don't know* *9. No answer*

89. Have you seen information on the bulletin board?

1. Yes *2. No* *8. Don't know* *9. No answer*

90. Have you seen children's drawing at cultural center?

1. Yes *2. No* *8. Don't know* *9. No answer*

91. Have you heard about poem contest for safe water?

1. Yes *2. No* *8. Don't know* *9. No answer*

92. Have you received information about water treatment system and clean water & environment by flip chart communication through collaborator and/or WMU?

1. Yes *2. No* *8. Don't know* *9. No answer*

93. Have you received information about safe food and nutrition by flip chart communication through collaborator and/or WMU?

1. Yes 2. No 8. Don't know 9. No answer

94. Among these following communication ways, which were useful for getting safe water and nutrition related information? List the best 3 items.

1. Television 2. Radio 3. Newspaper 4.Public loud-speaker
5. Meetings in commune 6. Newsletter from project 7. Leaflet/ Banner/ Slogan
8. Information box 9. Others, specify 10. No answer
11. Poster through collaborator and/or WMU 12. Workshops from project
1._____ 2._____ 3._____

95. Have you done anything to improve WMU in the village? (Multiple choice based on the answer in the 1st evaluation)

1. Save water 2. Offer WMU suggestions for a better management 3. Follow regulation/payment on time
4. Remind others to save water, protect water resources and environment 5. Environmental sanitation activities
6. Join meetings and trainings 7. Check water quality/inform WMU about water quality 8. Others, specify
9. Don't know 10. No answer

96. Have you done anything to improve food safety & hygiene behavior at household? (Open answer)

_____

_____

97. Did you attend the first survey in Jan 2006?

1. Yes 2. No 8. Don't remember 9. No answer

98. Did you attend the second survey in Jan 2007?

1. Yes 2. No 8. Don't remember 9. No answer

Appendix 2

Code: _____
Date of survey: / /
Name of interviewer:
_____

Questionnaire for Anthropometry and Clinical Examination

Province: Hanoi District: Thanh Tri Commune: Tam Hiep Village: Huynh Cung

1. Name of caregivers: _____
2. Name of child: _____
3. Date of birth: ___/___/____ 1. Solar calendar 2. Lunar calendar
4. Sex: 1. Boy 2. Girl
5. Weight of child: _____ *kg*
6. Height of child: _____ *cm*

Clinical examination:

7. Diarrhea:

   1. Yes *2. No*

8. Bronchitis:

   1. Yes *2. No*

9. Pneumonia:

   1. Yes *2. No*

10. Others diseases:

_____

_____

様式第２号

倫　理　委　員　会
審　査　結　果　報　告　書

平成１８年１月３０日

申請者　神馬征峰　殿

大学院医学系研究科・医学部
倫理委員会
委員長　赤林　朗　印

受付番号　１３２９

研究課題　ベトナムにおける安全な水の供給及び健康教育・栄養教育の評価研究

研究者　若井晋、神馬征峰、高梨久美子、長南祐子

上記研究計画を平成１８年１月３０日の委員会で審査し下記のとおり判定しました。
ここに通知致します。

判　定 ○承認する。　　承認しない。 条件付きで承認する。　　該当しない。 変更を勧告する。
条件あるいは変更勧告の理由（細則第３条第２項）

BỘ Y TẾ **VIỆN DINH DƯỠNG** **Số:** 50 **/ VDD-QLKH** **V/v:** ***Chấp thuận các vấn đề YĐức NCYSH của đề tài:*** ***" Điều tra đánh giá tình hình nước sạch, vệ sinh môi trường và tình trạng dinh dưỡng trẻ em từ 6 tháng đến 60 tháng tuổi tại 3 xã nông thôn Việt Nam"***	**CỘNG HÒA XÃ HỘI CHỦ NGHĨA VIỆT NAM** ***Độc lập – Tự do – Hạnh phúc*** *Hà nội, ngày 9 tháng 2 năm 2006*

- Căn cứ Quyết định số: 230/QĐ-QLKH ngày 19 tháng 8 năm 2005 của Viện trưởng Viện Dinh dưỡng về việc thành lập Hội đồng Đạo đức trong nghiên cứu Y sinh học (ĐĐNCYSH) xét duyệt các vấn đề Đạo đức trong nghiên cứu Y sinh học của các đề tài/dự án.
- Trên cơ sở biên bản họp Hội đồng ngày 11 tháng 1 năm 2006 (có biên bản kèm theo) Hội đồng đạo đức trong nghiên cứu Y sinh học Viện Dinh dưỡng chấp thuận về các khía cạnh đạo đức trong nghiên cứu đối với đề tài:

" Điều tra đánh giá tình hình nước sạch, vệ sinh môi trường và tình trạng dinh dưỡng trẻ em từ 6 tháng đến 60 tháng tuổi tại 3 xã nông thôn Việt Nam"

- Chủ nhiệm đề tài: **Ths. Đào Tố Quyên**
- Đơn vị chủ trì: Khoa Hoá - Vệ sinh thực phẩm
- Đơn vị chủ quản: Viện Dinh Dưỡng
- Địa điểm triển khai nghiên cứu: **Tại 3 xã nông thôn Việt Nam**:

Xã Tam Hiệp - Huyện Thanh Trì Hà nội; xã Đại Mỗ - Huyện từ Liêm - Hà nội và xã Quang Trung - Huyện Vụ Bản. Nam Định.

- Thời gian nghiên cứu: 36 tháng (từ tháng 9/ 2005 đến tháng 9/2008)

Ngày chấp thuận: 11 tháng 1 năm 2006

CƠ QUAN CHỦ QUẢN	**Chủ tịch Hội đồng**	**Thư ký Hội đồng**
(Ký tên và đóng dấu)	(Ký - Ghi rõ họ tên)	(Ký - Ghi rõ họ tên)
KT. VIỆN TRƯỞNG PHÓ VIỆN TRƯỞNG VIỆN DINH DƯỠNG		
PGS. TS. Nguyễn Thị Lâm	*TS. Phạm Văn Hoan*	*ThS. Phùng Thị Liên*

Socialist Republic Vietnam
Independence – Freedom - Happiness

Ministry of Health
National Institute of Nutrition
No. 50 / VDD-QLKH

Hanoi, February 9th, 2006

About: the approval to Ethical issues of Project::

Participatory Approach for Contribution to Improvement of Safe water, Nutrition and Health Environment in three Rural Communes in Vietnam

- The head of the project: Dr Dao To Quyen
- Organization in charge: National Institute of Nutrition
- Location of researching: In three rural communes in Vietnam
  - Tam Hiep Commune – Thanh Tri District – Ha Noi Province
  - Dai Mo Commune – Tu Liem District – Ha Noi Province
  - Quang Trung Commune – Vu Ban District – Nam Dinh Province
- Time of researching: 36 months (from Sept – 2005 to Sept – 2008)

Approved date: January 11th, 2006

Organization in charge	Chairman of Council	Secretary of Council
(signature)	(signature)	(signature)

Form of consent to participate in the survey

Name of the survey: Survey on the impact of safe water supply, nutrition education in three rural communes in Vietnam

Main researcher: Prof. Masamine Jimba - University of Tokyo
Dr. Dao To Quyen – National Institute of Nutrition.

* *

We would like to evaluate the study on improvement of safe water, nutrition and health environment in some rural communes in Vietnam. Following are study's objectives:

1. To collect baseline data on water supply, health/nutrition status in 3 rural communes using printed questionnaire and clinical examination of children under five.
2. To identify appropriate measure to improve water supply, health and nutrition status in 3 rural communes in the project area.
3. To apply selected approaches to improve water supply, water management and health nutrition status in 3 rural communes in the project area.
4. To evaluate the approach after 1, 2, and 3 years.

If you and your children under five want to participate in this survey, we shall interview you. During the interview, we shall give you questions on your knowledge, attitude, and practices on nutrition, food safety, safe water and environment sanitation. We shall also assess the health and nutrition of your child by examining their health status. The information you provide us will help us to improve water supply, improve health, nutrition status, and environment of the commune.

In order to keep secret, the remarks on health, nutrition status of your children and your provided information will not have written name. The information will be erased at the completion of the survey.

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If you think that you understand well the above commitment and are willing to participate in the survey, please sign in the enclosed paper.

For more information, please contact:

Dr. Dao to Quyen
National Institute of Nutrition
Tel: 04- 8211413

Form of consent to participate in the survey

Name of the survey: Survey on the impact of safe water supply, nutrition education in three rural communes in Vietnam

Main researcher: Prof. Masamine Jimba University of Tokyo
Dr. Dao To Quyen – National Institute of Nutrition.

* *

My name is ..... After reading carefully and given explanation on the content of the study, I understand how I can participate in the study, I agree to involve in the study.

I understand:

1. Objectives and procedure of the study.
2. I myself and my child will not be put in disadvantage situation/ or worried
3. I and my child can withdraw from the study at any time without showing any reasons.
4. The information I and my child provide will be recorded without written name. The information will be erased at the completion of the survey.

Signature / name of child (.....)
Signature / name of caregivers (.....)
Date.....
Address :.....
.....
.....

I, researcher certify that I have explained to the mother on content, procedure of the study following the content of the enclosed paper. I have referred to all items of the form of consent to participate in the survey

Signature/ name.....
Date.....

Table 1. Socio-demographic characteristics (Ngoc Truc Village)

	Baseline (n=149)		Evaluation (n=131)		
	n	(%)	n	(%)	P value[*1]
Caregivers type					**P<0.001**
Other	19	(12.8)	0	(0)	
Mother	130	(87.2)	131	(100)	
Age (years)					**0.018**
29 or younger	82	(55.0)	68	(51.9)	
30-34	20	(13.4)	34	(26.0)	
35 or older	47	(31.5)	29	(22.1)	
Occupation					0.690
Farmer	63	(42.3)	56	(42.7)	
Factory worker	15	(10.1)	7	(5.3)	
Housework / retired	22	(14.8)	21	(16.0)	
Civil servant / company employee	13	(8.7)	12	(9.2)	
Home-based business[*2]	36	(24.2)	35	(26.7)	
Education					0.307
Secondary school or less[*3]	92	(61.7)	73	(55.7)	
High school or more[*4]	57	(38.3)	58	(44.3)	
Number of people in household					0.113
4 or fewer	61	(40.9)	66	(50.4)	
5 or more	88	(59.1)	65	(49.6)	
Refrigerator possession					**P<0.001**
No	56	(37.6)	18	(13.7)	
Yes	93	(62.4)	113	(86.3)	
Boil water for drinking					
Yes			-	-	
Sometimes			-	-	
Type of latrine					**0.016**
No / unhygienic latrine	5	(3.4)	2	(1.5)	
Other type of hygienic latrines[*5]	19	(12.8)	5	(3.8)	
Water-flush latrine	125	(83.9)	124	(94.7)	

*1: Chi-square test; Fisher's exact test
*2: Those with a home-based business include seller, hairdressers, tailors, etc.
*3: *Secondary school or less* includes not being able to read and write, only being able to read and write, primary school attendance only, and up to secondary school attendance only.
*4: *High school or more* includes high school and higher education.
*5: *Other type of hygienic latrines* includes single-vault latrines, double-vault latrines, septic tanks, and biogas-vault latrines (MOH 2005).

Table 1 (continued). Socio-demographic characteristics (Ngoc Truc Village)

	Baseline (n=149)		Evaluation (n=131)		
	n	(%)	n	(%)	P value[*1]
Number of children under five years					0.106
1	102	(68.5)	101	(77.1)	
2 or more	47	(31.5)	30	(22.9)	
Birth order of child					0.325
Second or higher	80	(53.7)	78	(59.5)	
First	69	(46.3)	53	(40.5)	
Child's age (months)					**P<0.001**
6-11	36	(24.2)	0	(0)	
12-23	42	(28.2)	22	(16.8)	
24-35	30	(20.1)	31	(23.7)	
36-47	17	(11.4)	37	(28.2)	
48-59	24	(16.1)	41	(31.3)	
Child's sex					0.941
Male	78	(52.3)	68	(51.9)	
Female	71	(47.7)	63	(48.1)	

*1: Chi-square test; Fisher's exact test

Table 2. Water use details (Ngoc Truc Village)

	Baseline (n=149)		Evaluation (n=131)		
	n	(%)	n	(%)	P value[*1]
WTF water access level					0.366
Basic - Intermediate (0-59L/c/d)	18	(14.1)	11	(10.2)	
Optimal (More than 60L/c/d)	110	(85.9)	97	(89.8)	
Main drinking water source					0.738
Other water sources[*2]	4	(2.7)	5	(3.8)	
WTF water or Purified bottled water	145	(97.3)	126	(96.2)	
Main cooking water source					1.000
Other water sources[*2]	5	(3.4)	4	(3.1)	
WTF water	144	(96.6)	127	(96.9)	
Main food preparation water source					0.447
Other water sources[*3]	10	(6.7)	12	(9.2)	
WTF water or Purified bottled water	139	(93.3)	119	(90.8)	
Main laundry and bathing water source					**0.031**
Other water sources[*3]	15	(10.1)	25	(19.1)	
WTF water	134	(89.9)	106	(80.9)	

*1: Chi-square test; Fisher's exact test
*2: Rain water or drilled well
*3: Rain water, drilled well or dug well

Table 3. Coverage of mass media channels (Ngoc Truc Village)

	Baseline (n=149)		Evaluation (n=131)		
	n	(%)	n	(%)	P value[*1]
Mass media channels					
Television	100	(67.1)	98	(74.8)	0.158
Radio	19	(12.8)	25	(19.1)	0.146
Newspaper	16	(10.7)	20	(15.3)	0.259
Mean		(30.2)		(36.4)	

*1: Chi-square test; Fisher's exact test

Table 4. Diarrhea prevalence among children under five (Ngoc Truc Village)

	Baseline		Evaluation		P value[*1]
	n/N	(%)	n/N	(%)	
Diarrhea prevalence in the past two weeks					
Under 5 years	30/149	(20.1)	4/131	(3.1)	**P<0.001**
Stratified by month category					
6-11 months	12/36	(33.3)	---	---	
12-23 months	13/42	(31.0)	2/22	(9.1)	
24-35 months	1/30	(3.3)	2/31	(6.5)	
36-47 months	2/17	(11.8)	0/37	(0)	
48-59 months	2/24	(8.3)	0/41	(0)	

*1: Fisher's exact test

Table 5. Changes of the practice rates of FHFS behaviors (Ngoc Truc Village)

Baseline		Evaluation		Baseline to evaluation	
n/N	(%)	n/N	(%)	Absolute change %	P value[*1]
Caregivers' food hygiene behaviors					
Before eating					
76/149	(51.0)	75/131	(57.3)	6.3	0.296
Before feeding					
67/149	(45.0)	49/131	(37.4)	-7.6	0.200
Before food preparation					
63/149	(42.3)	44/131	(33.6)	-8.7	0.135
After handling raw food					
51/149	(34.2)	23/131	(17.6)	16.6	**0.002**
Handwashing with soap at sanitation-related points					
After using the toilet					
88/149	(59.1)	78/131	(59.5)	0.4	0.935
After cleaning child's bottom					
57/149	(38.3)	39/131	(29.8)	-8.5	0.136
After handling garbage					
60/149	(40.3)	25/131	(19.1)	-21.2	**P<0.001**
When hands look dirty					
65/149	(43.6)	32/131	(24.4)	-19.2	**0.001**

Table 5 (continued). Changes of the practice rates of FHFS behaviors (Ngoc Truc Village)

Baseline		Evaluation		Baseline to evaluation	
n/N	(%)	n/N	(%)	Absolute change %	P value[*1]
Children's food hygiene behaviors					
Handwashing with soap before eating					
30/112	(26.8)	63/127	(49.6)	22.8	**P<0.001**
Handwashing with soap after toilet use					
38/101	(37.6)	89/130	(68.5)	30.9	**P<0.001**
Mean	(41.8)		(39.7)		

Table 5 (continued). Changes of the practice rates of FHFS behaviors (Ngoc Truc Village)

Baseline		Evaluation		Baseline to evaluation	
n/N	(%)	n/N	(%)	Absolute change %	P value[*1]
Caregivers' food safety behaviors					
Cross-contamination					
Using separate utensils (cutting board and knife) for raw food and cooked food					
86/114	(75.4)	121/131	(92.4)	17.0	**P<0.001**
Washing child's utensils (cup, bowl and spoon) with soap					
10/115	(95.7)	123/131	(93.9)	-1.8	0.538
Food preparation on tables					
92/149	(61.7)	95/131	(72.5)	10.8	0.056
Food at safe temperature					
Proper cooked food storage behavior (food for child in summer, more than 2 hours)					
129/149	(86.6)	118/130	(90.8)	4.2	0.273
Proper cooked food storage behavior (food for child in summer, less than 2 hours)					
148/148	(100)	129/131	(98.5)	-1.5	0.220
Proper raw food storage behavior (food for child in summer)					
141/146	(96.6)	127/127	(100)	3.4	0.063
Adequate cooking					
Reheat leftovers of whole family before eating (food for whole family)					
75/75	(100)	122/123	(99.2)	-0.8	0.434
Mean	(88.0)		(92.5)		

*1: Chi-square test; Fisher's exact test

Table 6. Changes of the FHFS scores (Ngoc Truc Village)

Baseline		Evaluation		
n/N	Mean (SD)	n/N	Mean (SD)	P value[*1]
99/149	7.62 (3.8)	126/131	7.44 (3.1)	0.716

Cronbach alpha of 14 items: 0.851 at the baseline and 0.792 at the evaluation

*1: Student's t-test **(**Independent samples)