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# Community Diagnosis for Development of Health Digital Technologies

Amarin Tawata

Faculty of Management Science, Silpakorn University, Thailand

## Abstract

Community diagnosis was applied as an early stage of innovation management to find relevant digital technologies of health solutions at Mae Ka Sa district, Thailand. It included descriptive and analytical levels. The descriptive level derives from document analysis, interviews, and observation in the community. The analytical level implies to analyze data and get community involvement for proposing solutions. As for the findings, community diagnosis provided information about health and health service problems in the community, including consuming rain without considering the risk of contamination; lonely elders at risk of sudden illness, forgetting prescriptions and medical appointments; and receiving patients' unclear information for health diagnosis. These led to proposed ideas for digital technology development for health solutions in the community including    measuring rain quality, detecting abnormal motion of elders, sending message alerts from elders, reminding patients to follow medical orders, and recording patients' symptoms.

Keywords: Innovation Management, Community Health, Community Diagnosis, Digital Technology

## Introduction

The Thai Network Information Center Foundation (THNIC) has an objective to enhance positive digital technology use in Thai society.  It has set up a project utilizing the Thailand Networking Group (THNG) since 2010. The project aims to find volunteers of college students for digital technology production and implementation in rural Thai communities.  In 2017, the THNIC set up a project for the THNG that concerned with producing digital technology solution for community health in Mae Ka Sa district, Amphoe Mae Sod, Tak province, Thailand.  As part of the project, the THNG planned to identify the community health requirements. Then it sought to develop digital technology solutions for community health. This involved applying innovation management for the community. From a study by Engel et al. (2015), a set of innovation management refers to finding innovation requirements. This is early stage of innovation management.

The health requirements of a community can be reflected by community diagnosis as a health situational evaluation of the community. Based on a study by Hafez et al., 2012, community diagnosis is identified as determining health and health service problems. Also, it is conducted to find the causes of health problems in a community. It can show individual or groups at health risk in a community. As a result, it can lead to relevant solutions in a community.

Community diagnosis is an initial stage for planning and implementing health programs and solutions (Steckler *et al.*, 1993; Williams, Chung and Muennig, 2017). Particularly, it delivers details of the health situation of a community to health planners. The details can include culture, leadership structure, communication, patterns of assitance, important community institutions, history, health problems and causes of health problems. Then health planners can design and implement health programs and solutions in a community.

In the overall picture, Haglund (1988) proposed that community diagnosis can be divided into three levels: the descriptive level, the analytical level, and action level. The descriptive level means identifying facts in a community that may consist of a community profile, a health risk profile, a health profile, and a health service profile. The analytical level refers to analyze requirements and capabilities of a community by focusing on community involvement. The action level involves setting up people to work and take responsibility in health program in a community.

Community diagnosis requires community involvement to achieve implementation of a health program in a community (Nichter, 1984). It includes researchers' processes such as questioning, listening, sharing knowledge, and participating in activities in a community. These are examples of community involvement. As another perspective of community involvement, a researcher should lead people in a community to share information, answer questions and participate in health action programs. These are examples of community participation that can occur in processes of community diagnosis. The study by Macqueen et al. (2001) identifies factors such as social ties, sharing common perspectives and engaging in joint action in geographical locations or settings that have an influence on community participation.

With this study, community diagnosis is identified as a process to find health and health service problems and requirements of digital technologies to solve health and health service problems. The study presents two levels of community diagnosis consisting of descriptive

level and analytical level. A process of descriptive level concerns collecting data of health and health service problems and their causes in the community. A process of analytical level refers to identify health and health service problems and design digital technology solutions with consideration of community involvement.

## Methods

The THNIC announced it was seeking 28 volunteers from Thai universities in various fields involving digital technology such as computer sciences, computer engineering, information technology engineering, and social sciences such as business management, community development, and social work. There were 19 volunteers from the fields of digital technology and 9 volunteers from the field of social sciences participating in this project. The volunteers were trained about community diagnosis and divided into five groups to collect data in five villages within Mae Ka Sa district, Amphoe Mae Sod, Tak province. These five villages are in charge of the district health promotion hospital. There were three groups had six students and two groups had five students. Each group consisted of students from fields involving digital technology and social sciences.

As for the descriptive level, the volunteers collected data about the context of Mae Ka Sa district by adopting methodological triangulation. The methodological triangulation included reviewing documents, interviewing key informants and observing community health. They searched information about the community context from the Mae Ka Sa website and the district health promotion hospital. They interviewed a public health officer, village health volunteers, and village headmen. They also observed community activities.

With respect to the analytical level, a focus group was established with the five groups for content analysis. This led to identify health and health service problems and propose digital technology development for the community. Each group presented their findings, identified health and health service problems and proposed ideas for the use of digital technology for health solutions to other groups. It received comments about limitations and possible development of digital technologies from the other groups. Then, it adjusted the ideas and presented new ideas based on the comments. Later, each group developed a sample (mockup) digital technology and presented the advantages and processes of the digital technology to the community. This concerned community involvement. Each group received comments from the community and then developed relevant a sample (mockup) digital technologies for the community.

## Results

### *Descriptive level*

### *Reviewing documents*

The five villages of Mae Ka Sa district have a population of 3,751 with 48.47 percentages of male and 51.53 percentages of female. There are 17.15 percentages of elderly people (60 years old and over), 61.57 percentages of working age people (age between 20-59 years) and 21.28 percentages of children and youth (19 years old and under). There are 1.83 percentages of disabled people, and 0.45 percentages of bed patients. There is one district health promotion hospital. In 2017, the top two chronic diseases were high blood pressure with 393 patients and diabetes with 134 patients. The majority of epidemic disease patients who were serviced from the district health promotion hospital were suffering from diarrhea since 2015 to 2017. The number of patients in the top four categories during 2015-2017 are shown in Table 1.

**Table 1:** The top four patient categories from records obtained from the district health promotion hospital

| No. | 2015 | | 2016 | | 2017 | |
|-----|------|--|------|--|------|--|
| | Diseases | No. of patients | Diseases | No. of patients | Diseases | No. of patients |
| 1 | Diarrhea | 72 | Diarrhea | 66 | Diarrhea | 74 |
| 2 | DHF | 17 | Conjunctivitis | 8 | Conjunctivitis | 35 |
| 3 | Conjunctivitis | 2 | Shigellosis | 5 | Food poisoning | 24 |
| 4 | Shigellosis | 1 | DHF | 1 | DHF | 11 |

### *Interviewing key informants*

Most of the working age people work in urban areas and do not live in the district. Some of the working age people do agriculture in the district. They go to their farms in the daytime. Most of the agricultural areas within the district are involved in chemical agriculture. Elderly persons and disabled persons stay in their houses in the daytime. On weekends, the elders stays with their grandchildren. In the daytime, the elders sometimes are involved in accidents or have emergency illnesses, but no youth stays in their houses to help them. Without timely assistance, their accidents and emergency illnesses may result in serious health problems like becoming disabled people, or even death.

Some patients in the community forget to take medicines in a scheduled time or may forget appointments with doctors or health public officers. In fact, some patients have lost their doctor appointments. This leads to discontinuous medical treatment that may result in drug-resistance and incurable health problems. The public health officers and the village health volunteers do not have enough time to follow all patients.

Proper health diagnosis from doctors and public health officers has an obstacle about receiving unclear information from patients. Patients (particularly elderly patients) do not give enough details about their symptoms because they forget their symptoms or miscommunicate them. Therefore, doctors or public health officers cannot correctly diagnose them.

People in the community like to use water gathered from the rain. They have used rainwater for drinking, cooking, and washing for a long time. Almost every house has water jars for collecting rain. However, the rain may not be the same purity as in the past due to the use of chemicals for doing agriculture. Moreover, being within a special economic zone of Thailand, the increased development of Amphoe Mae Sod and transportation practices may contribute to the contamination of the air.

*Observing community health*

Most people who stay at houses in the community are elderly and disabled. Elders in the community have joined together on some occasions; especially, they go to the senior school of the community every week. They are well-acquainted with each other. They can help each other as much as possible, when the youth looking after them are not in their houses. They do have smart phones. Most of them can use the application 'Line' (an online social media application). In the community, there is access to the Internet signal via a private network. A market area and a community hall area have public networks.

Many houses in the community have water jars to collect rain. The water jars have no water filtration system. The district health promotion hospital has a community campaign concerning the need for the community to consume only filtered water. There are a few filtered water vending machines in the community.

*Analytical level*

As an epidemic disease, diarrhea was the most widespread disease in the community from 2015 to 2017. A cause of diarrhea relates to consuming contaminated food and water. With finding of the study, people in the community like to consume rainwater. The water may be contaminated with toxins and dust from agrochemicals, the production processes of

factories and vehicles. Therefore, a group of the THNG decided to develop a digital technology solution to measure rain quality and record it as a rain statistic. The information gathered includes pH, turbidity, conductivity, dissolved oxygen, oxidation-reduction potential and cleaning sensors. It also has a rain meter. The sensors and meter can send data to a server, then a server sends data to an application on smart phones. This enables the community to know about rainwater quality.

Most elders of the community stay alone in the daytime. They are taking risks about sudden illnesses and may have accidents without timely assistance. Some elders who have high blood pressure and diabetes have more risks of sudden illness and accidents. Elders' sudden illness and accidents without timely assistance may result in them becoming disabled or even dying. Therefore, two groups of the THNG proposed digital technology solutions for elders. First, a group adopted a smart wristband and an accelerator sensor that can detect abnormal motion of elders. The smart wristband and the accelerator can send a signal about abnormal motion and location to an application on relatives' smart phones. Then, the relatives can proceed to help their elders. Second, the other group presented a wristband with a toggle switch and GPS sensor. When the elders have health problems, they can send message alerts to their relatives' and village health volunteers' smart phones by turning on the toggle switch. The message alert includes the present location of the elders.

One of the health service problems in the community is that patients do not follow medical prescriptions and medical appointments due to patients' being forgetful. Therefore, public health officers and village health volunteers require a solution that can alert patients. Therefore, a group of the THNG planned to develop a solution for alerting patients. The solution can remind patients about taking their medicine. This leads to continuous treatment and an eventual cure. The public health officers or doctors are able to key in data about the time to take medicine, as well as appointment times, to their computer servers. The servers can send messages to patients' mobile phones.

Health diagnosis by doctors and public health officers requires information from patients. However, patients may not give enough or clear information. They may forget their symptoms. Therefore, a group of the THNG proposed an application on a smart phone that can record patients' symptoms. The application consists of a calendar, timing, lists of symptoms and identifying symptoms. The application users may be patients and their relatives that can record data into the application on smart phones. This can help doctors and public health officers in their health diagnosis duties.

## Discussion

Community diagnosis is a process of community health analysis. It presents the health and health service situation of a community (Hafez et al., 2012), especially the health and health service problems and their causes. Furthermore, its information can lead to identity a health program that concerns health development in a community (Steckler *et al*., 1993; Williams et al.,, 2017). Its process requires community involvement for an actionable and relevant program (Nichter, 1984).

With this study, community diagnosis was applied to develop health digital technologies for a community. It was referred to as an early stage of innovation management as analyzing a community to find relevant technology (Engel et al., 2015). The study followed levels of community diagnosis (Haglund, 1988). It began with the descriptive level. The descriptive level leads to innovators' understanding of community health problems. In the analytical level, innovators can identify community needs and opportunities for digital technology development.

The results presented health and health service problems in the community. They included consuming rain that may be contaminated; lonely elders at risk of accidents and sudden illnesses without timely assitance, forgetting to take medicines and medical appointments; and unclear information from patients for health diagnosis. These problems led to innovators proposing digital technologies for health solutions in the community. The digital technologies included a rain quality gaguge, a smart wristband for detecting abnormal motion of elders, a toggle switch on elders' wristband for sending message alerts, message alerts from health service officers for reminding patients, and an application for recording patients' symptoms.Then, innovators can produce the technologies and implement them within a community as the action level.

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