

Original Research Paper

Development of Health Informatics for Caring for Children in Occupational Therapy Service Communities

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Abstract: Health Informatics (HI) is an integration of health information and technology to be improving levels of efficiency in Occupational Therapy (OT) care managers in the community. The purpose of this study was to develop HI in the community for care managers caring for children from birth to 6 years old. Fifteen participants were occupational therapists, who worked as care managers in the community. The research instrument was a questionnaire that comprised 22 items in 4 aspects including requirement, function, usability and security. The HI system in this study comprised 6 parts such as log in, data display and summary, history, assessment, intervention and follow-up. Efficiency of the HI system was at the good level from the perspective of users (4.30 ± 0.58). When the efficacy of aspects was considered, the result found that usability was presented at the high level and had the highest mean, next to security, function and requirement, consecutively.

Keywords: Health Informatics, Care Manager, Community-Based Services, Children

Introduction

The current population in Thailand is about 63.50 million people, of which roughly 7.65 million are in the birth to 6 year-old age group (NICDF, 2011). The number in this age group is declining continually because of a dropping birth rate from 31.80% during 2001-2005 to an estimated 19.70% in 2026-2030 (HIS, 2015). As Thailand will have become an aging society by 2064-2574 (Prasatkun, 2016), earlier child development is encouraged as a way to increase the quality of future human resources (Wungchanthanon *et al.*, 2014). Therefore, the National Economic and Social Development Plan intends to encourage appropriate health services for children, which supports a healthy community system in all dimensions (ONESDB, 2017). However, health professionals in communities are limited. Health service providers, who work in communities have more than one role to play and they operate with community members as a team. Care managers play an important role in community hospitals in Thailand. They are responsible for providing primary health services such as developmental screening, home visiting, home programing, database recording and so on. Therefore, some health service providers have been health professionals and also care managers at the same

time. Most care managers in Chiang Mai province are occupational therapists.

The Model of Human Occupation (MoHO) has the principle of applying human activity to community-based practice (Scaffa and Reitz, 2014). This model focuses on community change and describes its structures in the human system, of which there are two; the trajectory of change and adaptive and maladaptive cycles (Scaffa, 2001). The model can be applied to encourage community response, involvement and empowerment by analyzing internal needs such as identity, values and interests, as well as external environments, for instance, a physical and social environment. Health service providers have to participate in community-based service and promote community health by increasing community performance for making decisions and solving problems regarding health. This performance will develop into community-based skills that strengthen the capacity of the community. In fact, community-based practices in health promotion, community knowledge and community participation make the community stronger with community members in good health (Solomon and O'Brien, 2011).

Health Informatics (HI) is an integration of health information and technology that designs, develops and applies innovated information technology in public health services (Thiratsirikul and Caefan, 2010; Hebda *et al.*,

2005). In particular, evaluating and monitoring the health of a community population tends to use HI to develop effective service systems (Beck *et al.*, 1998). In developing HI to be consistent with the context of healthcare delivery, it comprises three levels such as the operational, management and executive information system level (SISTH, 2013). In the 21st century, the national era of information technology is vital to the health care system by designing, developing and applying integrated health and technology information for health care services. This system can support health service providers in making decisions for evaluating, treating and following up health outcomes effectively (Yana and Sirapanitkul, 2015). The HI has been currently used in both written and electronic forms of management and stored as many medical information profiles per Thai hospitals. It needs to be more accurate data during the process of diagnosis and treatment plans by, reducing those duplicated data and improving efficient services (Triviriyapab *et al.*, 2013). As a result, the government recognized the importance of developing HI and has set a policy to reform the public health system and improve the quality of life for people in the community. In particular, health services for children in the community are termed as holistic child care, which is based on the understanding that all children could have various programs of potential enhancement (Yana and Sirapanitkul, 2015). Therefore, a development of information systems for children at birth to six years of age would be making a big change of better quality of life in a recognition of government policy.

The HI is studied quite widespread in medical and nursing professions with community hospitalized contexts of Thailand remains using structured forms of medical information system, which has focused on a decision making and organizing for national health promotion programs including a hospitalized client classification system (Kuntawong, 2007; Rimsuk, 2012). However, it rarely develops into other paraprofessionals such as Occupational Therapy (OT) services (Schaper and Pervan, 2007). Therefore, the purpose of this research was to develop HI in community-based services for OT in children from birth to 6 years of age. The HI system was based on using information management of assessment, intervention and follow-up on developing children in the communities toward accessible services gained in the community healthcare system and technology.

Materials and Methods

This research was approved by the Research Ethics Committee of the Faculty of Associated Medical Sciences, Chiang Mai University, Thailand (AMSEC-61EX-008). There were two phases, with the first being development of the HI system that comprised two steps, i.e., (a) designing program contents and (b) developing

the HI system. Indeed, before developing the HI system, its content and process was design by reviewing related literature (Naipat, 2005), expert examination and member checking. The second phase was an efficiency study of the HI system. In this phase, occupational therapists of the Chiang Mai Occupational Therapist Club were invited as care managers in their service communities to participate and investigate efficiency of the HI system. The inclusion criteria were (a) working as a care manager of occupational therapy in the communities, (b) working at least 1-years' experience in pediatric services in the communities under a government hospital at Chiang Mai province and (c) making a consent form signed for being a participant in this study. As a result, there were fifteen participants in this study, as shown in Table 1. They conducted a trial session for 1 hour before evaluating efficiency of the HI system by using a questionnaire (Ubonsuk *et al.*, 2013), which was a Likert scale that comprised 22 items in 4 aspects including requirement, function, usability and security. The interpretation level of efficiency in the HI system was classified into five levels as follows:

Mean	Level of the efficiency
4.50-5.00	High
3.50-4.49	Good
2.50-3.49	Medium
1.50-2.49	Low
1.00-1.49	Very Low

Table 1: General information of the participants (n = 15)

General information	Numbers	Percentage
Gender		
Male	6	40.00
Female	9	60.00
Age (years)		
Less than 26	2	13.30
26-30	9	60.00
31-35	3	20.00
More than 35	1	6.70
Organization		
Community hospital	11	73.30
General hospital	2	13.30
Provincial hospital	1	6.70
Medical institute	1	6.70
Work experience		
1-3 years	2	13.30
4 years	4	26.70
More than 4 years	9	60.00
Work experience in pediatrics		
1-3 years	5	33.34
4 years	4	26.66
More than 4 years	6	40.00
Work experience in the community		
1-3 years	5	33.34
4 years	4	26.66
More than 4 years	6	40.00

Results

Development of the HI System

The HI system was designed to have six parts such as log in, data display and summary, history, assessment, intervention and follow-up. The process of the system progressed from the log in to follow-up, as shown in Fig. 1.

After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper.

The log in part is shown on the first page of the HI system. It comprises the name of the system, user ID box and password box (as shown in Fig. 2).

The data display and summary part shows the result of developmental screening, personal data and client status. In general, occupational therapists have the responsibility as care managers to screen the development of children in the community. The type of screening tool in this study depended on the birth weight. Children who had a low (< 2,500 grams) and normal (\geq 2,500 grams) birth weight were screened for development by the Developmental Assessment For Intervention Manual (DAIM) and

Developmental Surveillance and Promotion Manual (DSPM), respectively. However, some communities had no occupational therapists in the community hospitals. Occupational therapists at the second and third level, in general and provincial hospitals or medical institutes, might be care managers in the community and use screening tools such as the DAIM and DSPM. Moreover, they were supposed to use the Thai Early Developmental Assessment for Intervention (TEDA4I) as a tool for helping preschool children with delayed development. For these reasons, the data display and summary part included results of the DAIM, DSPM and TEDA4I (Fig. 3).

The history part comprised general and health history. General history included national ID, name, name of caregiver, nationality, address, record date, birth date, gender, health scheme, hospital number, age and health condition. The health history included medical history, pregnancy history of mother and developmental screening record. Users of the developmental screening record were able to search the results of screening in the year the children were screened. The results of screening showed developmental areas in which the children were delayed such as Gross Motor (GM), Fine Motor (FM), receptive language (RL), Expressive Language (EL) and Personal-Social (PS) development (as shown in Fig. 4).

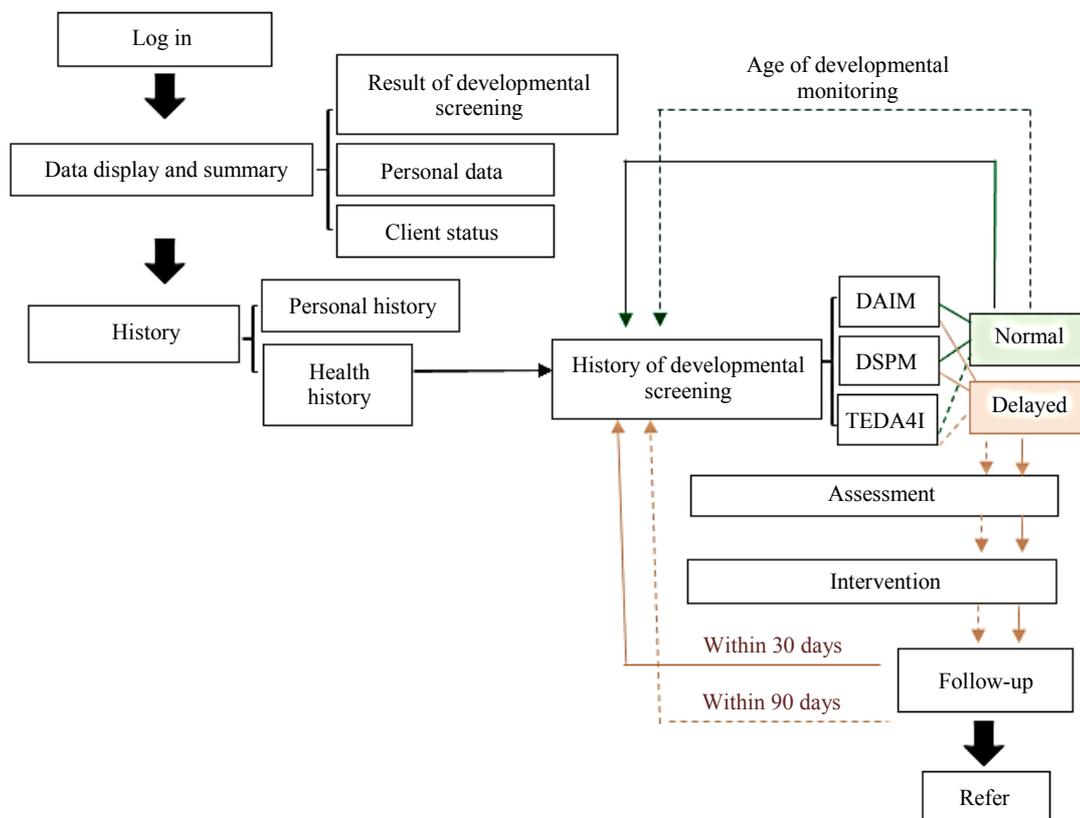


Fig. 1: Process of the HI system

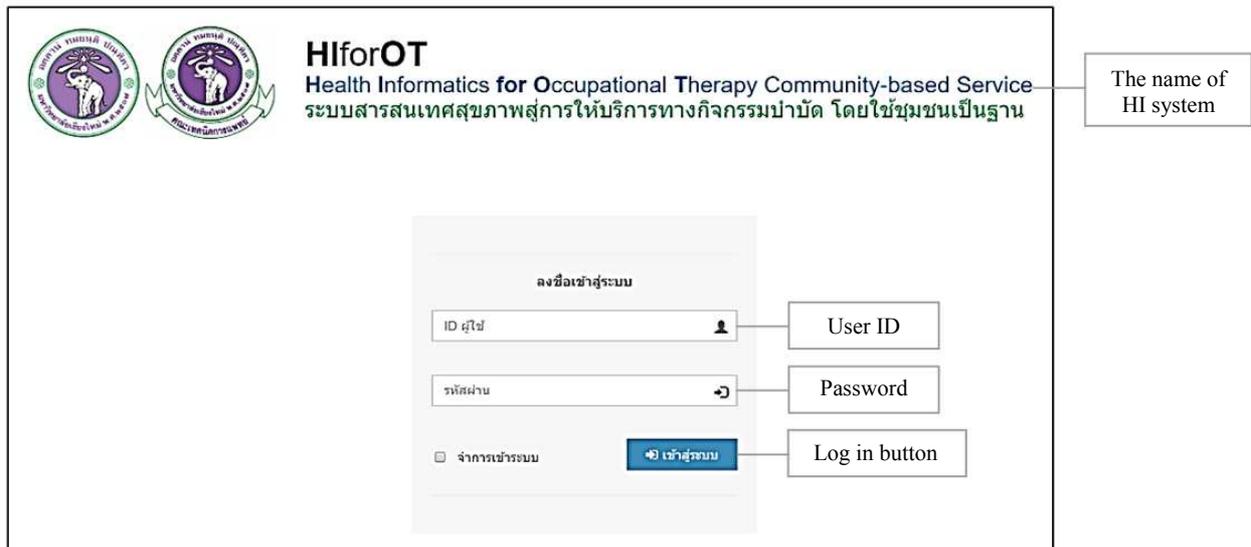


Fig. 2: The log in part



Fig. 3: The data display and summary part

The assessment part showed the assessment tools that care managers were able to choose. These tools related to the developmental areas in which the children were delayed. The lists of assessment tools in terms of GM

were The Miller Assessment for Preschoolers (MAP), Vineland Adaptive Behavior Scales (VABS), Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2), Clinical Observation for Sensory Integration,

Short Sensory Profile and Reflex Testing Chart. The lists of assessment tools in terms of FM were MAP, VABS, BOT-2, Developmental Test of Visual Perception, Second Edition (DTVP-2), Beery-Buktenica Developmental Test of Visual-Motor Integration, Sixth Edition (Beery-VMI), Motor-Free Visual Perception Test, Third Edition (MVPT-3), Dynamic Occupational Therapy Cognitive Assessment for Children (DOTCA-ch), Clinical Observation for Sensory Integration, Short Sensory Profile and Reflex Testing Chart. The lists of assessment tools in terms of RL were MAP, VABS, BOT-2, DTVP-2, Beery-VMI, MVPT-3, DOTCA-ch, Clinical Observation for Sensory Integration, Short Sensory Profile and Reflex Testing Chart. The lists of assessment tools in terms of EL

were MAP, VABS, BOT-2, DTVP-2, Beery-VMI, MVPT-3, DOTCA-ch, Clinical Observation for Sensory Integration, Short Sensory Profile and Reflex Testing Chart. The lists of assessment tools in terms of PS were VABS, Short Sensory Profile and Reflex Testing Chart.

The intervention part comprised the intervention program, service code of the ministry and service code of the hospital. The care managers were able to choose the intervention program that suited the developmental problems of the children such as coordination and hand function training, oral-motor stimulation and training, perception and learning and pre-speech, sensorimotor component, sensory integration, BADL, IADL and preschool skill training (Fig. 5).

The screenshot displays the 'HI for OT' software interface. The top navigation bar includes 'ภาพรวม', 'ทะเบียนประวัติ', 'ติดตามผล (Follow up)', and 'ออกจากระบบ'. The main content area is titled 'ทะเบียนประวัติ - เพิ่มใหม่' and contains several form sections:

- ข้อมูลทั่วไป (General Information):** Fields for ID, name, gender, date of birth, address, and phone number.
- ข้อมูลสุขภาพ (Health Information):** Includes 'ข้อมูลทางการแพทย์' (Medical Information) with options for chronic diseases and 'ประวัติการตั้งครรภ์' (Pregnancy History) with details on pregnancy type, delivery method, and weight.
- การคัดกรองพัฒนาการ (Developmental Screening):** A section for recording screening results, including checkboxes for DSPM and TEDA 41, and dropdown menus for age and sex.

On the right side, five callout boxes with lines pointing to specific parts of the interface identify the following sections:

- General history
- Health history
- Pregnant history of mother
- Medical history
- Developmental screening record

Fig. 4: The history part

Intervention Program	Service Code of the Ministry	Service Code of Hospital
<input type="checkbox"/> Coordination Training	934-96-43 , 57101	H9383.1
<input type="checkbox"/> Hand Function Training	726-96-52 , 57702	H9383.1
<input type="checkbox"/> Oral - motor Stimulation and Training	927-96-01 , 57102	H9383.1
<input type="checkbox"/> Perception and Learning Training	934-96-42 , 57903	H9383.1
<input type="checkbox"/> Pre - speech Training	940-96-79 , 57909	H9383.1
<input type="checkbox"/> Sensorimotor Components Training	935-96-45 , 57999	H9383.1
<input type="checkbox"/> Sensory Integration Training	935-96-46 , 57999	H9383.1
<input type="checkbox"/> Basic Activity of Daily Living Training	900-96-81 , 57001	H9383.1
<input type="checkbox"/> Instrumental Activity of Daily Living Training	900-96-81 , 57999	H9383.1
<input type="checkbox"/> Preschool Skill Training	900-96-81 , 57906	H9383.1

Fig. 5: The intervention part

The screenshot shows a web interface for 'ติดตามผล (Follow up)'. It has a top navigation bar with 'HI for OT' and 'ติดตามผล (Follow up)'. Below the title, there are two main sections for developmental monitoring:

- ประเมินครบอายุ 9 เดือน (Assessment at 9 months):** This section includes a table with columns: 'ที่' (No.), 'ID', 'HN', 'ชื่อ - สกุล' (Name), 'เพศ' (Gender), 'ว/ด/ป เกิด' (Date of Birth), and 'อายุปัจจุบัน(เดือน)' (Current Age). A callout box on the right points to the 'อายุปัจจุบัน(เดือน)' column with the text 'Age of developmental monitoring (9 months)'. Below the table, there are buttons for 'Excel', 'เลือกการค้นหา' (Select search), 'เลือกผล' (Select result), 'รายการ ต่อหน้า' (Items per page), and 'ค้นหา' (Search).
- ประเมินครบอายุ 18 เดือน (Assessment at 18 months):** This section has the same structure as the 9-month section. A callout box on the right points to the 'อายุปัจจุบัน(เดือน)' column with the text 'Age of developmental monitoring (18 months)'. Below the table, there are buttons for 'Excel', 'เลือกการค้นหา' (Select search), 'เลือกผล' (Select result), 'รายการ ต่อหน้า' (Items per page), and 'ค้นหา' (Search).

Fig. 6: The follow-up part

The follow-up part was set to alert care managers to re-screen the development of children when they were at the age of developmental monitoring such as 9 months, 18 months, 30 months and 42 months (Fig. 6).

Table 2: Efficiency of the HI system (n = 15)

Opinion on efficiency	$\bar{X} \pm SD$	Interpretation
Requirement	4.15±0.54	Good
User management	4.20±0.56	Good
Data management	4.33±0.48	Good
Information alert management	3.93±0.59	Good
Function	4.19±0.59	Good
Validation of data storage	4.53±0.63	High
Validation of data editing	4.53±0.51	High
Validation of data processing	4.53±0.63	High
Speed of data processing	4.13±0.63	Good
Reliability of data processing	4.06±0.59	Good
Compatibility between the HI system and health service system	3.66±0.48	Good
Error of prevention	3.93±0.70	Good
Usability	4.52±0.52	High
Simple to use	4.26±0.45	Good
Type of Font	4.53±0.51	High
Size of font	4.40±0.73	Good
Color of font	4.53±0.51	High
Data display and summary	4.66±0.48	High
Components of data display	4.66±0.48	High
Simple words/understandable technical terms	4.66±0.48	High
Security	4.36±0.67	Good
Setting of user's status	4.33±0.72	Good
Protection of privacy data	4.40±0.63	Good
Total	4.30±0.58	Good

The efficiency of the HI system

After the HI system trial, the participants gave their opinion on its efficiency. Results from the perspective of the users indicated that HI efficiency was at the good level. When the aspects of efficacy were considered, the result found that usability showed the highest mean (4.52±0.52) and was presented at the high level, next to security, function and requirement, consecutively (Table 2).

Discussion

HI for care managers of children from birth to 6 years of age in the community was designed in this study from literature reviews, expert advice and member checking. That is to say, the development of HI was considered under policies of the Ministry of Health and context of the management system of community hospitals that are at the primary care service level (SISTH, 2013). Also, it related to the current situation of community health systems. Moreover, in designing the program, community-based practice was applied with adapted MoHO, which is the service practice and model for analyzing the internal and external needs for encouraging community participation (Scaffa, 2001). Thus, the HI system was expected to improve work effectively for health service providers at primary care hospitals and increase the quality of life for children in the community (SISTH, 2013; Yana and Sirapanitkul 2015). This issue related to Kaewyoo (2007), who found that the development of information

systems by analyzing data in current situations was able to reduce the work process and increase work production more effectively. There is a tendency to use information systems in nursing to make work easier and be an important tool for the provision of health services, particularly in the health service area (Rimsuk, 2012).

In terms of efficiency, results of the prototype HI showed that it was at the good level after trialing the participants. This was because HI was developed for the needs of the users, who were occupational therapists working as care managers and having experience in providing services for children in the community. These care managers faced up to the problems of data overload and realized the usefulness of the HI system in improving the efficiency of health services in the public health system (SISTH, 2013). When considering each aspect of efficiency, the results found that usability was at the high level and had the highest mean. This was because the content of data recorded used general language and familiar technical terms of the health service. In addition, the data display was designed to be similar to that of the medical record system. Therefore, the participants noticed that the HI system was simple, easy to use and understandable. All of the other aspects (Table 2) were at the good to high levels. The HI program also provides security in accessing information by filling in a username and password before logging in. This process was checked the status and rights of the user. By setting up a user ID and unique password, the user would feel satisfied with

the privacy and security of the data (Sunitsawan, 2012). Furthermore, the function of recording who and when the individual client accesses the data might be added, which would increase data privacy and security of the HI system.

Although the efficiency of the HI system were at the good level, the three lowest means were compatibility between the HI system and health service system, error of prevention and information alert management. This is because development of the HI system in community hospitals was at the primary care level, which is new in Thailand (Triviriyapab *et al.*, 2013) and the main health service system still does not support the hi-tech system. As seen some limitations, this HI system was studied within local areas, so that it was unable to be connected in between different areas and caring levels hospitals. Thus, complications in the main program of each hospital limited data alert management between them. However, further study might reflect the results of this study to related policy makers and make them aware and support this system. When the HI system is made to be managed easily and more completely, it will bring about active use for the user (Eungwattana *et al.*, 2015).

Conclusion

The HI system was developed in this study and comprised six parts including log in, data display and summary, history, assessment, intervention and follow-up. Efficiency of the prototype HI system was trialed and opinions were given from fifteen occupational therapists, who worked as care managers for children from birth to 6 years of age in the community. Most of the participants were female and aged 26-30 years old and had more than 4 years' experience of pediatrics in the community. Their perspectives indicated that efficiency of the HI system was at the good level. Furthermore, the usability aspect was at the high level. The results of this research could be reflected in order to push for a future community health policy that improves the community health service system. However, this research has the limitation of applying HI in different contexts, because the study was conducted in a specific area.

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Author's Contributions

Kewalin Panyo: Reviewed the literature, designed the research, collected and analyzed the data and developed the manuscript.

Supawadee Putthinnoi: Provided advice on the research design and approved the manuscript.

Suchitporn Lersilp: Provided advice on the research design, approved and analyzed the data and developed and approved the manuscript.

Ethics

This research was approved by the Research Ethics Committee of the Faculty of Associated Medical Sciences, Chiang Mai University, Thailand (AMSEC-61EX-008).

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