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Elderly self-care and their perception of healthcare technology use

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Abstract

One of the critical factors in promoting self-care and changes in health behavior among the elderly is to digitize personal health information so that it is readily available to all parties involved when needed, especially for health promotion purposes. This study identifies factors influencing the elderly's perception of the use of health-related technology to record health data digitally. The factors are drawn from the personality pattern of aging, nostalgia, elderly self-care behavior, and the perception of healthcare technology and their health record behavior literature. The integration of both the social perspective and technological research serves as a foundation for technological development in the digital health industry in order to develop an effective health promotion strategy. A total of 430 useable responses were obtained from two types of surveys – 341 paper-based surveys and 89 via Google-form. The samples were purposively chosen to cover the elderly participating in various social and health-related activities. Three groups of the elderly, defined as young-old (60-69 years), old-old (70-79 years), and oldest-old (≥80 years), are used to present all descriptive statistics. Results show that the majority of respondents are young-old females, have lower than a bachelor's degree, do not work, live with 3-4 family members, and receive less than 10,000 baht of monthly income from family support. They acquire health information technology, health record, and are willing to share their health data. Their personality pattern in aging consists of low social roles or interactions and medium life satisfaction, which is classified as an armored-defended (constricted) person. These elderly people have moderate nostalgia, but they are studious in health promotion behaviors. They approve of health information technology usage at a moderate to high level. Perception and use of health information technology relate highly to both the importance of and satisfaction with social roles, nostalgia, and health promotion behavior. Elderly perception of overall life satisfaction relates only slightly to their overall level of health assessment.

Keywords: older adults, patterns of aging, social roles, overall life satisfaction, nostalgia, elderly self-care, healthcare technology, personal health record (PHR)

1. Introduction

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Self-care is an essential preventive behavior for the elderly. Researchers in the Health Belief Model (Becker et al., 1977; Rosenstock, 1974) refer to it as a psychological model that can be rendered by the use of personal health information management, focusing mostly on physical activities (Carroll et al., 2012; Chung et al., 2017). Nevertheless, many elderly people do not record their health information; they pass the baton to healthcare professionals who do so in the form of electronic medical records (EHRs) which are kept at the healthcare facility.

Personal health records (PHR), on the other hand, have been put into use so that individuals can self-care and self-monitor their health. With PHR, users are able to access personal data anywhere and anytime, and provide the data to whomever they see fit. Previous studies on PHR have focused on topics such as adoption, acceptance, implementation, and the structure of the system (Archer et al., 2011; Roehrs et al., 2017). However, more focus on the design of the PHR system is needed so that elderly people can use it to pursue self-care and health promotion effectively.

Like any other health-related technologies, the design of the PHR system must take into consideration the principle of behavioral design, as in the Fogg Behavior Model. According to B. J. Fogg, there is an influence of digital interfaces or the intersection between computer technology such as video games, devices or intermediaries, and persuasive concepts like behavioral change, motivation, opinion change, compliance, or attitude change. The intersect area is called "CAPTOLOGY," which stands for Computers As Persuasive Technologies (Figure 1). This interaction is where changes such as behavior change, feeling and attitude changes, reinforcement, or thoughts about some issues or actions, take place (Fogg, 1999; Hamari et al., 2014).

Figure 1. CAPTOLOGY (Fogg, 1999)
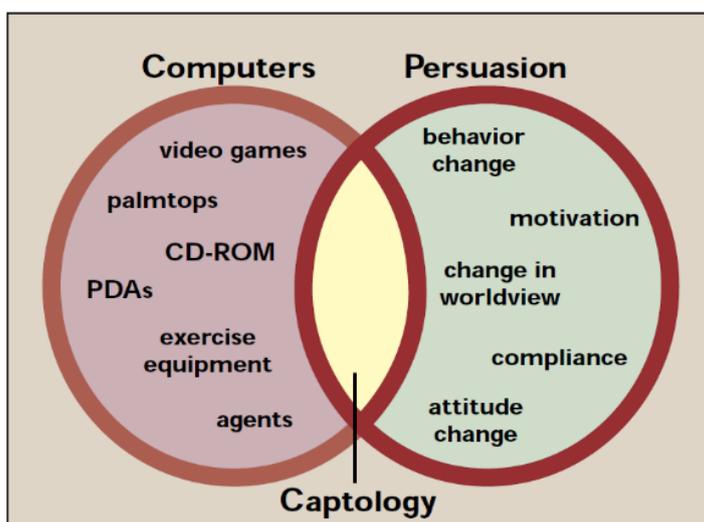
Fogg (2009) states that successful designers must understand the factors that can change the targeted behavior. The design should combine the benefits and capabilities of technology with psychological factors in order to improve target behavior systematically.

The purpose of this study is to examine the relationship between the use of personal healthcare technology and elderly self-care and health promotion behaviors. The remaining sections include a literature review, description of the research method, results, and discussion and conclusion. The literature review starts with the theoretical background, which is then followed by identification of factors affecting the elderly's perception and use of healthcare technology, i.e. personal health records, and, subsequently, self-care and help promotion behavior. The reviews provide a framework for the present study. The research method section describes the sampling frame, data collection method, and measurements. Findings are reported using the study framework. The last section discusses the results and concludes with recommendations for future research.

2. Literature review

Continuity theory is one of the sociological theories of aging, which hypothesizes that personality influences the roles people choose, and that how they enact them then influences their satisfaction with living. The theory suggests that a well-developed personality by the time people reach old age tends to remain consistent throughout their lives (Antonucci et al., 2001), and that social roles positively relate to overall life satisfaction in old age (Lemon et al., 1972). The population norms of long-term, age-related change lie in a host of social support and social network variables during late life (Shaw et al., 2007). Specific personality traits are related to activity participation, time allocated, and experience (Newton et al., 2016). According to Continuity Theory and Captology, the four factors that influence elderly people's perception and use of healthcare technology are *personality patterns in aging*, o*verall life satisfaction*, *nostalgia,* and *overall health perception*.

2.1 Personality patterns in aging

Havighurst (1968) created "Continuity Theory" which hypothesizes that personality influences the roles people choose and how they enact those roles. This in turn influences satisfaction with living. Continuity theory suggests that personality is well developed by the time an individual reaches old age and tends to remain consistent throughout people's lives. As shown in Table 1, his study classified four personality patterns/types of older adults by observing the personality patterns in aging and classifying them using role-activity and overall life satisfaction. The four types are *integrated, armored-defended, passive-dependent*, and *unintegrated*.

Table 1. Classification of personality patterns in aging

Life satisfaction	Social roles		
	Low	**Medium**	**High**
Low	**Unintegrated** (disorganized)	**Passive-dependent** (apathetic)	
Medium	**Armored-defended** (constricted)	**Passive-dependent** (succorance-seeking)	**Armored-defended** (holding-on)
High	**Integrated** (successful disengaged)	**Integrated** (focused)	**Integrated** (re-organizer)

1. Integrated personality type has *adjusted, or reorganized* activities and roles well, as evidenced by a high level of both role-activity and overall life satisfaction. Some people have ***focused*** on their activities and characters, as evidenced by *a medium level of role-activity and a high level of overall life satisfaction*. Some successful ***disengaged*** older people have voluntarily moved away from role commitments as evidenced by *a low level of role-activity and a high level of overall life satisfaction.*

2. Passive-dependent personality type is either highly dependent or exhibits disinterest in the external world. ***Succorance-seeking*** elderly are successful in getting emotional support from others, as evidenced by *a high or medium level of both role-activity and overall life satisfaction*. ***Apathetic*** are those who have never been given much to live and never expected much, as evidenced by *a low level of role-activity combined with a medium or low level of overall life satisfaction.*

3. Armored-defended personality type tends to continue the activities and roles *held* during middle age, as evidenced by a high or medium level of role-activity and a high level of overall life satisfaction. Some people have *constricted* their activities and roles as a defense against aging, as evidenced by *a low or medium level of role-activity and a high or medium level of overall life satisfaction.*

4. Unintegrated personality type is the least well-adjusted. These elderly people are *disorganized* and fail to cope with aging successfully, as evidenced by *a low level of role-activity and a medium to low level of overall life satisfaction.*

Personality types provide a clue as to how an older adult will adjust to changes in health, environment, or socioeconomic conditions, and in what activities that person will engage. Moreover, the social context within one age may be more important than personality in determining the roles (Antonucci et al., 2001). Thus, one can argue that the happiness and satisfaction in the latter part of one's life depend on personality patterns of aging, and other common factors such as motivation, social status, economic status, and everyday context (Allemand and Mehl, 2017; Havighurst, 1968).

2.2 Life satisfaction

Besides the satisfaction from associating with different social roles that allow individuals to integrate emotional and rational elements of their personality pattern, overall life satisfaction is an all-inclusive factor affecting how the elderly perceive the world. Previous research has found that life satisfaction relates positively to health promotion behaviors and preventive healthcare services (Kim et al., 2015; Osman et al., 2015). When people are satisfied with their lives, they are more proactive in taking care of their health; thus, they are likely to be more positive in taking care of their health and seeking to use healthcare technology to do the job (Alturkistani et al., 2018).

2.3 Nostalgia

Elderly *nostalgia* is essential for integrating their own experience from the past into their present life in old age. The more aged attitudes change responsive to their experiences that support the lifelong openness model of attitude change (Gergov and Stoyanova, 2013). Nostalgia is a sentimental longing for the past, and it leads to greater feelings of optimism, with earlier research demonstrating that optimistic thinking (general and health-orientated) is associated with better physical and psychological health (Kersten et al., 2016). Nostalgia is an essential resource for individuals' well-being (Bonus et al., 2018; Cox et al., 2015; Fawn, 2018; Zhang, 2016). Gergov and Stoyanova (2013) revealed the importance of the past for older adults'

present attitudes and feelings. The failing of loss of social support could strengthen nostalgia. The cause may be the loss of their peers at work through retirement, or loss of family and friends/companions through death or relocation.

2.4 Health assessment

Health screening or assessment is important for older adults. Most initial health assessment is performed by a nurse when an elder person receives healthcare service. In many cases, lay individuals who work under the direction of professionals are the ones who do the preliminary health evaluation. However, with the advent of healthcare technology, the elderly can do certain general health assessment on their own (i.e., blood pressure, cholesterol, and heart rate). Worrying about the deterioration of their own health status, the elderly want to be alert to any changes that take place. Personal health assessment with health information technology can facilitate health promotion and self-care. Previous research has found that older adults accept and use health information technology because the elderly can do the health assessment on their own (Fischer et al., 2014).

2.5 Healthcare-related technology

Information derived from healthcare-related technology is an important factor in health promotion and self-care systems. Most health information resides in a hospital where the medical or health care providers record and collect information about demographics, treatment history, drug therapy, drug allergy, immunization, laboratory analysis, X-ray film, vital signs, also personal data such as age, weight, height, etc. However, advancement in information technology and consumer behavior change (Roehrs et al., 2017) are likely to provide a boost to the self-care management of one's health, an important starting point for the promotion of well-being.

Health information technology (HIT) is an important part of hospitals, primary care practices, community care, and a variety of other healthcare locations. Different forms of HIT exist)e.g., Electronic Patient Record systems, virtual wards, mobile and assisted living technologies(, and have brought about many changes to the conduct of work and healthcare delivery services for patients (Waterson, 2014). Personal health record)PHR(is one of the emerging health information technologies that provides powerful and transformative potential for enhancing the delivery of health care (Wen et al., 2010). PHR is a tool for improving self-care behavior. It is an electronic application that consumers can use to enter and exchange their health data, and to gain access to information from their medical records and other resources. Many organizations such as the Digital Economy Promotion Agency in Thailand, National Electronics and Computer Technology Center in Thailand, and others are focused on the value of this tool. These organizations have developed the information technology system for collecting personal health records to support the healthcare system so that individuals can access, manage, and edit their data. The system can also allow them to share information with authorized persons, such as family members or health care providers. This data is useful for the individual, caregivers, and health care providers in developing tools, processes, or methods for promoting self-care management to enable better health, disease prevention, or the most appropriate treatment. Recorded health data such as weight, height, blood pressure, daily activities, doctor's appointments, medical conditions or treatment, and so on can be stored and shared with health care providers (Archer et al., 2011; Roehrs et al., 2017; Tang et al., 2006).

Therefore, the PHR, one important HIT, is a central system that patients or users can control themselves for the purposes of information collection, information sharing, information exchange, and self-management through EHR (Electric Health Record). This system is useful and will connect with many health service providers and stakeholders such as pharmacists, radiologists, laboratories, and life insurance companies. Nevertheless, the limitations of the personal health record system include data standardization, data reliability, security, and privacy (Kaelber et al., 2008). For the PHR system to work, elderly people must decide to change their health behavior -- a decision that is likely to derive from the social context of their lives. Besides social factors, motivation for self-care and own health promotion behavior may relate to the use of health information technology and personal health record. These factors should be taken into consideration during the design of a PHR system, which is embedded by persuasive technology to incrementally define, modify or change behaviors or attitudes for systematic goal achievement (Fogg, 2002; Oinas et al., 2009; Orji and Moffatt, 2016). With recent advancements in devices, mobile applications, and communication channels, the health care system integrates digital technologies to enhance self-care behavior for health promotion purposes.

Figure 2 shows the development of a health promotion study framework. Factors that influence the perception and use of health information technology are personality patterns in aging, life satisfaction, nostalgia, and own-health assessment. The usage of health information technology can subsequently affect elderly self-care, especially their health promotion behavior. Both behavioral and technological development set a foundation for generating an effective health promotion strategy on self-care management, especially in the digital health industry.

Figure 2. Study framework
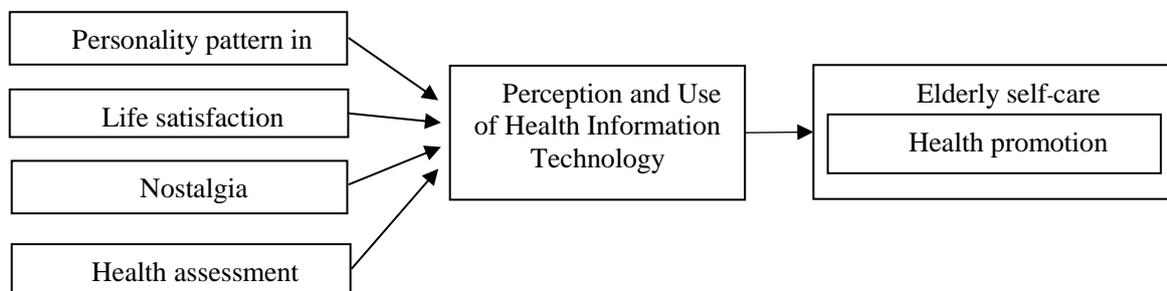
3. Research method

The sampling frame for the present Thailand-based research is about 14 million older people who are aged 60 years and over, accounting for 21% of the whole Thai population (United Nations, 2019). The target sample size is at least 400 participants. They participated voluntarily in the study and were purposefully selected to be older people of any gender who can take care of themselves and can read, write, understand, or communicate in the Thai language.

3.1 Sample and data collection

The survey was conducted, and questionnaires were distributed to participants for two months (April-May 2019) using a convenient sampling selection. For the offline or paper-based survey of 443 participants, senior members were purposively selected from those who have activities at the Healthy Aging Club of the Thai Red Cross society, Yannawa Elderly School, Din Daeng School, Taechew Park, Senior Club at Lumpini community, and others in the greater Bangkok area. The online survey employing Google forms was sent through social networks such as Line and Facebook. By using the snowballing method, volunteer participants were requested to send the online survey to other friends and family members.

After filtering out the outliers and incomplete responses, there were 430 usable respondents, 341 (79.3%) from paper-based responses, and 89 (20.7%) via online survey. Although the response rates between the two sources differ, their respondent profiles are similar. Table 2 shows the majority of respondents are young-old (60-69 years) females. Online respondents appear to be higher educated than those who completed the paper-based survey.

Table 2. Profiles of online and offline respondents

Characteristics	Total respondents		By offline or paper-based		By online or google form	
	Number	(%)	Number	(%)	Number	(%)
Gender	**429**		**340**		**89**	
Male	121	(28.2%)	91	(26.8%)	30	(33.7%)
Female	308	(71.8%)	249	(73.2%)	59	(66.3%)
No answer (Missing)	1		1		0	
Age	**430**		**341**		**89**	
Young-old (60-69 years)	277	(64.4%)	207	(60.7%)	70	(78.7%)
Old-old (70-79 years)	120	(27.9%)	105	(30.8%)	15	(16.9%)
Oldest-old (≥80 years)	33	(7.7%)	29	(8.5%)	4	(4.5%)
Educational level	**424**		**335**		**89**	
No formal education, No degree	31	(7.3%)	27	(8.1%)	4	(4.5%)
Lower than bachelor's degree	260	(61.3%)	235	(70.1%)	25	(28.1%)
Bachelor's degree	88	(20.8%)	59	(17.6%)	29	(32.6%)
Master's degree	33	(7.8%)	13	(3.9%)	20	(22.5%)
Doctoral degree	12	(2.8%)	1	(0.3%)	11	(12.4%)
No answer (Missing)	6		6		0	

Ethics statement

All participants were informed about the aim of the study and gave their verbal consent. The study was approved by the research ethics review committee for research involving human research participants, the health sciences group, Chulalongkorn University.

3.2 Survey instrument

The survey instrument adapted questionnaire items from previous studies. Three experts who have extensive experience in health-related research and practices (a professor, a nurse, and a health promotion officer) validated the instrument, which was pilot-tested with five seniors to ensure feasibility and compliance with the objectives of the research and to make sure of the *content validity* of the questionnaire. The questionnaire consists of 4 sections with measurement development as follows:

Section 1 contains the demographic characteristics of the study sample.

Section 2 assesses the *personality pattern in aging* construct. Each respondent is asked to rate the importance of and satisfaction with eight social roles. As defined by previous research, the social roles are defined by the person or group of people with whom the elderly socialize (Gignac et al., 2008; Van Genderen et al., 2018). This includes employees at work, family members, school friends, friends with similar interests, neighbors, club members or associations, church members or members of the temple, and people having similar outlook or opinions. For each role, the respondent responds on a 3-point Likert scale, ranging from 1 for low importance/satisfaction to 3 for high. A personality pattern in an aging index is created by multiplying these scores. The resulting index is used to classify the respondents into different personality patterns in aging. An overall *life-satisfaction* is assessed, employing a 3-point Likert scale (Lange and Grossman, 2010; Van Genderen et al., 2018). Finally, *nostalgia*, which is associated with recalling the past, its personalities, and events (Gergov and Stoyanova, 2013; S. Stoyanova et al., 2015; S. Y. Stoyanova et al., 2017) is adjusted to include 11 statements and uses a 5-point Likert scale, ranging from 1 for strongly disagree to 5 for strongly agree.

Section 3 includes the perception and use of health information technology and personal health record using a 5-point Likert scale, ranging from 1 for strongly disagree to 5 for strongly agree, for each statement. The elderly were asked to rate the health information seeking media on a 5-point Likert scale ranging from 0 for never use to 4 for frequently use. How they record health data (i.e., paper and pencils or smartphone) and what health data such as blood pressure, calories, etc. are recorded (the index of health record) are measured using a 5-point Likert scale ranging from 0 never record to 4 for the everyday record.

Section 4 asks the respondents to assess the strength of their overall health level (1 weak – 10 strong) as well as the objective questions about elderly *self-care* from the health promotion behavior standpoint using a 5-point Likert scale, ranging from 0 for never do to 4 for frequently. Additional data collected include chronic health conditions, caregiver, annual health check-up, health services, healthcare expenses, and healthcare activities.

The internal consistency of all variables was assessed for *reliability* using Cronbach's alpha (Table 3*)*. Based on the 95% confidence of the intraclass correlation coefficient (ICC), estimated scores to indicate the level of reliability are excellent reliability (0.90 and above), high reliability (0.75-0.90), moderate reliability (0.50-0.75) and low reliability (0.50 and below) (Koo and Li, 2016). Elderly self-care in health promotion behavior shows a Cronbach's Alpha of 0.604, which is the lowest score among all variables. Social roles (both importance and satisfaction), nostalgia, and the use of health information technology and personal health record, each has a Cronbach's Alpha of more than 0.75. All these variables have high reliability.

Table 3. Reliability of the instrument

Construct criteria	No of Items	Cronbach's Alpha	Reliability Level
● Personality pattern of aging			
- Social roles (Importance)	8	0.803	High
- Social roles (Satisfaction)	8	0.823	High
● Nostalgia	11	0.811	High
● Perception and Use of Health Information Technology			

- Method of health record	6	0.847	High
- Health information technology usage	10	0.773	High
● Elderly self-care (Health promotion behavior)	11	0.604	Moderate

4. Result

4.1 Sociodemographic data

According to the National Statistical Office (2018) in Thailand, there are three groups of older adults. The young-old (aged 60-69 years) still take care of themselves. Old-old individuals (aged 70-79 years) start suffering from illness, weakness, or congenital or chronic disease. The oldest-old (aged 80 years and older) have frequent disease, organ deterioration, or disability. The classification of the elderly by age is objective and provides the basis for various government-subsidized welfare programs in developing countries, including Thailand. Although there may be other dimensions besides age in the classification of older people, i.e., chronological, biological, psychological, and social, they are outside the scope of the present study. In all of the descriptive statistics in this section, the number of responses may differ. Some respondents might have been more sensitive towards certain items, answering one item and skipping other items. Thus, all individual item analyses show the number of responses (n).

Of the 430 older adults who completed the survey, 308 (71.8%) are female and 260 (61.3%) have lower than a bachelor's degree level of education. Most of the young-old, 80 (25.6%), stated their current employment status as housework, while the largest proportion of old-olds and oldest-olds stated that they do not work, 47 (34.8%) and 16 (50.0%). Employment before the age of 60 varies. The young-olds and the old-olds were primarily traders at 64 (15.0%) and 27 (6.3%) respectively. Eight (1.9%) of the oldest-old government officials. Personal income (Baht/month) is less than 10,000 baht per month, with the sources of income varying. 155 (37.6%) young-old respondents stated that income is obtained from working, while 131 (33.9%) old-old and oldest-old receive family support, 66 (42.6%) and 24 (60.0%) respectively. 252 (59.0%) stated that all income from all sources was sufficient for their current lifestyle. 197 (46.7%) of participants live with 3-4 individuals in the same house, and most of them 254 (38.0%) live with their children. Table 4 presents the sociodemographic details by age groups.

Table 4. Sociodemographic details of respondents by adult age group

Characteristics	**Total respondents**		**Young-old**		**Old-old**		**Oldest-old**	
	Number	(%)	Number	(%)	Number	(%)	Number	(%)
Gender	**429**		**277**		**119**		**33**	
Male	121	(28.2%)	78	(28.2%)	31	(26.1%)	12	(36.4%)
Female	308	(71.8%)	199	(71.8%)	88	(73.9%)	21	(63.6%)
No answer (Missing)	1		0		1		0	
Educational level	**424**		**273**		**118**		**33**	
< Bachelor's degree	291	(68.6%)	167	(61.2%)	95	(80.5%)	29	(87.9%)
≥ Bachelor's degree	133	(31.4%)	106	(38.8%)	23	(19.5%)	4	(12.1%)
No answer (Missing)	6		4		2		0	
Personal income (Baht/month)	**412**		**269**		**113**		**30**	
≤ 10,000 baht	155	(37.6%)	94	(34.9%)	45	(39.8%)	16	(53.3%)
10,001-50,000 baht	213	(51.7%)	141	(52.4%)	59	(52.2%)	13	(43.3%)
≥ 50,001 baht	44	(10.7%)	34	(12.6%)	9	(8.0%)	1	(3.3%)

No answer (Missing)	18	8	7	3

4.2 **Personality patterns in aging**

Table 5 shows the elderly participants' perceived importance of the eight social roles and respective satisfaction with those roles. They associated the importance of and satisfaction with roles that are *not different* at the 0.05 level of significance. They rated the importance of different roles the same as the satisfaction with those roles ($\overline{XImp}$=1.60, $\overline{XSat}$=1.59, t=1.166, p=.244). An index multiplying the importance and satisfaction toward each social role was used as a proxy for the overall personality pattern in the aging of each person. The level of importance and satisfaction with the roles or social activities are in the same direction. The *high level* consists of family members (parents, grandparents, relatives, siblings, spouses, and children). The *middle level* consists of friends with similar interests and neighborhoods. The *low level* consists of employees at work, school friends, club members or associations, church members or members of the temple, and people having similar outlook or opinions.

Table 5. T-test of the means of social roles

Social roles	Importance $\overline{XImp}$ (SD), n1	Satisfaction $\overline{XSat}$ (SD), n2	t-test (p) [Imp and Sat]	Importance × Satisfaction $\overline{XImp} \times \overline{XSat}$ (SD), n
Employees at work	1.45(1.05), 403	1.41 (.97), 401	1.753 (.080)	4.09 (2.28), 277
Family member	2.41 (.78), 421	2.4 (.79), 420	.566 (.571)	6.56 (2.79), 398
School friend	1.47 (.95), 407	1.49 (.96), 406	-.450 (.653)	3.84 (2.49), 308
Friends with similar interests	1.82 (.93), 405	1.79 (.91), 409	1.095 (.274)	4.61 (2.68), 342
Neighborhood	1.78 (.80), 415	1.74 (.82), 415	1.542 (.124)	4.01 (2.46), 372
Club members or associations	1.35 (.97), 405	1.32 (.92), 403	1.299 (.195)	3.45 (2.3), 287
Church or temple members	1.37 (.91), 409	1.39 (.94), 408	0.000(1.000)	3.41 (2.49), 310
People having a similar opinion	1.37 (.88), 416	1.43 (.90), 416	-1.799 (.073)	3.31 (2.32), 325
Total	**1.60 (.59), 380**	**1.59 (.61), 381**	**1.166 (.244)**	**4.33 (1.46), 181**

*p<0.05

Table 6 summarizes the percentage of the elderly categorized by their life satisfaction and social roles. Only 5.6% have high social roles and high life satisfaction. The largest group of people have low social roles and medium life satisfaction (28.7%) which is identified as armored-defended personality pattern in aging. They tend to continue the activities and social roles held during middle age.

Table 6. Classification of personality patterns in aging

Life satisfaction	Social roles					
	Low		Medium		High	
	Number	(%)	Number	(%)	Number	(%)
Low	27	(7.2%)	3	(0.8%)	0	(0.0%)
Medium	107	(28.7%)	72	(19.5%)	2	(0.5%)
High	64	(17.2%)	73	(19.8%)	21	(5.6%)

4.3 **Life satisfaction**

The elderly participants' level of overall life satisfaction is moderate to high ($\overline{X}$=2.34, SD=.609). Table 7 shows the overall life satisfaction by age group. Overall life satisfaction of male was not quite different from that of female; female ($\overline{X}$=2.38, SD=.627), male ($\overline{X}$=2.26, SD=.556). The young-old females have a higher level of overall life satisfaction than males (F(1,273)=5.561, p=0.019) at the 0.05 level of significance. Elderly participants with different levels of education and personal incomes appear to have different level of overall life satisfaction i.e. education (F(1, 420)=8.356, p=0.004) and personal income (F(2, 407)=8.555, p=0.000) at the 0.01 level of significance. The old-old participants with a high education level have a higher level of overall life satisfaction than those with low education (F(1,116)=4.578, p=0.034) at the 0.05 level of significance. However, the young-old participants with high income differ from those with low income in their overall level of life satisfaction (F(2,264)=4.924, p=0.008) at the 0.01 level of significance.

Table 7. Overall life satisfaction by age group and gender

Overall life satisfaction	Total respondents $\overline{X}$ (SD), N	Young-old $\overline{X}$ (SD), N	Old-old $\overline{X}$ (SD), N	Oldest-old $\overline{X}$ (SD), N
Gender				
Male	2.26 (.556), 121	2.28 (.556), 78	2.13 (.562), 31	2.42 (.515), 12
Female	2.38 (.627), 306	2.46 (.576), 197	2.27 (.656), 88	2.00 (.775), 21
ANOVA	F(1,425)=3.362 p=0.067	F(1,273)=5.561 p=0.019*	F(1,117)=1.180, p=0.280	F(1,31)=2.755 p=0.107
Education				
<Bachelor's degree	2.28 (.613), 291	2.38 (.556), 167	2.17 (.647), 95	2.10 (.724), 29
≥ Bachelor's degree	2.47 (.586), 131	2.46 (.606), 104	2.48 (.511), 23	2.50 (.577), 4
ANOVA	F(1,420)=8.356, p=0.004**	F(1,269)=1.375, p=0.242	F(1,116)=4.578, p=0.034*	F(1,31)=1.092, p=0.304
Personal income (Baht/month)				
≤ 10,000 baht	2.23 (.619), 155	2.32 (.553), 94	2.11 (.682), 45	2 (.730), 16
10,001-50,000 baht	2.38 (.600), 211	2.41 (.600), 139	2.34 (.576), 59	2.23 (.725), 13
≥ 50,001 baht	2.64 (.532), 44	2.68 (.475), 34	2.44 (.726), 9	3 (.000), 1
ANOVA	F(2,407)=8.555, p=0.000**	F(2,264)=4.924, p=0.008**	F(2,110)=2.094, p=0.128	F(2,27)=1.094 p=0.349
Overall	**2.34 (.609), 428**	**2.41 (.575), 275**	**2.23 (.632), 120**	**2.15 (.712), 33**

**p<0.01, *p<0.05

4.4 Nostalgia

Table 8 shows the statements used to measure nostalgia. They reflect the sentimentality for the past, typically for a period or place with happy personal associations. The overall mean is at a moderate level (Mean=3.75). The highest level of the agreed statement is, "I do activities that are suitable for my age" (Mean, SD=4.13, .740).

Table 8. Nostalgia

Nostalgia [Range 1-5]	Mean	SD	N
Overall Nostalgia	**3.75**	**.505**	**417**
I often miss my past life.	3.64	.807	425
Good past life determines my present and future.	3.88	.796	425
I am proud of my past life.	3.95	.771	425

I will live my life the way I did in the past	3.37	.971	425
I can do a variety of activities.	3.90	.880	426
I can adjust or manage my current life by finding new activities instead of the former activities that have disappeared in the past.	3.88	.783	427
I will do the same activities that I have done in the past if I can.	3.40	.893	426
I do activities that are suitable for my age.	4.13	.740	430
I like working with a lot of people in public.	3.41	.967	428
I am happy to work, support others anonymously	3.76	.863	429
I am happy to go to the temple or church	3.96	.957	429

Elderly nostalgia is essential for integrating their own experience from the past into the present life in old age. Older adults who are armored-defended (constricted) type, *a low level of role-activity, and a medium level of overall life satisfaction,* had a medium level of nostalgia (27.0%) as shown in Table 9.

Table 9. Relationship between personality pattern in aging and nostalgia

Personality pattern in aging	Nostalgia							
	Low		Medium		High		Total	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Unintegrated (disorganized)	0	(0.0%)	24	(6.5%)	3	(0.8%)	27	(7.3%)
Armored-defended (constricted)	1	(0.3%)	100	(27.0%)	5	(1.3%)	106	(28.6%)
Integrated (successful disengaged)	0	(0.0%)	53	(14.3%)	11	(3.0%)	64	(17.3%)
Passive-dependent (apathetic)	0	(0.0%)	2	(0.5%)	1	(0.3%)	3	(0.8%)
Passive-dependent(succorance-seeking)	0	(0.0%)	54	(14.6%)	17	(4.6%)	71	(19.1%)
Integrated (focused)	0	(0.0%)	42	(11.3%)	35	(9.4%)	77	(20.8%)
Armored-defended (holding-on)	0	(0.0%)	1	(0.3%)	1	(0.3%)	2	(0.5%)
Integrated (re-organizer)	0	(0.0%)	7	(1.9%)	14	(3.8%)	21	(5.7%)
Total	1	(0.3%)	283	(76.3%)	87	(23.5%)	371	(100.0%)

4.5 Health assessment

Table 10 reveals that when asked about their overall health during the previous seven days, the respondents felt that it had been strong, with an average of 7.33 (SD=1.882). Overall health assessments of different genders and personal incomes were not quite different. The elderly participants with different levels of education appear to have had different levels of overall health assessment (MSD=14.417, $F_{(1, 379)}=4.109$, p=0.043) at the 0.05 level of significance.

Table 10. Overall health level by age group, gender, and education

Overall health level	Total respondents $\overline{X}$ (SD), N	Young-old $\overline{X}$ (SD), N	Old-old $\overline{X}$ (SD), N	Oldest-old $\overline{X}$ (SD), N
Gender				
Male	7.29 (1.819), 112	7.56 (1.682), 70	6.73 (2.083), 30	7.17 (1.697), 12
Female	7.34 (1.914), 270	7.52 (1.811), 178	7.12 (2.113), 74	6.50 (1.823), 18
ANOVA	F(1,380)=0.55, p=0.814	F(1,246)=0.019, p=0.890	F(1,102)=0.727, p=0.396	F(1,28)=1.016, p=0.322
Education				
<Bachelor's degree	7.19 (1.955), 253	7.42 (1.795), 144	6.95 (2.227), 82	6.7 (1.772), 27

≥ Bachelor's degree	7.60 (1.699), 128	7.69 (1.729), 102	7.26 (1.544), 23	7.33 (2.082), 3
ANOVA	$F(1,379)=4.109$, $p=0.043*$	$F(1,244)=1.388$, $p=0.240$	$F(1,103)=0.391$, $p=0.533$	$F(1,28)=0.332$, $p=0.569$
Personal income (Baht/month)				
≤ 10,000 baht	7.14 (2.038), 133	7.34 (1.894), 79	7.08 (2.341), 38	6.31 (1.852), 16
10,001-50,000 baht	7.35 (1.782), 195	7.54 (1.785), 129	6.96 (1.791), 54	7.00 (1.477), 12
≥50,001 baht	7.67 (1.822), 43	7.97 (1.357), 33	6.56 (2.877), 9	8.00 (.000), 1
ANOVA	$F(2,368)=1.371$, $p=0.255$	$F(2,238)=1.465$, $p=0.233$	$F(2,98)=0.223$, $p=0.800$	$F(2,26)=0.881$, $p=0.426$
Overall	**7.33 (1.882), 383**	**7.53 (1.772), 248**	**7.02 (2.094), 105**	**6.77 (1.775), 30**

*$p<0.05$

4.6 Perception and use of health information technology

Table 11 shows the elderly partcipants' level of positive feeling towards health information technology usage at a moderate to a high level (Mean, SD = 3.78, .517). They highly agree that taking care of oneself is essential (Mean, SD= 4.64, .531).

Table 11. Perception and Use of Health Information Technology

Health information technology usage [**Range 1-5**]	**Mean**	**SD**	**N**
Overall health information technology usage	**3.78**	**.517**	**402**
Technology makes it easier to take care of your health.	4.03	.856	425
Taking care of yourself is essential.	4.64	.531	426
Mobile phones are a necessity in life.	4.04	.895	421
There should be more health facilities for older people.	4.32	.673	425
Drug alert devices are necessary.	3.82	.893	417
You take photos of your food before eating.	2.29	1.215	408
You like playing games	2.10	1.261	409
Children should pay attention to healthcare for the elderly.	4.18	.773	421
Being aware of your health information is essential.	4.39	.734	421
Health data collection with modern equipment is reliable.	4.04	.934	420

Table 12 presents the media used by older adults to record their health data. Use of notebooks or note paper is the most popular means (Mean, SD= 0.94, 1.264). However, the young-old participants use more digital media in their recording than the two other groups, for example, smartphone applications (MSD=3.232, $F(2, 401)=3.245$, $p=0.040$), social media (MSD=7.516, $F(2, 402)=6.996$, $p=0.001$), chat programs (MSD=3.924, $F(2, 404)=3.214$, $p=0.041$), and medical devices (MSD=3.098, $F(2, 400)=4.386$, $p=0.013$).

Table 12. Method of recording health data

Method of recording health data [Range 0-4]	Total respondents $\overline{X}$ (SD), N	Young-old $\overline{X}$ (SD), N	Old-old $\overline{X}$ (SD), N	Oldest-old $\overline{X}$ (SD), N
Notebooks or note paper	0.94 (1.264), 413	0.92 (1.238), 268	0.92 (1.278), 115	1.2 (1.448), 30
Smart phone applications	0.45 (1.004), 404	0.54 (1.08), 265	0.28 (0.848), 109	0.27 (0.691), 30
Food photos	0.55 (1.079), 409	0.64 (1.159), 269	0.36 (0.864), 110	0.4 (0.968), 30
Social media with text or images	0.53 (1.052), 405	0.66 (1.141), 265	0.22 (0.672), 109	0.48 (1.151), 31
Chat programs with text or images	0.54 (1.111), 407	0.64 (1.162), 266	0.32 (0.928), 110	0.52 (1.18), 31

Medical devices	0.34 (.848), 403	0.43 (.951), 268	0.15 (.531), 106	0.24 (.636), 29
Others such as EHR report, appt., line app, etc.	0.85 (1.281), 13	1.14 (1.676), 7	0.5 (0.548), 6	0 (.000), 0

The health indices which the respondents kept themselves included blood pressure index (Mean, SD= 1.43, 1.233) and heart rate measurement (Mean, SD= 1.06, 1.31). The respondents in the young-old (43.1%) and old-old (32.2%) groups seek and prepare the equipment used for recording health data by themselves. The children of the oldest-old group provide or prepare the equipment for their parents (31.3%). Most elderly are willing to share health records with others such as doctors, nurses, caregivers, and their children to make healthcare more convenient. TV programs appear to be the most popular medium or channel used by the respondents to search for health information or news (Mean, SD= 2.34, 1.277).

4.7 Self-care and health promotion behaviors

Table 13 shows the survey results related to self-care. Most respondents have chronic health conditions (71.4%), the most common of which is hypertension (58.0%). More than half (68.4%) have a caregiver in daily living who takes care of their health. Caregivers are commonly including a child (73.7%) or grandchild (42.6%). About seventy percent have health check-ups (70.3%), and the majority of them (71.3%) go to a government facility annually. They also use health services (62.1%) and hospital staff (65.3%). However, 84.8% of them spend less than 10,000 baht/month on healthcare expenses. Young-old and old-old groups were able to obtain reimbursement for the healthcare costs on their own, but the oldest-old group could not afford the expenses without help from their families. Most of the healthcare expenses are for medicine (40.8%).

Table 13. Self-care by adult age group

Self-care	Total respondents		Young-old		Old-old		Oldest-old	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Annual health check-up	**424**		**274**		**117**		**33**	
Yes	298	(70.3%)	192	(70.1%)	84	(71.8%)	22	(66.7%)
No	126	(29.7%)	82	(29.9%)	33	(28.2%)	11	(33.3%)
Receive health services	**420**		**272**		**117**		**31**	
Yes	261	(62.1%)	165	(60.7%)	74	(63.2%)	22	(71.0%)
No	159	(37.9%)	107	(39.3%)	43	(36.8%)	9	(29.0%)
Health care expenses (Baht/month)	**396**		**255**		**109**		**32**	
≤ 10,000 baht	336	(84.8%)	229	(89.8%)	82	(75.2%)	25	(78.1%)
10,001-20,000 baht	44	(11.1%)	19	(7.5%)	20	(18.3%)	5	(15.6%)
≥20,001 baht	16	(4.0%)	7	(2.7%)	7	(6.4%)	2	(6.3%)

These older adults often exhibit health promotion behavior (Mean, SD = 2.85, .476). They usually eat vegetables or fruits (Mean, SD = 3.42, .773) and do not smoke or drink alcoholic beverages (Means, SD = 3.85, .606 and 3.52, .859 respectively). As shown in Table 14, different age groups vary their opinion about the drinking of alcoholic beverages ($F_{(2, 408)}$=4.923, p=0.008); the young-old participants perceive their health and health promotion behavior at high levels.

Table 14. Elderly perception of own health level and health promotion behavior

Health promotion behavior [Range 0-4]	Total respondents $\overline{X}$ (SD), N	Young-old $\overline{X}$ (SD), N	Old-old $\overline{X}$ (SD), N	Oldest-old $\overline{X}$ (SD), N
Overall health promotion behavior	**2.85 (.476), 430**	**2.88 (.436), 277**	**2.83 (.533), 120**	**2.74 (.569), 33**
Eat vegetables or fruits	3.42 (.773), 430	3.41 (.782), 277	3.43 (.785), 120	3.45 (.666), 33
Do not drink alcoholic beverages	3.28 (.886), 430	3.31 (.887), 277	3.23 (.837), 120	3.24(1.062), 33
Do not smoke	3.52 (.859), 411	3.43 (.920), 271	3.72 (.647), 112	3.61 (.875), 28
Do not add fish sauce, soy sauce or salt added to food	3.85 (.606), 407	3.82 (.651), 270	3.91 (.499), 110	3.85 (.534), 27
Do not eat very fatty foods.	2.47(1.225), 421	2.47(1.229), 274	2.57(1.175), 114	2.03(1.311), 33
Do not eat desserts, sweet drink, soft drinks.	2.34 (.858), 422	2.29 (.894), 274	2.47 (.77), 118	2.27 (.828), 30
Eat eggs or foods that contain eggs.	2.39 (.919), 420	2.33 (.918), 272	2.51 (.855), 118	2.43 (1.135), 30
Do not eat offal	2.74 (.918), 427	2.76 (.931), 275	2.61 (.904), 119	3.00 (.791), 33
Exercise	2.76 (.962), 422	2.74 (0.94), 276	2.74 (.997), 116	3.00 (1.017), 30
	2.60 (1.23), 424	2.64 (1.221), 276	2.50 (1.248), 116	2.66 (1.26), 32
	2.67(1.199), 425	2.76 (1.129), 276	2.47 (1.302), 116	2.61 (1.345), 33

4.8 Relationships among variables

The correlation matrix among study variables is depicted in Table 15. It showed highly significant relationships except for the relationship between health promotion behavior and the personal pattern in aging or nostalgia. The Pearson correlation coefficient (r) conveys a positive relationship between health information technology usage and the personal pattern in aging (r=0.381), nostalgia (r=0.306), overall health assessment (r=0.172), and overall life satisfaction (r=0.151), respectively. The relationship between health information technology usage and health promotion behavior is positive (r=0.304). All these correlation coefficients are at the .01 level of significance.

Table 15. Relationship among variables

Variables	1	2	3	4	5	6
1 The personal pattern in aging	1.000					
2 Overall life satisfaction	.646**	1.000				
3 Nostalgia	.514**	.315**	1.000			
4 Overall health assessment	.265**	.244**	.236**	1.000		
5 Health information technology usage	.381**	.151**	.306**	.172**	1.000	
6 Health promotion behavior	.134*	.119*	.134**	.273**	.304**	1.000

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

All in all, the young-old (or the participants aged 60-69 years) have a different level of perception and use of health information technology from the other groups. The relationships between HIT usage and the personal patterns in aging, Nostalgia, and overall health assessment are most evidenced in this group. Also, the links between health promotion behavior to Nostalgia and overall health assessment of the young-old group is the strongest.

5. Discussion and conclusion

The results of this study indicate that, when compared to the study of the personality patterns in aging (Havighurst, 1968), older Thai people generally demonstrate the *passive-dependent* personality type, with a low level of social roles but a moderate level of overall life satisfaction; specifically, they are identified as apathetic individuals who have never been given much to live and never expected much. This is different from the study in Charlotte County, Florida which showed lower levels of participation in social roles or activities and life satisfaction (Jang et al., 2004). Moreover, nostalgia may motivate people to engage in higher preventative health behaviors by promoting more optimistic feelings about the future (Cheung et al., 2013), and a source of self-continuity. Kersten et al. (2016) identified the importance of nostalgia on health attitudes and behaviors. Nostalgia leads to increases in self-continuity, and those increases have been found to be higher for personal continuity than temporal continuity (Sedikides et al., 2015). Elderly Thai people in this study have a moderate level of nostalgia, similar to the older adults in Bulgaria and Greece (Stoyanova et al., 2017).

Thai older people still live with their families, who are the significant caregivers in daily living, including healthcare. Also, family members provide or prepare the equipment of health data records for their elders. Oh (2018) suggested that there are a number of possibilities for converting the digital minority into active smartphone users if the elderly are given opportunities by their family members to learn to use smartphones and their services in daily life.

This study was conducted to explore the factors influencing an elder's recording of personal health data. The outcome of this study found that the personal pattern in aging, nostalgia, and health promotion behavior has a strong, direct, and positive relationship with healthcare technology usage. Zang (2016) identified that nostalgia has positive effects on people's sense of well-being and connectedness, and that it has multiple levels of meaning and significance for individuals. Agrigoroaie and Tapus (2016) developed a framework for a behavior control system that is able to provide personalized interaction and care for the elderly by adapting behavior based on the specific needs of the person. Noar and Harrington (2016) presented several recent reports indicating that customized advertising has significantly increased on the internet, using location data and data accessed from one's personal computer. In the health promotion area, a perfect storm that ultimately led to the development of tailored communication interventions occurred. Overall life satisfaction and overall health level were less correlated in a positive direction with healthcare technology usage.

In conclusion, the study of a personal health record for seniors must consider the motivation guidelines of technology design, user-friendliness, privacy, security, and trustworthiness. Furthermore, the patterns of aging (social roles, life-satisfaction, and nostalgia), elder self-care, and own health promotion behavior of the user are significant factors for the system development if the system is to be accepted and valid. Moreover, the design and development should provide a platform to record personalized health data because the information may be valuable for further development, creation of new products, services, or businesses, and offering a way to promote, support, and design innovation in the future.

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