University Students' Attitudes toward Adoption of Mobile Health Application for Serving Older People

Pei-Ju Chao,[1] Yu-Huei Cheng,[2] Yi-Hui Liu,[3] and Tsu-Hsuan Hsu[4*]

[1]Travel & Tourism Program, International College, Ming Chuan University,
5 De Ming Rd., Gui Shan District, Taoyuan 333, Taiwan, R.O.C.
[2]Department of Information and Communication Engineering, Chaoyang University of Technology,
168 Jifeng E. Rd., Wufeng District, Taichung 413, Taiwan, R.O.C.
[3]Department of Senior Citizen Service Management, National Taichung University of Science and Technology,
No. 129, Sec. 3, Sanmin Rd., North District, Taichung 404, Taiwan, R.O.C.
[4]Graduate Institute of Rehabilitation Counseling, National Changhua University of Education,
1 Jin-De Rd., Changhua City 500, Taiwan, R.O.C.

In this quantitative study, we examined the awareness of mobile health (mHealth) applications among Taiwan's university students, particularly the government-operated *My Health Bank* application. The *My Health Bank* application allows users to access their personal health information simply through their smartphone's sensor-assisted facial recognition camera and fingerprint sensor. Whether these university students might help older adults to use this application if they perceive it to be helpful was also explored. Two instruments were used in this study, namely, the Perceptions toward My Health Bank (PMHB) and Geriatric Attitudes Scale (GAS). Two hundred twenty-five (225) university students from the Departments of Senior Citizen Service Management ($n = 136$) and Nursing ($n = 89$) at two universities participated in this study. The findings indicated low adoption of *My Health Bank* and related mHealth applications among students even though they had high adoption rates of smartphones. However, they perceived that the functions of this application are useful and should be promoted to older adults. Thus, building a basic foundation of mHealth and related technology courses is recommended to assist healthcare students in being well-prepared for working with older adults in the digital society.

1. Introduction

The development of technology has improved social services and healthcare practices. For example, some researchers explored a psychological artificial intelligence chatbot that can be used to decrease symptoms of depression, whereas other researchers stressed the importance of using online mobile health (mHealth) by social service practitioners to assist minority groups in overcoming their language barriers.[1,2] Thus, the concepts of "e-Social Work" and "digital Social Work" were identified to promote the delivery of human services more effectively.[3,4]

Realizing the importance of technology applications in healthcare service, Taiwan has improved the mHealth system to support its 23.59 million people. For example, the *My Health Bank* application for computers and mobile devices (e.g., smartphones) was introduced in 2014. It allows users to access their health information anytime, including inpatient and outpatient records, vaccination records, and examination reports. Since the COVID-19 pandemic spread in 2019, this application has added more significant features, such as establishing online face mask purchase and distribution systems (eMask purchase system) for residents. The biometric login functions of facial cognition and fingerprint identification were also added to the *My Health Bank* application in 2021. Registered users can log in to the application and access their health information more effectively through sensor-assisted facial authentication.[5] As a result, the number of *My Health Bank* registered users increased sharply from 5.8 million in the mid of 2021 to 7.4 million as of December 2021.[6]

While the number of *My Health Bank* registered users has increased owing to the influence of the COVID-19 pandemic and the implementation of sensor technologies on smartphones, it is still a question whether older Taiwanese adults would adopt e-service, specifically mHealth. For example, the family member management function was added to ensure that one family member can check the *My Health Bank* for their older relatives.[6] News also indicated that older adults preferred to wait in person to purchase face masks for several reasons. These reasons include but are not limited to (1) preferring person-to-person transactions, (2) distrusting online transactions, and (3) feeling unfamiliar with online purchasing workflow.[7]

To assist people in adopting mHealth in this digital society, some researchers have conducted studies to explore whether healthcare practitioners and students in related college programs can help improve awareness and adoption of mHealth among their target populations. For example, Wangler and Jansky found that German primary care physicians agreed with the positive functions of online health applications (e.g., managing medicines and medical appointments) but were reluctant to recommend them to their patients due to the issues of transparency and privacy.[8] In contrast, Jabour *et al.* found that Saudi Arabian health college students perceived the positive functions of mHealth applications (e.g., fitness management and calorie counting) and may continue using and promoting them.[9]

Our colleagues have also conducted a similar study to investigate the perceptions toward mHealth adoption to serve the elderly population based on university students from social service programs.[10] The findings showed that students believe that adopting mHealth is vital for future social service practitioners and the older population. However, limited research was conducted based on students from the direct health management domain. Therefore, we followed up on our previous study to determine whether university senior citizen service management and nursing students are willing to adopt mHealth and if they can help facilitate mHealth adoption for the older population.

2. Literature Review

In this study, we aimed to investigate perceptions of *My Health Bank* (an mHealth application) and attitudes toward its functions among university senior citizen service management and

nursing students in Taiwan. We also investigated whether students can help older adults adopt the *My Health Bank* if they perceive that this application is helpful in conducting self-health monitoring. Since these young students were born in the digital era, it would be necessary to explore their perceptions toward technology adoption in supporting the health service domain. In the following literature review section, several issues are covered. These issues include conceptual theories for this study, the description of *My Health Bank*, attitudes toward the functions and adoption of mHealth applications, and finally, attitudes toward serving older adults, since aging has become a significant issue in the social and healthcare service areas.[11]

2.1 Digital natives and contact hypothesis

This study was based on two significant theories: (1) digital natives and (2) contact hypothesis. Identified by Prensky, digital natives can be described as individuals who were born and "have spent their entire lives surrounded by and using computers."[12] This explanation implies that our current healthcare service students may have considerable knowledge and experience in the use of mHealth and related applications. This may allow them to be well-equipped to facilitate mHealth adoption among older adults when opportunities are provided.

This study's second important foundation theory is based on the contact hypothesis that Allport introduced in 1954.[13–15] The theory emphasizes that positive personal contact experience is one of the essential factors in reducing stereotypes about a range of specific groups, such as older adults and people with disabilities.[16,17] Since healthcare service students may be more likely to be exposed to older adults, they may be more knowledgeable about them and the need for mHealth adoption among this population. Also, examining their attitudes toward older adults provided an opportunity to determine how proper aging education should be promoted.

2.2 My Health Bank application

Introduced in 1995, the National Health Insurance (NHI) is a government-owned human service and healthcare program available to all citizens, new immigrants, and long-term legal foreign residents in Taiwan. The latest (2022–2023) report of the NHI showed that about 23.86 million people participated in NHI as of December 2021.[6] In 2014, the National Health Insurance Administration (NHIA) introduced the *My Health Bank* application through which registered users can access their health records, such as recent doctor visits and prescriptions, at their most convenient time. The NHIA also introduced a new feature of family member management to this app in 2019 to assure that caregivers of older adults can access their medical history. However, this feature may not be a perfect answer for solitary elders. Thus, adopting the mHealth app by older adults who can live independently is a potential method for improving health management by themselves.

Fortunately, improvements in sensor technologies allow the NHIA to make the *My Health Bank* application more accessible to registered users. For example, since 2021, the registered users of the *My Health Bank* can benefit from sensor-assisted facial authentication and

fingerprint sensor camera to instantly log in to the application on their smartphones or other mobile devices. In fact, some researchers already suggested that a sensor-assisted facial recognition authentication system for smartphones should be promoted.[18] This would help people reduce difficulty in memorizing a list of users' names and passwords for different websites and applications and help them safely access private and confidential information.[18,19] Similarly, fingerprint sensor technology also allows owners of smartphones to access their personal information on healthcare applications more securely.[20] As a result, it is expected that the development and improvement of smartphone sensor systems may be helpful for people to adopt healthcare applications more efficiently.

2.3　Promotion of mHealth adoption

Many studies were conducted to explore attitudes toward promoting mHealth applications. For example, Mueller discovered several factors that can explain whether family nurse practitioners recommend adopting mHealth applications, including ease of use, clarity of patient data, and access to trusted applications.[21] Similarly, other researchers found that health college students may continue using and promoting mHealth applications in the future if they perceive their positive functions (e.g., fitness management and calorie counting).[9] As a result, some professionals concluded that healthcare professionals and relevant practitioners should design user-informed mHealth applications for their target populations.[22]

However, some researchers discovered that even though primary care physicians agreed with the positive functions of mHealth applications (e.g., managing medicines and medical appointments), they were unwilling to recommend them to their patients due to the issues of transparency and privacy.[8] Similarly, other researchers discovered some concerns that might influence attitudes toward mHealth adoption and/or promotion, including data privacy policy, data disclosure, and data ownership.[23,24] Therefore, it is clear that mHealth application adoption and promotion are controversial in the healthcare service domain.

2.4　Attitudes toward older adults

Taiwan, an island in East Asia, had a population of about 23.38 million in 2021.[25] However, the number of older adults aged 65 and above is expected to reach 20% in 2026, which will make Taiwan a super-aged society within a few years.[26] As mentioned previously, Allport developed the contact hypothesis concept.[13–15] In the gerontological domain, the theory emphasizes that positive personal contact between older and younger people reduces prejudice or stereotypes toward older adults.[16] Therefore, studying the perceptions of direct healthcare students about this population is an important issue that allows researchers to understand how to promote proper aging education for students to improve their future services for this population.

Some Macao and Hong Kong researchers found that religion and gerontological nursing education were two significant factors associated with students' positive attitudes toward older adults.[27] Other researchers found that Korean and American nursing students' contact quality and empathy were related to their perceptions of caring for older people.[28] Like healthcare

students, social work students had improved attitudes and comfort levels about working with older adults after experiencing a designed curriculum focused on aging knowledge and interaction opportunities with guest speakers from relevant fields.[29]

In fact, researchers found that incorporating an optimistic perspective on aging into the curriculum helps students from social work programs recognize their stereotypes about older adults, which improves their service delivery to this population.[30] Thus, studying future direct healthcare students' attitudes toward older people would help us realize the possible areas that can be improved.

3.   Purpose of This Study

The primary purpose of this study was to investigate awareness of *My Health Bank* and attitudes toward its functions among direct healthcare service university students in Taiwan. We also investigated whether students can help older adults adopt this mHealth application if they perceive that it facilitates self-health monitoring. Finally, we examined students' attitudes toward older people since Taiwan is expected to move into a super-aged society. Student attitudes toward older people, would be influential in terms of their service delivery in this digital society. Three research questions were specifically designed to direct the present study.

(1) Are Taiwanese university students from direct healthcare programs (senior citizen service management and nursing programs) aware of the mHealth application operated by the government?

(2) What are the perceptions held by students from direct healthcare service programs about the importance of the government-operated mHealth's primary features for the students themselves and older adults?

(3) What are the general attitudes toward older adults held by direct healthcare service university students?

4.   Research Methods

To achieve the main objectives of this research, a quantitative research design method using self-reported survey questionnaires was employed. The following sections explain several research issues, including participants (setting, ethical concerns, and data collection), measures, and research design and statistical analysis.

4.1   Participants

4.1.1   Setting

Campbell *et al.* mentioned that "purposive sampling is the better matching of the sample to the aims and objectives of the research, thus improving the rigor of the study and trustworthiness of the data and results."[31] Therefore, participants were recruited using a purposive sampling technique. This technique allowed us to select participants representing students in senior citizen

service management and nursing fields. Two universities located in central Taiwan were chosen for recruiting participants for convenience. University 1 is a public school and University 2 is a private school. Two hundred twenty-five (225) human services students from the Departments of Senior Citizen Service Management ($n = 136$) at university 1 and Nursing ($n = 89$) at university 2 participated in this anonymous study. Thirty-seven (16.4%) were males and 188 (83.6%) were females. The complete demographic background of the participants is shown in Table 1.

4.1.2 Ethical concerns

The rights and confidentiality of participants were ensured through several steps. First, a letter describing the study was provided to the two department heads of Senior Citizen Service

Table 1
Demographic information of research participants.

Characteristic	University 1 Senior Service ($n = 136$)		University 2 Nursing ($n = 89$)		Overall ($n = 225$)	
	n	Percent	n	Percent	n	Percent
Year of study						
Freshmen	35	25.7	0	0	35	15.6
Sophomore	38	27.9	45	50.6	83	36.9
Junior	53	39.0	43	48.3	96	42.7
Senior	10	7.4	1	1.1	11	4.9
Most frequently used devices						
Smartphone	135	99.3	89	100.0	224	99.6
Laptop	62	45.6	52	58.4	114	50.7
Desktop	24	17.6	8	9.0	32	14.2
Tablet	9	6.6	9	10.1	18	8.0
Wearable device (e.g. Smartwatch)	3	2.2	6	6.7	9	4.0
Heard about My Health Bank?						
Never heard	64	47.1	30	33.7	94	41.8
Heard but not downloaded	54	39.7	31	34.8	85	37.8
Heard and downloaded	18	13.2	28	31.5	46	20.4
Other mHealth apps do you use regularly?						
None	68	50.0	36	40.4	104	46.2
Women's health	54	39.7	33	37.1	87	38.7
Exercise or fitness monitoring	23	16.9	19	21.3	42	18.7
My Health Bank	4	2.9	9	10.1	13	5.8
Health provider's apps	4	2.9	6	6.7	10	4.4
Diet and nutrition	5	3.7	3	3.4	8	3.6
Lifestyle management and mood	2	1.5	2	2.2	4	1.8
Have you ever studied mobile health technology or health information system at school?						
Yes	14	10.3	11	12.4	25	11.1
No	122	89.7	78	87.6	200	88.9
Are you willing to assist older adults to learn how to use health apps if needed?						
Yes	116	85.3	74	83.1	190	84.4
No	2	1.5	5	5.6	7	3.1
Don't know	18	13.2	10	11.2	28	12.4

Management and Nursing in person. Upon agreement after discussion, willing professors and lecturers announced this research project in their classes to recruit students who were willing to join in this anonymous study. All documents were handed out to everyone. Nonparticipation or withdrawal from this research project at any time did not affect their grades in any way.

4.1.3 Data collection

The researchers provided willing participants with several files, including a voluntary informed consent form and the guidelines of two surveys that they need to complete. Since this is an anonymous study, the participants were not required to write their names on these documents. They were allowed to complete those documents at the times and locations of their choice. Also, all the participants were provided a sealable envelope to return their completed surveys. The informed consent forms were collected separately to ensure that collected surveys were not identifiable. The researchers retrieved those documents in person about one month after distribution. The participants who did not return those documents were considered to have withdrawn from the study. All the collected documents were locked in a cabinet in the researchers' office for three years and will be destroyed using paper shredders.

4.2 Measures

4.2.1 Perceptions toward My Health Bank (PMHB)

Developed by our colleagues on the basis of the primary functions of this government-operated mHealth application, the PMHB originally included eleven items to explore the perceptions of the importance of these functions to older adults and Taiwanese university students from social work and human service programs.[10] However, in this study, we decided to recruit participants, particularly in senior citizen service management and nursing programs, since they may have more opportunities to interact with older people directly in different healthcare settings. Their perceptions of mHealth applications' functions may allow us to understand the challenges of mHealth adoption for younger and older generations.

As mentioned, the original version of the PMHB scale was developed on the basis of *My Health Bank*'s eleven features.[10] Owing to the improvement of this application to contain the pandemic and the government's stricter requirement of wearing masks in all public areas at that time, two more of the latest features in terms of the mask purchase system were included. As a result, there are thirteen items in this new version, namely, (1) inpatient, (2) outpatient, (3) dental records, (4) vaccination records, (5) allergy history, (6) records of drug use, (7) reports of examinations, (8) donation of organs, (9) preferences of hospice care, (10) reminders of health checkup, (11) self-insert health tracking system (e.g., blood pressure), (12) map of face mask availability, and (13) preordering of face masks (see Table 2).

Two subscales reside in the PMHB instrument. Our participants had to rate all items concerning the importance levels for themselves and older people. A 5-point Likert response

Table 2
Key item analysis of PMHB.

| | Important to Self | | | | | | | | | Important to Older Adults | | | | | | | | |
| | University 1 Senior service ($n = 136$) | | | University 2 Nursing ($n = 89$) | | | All participants ($n = 225$) | | | University 1 Senior service ($n = 136$) | | | University 2 Nursing ($n = 89$) | | | All participants ($n = 225$) | | |
	Mean	*SD*	Rank	*Mean*	*SD*	Rank	*Mean*	*SD*	Rank	*Mean*	*SD*	Rank	*Mean*	*SD*	Rank	*Mean*	*SD*	Rank
F1	4.30	0.67	7	4.30	0.70	6	4.30	0.68	6	4.71	0.54	5	4.62	0.51	6	4.68	0.53	5
F4	4.32	0.77	5	4.54	0.64	3	4.41	0.73	4	4.64	0.59	7	4.55	0.72	9	4.60	0.65	7
F5	4.60	0.62	1	4.60	0.54	1	4.60	0.59	1	4.79	0.45	1	4.71	0.48	4	4.76	0.46	3
F6	4.43	0.72	3	4.54	0.62	2	4.47	0.68	3	4.75	0.48	3	4.78	0.45	3	4.76	0.47	2
F7	4.54	0.60	2	4.46	0.66	4	4.51	0.62	2	4.77	0.47	2	4.80	0.46	1	4.78	0.46	1
F10	4.39	0.65	4	4.33	0.72	5	4.36	0.68	5	4.74	0.51	4	4.79	0.44	2	4.76	0.48	4
F12	3.86	0.90	12	4.02	0.84	11	3.92	0.89	12	4.15	0.94	12	4.26	0.79	11	4.19	0.88	12
F13	3.80	0.89	13	4.03	0.86	10	3.89	0.89	13	4.01	0.97	13	4.10	0.85	13	4.04	0.93	13
Overall	4.26	0.53		4.26	0.57		4.26	0.77		4.56	0.43		4.53	0.44		4.55	0.69	

Note: The response ranges from 1 (*unimportant*) to 5 (*very important*).
App functions: F1: Inpatient, F4: Vaccination records, F5: Allergy history, F6: Records of drug use, F7: Reports of examinations, F10: Reminders of health checkup, F12: Map of face mask availability, F13: Preorder face masks (eMask)

was applied for each item, ranging from 1 = *Unimportant* to 5 = *Very Important*. We also conducted an internal consistency reliability analysis of these two subscales. The results showed Cronbach's alpha values of 0.90 for the self dimension and 0.91 for the older adults dimension.

4.2.2 Geriatric attitudes scale (GAS)

Designed by Reuben and his colleagues, this instrument has 14 items that can be applied to explore attitudes and perceptions toward the older population in four dimensions.[32,33] These four dimensions include (1) perceived social value, (2) medical care, (3) compassion, and finally, (4) distribution of social resources. Reuben permitted us to use the GAS instrument after several emails. A double translation method was used to ensure that the instrument could be translated appropriately.[34] Since Taiwan's health service systems are different from those of the United States, one statement in the Distribution of Social Resources was deleted (*Government should reallocate money from Medicare to AIDS research*). The remaining three survey statements were shifted to the Perceived Social Value of Older Adults. Thus, the final version of GAS for this study has three dimensions with 13 items (see Table 3).

All 13 statements were rated with 1 = *Strongly Disagree* to 5 = *Strongly Agree*. In addition, the rest of the eight negative statements (1, 2, 4, 5, 6, 7, 8, and 9) were reverse-coded (see Table 3). The higher the item means and the overall mean (higher than 3), the more positive the attitudes our participants have toward older adults.[33]

Our study yielded an appropriate Cronbach's alpha value of 0.74 for the entire instrument. Also, a series of consistency reliability analyses of three dimensions generated acceptable Cronbach's alpha values of 0.67 for PV dimension, 0.52 for SE dimension, and 0.71 for CO

Table 3
Item analysis for GAS instrument.

Subscales & Items	University 1 Senior service (n = 136)			University 2 Nursing (n = 89)			All participants (n = 225)			
	Mean	*SD*	Rank	*Mean*	*SD*	Rank	*Mean*	*SD*	Rank	Cronbach's alpha
Perceived social value of older adults (PV)	3.42	0.87		3.35	0.87		3.93	0.87		0.67
1. They don't contribute their fair share toward paying for their health care.	3.11	1.00	5	3.19	0.84	4	3.14	0.94	4	
2. They act too slowly for modern society.	3.16	0.95	4	3.08	0.89	5	3.13	0.92	5	
3. It is society's responsibility to provide care for its older adults.	3.85	0.87	1	3.65	0.94	1	3.77	0.90	1	
4. NHI for them uses up too much human and material resources.	3.24	1.00	3	3.20	0.98	3	3.23	0.99	3	
5. They do not contribute much to society.	3.74	0.85	2	3.63	1.00	2	3.69	0.91	2	
Service care provided to older adults (SE)	2.96	0.74		2.95	0.89		2.95	0.80		0.52
6. If I have the choice, I'd rather see younger ones.	3.06	0.88	2	3.19	0.88	2	3.11	0.88	2	
7. As people grow older, they become less organized and more confused.	2.46	0.90	3	2.31	0.83	4	2.40	0.88	4	
8. Taking a medical history from them is frequently an ordeal.	2.39	0.80	4	2.47	1.02	3	2.42	0.89	3	
9. Treatment of chronically ill older adults is hopeless.	3.92	0.85	1	3.81	1.02	1	3.88	0.92	1	
Compassion toward older adults (CO)	3.76	0.64		3.86	0.81		3.80	0.71		0.71
10. Most of them are pleasant to be with.	3.56	0.86	4	3.58	1.02	4	3.57	0.92	4	
11. They tend to appreciate more the services I provide than do younger clients.	3.63	0.77	3	3.93	0.84	2	3.75	0.81	2	
12. I tend to pay more attention and have more sympathy toward my older clients than younger clients.	3.70	0.87	2	3.79	0.87	3	3.73	0.87	3	
13. It is interesting listening to their past experiences.	4.15	0.69	1	4.12	0.85	1	4.14	0.75	1	
Overall	3.38	0.76		3.38	0.86		3.38	0.80		0.74

Note: Negative statements were reverse coded for scoring (1, 2, 4, 5, 6, 7, 8, 9).

dimension. We also conducted a confirmatory factor analysis. The results showed that these 13 items met the factor loadings when convergent validity was set at 0.50.[35] Finally, to obtain useful information to meet the goal of this study, the two terminologies of "Medicare" and "medical care" were changed to "NHI and "service" throughout the GAS.

4.3 Research design and statistical analysis

A few short questions were included in the personal information sheets to obtain the results of research question one regarding awareness of the *My Health Bank* application held by students from the senior citizen service management and nursing programs. Samples of these short questions are "Have you heard of the *My Health Bank*?" and "Have you ever studied mHealth

technology or health information system at school?". Since no causal relationships existed between questions about participants' awareness of the application, we performed descriptive data analysis to report the results.

For question two concerning perceptions toward the functions of this mHealth application (PMHB), the item mean of each statement, standard deviation (SD), and Cronbach's alpha values of two dimensions of the PMHB were calculated and reported. Later, an independent sample *t*-test and a Spearman correlation were implemented to investigate if personal factors (gender, year of study, and contact experience in senior care facilities) of the independent variable were associated with the dependent variable of attitudes toward the functions of the application held by students from senior citizen service management and nursing programs. Owing to the limited number of participants, freshmen ($n = 35$) and sophomore students ($n = 38$) were categorized into group 1, whereas junior ($n = 53$) and senior students ($n = 10$) were categorized into group 2.

The independent sample *t*-test was implemented because each of these personal demographic features (gender, year of study, and contact experience in senior care facilities) had two groups. Then, we used a Spearman correlation to verify the outcomes. According to Refs. 36 and 37, a sample size greater than 30 is considered normal. Therefore, we ran a series of normality tests, such as skewness, kurtosis, and a Shapiro–Wilk test to confirm whether the data reached the assumption of normal distribution. The result showed that the dependent variables of the current study are normally distributed (see Table 4).

To obtain the answers to question three, we calculated and reported the item mean and SD of each item of the GAS instrument. The composite score was also calculated and reported. A one-way ANOVA and a series of independent simple t-tests were applied to determine if the different personal background features of independent variables were related to the dependent variable of attitudes toward older adults. Each independent variable was divided into two subgroups. For example, gender was split into male and female. The academic program was divided into senior citizen service management and nursing. Again, owing to the limited number of participants, freshmen ($n = 35$) and sophomore students ($n = 38$) were categorized into group 1, whereas junior ($n = 53$) and senior students ($n = 10$) were categorized into group 2. Finally, contact experiences were divided into participants with and without experience with older adults.

5.   Results

5.1   Low awareness and adoption of My Health Bank application

Demographic information indicated that the participants could be considered digital natives since most of our participants indicated that they use a smartphone ($n = 224$) and a laptop

Table 4
Results of normality test of PMHB.

Dependent variables	Skewness	Kurtosis	Shapiro–Wilk test (*p*-value)
Important to self	−1.22	−0.42	0.088
Important to older adults	−0.12	0.13	0.164

Note: Skewness and kurtosis values between −1.96 and +1.96 and *p*-value of Shapiro–Wilk test greater than 0.05 represent normally distributed data.[38]

(n = 114) frequently (see Table 1). This high smartphone adoption rate indicated that our participants have the potential to facilitate the adoption of mHealth applications for the older population. The results of another question confirmed that most of our human service (85.3%) and nursing (83.1%) students were willing to assist older adults in learning mHealth if needed. However, it is interesting that many senior citizen service management (47.1%) and nursing students (33.7%) were not aware of the *My Health Bank,* and only about one-fifth (20.4%) of all the participants had downloaded it.

A low adoption of mHealth and related applications among senior citizen service management and nursing students was also found. For example, 50% of senior citizen service management students and 40.4% of nursing students reported not adopting any mHealth applications listed on the demographic sheet (see Table 1). Women's health (38.7%) and exercise or fitness monitoring (18.7%) were the top two mHealth applications that our participants adopted for themselves. Finally, only 10.3% of human service students and 12.4% of nursing students took mHealth technology or health information system courses in their schools. This finding could be one of the significant barriers that may prevent them from acquiring mHealth knowledge and being well-equipped as future digital service practitioners.

5.2 High positive PMHB

The outcomes shown in Table 2 indicated that our respondents have positive perceptions toward these critical features since the mean scores of the overall two subscales of PMHB were over 4 points. More specifically, findings indicated that both senior citizen service management and nursing students considered these 13 features more critical for older adults (M = 4.55, SD = 0.69) than themselves (M = 4.26, SD = 0.77). We also conducted a dependent *t*-test. The outcomes showed that this difference was statistically significant, $t(224)$ = −10.55, $p < 0.001$.

Within these 13 items, our respondents indicated that *allergy history* (item 5), *reports of examinations* (item 7), and *records of drug use* (item 6) were the top three significant functions for themselves. Identically, they reported that *reports of examinations* (item 7), *records of drug use* (item 6), and *allergy history* (item 5) were the top three functions for older adults. However, mask availability and online mask ordering (items 12 and 13) are the most insignificant functions for themselves and older adults rated by our respondents, regardless of their academic programs.

We also investigated if the demographic features (gender, year of study, and contact experiences in senior care facilities) of senior citizen service management and nursing students were associated with their perceptions toward *My Health Bank* functions. Owing to the limited number of participants, freshmen and sophomore students were categorized into group 1, whereas junior and senior students were categorized into group 2. First, we conducted an independent sample *t*-test, and the findings indicated that senior citizen service management students' gender $t(134)$ = −.83, p = 0.41, contact experiences $t(134)$ = 0.16, p = 0.87, and year of study $t(134)$ = 1.07, p = 0.29 were not related to the self subscale. These three demographic factors of senior citizen service management students were also not related to the older adults

subscale. The results of a Spearman correlation confirmed the findings found from the independent sample *t*-test.

Unlike the outcomes mentioned above, the results of an independent sample *t*-test indicated that the year of study $t(87) = -2.12$, $p = 0.04$ of our nursing students was related to the self subscale. Identically, the year of study $t(87) = -2.44$, $p = 0.02$ of nursing students was also related to the older adults subscale. To be more specific, junior and senior nursing students (group 2) considered that these 13 features were more important for themselves and older adults than freshmen and sophomore nursing students. Again, the results of a Spearman correlation demonstrated that the year of study was the only factor associated with the self subscale ($\rho = 0.21$, $p = 0.04$) and older adults subscale ($\rho = 0.23$, $p = 0.03$). The comprehensive statistical results are shown in Table 5.

5.3 Positive attitudes toward older adults (GAS)

The findings (Table 3) indicated an item mean of 3.38 for the GAS instrument. In addition, factor means for three dimensions are as follows: Perceived Social Value (3.93), Service (2.95),

Table 5
Association of demographic features on Important to Self and Important to Older Adults on PMHB.

		N	Important to Self			Important to Older Adults		
			Mean (SD)	*t*-test	*p*	Mean (SD)	*t*-test	*p*
University 1 (n = 136)	Male	19	54.26 (7.97)	−0.83	0.41	58.79 (6.96)	−0.36	0.72
	Female	117	55.57 (6.10)			59.32 (5.85)		
	Yr/Study (Group 1)	73	55.93 (6.81)	1.07	0.29	60.21 (5.36)	2.02	0.05
	Yr/Study (Group 2)	63	54.76 (5.82)			58.14 (6.52)		
	With contact	125	55.42 (6.27)	0.16	0.87	59.14 (5.95)	−0.69	0.49
	Without contact	11	55.09 (7.85)			60.45 (6.62)		
University 2 (n = 89)	Male	18	57.78 (6.35)	1.75	0.08	60.06 (4.72)	0.89	0.38
	Female	71	54.75 (6.62)			58.63 (6.32)		
	Yr/Study (Group 1)	45	53.91 (6.88)	−2.12	0.04*	57.42 (6.52)	−2.44	0.02*
	Yr/Study (Group 2)	44	56.84 (6.12)			60.45 (5.12)		
	With contact	30	56.40 (6.10)	1.05	0.30	59.33 (6.30)	0.46	0.65
	Without contact	59	54.83 (6.89)			58.72 (5.94)		

Note: Yr/Study (Group 1) includes freshmen and sophomore students; Yr/Study (Group 2) includes junior and senior students. *$p < 0.05$.

and Compassion (3.80). The results showed that our respondents had positive attitudes toward older people regarding social values and compassion dimensions since it was over the midpoint of 3.0.[33,39] Among these 13 items, item 7 (*As people grow older, they become less organized and more confused*) was rated the lowest, with $M = 2.40$. This finding implied that our participants might have concerns in terms of the cognitive ability of older adults.

We also investigated if gender, academic program, year of study, and contact experiences in senior care facilities of all participants were related to their perceptions toward older adults. Again, freshmen and sophomore students were categorized into group 1, whereas junior and senior students were categorized into group 2. The findings of a one-way ANOVA showed that "gender" ($F = 7.39$, $p = 0.01$) was the only demographic factor associated with the entire GAS instrument (see Table 6). This result indicates that our female respondents have more positive attitudes toward older people.

Also, the results of an independent sample *t*-test indicated that only "gender" was associated with the subscales of PV $t(223) = -3.40$, $p < 0.05$ and SE $t(223) = -3.21$, $p < 0.05$. Thus, our

Table 6
Associations of demographic features with GAS instrument.

Subscale	Gender				*t*-test			One-way ANOVA	
	Male		Female		*df*	*t*	*p*	*F*	*p*
	M	*SD*	*M*	*SD*					
PV	15.43	2.91	17.27	3.01	223	−3.40	0.00*		
SE	10.73	2.59	12.02	2.16	223	−3.21	0.00*		
CO	15.51	2.70	15.13	2.42	223	0.87	0.39		
Overall	41.68	5.27	44.41	5.67	223	−2.72	0.01*	7.39	0.01*
	Academic program								
	Senior citizen service mgmt		Nursing						
	M	*SD*	*M*	*SD*					
PV	17.10	2.99	16.75	3.17	223	−0.84	0.40		
SE	11.82	2.33	11.79	2.22	223	−0.12	0.91		
CO	15.43	2.64	15.43	2.64	223	1.16	0.25		
Overall	43.96	5.77	43.97	5.58	223	0.01	1.00	0.00	1.00
	Year of study								
	Group 1		Group 2						
	M	*SD*	*M*	*SD*					
PV	17.19	3.19	16.72	2.92	223	1.14	0.26		
SE	11.76	2.29	11.86	2.29	223	−0.32	0.75		
CO	15.19	2.44	15.20	2.50	223	−0.03	0.98		
Overall	44.14	5.92	43.78	5.43	223	0.47	0.64	0.22	0.64
	Contact experience								
	With experience		Without experience						
	M	*SD*	*M*	*SD*					
PV	16.95	3.13	17.00	2.94	223	−0.12	0.91		
SE	11.70	2.38	12.04	2.05	223	−1.03	0.30		
CO	15.19	2.38	15.20	2.66	223	−0.04	0.97		
Overall	43.84	5.68	44.24	5.72	223	−0.49	0.62	0.24	0.62

Note: PV = Perceived Social Value of Older Adults, SE = Service Care Provided to Older People, CO = Compassion toward Older Adults; Group 1 includes freshmen and sophomore students, Group 2 includes junior and senior students. *$p < 0.05$

female participants had more positive attitudes toward older adults regarding their social value and perceived service provided to them.

6. Discussion

6.1 Awareness and adoption of My Health Bank application

While the respondents in this study can be considered digital natives due to their high adoption rate of the smartphone (99.6%), less than half of them had heard about *My Health Bank* (37.8%) or had downloaded this app (20.4%). A low adoption rate of different mHealth applications, ranging from women's health (38.7%) to lifestyle management (1.8%), was also discovered (see Table 1). These discoveries paralleled the findings from Jabour *et al.* that their 383 Saudi Arabian health college students had a 100% adoption rate of the smartphone but had a low adoption rate of mHealth applications (56%), with adoption mostly in the fitness and exercise category.[9] These findings illustrated that while young generations can be considered digital natives, they may not believe that adopting mHealth is essential. It is also possible that students may have some concerns about mHealth applications that may affect their attitudes toward mHealth adoption, such as data privacy policy, data disclosure, and data ownership.[23,24]

Nevertheless, these two findings showed that providing mHealth and related courses to promote awareness of usage of sensor and related technologies among students is necessary, especially because only 11.1% of participants have studied mHealth technology or health information system at their schools. Otherwise, having limited mHealth knowledge could be one of the significant factors that may prevent them from developing proper sensor and digital service competence to meet future human and healthcare service trends.

Among these 225 participants, 125 (91.9%) senior citizen service management and 30 (33.7%) nursing students mentioned that they had experiences conducting internships or being volunteers in senior service centers and related institutions. While nursing students had less contact experience with older adults, 116 (85.3%) senior citizen service management and 74 (83.1%) nursing students indicated they are willing to support the older population in learning and adopting mHealth applications. This finding confirmed that our participants are willing to help older adults adopt mHealth, especially when they perceive that the functions of mHealth are helpful for conducting self-health management. Therefore, we recommend a reasonable effort to develop a groundwork for the availability of an mHealth subject scheme for senior citizen service management and nursing students. In addition, many journal articles about current trends of mHealth applications are available to department heads and lecturers, which they may introduce to their students. This would be a great way to improve students' competence in mHealth knowledge, specifically about digital services and sensor technologies used for their clients.[4,20,24]

6.2 PMHB functions

The outcomes showed that our participants perceived the 13 functions of the app as important as the mean scores of their overall Important to Self and Important to Older Adults subscales

exceeded the 4 point level at 4.26 and 4.55, respectively (see Table 2). The results also indicated that our participants believe that these 13 features are more important for older people. Therefore, it is clear that promoting awareness of the *My Health Bank* should be one of the major tasks that the NHIA should focus on, especially for future senior citizen service management and nursing students due to their higher opportunities to interact with older adults.

Among these 13 functions, our participants, regardless of their academic programs, rated *allergic history*, *records of drug use*, and *reports of examinations* (items 5, 6, and 7, respectively) as the top three crucial functions for themselves and older people. *Vaccinations* (item 4) and *reminders of health checkups* (item 10) were also rated highly for themselves and older adults, respectively (see Table 2). However, the findings showed that junior and senior nursing students (group 2) considered these 13 functions more important for themselves and older people than the rest of all senior citizen service management students and freshman and sophomore nursing students (group 1). One possible explanation is that junior and senior nursing students may be more knowledgeable about healthcare issues than senior citizen service management students due to their curriculum and internship experience. As a result, they might perceive that this application's primary functions help to acquire health information.

It was important to find that the locations of pharmacies where face masks were available (item 12) and online face mask preorders (item 13) were rated as the bottom two functions for self and older adults. While the reasons were unclear, respondents may perceive that face masks were easy to obtain during the COVID-19 pandemic or believe that older adults may prefer person-to-person transactions as mentioned in the news.[7]

Despite our findings, the outcomes of an earlier study indicated that even though German primary care physicians agreed with the positive functions of mHealth applications (e.g., managing medicines and medical appointments), they were unwilling to recommend them to their patients due to the issues of transparency and privacy.[8] Nevertheless, while the COVID-19 pandemic caused a health crisis worldwide, it also created an opportunity for the NHIA to promote the *My Health Bank* through the help of college administrators, lecturers, and healthcare providers. Therefore, the NHIA should explain concerns about mHealth adoption (e.g., privacy and data ownership and management) and their solutions (e.g., anti-forgery features and mechanisms to ensure information security) to those who are willing to promote mHealth knowledge.[5]

Finally, Hsiao and Tang noted that acceptance of mHealth technology, especially by older adults, could be affected by technological (e.g., usefulness, ease of use, and ubiquity), social (subjective norm), and individual factors (health knowledge and health care need).[40] Therefore, future researchers should conduct more studies to explore reasons that may prevent people from adopting mHealth technology from the perspectives of human service providers, healthcare professionals, older adults, and younger adults. Whether the use of sensor-assisted facial authentication and fingerprint sensor camera to log in to mHealth applications on people's mobile devices would improve their adoption rate should be explored as well. These studies may improve our strategies in designing and promoting mHealth applications for all stakeholders.

6.3 Perceptions toward older adults (GAS)

The results obtained using GAS were heartening since our respondents have positive attitudes toward older adults (see Table 3). While our participants were recruited from two universities, they all endorsed items 3, 9, and 13 as the top three most positive perceptions toward older people. The compassion subscale (CO) was rated highest by our senior citizen service management students. In comparison, nursing students ranked the social value subscale (PV) as the highest. These findings could be considered potential signs of their willingness to serve this population.

Two specific concerns were uncovered when all items (items 6, 7, 8, and 9) of the service care subscale (SE) were reverse-coded for the scoring according to the instruction (see Table 3). Items 7 and 8 were rated lowest by both senior citizen service management and nursing students. These findings implied that participants perceive aging as one of the significant factors affecting older adults' cognitive ability. As a result, tracking the medical history would be challenging for this population.

These findings indicated that stereotypes concerning cognitive decline with aging should be reduced through positive aging education, such as providing facts on aging and opportunities to interact with older adults.[41] Other strategies that can be applied may include but are not limited to observation and reflexive writing about the personal experience of interacting with this population. Providing brochures to disseminate accurate information regarding the aging process is another option.[42,43] Most significantly, it is crucial to educate students about the difference between the normal aging process and age-associated diseases, such as Alzheimer's disease and dementia.[44] This would be another method to ensure that correct aging processes and facts can be delivered to students.

Since participants perceived that tracking the medical history of older adults is challenging, adopting mHealth applications among this population would be one of the most effective methods to address this concern. Therefore, the government should promote this application through different means, such as commercials, college lectures, healthcare providers, and senior learning centers' staff. These strategies would also promote awareness and adoption of various mHealth applications run by the government and private agencies.

Finally, the results showed that female participants had better attitudes toward older people. While the reasons were unclear, providing simulations of daily life activities (e.g., mobility and managing medications) would be the right strategy to help students understand the challenges that older adults may face, especially those with mobile, visual, and physical limitations.[45] These simulations of daily life activities would also help students reduce their negative perceptions of aging and related stereotypes.

7. Implications for Practices

Our research participants perceived that the main features of this government-operated mHealth application were useful, and they were willing to be facilitators for older people to

adopt it. Therefore, we suggest developing courses on sensor-related mHealth applications and related technology usage, which would allow them to understand the latest trends in the healthcare domain and improve their ability to adapt health-related technologies into their actual practice.

In addition, as mentioned previously, some researchers found that the issues of transparency and privacy could be significant factors that may prevent primary care physicians from promoting mHealth applications to their target population.[8] In fact, there are many concerns in terms of mHealth applications, such as data privacy policy, data disclosure and transfer, data management, and data ownership.[23,24] While this study did not focus on these issues, school lectures should include them when incorporating mHealth applications into their curricula. This would ensure that students understand positive and challenging perspectives on adopting mHealth applications.

Finally, the results indicated that our respondents perceived a connection between cognitive ability deterioration and aging. Therefore, it is recommended that a few courses be included in the core curriculum for senior citizen service management and nursing students to help them learn about cognition in later life and explore their stereotypes toward aging and ageist beliefs and attitudes. Inviting retired older adults and health-related professionals to interact with students and give lectures would be a good start.[41]

8.   Limitations and Recommendations for Future Research

This study's results identified some limitations and produced recommendations for future researchers who would like to conduct relevant studies. First, the findings obtained from this research cannot be used to represent the perceptions toward similar issues held by students from other universities. A dozen schools have the same or similar programs, and students may have different perceptions of the same issues due to their personal experiences and courses. Future researchers should explore whether students from those educational programs perceive the same issues differently. The results would help all stakeholders understand whether there is a need to apply specific strategies that can be used to improve healthcare practices for older adults through future practitioners in this digital era.

Second, the social desirability response has always been a limitation when conducting a self-report attitudinal study.[46] Although the collected surveys were de-identified, we believe that conducting small-scale interviews would be helpful to obtain additional information regarding the attitudes toward adopting mHealth applications and older adults of our future human service practitioners. Their feedback could help researchers examine whether incorporating sensor-related applications and proper aging education into human service and healthcare domains is needed.

Third, people's attitudes toward specific subjects, such as technology adoption or a particular demographic group, can change due to their improved awareness, knowledge of related issues, or contact experiences.[9,47] Therefore, it is highly possible that participants' awareness of the *My Health Bank* application could be changed due to their participation in this study or personal

experiences of the COVID-19 pandemic. As a result, the information obtained from participants may represent their attitudes toward mHealth applications and older adults during this particular period instead of their permanent attitudes or perceptions toward similar topics.

Finally, several prior studies and reports indicated that Taiwanese older adults had a low adoption rate of mHealth applications. While this study did not explore older adults' perceptions toward adopting mHealth, future researchers should conduct relevant studies to examine challenges that may prevent older adults from adopting mHealth applications. The results would help identify strengths and weaknesses in promoting mHealth applications among older adults for designers and service practitioners.

9.   Conclusion

The primary goal of this study was to explore awareness of and perceptions toward the *My Health Bank* mHealth application and its functions among Taiwanese university students from human service programs. The researchers also investigated whether our participants might help older adults adopt this mHealth application if they perceive it to be helpful. The government operates the *My Health Bank* application, and registered users can log in to it easily through sensor-assisted facial authentication and a fingerprint sensor camera. While the results showed that most of our participants were unaware of this application, they perceived its functions as helpful in conducting health management for themselves and older adults more conveniently. The reasons for the low adoption and possible strategies to increase the *My Health Bank* application usage were discussed. Further research directions and suggestions regarding providing the foundation of sensor-related mHealth applications, related technology usages, and proper aging courses are also discussed and provided.

Acknowledgments

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About the Authors

Pei-Ju Chao received her Ph.D. degree in information and management from National Kaohsiung University of Science and Technology, Kaohsiung, Taiwan, in 2012. She is currently an assistant professor in the Travel & Tourism Program, Ming Chuan University, Taiwan. She has published several papers in journals and conferences, such as Engineering Letters, IAENG International Journal of Computer Science, Proceedings of IEEE, and Proceedings of DSI. Her current research interests include the human–computer interaction (HCI), business value in artificial intelligence, and the Internet of Things. (pjchao@mail.mcu.edu.tw)

Yu-Huei Cheng (Senior Member, IEEE) received his M.S. and Ph.D. degrees from the Department of Electronic Engineering, National Kaohsiung University of Applied Sciences, Taiwan, in 2006 and 2010, respectively. He crosses several professional fields, including biological and medical engineering, electrical and electronic engineering, and information engineering. He is a distinguished professor in the Department of Information and Communication Engineering, Chaoyang University of Technology, Taichung, Taiwan. His research interests include algorithms, artificial intelligence, automatic control, bioinformatics, biomedical engineering, carbon neutrality, computational intelligence, electric and hybrid vehicles, embedded systems, the Internet of Things, machine learning, mobile medical, power electronics, renewable energy, robotics, smart healthcare, smart parking, smart transportation, and unmanned vehicles. (yuhuei.cheng@gmail.com)

Yi-Hui Liu received her master's and doctoral degrees in adult and continuing education from National Taiwan Normal University. She is currently an associate professor at the National Taichung University of Science and Technology in Taichung, Taiwan. She is also a certified social worker, and her research interests include supporting students with disabilities in different school settings and senior education. (ursula@nutc.edu.tw)

Tsu-Hsuan Hsu received his B.A. degree in communications from the University of Hawaii at Manoa, M.Ed. degree in special education from the University of Hawaii at Manoa, and Ph.D. degree in human rehabilitation from the University of Northern Colorado. He is currently an assistant professor at the Graduate Institute of Rehabilitation Counseling, National Changhua University of Education, Taiwan. He has published papers in several top-ranked international journals. His research interests include providing assistive technology to support students with disabilities in higher education as well as facilitating mHealth adoption for older adults.
(fenton47@gmail.com)