Inequality in Internet Use across Areas and Older Adults in Taiwan

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Abstract

Context: Internet use has been viewed as one of the indicator of active aging. However, whether the differences of using Internet for older people due to area discrepancies or individual disparities influence Internet use for older people or not are not confirmed.

Objective: The study aims to examine the Internet use in different areas and other related individual factors for the middle-aged and older adults in Taiwan.

Design: The secondary data were from the 2013 middle-aged and older adults digital divide survey.

Setting and participants: The sample was drawn from the older population aged 50 years old or more. The interviews were collected over the phone in 2013 (n=7157). Descriptive analysis, Chi-square test, and logistic regression were applied.

Results: There were 43.0% of the participants using Internet. The participants who lived in the towns with higher digital development, female, younger, having higher education, with occupation related to technology/science/art, housewife/ students, and retirees, and those with higher incomes were more likely to use Internet. Different purposes for Internet users and barrier types for non-users were related to individual characteristics.

Discussion: Removal of the structural barriers and encouraging lifelong education in Internet use are suggested.

Keywords: Internet; Digital development; Older adults; Social participation

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Introduction

Internet use assists older people to be connected with social network as well as the society, as a good tool to social participation and social connectedness [1,2]. The Word Summit on the Information Society sponsored by the United Nations in 2003 and 2005 has reached a consensus "to build a people-centered, inclusive and development-oriented Information Society, where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life, premised on the purposes and principles of the Charter of the United Nations and respecting fully and upholding the Universal Declaration of Human Rights"[3]. Internet use at least once a week is also one of the indicators in Active Aging Index (AAI) [4]. Although the factors of Internet use for older adults have been explored, the area and context factors are less considered. Whether the differences of using Internet for older people due to area discrepancies or individual disparities influence Internet use for older people or not are not confirmed.

Previous research has indicated that Internet is an important resource to get health-related information [5-7] and other kinds of information, thus, helping them make better health decision [8,9]. Internet use is beneficial to reduce cognitive decline [10], better well-being and having less depressive and anxiety symptoms [11,12] or as a moderator to mental health [13], and reducing loneliness [1,14]. For the frail elderly, an Internet-based videoconference system may help in providing support to them [15]. Most of the previous researches focused on the general population or on the patients in specific diseases. Internet use

is not always positive in social capital: ICT use may be related to lower attachment to place [16], and heavy Internet users may be a little committed to online community [17].

More and older people use Internet around the world. American Association of Retired Persons (AARP) [18] reported that 60% of the older people who aged 50 years old or more in the US, use Internet for the primary purpose doing work-related tasks, searching information, online purchasing (purchasing product, making travel reservation), banking, and reading newspapers/books/magazines. In China, Internet users use it for information approaching, entertainment, communication, and for advanced professional purpose [19]. For the non-users, the US non-use reasons included having no time, no technical aptitude, concern about online security, no computer access, and believing that Internet is too expensive [18]. Another study in Serbia reported that older adults do not use Internet because they do not have a reason at all (76.5%) [20].

Individual characteristics affect the opportunity in using Internet. Age, ethnicity, education, income, presence of a computer at home, a job requiring computer, were related to use of Internet for the older people [6,21-24]. Physical disabilities, cognition, and comorbidity may affect the use of Internet for older adults [20,25-27]. The cost and disability were also related to discontinuing Internet use [22]. One study from Taiwan indicated that the Internet use for health information among adult population was related to higher education, living alone, exercise habit, living in urban area, and better self-rated health [5].

Using Internet by ADSL and cable in Taiwan has been widespread; the broadband coverage has reached to 96.08% [28]. The third generation (3G) and the fourth generation (4G) wireless mobile communication systems through smart phone to get online have been gaining popularity, except in some remote areas. The Ministry of Education launched an action plan "Digital Care" for the students in the remote areas from 2012 to 2015, to which the sources could be applied on the elder community colleges as well. It seems the Internet has been widely used among the younger cohorts, but not yet in the older adults, and the area level characteristics related to Internet use are barely known [29]. The purpose of this study is to explore the individual- and area-inequality in using Internet for the older people in Taiwan. The finding is expected to provide implications for aging policy.

Methods

Data and samples

The data was from a secondary telephone survey data, "the digital opportunity survey for the people aged 50 and over" [30], which was a telephone survey conducted in 2013. The sample was drawn by stratified sampling from the people who were aged 50 years old or more in all the 22 cities/counties in Taiwan. The telephone interview was conducted at nights of weekdays or in weekends from July to August, 2013. The sample was weighted based on city/county, age and sex distribution in analysis to generalize to the older population in Taiwan. In total, there were 7,157 participants in this study.

Ethics

The data were from an anonymous source. The research had been approved by Asia University Medical Research Ethics Committee (No.10503006) before the analysis.

Measures

Internet use: The respondents were asked if they used Internet. For those Internet users, they were asked if they used Internet for the following purpose: political opinion expression, family connection, friend connection, social contact, learning, fun, information search, sharing experience and feeling, making money, and job or profession related purpose. The different purposes were categorized into four categories: political participation, social connection (family, friend, and social contact), cognition (learning, fun, information search, and sharing), and work (making money or job related). The users were also asked about the crisis in using Internet. For the non-users, they were asked the reasons for not using the Internet. They were also asked of the barriers in buying computers for Internet use, and if they knew the free Internet places. We further grouped the barriers into four types: no barriers, having information (about free Internet) barrier only, financial barriers only, and double barriers.

Individual characteristics: Individual characteristics included sex (male/female), age (age 50-54, 55-59, 60-64, 65-69, and 70+), education (illiterate or non-formal educated, elementary school, primary high school, senior high school, college, university, graduate or above), occupations (primary industry (such as farming, fishing, woods, livestock), manufacturing (including electrics and gas, water and pollution, construction, sales. Transport and storage), services (hotel and restaurants, supportive services and other services), profession (including information, finance, estate, science and technology profession, public administration, defense, education, medical care and social work, art, and leisure), unemployment (housework/unemployed/student), and retirees), income (<NT19047 (salary wage minimum in Taiwan), NT19047-29999, NT30000-69999, NT 70000+), and illness affecting Internet use (yes/no).

Area characteristics: The digital development of the areas was scored according to township of the participants, which was defined according to the digital development level in human resources, socioeconomics, education and cultural development, transportation mobility, living environment and information infrastructure, and then scored all the township/districts from level 1 to level 5; level 1 indicated the highest development and level 5 indicated the lowest level [30]. In addition, the townships of the participants were also recoded to urban towns, lowly remote areas, and highly remote areas [31].

Analysis: Descriptive analysis, Chi-square test, and logistic regression analysis were applied. In the multiple logistic regression models, we put the individual-level and area-level variables separately into the first two models, and then included these two sets of variables together in the last model. Significance level for all analysis was set at 0.05.

Results

Table 1 shows the sample characteristics and the percentage of Internet use for each group. Forty three percent of the samples were reported as Internet users. The participants who were younger, male, with higher education, working in a professional or manufacturing occupation, having higher personal income, healthier, living in higher digital development area and living in urban/town area, were more likely to use Internet.

Table 2 shows the social participation by using Internet for those Internet users (n=3057). There were 65.6% who used Internet for social connection: 52.3% for family, 56.0% for friends, and 34.6% for other social contacts. Most of them (90.0%) used Internet for cognition purpose, including for learning (72.0%), fun (68.9%),

Table 1 Characteristics of the samples and the internet use percentage.

Variables	Number of persons	Percentage of total (%)	Percentage of Internet use (%)
Internet use			
Yes	3057	43.0	-
No	4100	57.0	-
Age*			
Age 50-54	1174	24.8	66.3
Age 55-59	1581	22.1	57.5
Age 60-64	1277	17.8	41.4
Age 65-69	735	10.3	27.6
Age 70+	1790	25.0	14.6
Sex*			
Male	3461	48.4	47.7
Female	3696	51.6	38.6
Education*			
Illiterate or non-formal	742	10.5	2.3
Elementary school	1637	23.1	11.0
Primary high school	1023	14.4	28.1
Senior high school	1852	26.1	56.9
College	763	10.8	78.0
University	881	12.4	83.0
Graduate or above	192	2.7	93.8
Occupation*			
Primary industry	438	6.2	17.6
Manufacture	1233	17.5	55.9
Services	496	7.0	49.4
Profession	718	10.2	85.9
Unemployment	1822	25.8	27.1
Retirees	2353	33.3	38.2
Personal income*			
None ~ NT 19047	3754	59.1	25.3
NT 19047 ~ 29999	895	14.1	45.7
NT30000 ~ 69999	1303	20.5	71.1
NT 70000+	400	6.3	87.5
Symptoms affecting computer use*			
No	1707	23.8	48.3
Yes	5450	76.2	41.3
Area in digital development level*			
Level 1	2458	34.3	53.6
Level 2	2851	39.8	43.0
Level 3	1346	18.8	28.6
Level 4	267	3.7	39.7
Level 5	234	3.3	17.1
Rural area*			
Urban/town	6348	88.7	45.4
Lowly remote	622	8.7	24.0
Highly remote	187	2.6	21.9

Note: N=7157. Missing cases were deleted list wise. Chi-square test was analyzed, $^*p<0.05$, $^{**}p<0.01$, $^{***}p<0.001$

Table 2 Internet use in social participation for internet users (n=3057).

Social participation by internet	%
Social connection	65.6
Family connection	52.3
Friend connection	56.0
Social contact	34.6
Cognition	90.0
Learning	72.0
Fun	68.9
Information searching	82.9
Sharing	45.8
Work	21.7
Making money	14.0
Job or profession	15.1
Political participation	5.5

informational searching (82.9%), and sharing (45.8%). And 21.7% of the users used Internet for work: 14.0% used it for making money, and 15.1% used it for job or professional purpose. Only 5.5% of the users used Internet in political opinion expression.

Those Internet users also reported crisis in using Internet, including computer virus (47.0%), data insecurity (41.9%), and reducing time for housework/exercise/sleep (21.1%), poor sleep quality (10.4%), Internet cheating (7.4%), addition (5.9%), cyberbully (2.4%), and others (30.5%).

For those non-users (n=4082), the main reason was learning difficulty issues (such as typing slow, illiterate or unable to use English, don't know how to go on Internet, feeling unable to learn, didn't want to learn, feeling no needs, not interested, too busy to learn)(881.%); other reasons included the health problem (such as sight problems, disabilities, getting old) (17.3%), inconvenient environment (such as too expensive, poor devices) (4.6%), fear of using Internet (worry to break computers, to be cheated or be hacked, worry to be addicted, radiation from computers, etc.) and others (3.8%). **Table 3** shows if they had financial stress from buying computer/smart phone or going online (financial barrier), and if they knew there were free Internet in some public places (informational barrier). There were 16.5% of non-users who did not have financial or informational barriers; 31.5% did not know the free Internet information; 10.7% reported financial barriers; and 41.4% of them reported both barriers.

Table 4 shows the result of the factors related to Internet use by logistic regression. M1 added the individual characteristics only; M2 added the area characteristics only, and M3 added both groups of independent variables in the model. In M1, when only consider the individual characteristics, being female, younger, higher educated, occupation in manufacture, services, technology/science/art, unemployed, retiree (compared to primary industry), having higher income and having no serious health problem to affect Internet use, were more likely to use Internet. In M2 when considering area characteristics only, the areas with higher digital development level and urban townships were more likely to use Internet. M3 shows the completed model: The older persons who were female (OR=1.281),

Table 3 Barriers for non-users (n=4100).

Type	%
No barriers	16.5
Informational barriers (of free Internet) only	31.5
Financial barriers only	10.7
Both barriers	41.4

younger (OR=0.614), higher educated (OR=2.168), occupation of technology/science/art (OR=3.216), unemployed (OR=1.490), retiree (OR=2.431), and higher income (OR=1.549), as well as living in higher digital development level 1 (OR=2.441) and level 2 (OR=1.84), were more likely to use Internet. We also tried to add interaction terms of area level variables with education, income, or occupation, but those were insignificant.

Table 5 shows the related factors to social participation by Internet for older people; only the Internet users were included in the analysis. Four types of social participation activities were included: political participation, social connection, cognition and learning, and work purpose. Those with higher education (OR=1.422) were more likely to use Internet in political participation, while the unemployed (housewives, students, unemployed) were less likely compared to the primary industry workers in political participation by Internet (OR=0.195). The users who were female (OR=1.679) and with higher educated (OR=1.225) were more likely to use Internet for social connection. Those who were female (OR=1.653), higher educated (OR=1.317), working in technology/science/art (OR=2.713), having higher income (OR=1.203), and having illness (OR=1.774), were more likely to use Internet for cognition and learning purpose. Those who were younger (OR=0.758) and having higher income (OR=1.208) were more likely to use Internet for work purpose. The area characteristics were non-significant in different social participation, which means the pattern of Internet use were similar across areas.

Table 6 shows the information and financial barriers for non-users by multinomial logistic regression; the non-barrier group was the reference group. The non-users who were male, older, lower educated, working in primary industry instead than retiree,

Table 4 Factors related to internet use by logistic regression (odds ratios).

Variables	Model 1	Model 2	Model 3
Individual			
Sex (Female)	1.343***	-	1.281**
Age	0.622***	-	0.614***
Education	2.217***	-	2.168***
Manufacture	1.542*	-	1.193
Services	1.694*	-	1.278
Technology science or art	4.004***	-	3.216***
Housework, unemployed, students	1.937**	-	1.490*
Retiree	3.168***	-	2.431***
Income	1.567***	-	1.549***
Illness	0.854*	-	0.857
Area			
Digital development level			
1	-	4.063***	2.441**
2	-	2.742***	1.884*
3	-	1.658*	1.323
4	-	2.844***	1.856
Remote area			
Highly remote	-	0.585*	0.802
Lowly remote	-	0.716**	0.915
-2LL	5437.986	8239.308	5387.803
Chi-square	3059.922 (df=16)	258.600 (df=6)	3110.105 (df=16)

Note: N=7157. The reference group: Internet use (no), sex (male), age (50-54 years old, every 5 years as a category), occupation (primary industry), rural area (urban/town), area digital development (lowest); other variables were ordinal variables, *p<0.05, **p<0.01, ***p<0.001

Table 5 Factors related to social participation by internet for older adult internet users by multiple logistic regressions.

Variables	Political participation (OR)	Social connection (OR)	Cognition (OR)	Work (OR)
Individual				
Sex (Female)	0.679	1.679***	1.653**	0.945
Age	0.844	0.957	0.918	0.758***
Education	1.422***	1.225***	1.317***	1.049
Manufacture	0.500	0.959	1.488	1.671
Services	0.365	0.774	1.714	2.087
Technology science and art	0.405	0.922	2.713*	1.10
Housework, unemployed, students	0.195**	0.758	1.381	1.622
Retiree	0.406	0.946	1.346	1.755
Income	0.837	1.067	1.203*	1.208**
Illness	0.868	1.095	1.774***	0.832
Area				
Digital development level				
1	2.883	2.002	0.871	1.367
2	2.628	1.944	1.354	1.177
3	1.007	1.328	1.168	1.049
4	2.641	2.006	1.020	0.887
Remote area				
Highly remote	1.763	1.427	1.222	1.481
Lowly remote	1.520	1.494	1.642	1.169
Model -2LL	1067.068	3230.524	1493.276	2628.685

Note: N=3057. Social connection included family contact, friend contact, social contact; cognition included learning something new, for fun, for information searching, or sharing; work included making money or profession/work related use. The models were conducted by multiple logistic regressions. The reference group of the categorical variables was: sex (male), occupation (primary industry), illness (no serious problem to affect computer use), digital development level (level=5, lowest), and remote area (urban); other variables were ordinal variables. -2LL represents -2 log likelihood, *p<0.05, **p<0.01, ***p<0.001

Table 6 Factors related to informational and financial barriers for non-users by multinomial logistic regression (odds ratios).

Variables	Don't know free Internet only	Financial pressure only	Both financial and informational barrier
Individual			
Sex (Female)	0.531***	0.800	0.538***
Age	1.312***	1.014	1.318***
Education	0.717***	0.827**	0.575***
Manufacture	0.612	1.826	1.148
Services	0.781	2.662*	1.320
Technology science and art	0.516	2.108	0.972
Housework, unemployed, students	0.846	1.192	1.093
Retiree	0.564*	1.113	0.710
Income	0.843*	0.525***	0.440***
Illness	0.757*	1.129	1.185
Area			
Digital development level			
1	1.825	1.316	0.771
2	1.842	1.140	0.945
3	1.884	0.939	1.093
4	1.594	0.810	0.974
Remote area			
Highly remote	1.035	0.785	1.034
Lowly remote	1.144	1.178	1.297

Note: N=4100. The reference group for the dependent variable was no financial or informational barrier (knowing free Internet place and no financial pressure in Internet or computer). The reference group of the categorical variables was: sex (male), occupation (primary industry), illness (no serious problem to affect computer use), digital development level (level=5, lowest), and remote area (urban); other variables were ordinal variables, -2 log likelihood=5.442E3, Chi-square=753.629 (df=48)

lower income, and no serious health problem, more likely had the information (of free Internet) barrier. Being less educated, working in service industry (compared with primary industry), and lower income were more likely to have financial barrier in Internet facility/gadget. And those who were male, older, lower educated, and lower income were more likely to have both financial and informational barriers. Area characteristics (digital development area and remote area) were non-significant, that means the individual characteristics were the primary factors in these two types of barriers instead of area factors among the non-users.

Discussion

This study examined the behavior of Internet use and its individual- and area- disparities among older adults in Taiwan. There were 43.0% of the older adults reporting Internet use. Individual characteristics (age, sex, education, occupation, income) as well as area-level characteristics (digital development degree and urban area) were related to Internet use, indicating that there were disparities among individuals and across areas. However, there were only individual differences in social participation by Internet among the Internet users, but no area differences. For the non-users, the barrier types were only related to individual characteristics but not area characteristics.

Area disparities in using internet

Area characteristics were associated to Internet use among older adults in Taiwan. It is possible that the higher digital development areas set more Wi-Fi hot spots or through 3G or 4G wireless mobile

communication system were easily accessible. It is also possible that the lifestyles in these areas are more likely to use Internet, such as a technology industry district or a university town. The people in these areas may have higher Internet stickiness in daily life. The towns/districts located in remote areas were related to lower possibility to use Internet, which was consistent with previous research [5]. The towns/districts in remote areas may have limited access to Internet. Internet use has been viewed as one approach to connect with social network and social participation. The Internet infrastructure should be equally built up and the area inequality can be removed as much as possible.

Individual disparities in using internet

Individual variables were stronger predictors than the area-level variables to affect Internet use. The older people being female, younger, highly educated, having higher income, and occupation in technology/science/art, unemployed, or retiree (compared to the primary industry occupation) were more likely to use Internet. The results of age, education, and income were consistent with previous research [6,11,21,23]. Previous studies did not indicate gender difference in using Internet for older people. It is interesting that the older females were more likely to use Internet than older males in Taiwan. In the oldest cohort, the females have lower education level than males, and thus the oldest females should have lower Internet use percentage. However, the gender difference in the education opportunity for the middle-aged and younger cohorts has been diminished in Taiwan. And using Internet through mobiles is easier compared with learning computers.

Regarding to occupation differences in Internet use, it is possibly due to the different working needs and lifestyles for various occupation in using Internet. The unemployed, students, housewives, or retirees are also more likely to use Internet, probably because the Internet is one of the important ways for them to connect with society, or these people have more time in using Internet for learning or leisure.

In addition, cognitive decline may be a barrier for older people to use Internet, which maybe more severe when getting old [25]. A longitudinal study from England suggests that Internet use may reduce cognitive decline [10]. However, the cognitive function was unavailable in this data. The mutual causal relationship of cognitive function and Internet use needs further examination.

Differences in social participation with internet

The percentage of political participation through Internet was relatively low. Xie and Jaeger state that "governments do not do an adequate job of communicating to citizens the importance of online interactions with the government and other forms of online political participation", particularly in the countries that older adults were less likely to express political opinion through Internet or any other approach to avoid suspicion of dissenting from government [32]. The "spiral of silence" theory [33] explains that when the people have fear of isolation if they get punished by expressing their opinions in a social group or society, that would lead them to remain silence; and vice versa. Such phenomenon has been observed on political expression on Facebook [34]. We found that people having higher education and having a job were more likely to use Internet to express political opinions than the less educated ones or the unemployed. Possibly that the less educated and the unemployed older adults are relatively disadvantages in the society, and thus, they are more affected by the spiral of silence effect.

Female older adults were more likely to use Internet for social connection and for cognition purpose when the education was controlled in this study. Only few researches explored the gender difference in Internet use for social networking or social contacts [2]. In the traditional Taiwan society, the older males are more often engaged in work and political participation than older females, and the older males were easier to connect with colleges, friends and society than older females in all the approaches. Thus, Internet may be one convenient approach to social participation for older females. Additionally, older females usually spend more times on social networking with family and friends and lifelong learning than older males [35].

Differences in barriers for non-use of internet

Presence of a computer could be a related factor to Internet use [24]. Not only the cost of computers or smart phones is one of the barriers, using Internet also costs. Financial strain is a barrier to use Internet, especially when the free Internet is not available in the area. Thus, the informational barrier to free Internet may hinder the willingness to start Internet use. The free Internet is available in many places in the urban areas in Taiwan, such as in the metro station, government buildings, schools, or some stores. The free Internet hot spots may be fewer in the low digital development areas, that makes using free Internet is not convenient. In addition, there were some non-users who did not have information or financial barriers to use Internet.

Conclusion

This study examined the Internet use behavior and related factors among the older adults in Taiwan. There may be both area and individual inequality in Internet use. Internet is not the only way for social engagement, but it is a more and more popular way to connect with the world. The area inequality in using Internet should be as much as to remove in order to promote opportunities to active aging for older adults. In addition, the more disadvantageous older people who are older, male, less educated, or having lower income were less likely to use Internet. The disadvantageous older people should be assisted, encouraged, and educated to use Internet, thus to increase their chance and ability to more labor and social participation, social connectedness, and lifelong learning to promote active aging in the future.

Limitations

There were limitations of this study. First, this present study used secondary data for analysis; some variables were unavailable, such as cognitive function and the medical information searching behavior through Internet. Second, other area-level variables may also be the confounding factors to the Internet use behavior, such as the demographic distribution and local government administration.

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