Smartwatch Use Among Older Adults: Findings from Two Large Surveys

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Abstract. Access to modern mobile information and communication technologies (ICT) such as smartphones, tablets, smartwatches, and other wearables in later life remains poorly understood, as does the use of such technologies. Even though modern ICT devices permeate daily life, little is known about the distribution of modern handheld assistances such as smartwatches among older adults. This paper presents data on the distribution of smartwatches among older adults (and the predictors of this usage) by utilizing two representative data sets from Switzerland. Secondary analyses were based on two cross-sectional surveys of 1,824 participants (study 1: n = 811, age ≥ 56 years; study 2: n = 1,013, age ≥ 50 years). Both univariate and multivariate analyses were conducted. The results indicate that 4.4% (study 1) and 6.6% (study 2) of participants owned a smartwatch, and most used the technology daily. Univariate analysis showed that education, age, technological affinity, and the use of mobile ICT devices (smartphones, tablets, and fitness trackers) in particular distinguished smartwatch users from nonusers, whereas gender, income, quality of life, subjective health, participation in education offers and sports, and the use of classical ICT devices (such as radio, TV, and computers) were not significant predictors of group differences between user and non-user of smartwatch. Multivariate analyses confirmed the univariate findings by showing that education, interest in technology, and the use of mobile ICT devices predicted smartwatch usage. While the results must be viewed with caution because of the generally low number of smartwatch users, this initial evaluation of smartwatch use among older adults should nevertheless enrich discussions of the acceptance of wearables among them.

Keywords: Wearables · Information and communication technologies · Seniors · Smartwatches · Smart devices

1 Introduction

New information and communication technologies (ICT) tend to become embedded in the daily lives of older adults in digitalized societies. In response, the field of gerontology has recently placed technology usage on the research agenda [1]. Since the mid-1990s, the population in general has often viewed wearables as an opportunity to access information on the go and to communicate independently of location. Such technologies thus act as a "visual-memory prosthetic" and a "perception enhancer" [2]. Meaning that

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wearables can serve as body-near personal information repositories and human capability enhancer. The smartwatch in particular has been the focus of increased attention in recent years, notably since the release of the Apple Watch and the Samsung Galaxy Watch. A smartwatch is a wearable computer worn on the wrist that primarily acts as an extension of a mobile phone. Smartwatches can show notifications and track physical activities, heart rate, and other related metrics, among other uses [3, 4]. The newest smartwatches often include a touch screen and can support advanced features and display high-resolution information; they usually include mobile apps and have their own mobile operating systems.

Smartwatch ownership rates among the general population are lower than for smartphones or tablets, although current statistics show an increased number of uses [5]. One in six US adults owned a smartwatch in 2018, when the top three manufacturers (Apple, Samsung, and Fitbit) accounted for 88% of smartwatch sales [6]. Marketing reports predict that older adults will likely make up the fastest-growing segment of the population to adopt wearable devices such as smartwatches because of the growth of new health-related features (such as health monitoring and reminders of health-related behavior) that are appealing to older people [7].

Although increasing numbers of older people have started to use mobile digital devices such as smartphones, tablets, and fitness trackers [8–11], a divide [12, 13] still exists between younger and older people in both access and usage rates [9, 14]. For this reason, older adults must still be considered a special target group when discussing the use of handheld technologies and wearables. Studies have also shown that older adults have specific requirements when they handle mobile devices (and the applications on those devices) and that lack of familiarity or lack of need for such technologies are important reasons for nonuse [10, 15–17].

Due to the recent diffusion of smartwatches within the global market, older people increasingly use smartwatches to assist in everyday life, such as by managing emergencies, helping with reminders to take medication, controlling health indicators, encouraging physical activity, and helping them navigate new locations [18–24]. Current research shows that older adults use smartwatches in different ways and for various purposes, for example, a recent Spain-based qualitative study showed that the most common uses were to manage notifications and to keep track of sports activities [18].

Research on smartwatches among older adults remains scarce regarding the general distribution of smartwatch users among the older population. Almost nothing is known about the use of smartwatches within the general older population and the integration of these watches within older adults' everyday lives. Data about the distribution of smartwatches to some extent exists only for the general population (typically based on marketing reports), but the same is not true for the older population. Research on which factors influence the acceptance of smartwatch use among older adults remains scarce or is often based on convenience samples or small sample sizes [18]. For this reason, generalization to the general older population is almost impossible. Considering the potential benefits of smartwatches for users, reaching an understanding of older adults' intentions to use this type of technology and examining actual usage behaviors are becoming increasingly important research activities.

2 Research Questions

Given this current research background and the fact that current research on smartwatch usages among older adults remains scare regarding the general share of users and non-users of smartwatches, the present study has investigated the distribution of smartwatches among older adults by using two representative samples from Switzerland. From an empirical perspective, older people often exhibit lower usage rates of modern ICT devices such as computers, smartphones, tablets, or wearables than the younger population [9]. Older adults are generally not the first to adopt new technologies, which has led to a situation known as the "digital divide" [12, 13, 17]. The field of critical gerontology, however, reminds us to view technologies not only as helping seniors to improve their quality of life and to cope with everyday life tasks but also as daily expressions of individuality and leisure behavior [25]. The first question to be asked in this paper is thus not only why older adults often do not use smartwatches but also how many older adults *do* use smartwatches and include those technologies in their everyday lives for different purposes.

The second goal of this paper is to evaluate, using a more explorative approach, the significant predictors of smartwatch ownership. Bearing in mind previous gerontechnology research and technology-acceptance models on wearables usage among older adults [1, 16, 17, 26], the assumption in the present study is that socio-demographic variables such as age, gender, education, income, and health situation can help predict whether people are smartwatch users. Research has shown that beyond socio-demographic variables, having information about people's affinity for technology and current technology use in general is also important for examining people's intentional motivation to use smartwatches [27]. The assumption in this study is thus that those with an interest in new technologies and broader ICT experience in general will more often own smartwatches than those who lack such interest and experience.

Third, beyond examining general usage rates, individual reasons for using smartwatches should also be studied, which leads to another research question: What are the most common reasons for smartwatch usage? Based on previous work [18, 28], the study's assumption is that sports activities and the continuous monitoring of health-related information are important reasons for smartwatch usage.

3 Method

3.1 Samples

An important characteristic of this study's secondary data analysis is that the data was drawn from two large surveys performed in Switzerland. For this reason, replicating what emerged in one study in an independent second sample should add to the robustness of the findings.

The first study is based on data drawn from a representative survey [29] of 811 participants enrolled in the University of the Third Age at the University of Zurich and ETH Zurich, the Swiss Federal Institute of Technology, Switzerland (UZH3). The study was a self-guided survey administered in August 2018 that was given via paper and pencil or online. All participants of UZH3 were invited via mailed invitations to be involved

in the study; no financial incentives were offered to participate. The response rate of this survey was 28%. UZH3 offers periodic open lectures from different departments on various scientific topics for an annual participation fee. The survey participants had attended a talk an average of 12 times during the previous 12 months (standard deviation [SD]: 10.89). The participants included in this study (N = 811) were at least 56 years old, with an average age of 72.49 years (SD = 5.97); 48% were female. Table 1 provides a description of the study 1 sample.

Table 1. Study 1: Sample description and smartwatch user group description.

Parameter	Range	*M* or %	Smartwatch nonusers (n = 741)	Smart-watch users (n = 34)	T-test T (p) or Cramér's V (p)
Gender					
Female		50.2%	51.0%	35.3%	.065 (.073)
Male		49.8%	49.0%	64.7%	
Age					
Age mean	56–94	71.95	71.96	70.09	2.006 (.052)
Age group: < 60		0.4%	0.4%	–	.072 (.406)
Age group: 60–69		41.4%	41.0%	52.9%	
Age group: 70–79		44.9%	45.2%	44.1%	
Age group: 80–89		12.8%	12.8%	2.9%	
Age group: ≥ 90		0.5%	0.5%	–	
Education					
Primary		0.3%	0.3%	–	
Secondary		48.7%	49.4%	24.2%	**.104 (.017)**
Tertiary		51.1%	50.3%	75.8%	
Household income[1]	1–6	4.07	4.07	4.50	-1.974 (.056)
Quality of life[2]	1–6	5.49	5.50	5.41	.612 (.544)
Subjective health[3]	1–6	4.98	4.98	5.00	-.179 (.859)
Interest in technology[4]	1–5	3.79	3.77	4.15	**-2.040 (.049)**
Technology use difficulty[5]	1–5	2.65	2.68	1.97	**3.594 (.001)**
Classical ICT device count[6]	0–3	2.88	2.88	2.91	-.460 (.648)
Mobile ICT device count[7]	0–3	1.51	1.45	2.44	**-7.161 (<.001)**
Lecture visitation[8]	0–50	12.10	12.08	14.16	-.939 (.355)

Notes: 1: *Household income* (in Swiss francs [CHF]), from 1 (< 2,001) to 6 (> 10,000). 2: *Perceived quality of life*: scale from 1 (very bad) to 6 (very good). 3: *Subjective health*: scale from 1 (very bad) to 6 (very good). 4: *Interest in technology* ("I'm very interested in new technical things"): scale from 1 (does not apply at all) to 5 (applies fully). 5: *Technology use difficulty* ("I find it difficult to operate modern technical equipment"): scale from 1 (does not apply at all) to 5 (applies fully). 6: *Classical ICT device count* (count of three ICT devices: radio, TV, and computers). 7: *Mobile ICT device count* (count of three ICT devices: smartphones, tablets, and fitness trackers). 8: *Lecture visitation* (active lecture visits at the Senior University of the Third Age within the last 12 months).

The second study was conducted in November 2016 under the project title "Mobile Health Tracking in Old Age (mHealth50+)" [8]. A total of 1,013 adults aged 50 years and older from the German- and French-speaking regions of Switzerland were interviewed using a computer-assisted telephone interview (CATI) format. The response rate of the survey was 19%. All participants approved of the telephone interviews. A standardized questionnaire was administered with 24 questions about personal details (age, sex, education, sports, subjective health, and subjective quality of life) and mobile device usage

for health tracking. A random sample of the permanent-resident population of Switzerland aged 50 years and older was selected from the AZ-Direct database (based on the public phonebook). The age of the respondents in the sample ranged from 50 to 95 years, with a mean age of 65.3 years; 53% were female. Table 2 provides a description of the study 2 sample.

Table 2. Study 2: Sample description and smartwatch user group description.

Parameter	Range	*M* or %	Smartwatch nonusers (n = 934)	Smartwatch users (n = 66)	T-test T (p) or Cramér's V (p)
Gender					
Female		53.1%	53.5%	48.5%	.025 (.427)
Male		46.9%	46.5%	51.5%	
Age					
Age mean	50–95	65.28	65.35	62.62	**2.282 (.025)**
Age group: < 60		38.0%	37.8%	45.5%	.070 (.301)
Age group: 60–69		28.8%	29.0%	28.8%	
Age group: 70–79		20.0%	19.8%	21.2%	
Age group: 80–89		12.0%	12.3%	4.5%	
Age group: ≥ 90		1.1%	1.1%	–	
Education					
Primary		19.1%	18.6%	19.4%	.070 (.086)
Secondary		56.6%	57.7%	45.2%	
Tertiary		24.4%	23.7%	35.5%	
Household income[1]	1–5		2.56	2.91	-1.802 (.077)
Quality of life[2]	1–5	4.37	4.36	4.38	-.153 (.879)
Subjective health[3]	1–5	4.07	4.07	4.08	-.036 (.971)
Interest in technology[4]	1–5	3.18	3.14	3.79	**-3.820 (<.001)**
Technology use difficulty[5]	1–5	2.73	2.75	2.55	.922 (.325)
Mobile ICT device count[6]	0–3	1.18	1.12	1.97	**-8.401 (<.001)**
Sports[7]	0–5	3.49	3.49	3.61	-.670 (.505)

Notes: 1: *Household income* (in CHF), from 1 (< 4,001) to 5 (> 12,000). 2: *Perceived quality of life*: scale from 1 (very bad) to 5 (very good). 3: *Subjective health*: scale from 1 (very bad) to 5 (very good). 4: *Interest in technology* ("I'm very interested in new technical things"): scale from 1 (does not apply at all) to 5 (applies fully). 5: *Technology use difficulties* ("I find it difficult to operate modern technical equipment"): scale from 1 (does not apply at all) to 5 (applies fully). 6: *Mobile ICT device count* (count of three ICT devices: smartphones, tablets, and fitness trackers). 7: *Sports*: sports activity in general, rated from 0 (never) to 5 (daily).

3.2 Measures of Study Variables

The dependent variable "smartwatch use" was defined as smartwatch usage and was rated on a five-point scale (1 = daily, 2 = once a week, 3 = once a month, 4 = seldom, and 4 = never or I do not own). Smartphone users were defined as those who had used a smartwatch, regardless of frequency, whereas smartwatch nonusers were defined as those who did not own a smartwatch.

To examine whether standard demographic variables were significant predictors for smartwatch use, a set of variables was included in the univariate and multivariate models: age (in years), gender (female/male), education (primary/secondary/tertiary), and household income (gross household income in Swiss francs [CHF], from low to high).

Tables 1 and 2 include specific details of the scales used within the two surveys. In addition to those basic variables, information on life situation was also used, including perceived quality of life and subjective health (both measured with a five- or six-point Likert scale, from low to high). Tables 1 and 2 provide details.

As described in the introduction, the acceptance of new mobile technologies such as smartwatches is often influenced by people's "technological affinity" and the use of other technologies. The secondary analyses thus included information about people's attitudes toward technologies: more precisely their interest in technology (based on the statement "I'm very interested in new technical things") and their technology usage difficulty (based on the statement "I find it difficult to operate modern technical equipment"), rated on a Likert scale from 1 ("does not apply at all") to 5 ("applies fully"). Information about other ICT device use was also included, including "classical ICT device count," which is a count of the three ICT devices of radio, TV, and computers (used only in study 1), and "mobile ICT device count," which is a count of three modern mobile ICT devices (smartphones, tablets, and fitness trackers).

For the bivariate analyses, study-specific variables for the two survey studies were also included. For study 1, information about the frequency of lecture visits at the Senior University of the Third Age within the last 12 months (ranging from 0 to 50 visits) was included to examine whether active participation in educational settings influenced smartwatch usage, such as by using smartwatches as a tool for "situated reflection" within educational contexts [30]. For study 2, information about sports activities (sports activity in general, rated from 0 [never] to 5 [daily]) was used to examine whether participation in sports influenced smartwatch usage, such as using the devices to track one's physical activity [3, 8].

3.3 Analytic Strategies

SPSS (version 25) was used for the statistical analyses. Univariate analyses were used to describe the differences in the characteristics of the smartwatch user and nonuser groups by applying the Student's t-test and chi-square testing. In addition, two binary logistic regressions based on the two groups were calculated to analyze the statistical predictors of smartwatch use.

4 Results

4.1 Descriptive Data on Smartwatch Use

In study 1, which involved participants from the Senior University of the Third Age, 4.4% (n = 34) of participants were smartwatch users. Of these smartwatch users, 55.9% used their smartwatches daily, 5.9% used them once a week, 8.8% used them once a month, and the rest (29.4%) used them more infrequently than once a month. All smartwatch users were also smartphone users, and 90.9% of all smartwatch users also used a tablet; 61.8% of all smartwatch users also owned a fitness tracker in addition to their smartwatch.

In terms of standard demographics, the bivariate analyses (see Table 1) showed that only education was a significant distinguisher between smartwatch users and nonusers.

The regular descriptive frequency differences, however, showed that males, younger people, and those with higher incomes were more likely to be smartwatch users, although these findings were not significant. Quality of life and subjective health also showed no significant effects, whereas technological affinity showed significant explanatory power. Smartwatch users were more often interested in new technology in general and had less difficulty in the use of these technologies. Whereas the use of classical ICT devices (radio, TV, and computers) did not distinguish between users and nonusers, the use of modern mobile ICT devices (smartphones, tablets, and fitness trackers) did. People who used other mobile devices in addition to smartwatches were more often smartwatch owners. For the survey-specific variable "lecture visitation," which showed information about participation in educational settings, no significant relation was found within the bivariate analysis. If the findings are viewed descriptively, however, then smartwatch users visited these lectures more often on average.

In study 2, which was conducted among the 50+ population in Switzerland, 6.6% (n = 66) of participants were smartwatch users. Among these smartwatch users, 71.2% used smartwatches daily, 16.7% used them once a week, and the rest (12.1%) used them more infrequently than once a week. Among all smartwatch users, 92.3% also owned a smartphone, 76.9% also used a tablet, and 30.3% also owned a fitness tracker in addition to their smartwatch.

Regarding standard demographics, the bivariate analyses (see Table 2) showed that only mean age was a significant distinguisher between smartwatch users and nonusers: smartwatch users were younger on average than nonusers. The regular descriptive frequency differences, however, showed that males, and those with higher education levels and incomes, were more likely to be smartwatch users, although these findings were not significant. Again, quality of life and subjective health also showed no significant effects, whereas interest in technology showed significant explanatory power. Smartwatch users were more often interested in new technology in general. The use of modern mobile ICT devices was a significant distinguisher between users and nonusers. Smartwatch users often owned more than one additional mobile device. For the survey-specific variable "sports," which covered information about participation in sports activities in general, no significant relation was found within the bivariate analysis. If viewed descriptively, however, then smartwatch users were found to participate in sports more than nonusers on average.

Different standard demographic variables were found to be significant in the bivariate analyses of both studies: study 1's significant variable was education, while study 2's was age. In neither study were quality of life and subjective health significant distinguishers between users and nonusers. The same trend of group differences was noted in both studies; interest in technology and the use of mobile ICT devices were significant distinguishers between smartwatch users and nonusers in both studies.

To control for the different age ranges of the two studies, the frequency of smartwatch users was examined only between the ages of 65 (the retirement age in Switzerland) and 90: 4.1% owned a smartwatch in study 1, compared to 5.7% in study 2 within the same age range. These findings show that differences did exist, but they were not significant between the two studies (χ^2 [1, n = 1178] = 1.557, p = .212).

4.2 Multivariate Test of Group Differences

Additional analyses were conducted to check the bivariate results using a multivariate approach. Table 3 shows the results of two binary logistic regressions to address studies 1 and 2. In both models, smartwatch groups (1 = user, 0 = nonuser) were considered as the dependent variable, while age, gender, education, household income, quality of life, subjective health, interest in technology, technology use difficulty, and ICT device count were included as dependent variables. The tests of both full models showed statistical significance, which indicates that the predictors, as a set, reliably distinguished between users and nonusers (study 1: $\chi^2 = 57.563$ [10], $p \leq .001$, Nagelkerke's $R^2 = .263$, n = 714; study 2: $\chi^2 = 39.426$ [9], $p \leq .001$, Nagelkerke's $R^2 = .126$, n = 827).

Table 3. Multivariate binary logistic regression analysis for the predictors of smartwatch use.

	Study 1[A]			Study 2[B]		
Parameter	**OR**	***p*-value**	**95 % CI**	**OR**	***p*-value**	**95 % CI**
Female (ref. male)	.719	.493	.280, 1.847	.959	.893	.520, 1.768
Age	.969	.452	.892, 1.052	.992	.623	.959, 1.026
Tertiary education (ref. primary and secondary)	**3.395**	**.014**	1.276, 9.032	1.241	.528	.635, 2.425
Household income	1.122	.522	.789, 15.97	.996	.978	.763, 1.300
Quality of life	.468	.056	.223, .985	1.019	.935	.652, 1.592
Subjective health	1.176	.585	.657, 2.103	.958	.807	.676, 1.356
Interest in technology	.673	.129	.403, 1.123	**1.346**	**.033**	1.024, 1.768
Technology use difficulty	**.557**	**.018**	.343, .905	1.238	.064	.988, 1.552
ICT device count	.659	.530	.180, 2.419	–	–	–
Mobile ICT device count	**4.242**	**< .001**	2.289, 7.860	**2.403**	**< .001**	1.630, 3.543

Notes: The dependent variable is smartwatch use: 0 (no use) or 1 (use). A: study 1 model fit ($\chi^2 = 57.563$ [10], $p = <.001$, Nagelkerke's $R^2 = .263$, n = 714). B: study 2 model fit ($\chi^2 = 39.426$ [9], $p = <.001$, Nagelkerke's $R^2 = .126$, n = 827).

Study 1's model 1 showed that education, technology use difficulty, and mobile ICT device usage were significant prediction factors, whereas gender, age, income, quality of life, health, interest in technology, and classical ICT device usage were not found to be predictors in the multivariate analysis. People who had a tertiary education, those with few technology use difficulties, and those who used mobile ICT devices other than smartwatches were more often smartwatch users than those with lower education levels and more technology use difficulties, as well as those who used few or no mobile ICT devices.

Study 2's model 2 showed that interest in technology and mobile ICT device usage were significant predictors, whereas gender, age, education, income, quality of life, health, and technology use difficulty were not found to be predictors in the multivariate analysis. Participants who were particularly interested in technologies, and those who used mobile ICT devices, were more often smartwatch users than those with less interest in technology and those who used few or no mobile ICT devices.

4.3 Additional Findings on the Purpose of Smartwatch Use

Additional information about the purpose of wearables usage was available in study 2. Those participants who used a smartphone, smartwatch, or fitness tracker were asked why they used these technologies; they could choose among five different health-related purposes, and multiple answers were possible. Using only the subsample of smartwatch users (n = 66), the ranked answers were as follows (ordered by frequency): "to motivate myself to remain healthy" (53.3%), "to track daily physical activity" (42.6%), "to exchange health-related data with my physician" (21.3%), "to exchange health-related data with my friends" (18.6%), and "to track my sleep quality" (14.8%).

5 Discussion

Based on data drawn from Switzerland, this paper has presented the dispersion of smartwatches among older Swiss adults. Following the first research question of who among the older population uses smartwatches, the analysis of two large surveys revealed that roughly five people among 100 older adults aged 65 years and older owned a smartwatch.

As a comparison, data from a Swiss marketing study [31] of people aged 18 years and older found that 10% of participants used a smartwatch; in the present study, 4.4% (study 1) and 6.6% (study 2) used a smartwatch. Although older age groups have yet to match the usage rates of younger age groups, a growing number of older people are now incorporating mobile ICT devices into their daily routines. Researchers have discussed whether the digital divide between younger and older people could diminish or even vanish in the near future [32].

Even though few older adults use smartwatches, their usage rates are not markedly different from those of the general population. But the existing data on today's older smartwatch users indicates that these users are early purchasers of smartwatches. Such users are known as Roger's "early adopters" [33], meaning that, regardless of age, they belong to the first wave of users of a technical innovation. As a result, smartwatches cannot yet be thought of as a mass product within the ICT field. This situation also means that researchers who want to develop smartwatch-based interventions (for example, to monitor health-related information) should be aware of the scarcity of these devices among the older population as well as possible barriers to the use of these wearables [34]. Design requirements for developing wearables or applications for smartwatches for older adults should be developed accordingly [35, 36].

This paper's second research question addresses differences between smartwatch users and nonusers. The univariate analysis showed that education, age, technological affinity (having interest in and experiencing few difficulties with new technologies), and the use of mobile ICT devices (smartphones, tablets, and fitness trackers) were significant distinguishing factors between smartwatch users and nonusers, whereas gender, income, quality of life, subjective health, participation in education offers and sports, and the use of classical ICT devices (radio, TV, and computers) were not significant predictors of group differences. The multivariate analyses confirmed the univariate findings by showing that education, technological affinity, and the use of mobile ICT devices all predicted smartwatch usage. Even though the findings differed to some extent between the two studies, we may summarize by saying that typical parameters such as gender,

income, and subjective health did not distinguish significantly between smartwatch users and nonuser. In addition, age was only a significant distinguisher in study 2 and was not significant within the multivariate analyses. Interest in technology and one's current use of mobile ICT devices were found to be far more important factors.

Given that today's bestselling smartwatches interact with smartphones (and indeed require a smartphone to operate fully), this study's finding that nearly all smartwatch users were also smartphone users is not surprising. The analyses also showed, however, that large numbers of smartwatch users also used tablets and fitness trackers, neither of which are necessary to operate a smartwatch. Smartwatch users thus are familiar with modern mobile technologies in general and are also users of these technical innovations, which speaks to a lifestyle of technical affinity.

The findings show that, regardless of age, people who use smartwatches are often pioneers or early adopters, as Rogers [33] defines the term, meaning that age or other personal characteristics are not as important as factors such as technology affinity and having a lifestyle where people often use modern technologies and technical innovations. Smartwatches thus present a good example for the study of daily ICT use among older adults beyond mere functionality and perceived ease of use and usefulness. In addition to health-related functionality, fashionability, or the aesthetic appeal of smartwatches [27, 37–39], is often associated with older adults' usage of wearables. For example, Chuah et al. [4] suggest that smartwatches represent a type of "fashnology" (a portmanteau of "fashion" and "technology"). These attributes are influenced by people's perception of smartwatches as a technology and/or as a fashion accessory.

This study's third research question addresses the purpose of smartwatch use. The study participants' responses indicated that they used these devices to remain healthy and physically active more than they used them for social reasons, such as exchanging personal data with friends or documenting data for their physicians. Previous studies [28] have identified self-control and incentives to be active as reasons for using wearables. These findings also fit well with the fact that the most commonly used behavior-change techniques in current wearables interventions for older adults are to provide feedback, self-monitoring, and goal-setting [40]. Nevertheless, to return to the fashion aspect of smartwatches, neither study in the present research involved information about other reasons for buying smartwatches. Future studies thus should investigate people's different reasons for using smartwatches in more detail and within a large population sample, as recommended by Chuah et al. [4]. Longitudinal studies are also needed to investigate the long-term use of wearables among older adults: research shows, for example, that wearables such as fitness trackers are often used within certain timeframes but not on a permanent basis [41]. Finally, developing a quantitative analysis of smartwatch logs [42] would be helpful to better understand their usage patterns, particularly regarding usage and the "sense-giving" processes of smartwatch use within older adults' daily lives.

Smartwatches could be an interesting field for researchers in the future because of the opportunity they provide to use smartwatches as a data-collection tool for older adults' daily lives. This approach belongs to the family of ambulatory assessment and experience sampling, both of which allow for assessing and tracking older people's ongoing thoughts, feelings, behaviors, and physiological processes in daily life while using a mobile device [43]. The primary goal of mobile data collection via smartwatches is to

collect in-the-moment active data (e.g., subjective self-reports) and/or passive data (e.g., data collected from smartphone sensors). This method has become increasingly popular because of its many advantages [44]. First, the findings are ecologically valid, because they are collected during people's day-to-day lives in their real environments; second, the reports are collected in the moment and are therefore less prone to memory bias than retrospective assessments; third, intensive, repeated measurements of one participant can be used to capture within-person information; and fourth, real-life data is rich in contextual information, as the data allows for the combination of self-reports and objective activity assessments by using sensors that are already built into smartwatches.

5.1 Limitations

Several limitations must be noted. First, the present study has a specific regional focus (Switzerland), so the findings have limited generalizability. Second, while one could argue that the sample of active participants at the University of the Third Age is selectively biased, the group that was selected is believed to represent a heterogenic group of high educated and sometimes technology-friendly older adults in Switzerland. Third, the data has provided only a cross-sectional view of the various interplays examined in the study. Future researchers should investigate the dynamics of these interplays within the background of today's persistent digital transformation. Fourth, because of the limited width of the study variables that could be used, other important background factors could not be controlled for, such as technophobia [45], personality, technical skills, or attitudes toward wearables in general. Further studies using longitudinal designs and with a wider range of variables will therefore be required to examine this topic in more detail.

5.2 Conclusion

This study has presented representative data for Switzerland on the actual use of smartwatches in a population where new mobile devices are not in everyday use. The results indicate that 4.4% (study 1) and 6.6% (study 2) of participants aged 50 years or older owned a smartwatch, and most used the technology daily. Multivariate analyses showed that education, interest in technology, and the use of mobile ICT devices predicted smartwatch usage. The study showed, that, today, it is mainly those seniors with a marked interest in technology and a technology-friendly lifestyle in general who own smartwatches. The current study has provided evidence of the potential of smartwatch use by older people. Although very few older adults use these mobile devices today, such people make for interesting study subjects [46], since researchers can examine their daily use of new, commercially available technologies. Such people also offer the opportunity to investigate technologies that are especially designed for the aged population.

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