Effects of Smartphone Social Applications on Elderly People's Quality of Life

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Abstract—As people age, maintaining and improving their Quality of Life becomes increasingly important. To understand the impact of smartphone technology and communications applications on Quality of Life, a quasi-experimental study was conducted with elderly people living in Shiraz-Iran. The study population included all the registered senior in public health centers in Shiraz, Fars, Iran during 2018 and 2019. Overall, 119 elderly people participated in the study. The study randomly categorized participants into intervention (59 participants with mean age 66.19±2.73) and control (60 participants with mean age 66.67±3.00) groups. They were asked to answer the validated Persian version of the Control, Autonomy, Self-realisation, Pleasure scale (CASP-19) scale questionnaire for Quality of Life assessment. A significant mean difference was observed by the paired t-test between pre-and post-test (t= -8.61, p<0.00), post-and follow-up-test (t= -2.24, p=0.02), and pre-test and follow-up test (t= -8.42, p<0.00) in the intervention group. The results of paired t-test for the control group showed no significant mean difference between pre-test and post-test (t= 1.35, p=0.18), post-test and follow-up test (t= 0.38, p=0.70) and pre-test and follow-up test (t= 1.94, p=0.06) for Quality of Life. The rationale for this study, along with the educational training associated with it, was to help families, and the aging field practitioners to understand the importance of modern communication technology teaching to promote a greater Life Quality in the community of the elderly.

Keywords—Iranian elderly, quality of life, smartphone, social applications, CASP-19

1 Introduction

According to the World Health Organisation (WHO), the 21st Century is the century of the elderly [1]. The elderly population of many countries is growing rapidly and requires special attention to form and promote self-care and enhance their Quality of Life. [2-4]. In Iran, statistics show that approximately 9% of the 75 million population of the country are over 65 years of age [5, 6]. Studies have shown that in comparison to other age groups [7], Iranian older people have a low Quality of Life (QoL), with only 7% of elderly people in Iran having a high Quality of Life, 50% moderate, and 43% low Quality of Life [8, 9]. Iran is experiencing a continuous rise in medical costs

and prices. This reduces the elderly people's ability to cover their medical needs, mainly in the case of those who do not have any medical insurance [10]. Consequently, many countries including Iran have to deal with challenges including depression, isolation, loneliness, and anxiety [10]. These findings highlight the importance of studies that seek effective strategies to enhance the Quality of Life among Iranian elderly people [7].

Improving the level of wellbeing and Quality of Life for the elderly in Iran has recently been the subject of interest for many studies [11-13]. Various methods and educational programs aim at improvingIranian elderly people's Quality of Life [7, 14] have been investigated. For example, the results of a study by Salimi et al. in 2015 showed "self-care education" can help elderly people to improve their Quality of Life. [15]. Accordingly, the positive influence that training can have on different aspects of health and social activities, notably uplifting the wellbeing and Quality of Life of elderly people has been confirmed via some of these studies [16].

Technology these days has become an important part of people's lives [17]. At a universal level, information and communication technology (ICT) has emerged as the central driver of the advancement of modern society [18]. Information and communications technologies (ICT) have been at the service of the elderly people to preserve their independence, enjoy a longer life period, and enjoy a better QoL, all around the globe [19]. Our life is becoming totally dependend on modern technological gadgets because it is the easiest and cheapest time saving source of connection. As an example, we can use a smart phone device anywhere and everywhere according to our need [20]. Studies have shown that the brain function of aging people who use modern technologies such as the Internet and smartphones in their daily life is better than other aging people who are not using modern technologies. and the probability of being afflicted with diseases such as Alzheimer's is lower in them [21]. Being in a virtual community and dealing with the various protocols and rules of the web acts like a mind-raising club, by keeping the mind active. ICT can help the elderly to empower themselves, improve their QoL and enhance their ability to cope with common mental and physical problems [22, 23]. Smartphones are used widely nowadays, and is becoming inseparable part of daily life. As such, new platforms are provided for variety of applications [24]. The first models of smartphone in Iran appeared around 10 years ago (2010) and this technology quickly spread [25]. A study of Iranian elderly people using social networks by Momeni et al. [26] showed that the Iranian elderly people require basic knowledge of using computers and the internet as well as social networks. Social networks include Facebook, WhatsApp, LinkedIn, Telegram, Instagram and many others [27].

The Iranian elderly need to develop their understanding of some of the necessary concepts, including browser and search engine to be able to access the different websites and applications. According to Momeni et al. [26], two themes of individual concern are security and privacy as well as preconditions of use which are the need for facilities, equipment, and technical knowledge. Their study showed that the Iranian seniors who have access to the internet and use online social networks must be equipped with tools including laptops, tablets as well as up-to-date smartphones. Because of high prices and ergonomic barriers, it is difficult to make them available to seniors.

However, despite proven evidence globally, reviewing the literature on Iran shows that although positive effects of using the internet and communication devices such as smartphones on increasing QoL for the elderly have been pointed at in some studies, research specifically focused on determining the impact on Quality of Life through the use of smartphones and communication apps has not been undertaken.

We, therefore, pose the question:

To what extent does providing training on the use of a smartphone and social media apps change elderly people's Quality of Life?

2 Materials and methods

A quasi-experimental study with an educational package as the intervention was designed. The study included measurement at three points, before the intervention, after the intervention, and one month later as shown in the study overview diagram in Figure 1.

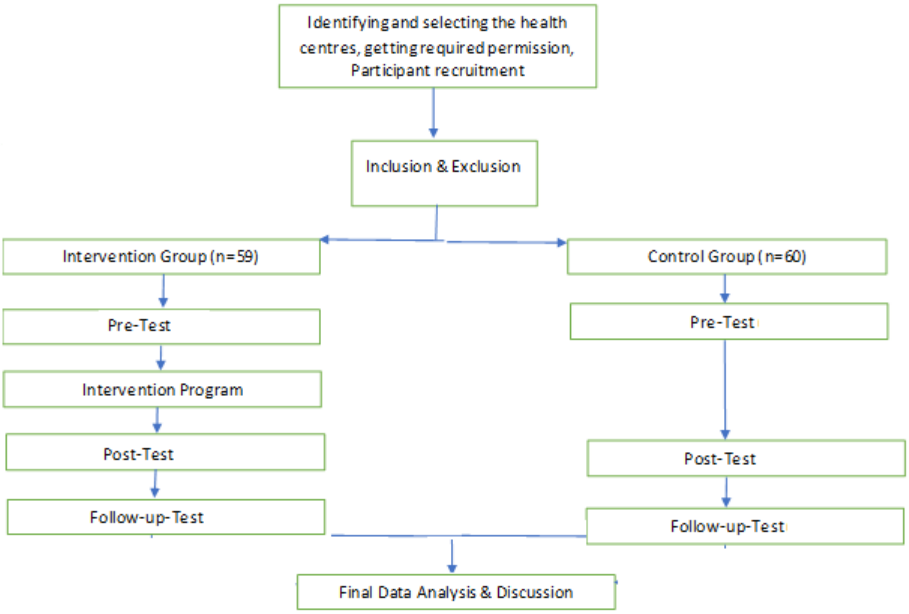

Fig. 1. Quasi-experimental study overview

A practical educational intervention was developed that included using the most popular communication apps in Iran; Instagram, WhatsApp, and Telegram.

At each stage (pre-, post-, and one-month follow-up), the CASP-19 questionnaire was administered. The CASP-19 questionnaire focuses on four domains including control, autonomy, pleasure as well as self-realization for assessing individuals' Quality of Life in the early phase of aging. The final CASP-19 score varies from 0 to 57; The

higher the score, the higher the QoL. The study samples were elderly residents who had registered in local public health centres (in the Persian language: "Marakez Behdasht") in Shiraz, Fars, Iran in 2018. The government's local health centres are the community's first and most extensive contact with the general health care system in Iran's urban and rural areas. Of 17 health centres located in Shiraz, five centres that provided primary health care for aging people joined the study. Residents 60 years and older registered in local public health centres located in Shiraz who meet all the study inclusion criteria were study participants. Inclusion criteria included social, demographical, and geographic factors. Exclusion criteria are defined as specifications of the potential participants who have the inclusion criteria plus an additional feature that can distort the process and/or results of the study.

- Inclusion criteria: those 60 years and above; having a smartphone (which is necessary for educational tasks).
- Exclusion criteria: have been identified to suffer from or be treated for psychiatric illnesses (based on the data gathered from participants and their families), resulted from individuals' peculiar mental and medical conditions/limitations with psychiatric illnesses; afflicted with health issues (based on the data obtained from participants and their families) because of individuals' particular learning conditions/limitations with mental retardation; almost completely familiar with the educational package (based on the reports of the participants and their families).

2.1 Sample size

The sample size (n) was calculated based on Aday and Cornelius [28]:

To date, no ICT-related intervention has been conducted among Iranian elderly people to improve their QoL. Therefore, to calculate sample size, the results of the most similar study were used which is the work of Hojatollah et al. [29] In this study, Hojatollah et al. [29] used these values:

$\mu_1 = 70.5 \; and \; \mu_2 = 58.1$

$\sigma_1 = 7.8 \; and \; \sigma_2 = 11.11$

with a 95% confidence level and a 90% power level.

Based on the formula, the calculated minimum sample size was 12.65 (~ 13) for each intervention and control group [30, 31].

2.2 Participant recruitment

Participant recruitment was started after obtaining the verbal consent of the centres' managers. In each centre, notices of study goals and qualifications were posted on bulletin boards. Eligible individuals were required to contact a telephone number within three weeks (from the first day of posting the announcement) to indicate their eagerness to be part of the study. At the end of the three weeks, of the 137 volunteers, 119 eligible individuals had expressed interest. Next, all the chosen participants were classified as intervention and control groups using simple random sampling (59 in the intervention and 60 in the control group).

2.3 Data collection

As the first step of data collection, all participants were asked to answer questions with socio-demographic aspects along with the ones related to their health conditions as well as the level of familiarity with social/communication smartphone apps. Responses to the questions were analysed based on the inclusion and exclusion criteria and qualified individuals were recruited for the study.

All participants participated in the pre-test. The intervention group then underwent the educational sessions, the post-test was then administered to both control and intervention groups. One month after the post-test the same test was administered as a follow-up test to help assess the longer-term impacts of the intervention study. The follow-up assessment was done one month after the post-test to limit the possibility of losing participants.

2.4 Study instruments

Eligible individuals completed a questionnaire containing two sections. The first part contained questions about socio-demographic characteristics and the second part covered topics related to smartphone usage. The socio-demographic characteristics included questions categorizing the participants from the viewpoint of age, educational level, gender, marital status, the number of children, and having/not having a smartphone. Information regarding the history of using a smartphone (duration of use, the main application(s) of the smartphone and smartphone usage skills was also collected in this stage).

The second section of the questionnaire was the validated Persian version of the Quality of Life Scale (CASP-19). This questionnaire has already been validated in Iran among the Iranian elderly and used several times in the studies related to the Iranian elderly's QoL. According to a study by Heravi et al. in 2018 [32] the reliability of the questionnaire was 0.82 (Cronbach alpha test), which is considered a good level of reliability [33].

CASP-19 was designed to not only focus on the medical and social care concerns which had traditionally been observed to typify aging research but also address the active and beneficial experiences of later stages life. The scale is consisted of 4 sub-scales and its initials form the acronym: Control, Autonomy, Self-Realization, and Pleasure [34].

2.5 Intervention module

Previous studies done on internet and communication devices training developed for elderly people (for example Sitti and Nuntachompoo in 2013 [35]) were used as a base for selecting the training package. Then it was modified to be responsive to the specific necessities of the target population, the environment that the participants lived in, the local culture, ethnic and religious diversity, similarities, the special health situations of participants, and limitations of time. This study was completed using smartphone instead of a computer.

Nowadays smartphone acts as primary computing device as this technology is more convenient and portable than a computer. Additionally, in Iran, issues such as depression, isolation, loneliness, and financial problem are factors contributing to the suffering of elderly people [36]. Therefore, due to their financial problems, smartphone was used instead of computer as smartphones are cheaper than desktop computers. This intervention program is new in Iran, and no one has designed any educational package related to educational package with smartphone.

Some social media and communications platforms, such as YouTube, Facebook, YouTube, and Twitter are filtered in Iran. Therefore, Telegram, Instagram, and WhatsApp were selected as these applications are the most popular social media apps, and are accessible in Iran. Using existing applications helped the researcher of this study to save money and time.

The social media sites and platforms of this study are free, easily accessible, user-friendly, and popular in Iran. Telegram, for example, is the most referred to application in Iran. It is widely used for contacting friends and relatives, sharing news, reporting events, as well as online shopping. WhatsApp and Instagram enjoy the same popularity. The educational package covers these topics: working with web browser on a smartphone; searching for information and news on a smartphone; working with Telegram; working with Instagram; and working with WhatsApp. The training sessions were programmed for three times a week (45 minutes for each session) over three months in all the five centres. All 59 participants attended the training session every time. There was also a 10-minute break during each session to allow participants to refresh during training sessions. At the end of the session, participants were recommended to go through additional exercises/homework related to materials that they have learned.

2.6 Data analysis

Using SPSS 21 software, all study variables were examined to evaluate normality and outlined through descriptive analysis and graphs such as histograms and scatter plots [37]. For all variables, the alpha level is the level of statistical significance (0.05). So, if the p-value is less than 0.05, there was a statistically significant difference. Missing data were handled by utilizing Little's MCAR test using SPSS 21 to check the missing values and the distribution. Data bias was checked to find out if data are missing randomly. Finally, the Expectation-Maximization method was used to treat the missing data [38].

Calculation of the mean and standard deviation and frequency (percentage) was the next step for descriptive data analysis. Chi-square test was also performed to check for significant changes among the ordinal/nominal variables. Before running the mean-based tests (t-test) the following tests were used: Kolmogorov-Smirnov test to assess Normality; Levene's test to assess Homogeneity of Variance; Box'M to assess Homogeneity of Co-variance, and Outliers significance.

3 Results

Demographic data were collected from the participants in each group to ensure that the groups were comparable. An overview of the demographic data collected about the groups is shown in Table 1.

Table 1. Socio-demographic characteristics of the participants in the intervention (n=59) and control (n=60) groups

-	Intervention (%)	Control (%)	Statistical Value*	p-value**
Age (Mean±SD)	66.19±2.73	66.67±3.00	-0.10	0.28
Educational Level				
Under Diploma	37.30	36.70	2.34	0.51
Diploma	49.20	46.70		
Bachelor	10.20	10.00		
Master and upper	3.40	6.70		
Gender				
Male	57.60	56.70	0.01	0.92
Female	42.40	43.30		
Number of Children				
One child	25.80	28.30	0.14	0.90
2-3 children	24.40	28.30		
More than 3 children	25.80	43.30		
Marital Status				
Married	75.00	72.30	0.60	0.73
Widow/er	15.00	17.60		
Divorced	10.00	10.10		
Hours of Using Smartphone/Daily				
Less than 1 hour	57.60	68.30	2.15	0.34
1-2 hours	23.70	48.10		
More than 2 hours	18.60	10.10		

*Independent t-test for continuous variable and Chi-Square Test for a categorical variable, **Significant at level $p<0.05$

The socio-demographic characteristics collected include age, gender, educational level, number of children, marital status, and duration of using smartphones. The age range for each group was 60-71 for the control group and 60-70 for the intervention group.

3.1 Impact of the intervention

To determine the overall influence of intervention on participants' Quality of Life, an independent t-test was performed to check the differences in mean score for Quality of Life for both intervention and control groups in the pre-, post- and follow up tests (see Table 2). Equality of variances was assumed, therefore the data of the first row

was checked. No significant difference was seen between intervention and control groups in the pre-test (t= -0.75, p=0.45). A lower mean score of all categories and total indices of the Quality of Life indicates lower Quality of Life.

Table 2. Independent t-test between intervention and control groups over the study time period

	F	Sig	t	Df	Sig (2-tailed)	Mean difference	95% CI	
							Lower bound	Upper bound
pre-test	4.17	0.05	-0.75	117.00	0.45	-0.67	-2.46	1.11
post-test	6.67	0.01	3.68	103.80	0.00	2.91	1.34	4.48
follow-up	13.77	0.00	4.06	96.97	0.00	3.47	1.77	5.16

*Independent t-test, **Significant at level p<0.05

Considerable difference was seen in both post-test (t= 3.68, p<0.00) as shown in Table 2 and Figure 2, and follow-up test (t= 4.06, p<0.00) between control and intervention groups, with participants in the intervention group reporting a higher Quality of Life. Table 2 also represents the results of the Levene's Test for Equality of Variances and independent t-test between intervention and control groups.

Fig. 2. Independent t-test between intervention and control groups over the study time

The effect size of the independent t-test between groups at the post- test and follow-up stages was calculated using the effect size formula for the independent t-test [37].

$$\text{Cohen's d} = (M_2 - M_1)/SD_{pooled} \quad (1)$$

where: $SD_{pooled} = \sqrt{((SD_{12} + SD_{22})/2)}$

Based on these formulae, the Cohen's d (effect size) in post-test were0 .67 and 0.74 (both large effect size). The effect size explains "whether or not the difference between two groups' averages is large enough to have practical meaning". The larger this number, the greater the practical impact of the intervention on the population. Therefore, the results have enough potential to have practical meaning.

3.2 Within group changes in quality of life

For clarifying the total effect on Quality of Life of the intervention on participants, a paired t-test was performed to check the variations in mean score for Quality of Life

at the post- and follow-up stages in the intervention and control groups. For the intervention group (see Table 3), paired t-test revealed a considerable mean difference between pre-test and post-test (t= -8.61, p<0.00), post-test and follow-up tests (t= -2.24, p=0.03) as well as pre-test and follow-up test (t= -8.42, p<0.00).

Table 3. The mean difference in Quality of Life for intervention group

	Mean	**Std. Deviation**	**Std. Error Mean**	**95% CI**		**T**	**Df**	**Sig. (2-tailed)**
				Lower Bound	***Upper Bound***			
Pre-test, post-test	3.11	2.77	0.36	-3.84	-2.39	-8.61	58.00	0.00
Post-test, follow-up-test	0.42	1.45	0.18	-0.80	-0.04	-2.24	58.00	0.02
Pre-test, Follow-up-test	3.54	3.22	0.42	-4.38	-2.70	-8.42	58.00	0.00

*Paired t-test, **Significant at level p<.05

The paired t-test findings indicated a major mean difference between pre- and post-test (t= -8.61, p<0.00) in the intervention group, as shown in Table 3. In addition, the results of paired t-test showed a significant mean difference between post-and follow-up-test (t= -2.24, p=0.02) in the intervention group, see Table 3. The results of paired t-test also showed a significant mean difference between the pre-test and the follow-up test (t= -8.42, p<0.00) in the intervention group, see Table 3.

The effect size of paired t-test within groups for the intervention group was calculated using the following formula:

$$d_z = \frac{\mu_1 - \mu_2}{\sigma_{x_1 - x_2}} \approx \frac{\bar{x}_1 - \bar{x}_2}{s_z} \quad (2)$$

Based on this formula, the Cohen's d (effect size) in pre-test and post-test, post-test, and follow-up as well as pre-test and follow-up were 0.82, 0.12 and 0.93, respectively (all large effect size). Cohen's [39] guidelines were used to explain the effect sizes (small = 0.20 or greater; medium = 0.50 or greater; and large = 0.80 or greater). The results of paired t-test for the control group (see Table 4) did not show tenable mean disagreement between pre-test and post-test (t= 1.35, p=0.18), post-test and follow-up test (t= 0.38, p=0.70) and pre-test and follow-up test (t= 1.94, p=0.06) for Quality of Life.

Table 4. Mean differences in Quality of Life for control group

	Mean	**SD**	**Std.Error Mean**	**Lower bound**	**Upper bound**	**t**	**Df**	**Sig (2-tailed)**
pre-test Post-test	-0.46	2.67	0.34	-0.22	1.15	1.35	59	0.18
post-test Follow-up	-0.13	2.74	0.35	-0.58	0.84	0.38	59	0.70
Pre-test Follow-up	-0.60	2.39	0.30	-0.02	1.21	1.94	59	0.06

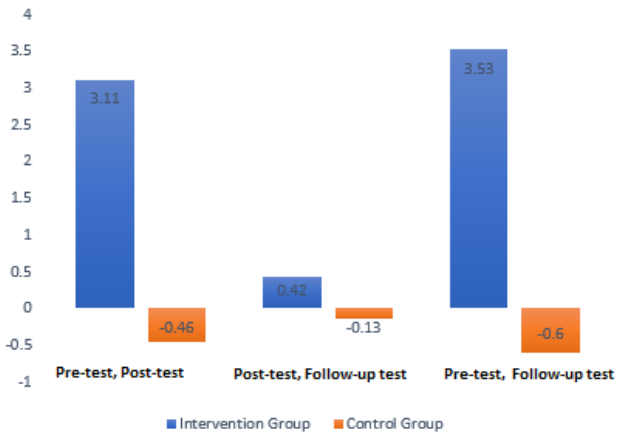

Fig. 3. Mean differences in Quality of Life between stages

4 Discussion

The effects of the technologies administrating online communications applications and activities, like the ones used in smartphones, on the elderly peoples lifestyle, Quality of Life, and well-being have recently undergone increased research consideration. This study focused on the effects of using an interventional educational package using smartphone communication apps (including Telegram, WhatsApp, and Instagram) to understand the impact that increased ability to use communication apps would have on the Quality of Life among elderly citizens in Shiraz-Iran. Overall, the results of the analysis of the data showed the positive effects of the educational program on the Quality of Life of the intervention group's participants. Overall mean score of Quality of Life showed an improvement between their pre, post, and follow up mean scores.

On the other hand, the data analysis findings offered insignificant changes in the level of QoL among the members of the control group during the duration of the study. So, it can be concluded that the big variations in the case of the QoL in the intervention group were due to the educational program. Therefore, overall, the findings of the study showed the positive effects of the educational program (using the smartphone social/communication apps) on the QoL of the elderly who were part of the study.

The findings of the recent study reveal an agreement with some of the recent relevant studies done in some countries. In 2013, an experimental study by Winstead et al. [40] among older independent elderly living in Alabama showed that Internet usage could be effective in reducing loneliness and improving social contact among the independent elderly living community. The participants in the intervention group received an 8-week training related to using the Internet to be in touch with their family/ friends as well as finding information through the internet [40]. The findings of the Winstead et al. [40] study are in agreement with the results of the current study in terms of the positive effect of using the internet on the participant's daily life. In 2014, a study by

Mealor and Van Belle [41] in South Africa investigated the impact of different aspects of using mobile phones on the Quality of Life of the elderly which participated in the study. Using CASP-19 as the study instrument, a meaningful relationship between the complexity of the constituent mobile phone usage variables and the participants' Quality of Life was understood. More specifically, using social/multimedia had a direct significant contribution to the participants' Quality of Life. The researchers pointed out that the elderly participants were able to maintain and expand their social/personal connections using social media and avoid isolation regardless of their specific age limitations [41]. In the Erickson et al.'s [42] study, participants mentioned the positive effect of using commination/social apps on their self-realization. These studies reveal more support for the current study findings

In another example, Quintana et al. [43] in 2018 investigated the relationship between Internet usage and the participants' psychological well-being among 2314 senior participants in Spain. The results showed a significant positive agreement between /email usage and psychological health among the participants. Although the purpose of this study was not focused on the participants' Quality of Life, the researchers of this study believe that given the importance of psychological health in an individual's Quality of Life, Internet usage could positively affect the level of the Quality of Life [43]. This conclusion is also in agreement with the conclusions of the present study.

In a relevant study, Rylands and Van Belle [44] studied the effects of using Facebook on the elderly people's Quality of Life in Cape Town, using CASP-19. Findings showed that the participants mostly used Facebook to stay in touch with their friends/family. Therefore, it added happiness to the participants' daily lives and cause an indirect improvement in Quality of Life [44]. Although Facebook as a social media was used compared with the current study that studied Telegram, WhatsApp and Instagram, this result supports the finding of this study in cases of the positive impacts of social/communication media on the aging people's Quality of Life.

Not all investigations have supported the positive function of the application of the Internet/social media in the psychological, social health, and Quality of Life among old people. As an example, social media application ended in no outcome (positive or negative) among the 191 elderly in Maastricht city, Netherlands with respect to their daily function and emotional well-being [23]. The findings of this experimental study, showed no impact of the internet usage training in two post-tests (after 4 and 12 months), compared with the pre-test [23].

This study faced some limitations. Regarding the implication of the educational program, in the first section, the participants were asked to not discuss the study details, except when necessary and only with family members, for the duration of the study. Due to the age of the participants in the study, the educational intervention was conducted over a longer period than the initial forecast.

5 Conclusions

Our work examines whether a program designed for smartphone training can impact the Quality of Life in the case of sample old Iranian people living in Shiraz. One hundred nineteen male and female elderly people participated in the study divided randomly into intervention (60 participants mean age 66.19±2.73) and control (59 participants mean age 66.67±3.00) groups and were asked to answer the validated Persian version of the CASP-19 scale questionnaire to assess Quality of Life. The results of this study showed improvement in the QoL of only participants in the intervention group. The significant changes in the level of the QoL in the intervention group was due to the educational program.

Our results have a strong foundation with previous related studies. However, the most significant gap filled by this study was the lack of research on the effect of the application of the internet and social/communication apps on the Quality of Life for Iranian elderly people. Although in the last years, a meaningful increase has been observed in studies addressing this topic, there are very little data and information on the Iranian elderly population. Since enhancing seniors' QoL in the community is a very important and essential concept, this study was done, having the educational training in perspective, to assist families and practitioners in the aging field to let them be more conscious about the necessity of teaching modern communication technology to enhance the rate of healthier ageing community.

In addition, according to the previous studies, policymakers spend billions of dollars annually tor elderly people mental condition [45, 46]. As discussed earlier, using existing applications helped the researcher of this study to save money and time. In addition, the intervention program was shown to be able to positively affect the Quality of life of the one who participated in this study, and the significant changes in the level of Quality of Life in the intervention group were due to the educational program. Therefore, policymakers can consider these types of packages and train elderly people with low budgets to reduce their mental condition.

Moreover, developers can design appropriate applications for elderly people who have physical issues. For example, for the control theme, some participants pointed to the fact that issues such as the physical limitations related to aging still exist. These issues include shaking hands and eyes condition. Therefore, application developers can develop appropriate applications with bigger screen size for elderly people who have eyes problems and to develop applications that work with elderly people sound rather their typing.

Future work could focus attention on other variables such as cognitive function, level of happiness, life satisfaction and privacy to measure the overall elderly people Quality of Life. Moreover, it could be beneficial to start similar studies in some countries and investigate the effects (if any) of local cultures and the type/purpose of the usage of an educational package and conducting training among elderly people. An expanded form of this research, with a larger sample size as well as added variables would bring to the fore other aspects of this critical topic.

6 Ethics

The study was approved by Lincoln University Human Ethics Committee. The participants and their families received detailed information about the study and ethical issues before starting data collection. Furthermore, all the participants in the study were given detailed information about different stages of the study. Personal information (such as demographic data) was collected from participants only after the participants gave consent to join the study. All interviews were recorded with the participant's permission. To ensure anonymity, the names of the health centres, are not reported.

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