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The use of information and communication technologies affects mental health and quality of life of older adults during the COVID-19 pandemic

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Abstract: Quality of life is a multidimensional concept. The World Health Organization estimates that the quality of life is affected by physical and mental health, social relations, and the physical environment. The purpose of the study was to determine which of these factors have affected the quality of life of older adults living in an institutional environment during the COVID-19 pandemic and how the use of ICT affects the mental health of older adults. Methods: Quantitative method, description method, and comparison method were used. With the questionnaire as a measuring instrument, we collected opinions from 128 older adults living in an institutional environment. Univariate and multivariate statistical methods were used. Results: The regression function was reliable only between the association with mental health and quality of life, so we confirmed one hypothesis. Mental health is the only factor that affects the quality of life. Discussion and conclusion: We find that superior mental health affects the quality of life of older adults living in institutional settings during the COVID-19 pandemic and that ICT has a significant impact on mental health, meaning that greater emphasis should be placed on strengthening the mental health of older people living in institutional environments, especially during the COVID-19 epidemic, when several measures have been taken to contain it. In the future, more attention needs to be paid to equipping homes with ICT and encouraging and helping employees so older adults can use ICT as well.

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Keywords: ICT, older adults, quality of life, COVID-19, mental health

1. INTRODUCTION

Population ageing is a process characterised by a growing proportion of older adults (65 years and older) in the population, leading to a lasting change in the population's age structure (Antczak & Lewandowska-Gwarda, 2019). Life expectancy in the EU-27 is increasing, and the proportion of older adults (65 years and older) is growing rapidly, standing at 20.4% in 2019 and is estimated at 24.4% in 2030 (European Commission, 2020).

Developers of digital solutions for older adults should consider how solutions influence users' quality of life, most of whom have declining functional capacities. Specialised housing solutions for older adults (Rogelj and Bogataj, 2020) combined with Ambient Assisted Living Technologies, and other smart home technologies facilitate integrated health and care services for older adults living in the community. Cyber-physical systems for support of people with declining functional capacities and mitigation of risks to which older adults are exposed should embed ambient assisted living technologies in age-friendly facilities and amenities (Rogelj and Bogataj, 2019) use cyber-physical systems to empower older adults and to enable them to live longer smart communities (Rogelj and Bogataj, 2020a; Bogataj et al., 2020b; Bogataj et al., 2020a; Rogelj et al., 2020b). Smart technologies can postpone or even prevent moving to a nursing home (Rogelj and Bogataj, 2018a; Rogelj and Bogataj, 2018b; Rogelj et al., 2019).

The quality of life of older adults is a multidimensional construct (Schenk et al., 2013), which includes several different domains such as health, psychological, social and environmental domains (Fernández-Ballesteros, 2011). The World Health Organization defines the quality of life as an individual's perception of their life situation in the context of the culture and values of the systems in which they live and according to their goals, expectations, standards and concerns (Skevington et al., 2004). Kaučič and his colleagues (2019) consider that an individual's quality of life is influenced by people who provide support and quality time to older adults. Health, functional status, help from family and friends, and social relationships are among the critical factors affecting the quality of life of older adults (Sparks et al., 2004). Health status is an essential factor that directly affects people's quality of life (Bilgili & Arpacı, 2014). The term ICT (information and communication technology) is used to cover a wide range of computer, information and communication devices, applications, networks and services (Baudchon & Brossard, 2003). Older adults who have used ICT for communication or entertainment have significantly improved the mental components of their quality of life (Chiu & Wu, 2019). Based on a review of the evidence, Nedeljko and colleagues (2021) find that ICT affects the quality of life of older adults and reduces social isolation and feelings of loneliness. Elliot and
colleagues (2014) state that using ICT does not directly improve mental health or wellbeing in older adults, although it may protect against the onset of depression symptoms. Older adults receiving care and using ICT have a larger social network and less need for information on chronic diseases and care, meaning that ICT undoubtedly contributes to health promotion (Torp et al., 2008). The World Health Organization (WHOqol, 1998) has divided the factors influencing the quality of life into four groups (physical health, mental health, social relations and the environment, as shown in Table 1.

**Table 1: WHOQOL-BREF domains of quality of life: overall quality of life and general health (WHOqol, 1998, p. 552)**

| Domain                | Facets incorporated within domains                                                                 |
|-----------------------|---------------------------------------------------------------------------------------------------|
| Physical health       | Pain and discomfort Sleep and rest Energy and fatigue Mobility Activities of daily living Dependence on medicinal substances and medical aids Work capacity |
| Psychological         | Positive feelings Thinking, learning, memory and concentration Self-esteem Bodily image and appearance Negative feelings Spirituality/religion/personal beliefs |
| Social relationships  | Personal relationships Social support Sexual activity                                              |
| Environment           | Freedom, physical safety and security Home environment Financial resources Health and social care : accessibility and quality Opportunities for acquiring new information and skills Participation in and opportunities for recreation/leisure activity Physical environment (pollution/noise/traffic/climate) Transport |

The goal of the research was to determine which of the four factors have affected the quality of life of older adults living in an institutional environment during the COVID-19 pandemic and how the use of ICT affects the mental health of older adults.

In accordance with what has been written, we are interested in the role of ICT use and key factors (e.g. physical health, mental health, social relations and the physical environment) in older adults living in an institutional environment, and their consequent impact on the quality of life of older adults during the COVID-19 pandemic.

2. METHODOLOGY

Quantitative research, which measured and studied the effects of relevant independent variables (physical health, mental health, social relations and the physical environment) on the quality of life in the institutional environment, was conducted in March and April 2021.

2.1 Method

The research was conducted on a non-random opportunity sample. The population consisted of older adults living in the institutional environment in Slovenia. The following inclusion criteria for participation in the research were considered. Persons who do not have dementia and who are in good physical condition were interviewed. We conducted the survey individually with each resident, and we asked them a question and then circled the relevant answer ourselves—this is the so-called informed landing. Univariate statistical methods (arithmetic mean and standard deviation) and multivariate statistical techniques were used to analyse data on the impact of relevant independent variables on the quality of life in the institutional environment.

2.2 Characteristics of respondents

The study involved 128 older people living in an institutional setting, including 65.6 per cent women and 34.4 per cent men. The majority of respondents were aged 81 to 90 (46.5%), followed by respondents aged 71 to 80 (21.7%). 14.7% of respondents came from the age group 91 or older, 12.4% were 61 to 70 years old, and the fewest respondents were aged up to 60 years (4.7%). Most respondents completed primary education (45.3%), followed by respondents with completed vocational education (23.4%) and secondary education (22.7%). The smallest share is represented by respondents who have completed higher education (5.3%) and university education (3.3%). As classified by pension type, the largest share of respondents is pensioners with an old-age pension at 75.8%, followed by pensioners receiving a partner pension (11.7%) and pensioners with a disability pension (10.9%). A much smaller share of the sample comprises respondents who have savings (1.6%). Most respondents have a personal monthly net income of more than € 701 (35.0%). However, a significant proportion of residents living in an institutional environment (10.9%) receive € 300 or less in monthly income.

We were also interested in whether the monthly income allows residents in an institutional environment a decent life. It turned out that 53.9% of residents in the institutional environment estimate that their monthly income enables them to have a decent standard of living. In contrast, the rest of the respondents estimated that their monthly income does not enable them to have a decent standard of living. Interestingly, 84.4 per cent of residents in the institutional environment identified themselves as religious, and the rest as atheists (15.6%).

2.3 Measuring instrument

To measure the quality of life of the elderly in the institutional environment and its dimensions, we used the World Health Organization questionnaire Quality of Life - WHOQOL-
BREF (World Health, 2004). We made the following hypotheses:

- **H1**: The physical health of older adults affects the quality of life in the institutional environment.
- **H2**: The mental health of older adults affects the quality of life in the institutional environment.
- **H3**: The social attitudes of the respondents affect the quality of life of the elderly in the institutional environment.
- **H4**: The physical environment of the respondents affects the quality of life of older adults in the institutional environment.

In the first part of the questionnaire, we covered social demographic factors (gender, age, marital status, level of education, monthly income of the respondent, decent living standard and religion). The second part of the questionnaire listed 26 questions for measuring items of individual standards and religion. The second part of the questionnaire included questions about the quality of life. Respondents expressed their opinion about them on a 5-point scale, ranging from 1, which meant "very bad", to 5, which meant "very good", or 1 meant "not at all / nothing" to 5 "very much", or from 1 which was "not at all" to 5 which was "completely ", or from 1 – "very dissatisfied" to 5 – "very satisfied", or from 5 – "never" to 1 – "always". Data were analysed using the SPSS statistical package (version 21).

### 2.4 Ethical aspect of the study

Prior to the research, the authors obtained a decision from the Ethics Committee of Alma Mater Europaea - ECM. The Ethics Commission issued a decision (No. 4 / 2020-21) stating that the research and the measuring instrument are in accordance with all ethical aspects of the research work and suitable for the implementation of the research work. Before starting the study, each respondent was informed about the purpose and course of the research and gave informed consent. Furthermore, study participants were informed that they could withdraw from the study at any time.

### 3. RESULTS

Responses of the respondents on the 5-point rating scale regarding the impact of independent variables (physical health, mental health, social relations and physical environment) on quality of life in the institutional environment were checked with reliability and validity analyses. In order to achieve convergent validity and reliability of measurements, we first assessed the dimensionality of individual constructs (physical health, mental health, social relations, physical environment). In the final exploratory factor analysis for each construct separately, we considered only variables whose eigenvalue exceeded 1.

The first factor analysis on physical health, which included seven variables, showed that the variables were weighted accordingly to the corresponding factors. However, we gradually eliminated three variables due to three lower utilities and a substantive difference compared to other variables within the same factor. We eliminated the "Do you have enough energy for everyday life?", "How well are you able to integrate into the environment?" and "How satisfied are you with your sleep?". In extracting the variables, we considered the content analysis and, at the same time, the calculations of Cronbach's alpha. The average of excluded variances in the second factor analysis was 76,329 (> 50), which means that the variance of two factors can explain more than two-thirds of the variance of all observed variables. The Kaiser-Meyer-Olkin coefficient was higher than 0.5 (KMO = 0.574), and the Bartlett sphericity test was also statistically significant (p = 0.001). Most factor weights are higher than 0.8, meaning we have achieved convergent validity, and Cronbach's alpha calculations have confirmed their internal reliability. We named the new variables: "Physical satisfaction of older adults" (first factor) and "physical health of older adults" (second factor).

The mental health construct was also analysed using factor analysis. The first-factor study that included six variables showed that the variables were weighted accordingly to the corresponding factors. The value of the Kaiser-Meyer-Olkin measure was more significant than 0.5 (0.723), and the Bartlett sphericity test was also statistically significant (p = 0.001). The average of excluded variances is the same (50,239), which means that the variance of one factor can explain more than half of the variance of all observed variables. However, due to lower utilities for three variables, we gradually eliminated three variables: "How well are you able to concentrate?", "How satisfied are you with yourself?" and "How often do you have at least one negative feeling, such as sadness, despair, anxiety, or depression?" The three excluded variables now explain more than 62% of the variance. In extracting the variables, we considered the content analysis and at the same time the calculations of the Cronbach's alpha. Table 1 shows the utilities, factor, and Cronbach's alpha calculation. The average of all utilities is close to or higher than 0.6. Most factor weights are close to or higher than 0.8, which means that we have achieved convergent validity. Cronbach's alpha confirmed the reliability of the mental health factor scale as it is greater than 0.7.

We also tested the dimensionality of the social relations construct. The final solution indicates that we can explain 72.73 percent of the variance with two variables with respect to the total variance of the two variables, since the orthogonal (varimax) factor matrix indicates the structure of one factor with two variables. The variable "How satisfied are you with your sex life?" was excluded. The question did not correlate particularly strongly with any of the associated variables (own value was very low, around 0.3). The Kaiser-Meyer-Olkin coefficient was exactly 0.500 and the Bartlett sphericity test was statistically significant (p = 0.000). Due to only two variables, the result is equal to the value of factor weights and utilities. The utilities are appropriately high, as are factor weights greater than 0.8. The coefficient of reliability (α = 0.602) is acceptable, although it consists of only two variables.

Below, we analysed the dimensionality of the physical environment construct. Exploratory factor analysis showed that the physical environment is a three-dimensional construct.
consisting of "physical environment with living space" (first factor), "physical environment with leisure" (second factor) and "financial satisfaction" (third factor). We omitted one question of the initial eight questions: "How healthy is your environment (e.g. air, water, living environment)?", as it was not adequately weighted on the associated factors. The final solution thus shows that 64.30 per cent of the variance concerning the total variance of all indicators can be explained by the three obtained factors. In addition, the Kaiser-Meyer-Olkin coefficient was higher than 0.7 (0.732), and the Bartlett sphericity test was statistically significant (p = 0.000). Table 2 shows the utilities, factor weights, and Cronbach's alpha calculations. All variables are appropriately weighted on three factors, the consequences being, in most cases, close to or higher than 0.8, indicating convergent validity. However, Cronbach's alpha calculations confirmed the reliability of the instrument scale for factor 1, as it is more than 0.6, which is not the case for factor 2 and factor 3. We look for the reasons mainly because it is essential for the elderly in the institutional environment to have their basic living needs met and belong to the generation of veterans characterised by modesty.

Table 2: Factor analysis of assessments of physical health, psychological health, social relations and the physical environment - values of Cronbach's alpha, communality and rotated matrix

| Questions                                                                 | C. alpha | Communalities | F. 1  | F. 2  | F. 3  |
|---------------------------------------------------------------------------|----------|---------------|-------|-------|-------|
| **Physical environment indicators**                                        | 0.630    | 0.727         | 0.892 |       |       |
| How satisfied are you with the ability to carry out activities in your daily routine? | 0.742    | 0.870         |       |       |       |
| How satisfied are you with your ability to work?                          | 0.735    | 0.800         | 0.858 |       |       |
| How much treatment do you need to function in your daily routine?         | 0.785    | 0.840         |       |       |       |
| To what extent does physical pain prevent you from doing what you need or want to do? | 0.678    | 0.824         |       |       |       |
| **Psychological environment indicators**                                  | 0.696    | 0.678         | 0.824 |       |       |
| To what extent do you enjoy life?                                         | 0.595    | 0.777         |       |       |       |
| To what extent is your life meaningful?                                   | 0.604    | 0.771         |       |       |       |

The analysis was continued by studying individual constructs' mean values and standard deviations. General results of the survey on quality-of-life show that respondents rate their quality of life as fairly positive. The latter can be supported by assessing the quality of life, which is close to a good quality of life with a value of 3.54 (arithmetic mean on the rating scale from 1 to 5). Furthermore, the analysis of the average values of responses for the physical health construct shows that the ability to perform activities in one's daily life is an important factor in physical health. The importance of accepting one's appearance is highly ranked, enjoyment of life and the meaning of life are generally not so important and, according to most respondents, are not manifested through mental health. In what follows, we can say that residents are satisfied with...
In the second phase of the research, we tested the set responses for the physical environment construct shows that security, information, living conditions, access to health services and the accessibility of transport are essential factors in residents' satisfaction in the institutional environment. In the present case, we must not neglect the fact that the above results represent the physical environment in the eyes of the residents in the institutional environment.

In the second phase of the research, we tested the set conceptual model with the help of multiple regression, whether the respondents' physical health, mental health, social relations, and physical environment have a positive effect on the quality of life in the institutional environment. It turns out (Table 3) that the regression function is reliable only between the link for mental health and quality of life. Contrary to expectations, the association between physical health and quality of life (r = 0.374) is statistically insignificant (p > 0.05), so the H1 hypothesis cannot be confirmed. On the other hand, the assumption of H2 is confirmed, as mental life and quality of life are positively related (p = 0.010; p < 0.05). On the other hand, a statistically insignificant association between social relations and quality of life (p = 0.100; p > 0.5) again shows that we cannot confirm the H3 hypothesis. By analysing the results given in Table 2, we also find that there is a statistically insignificant relationship between physical environment and quality of life (p = 0.195; p > 0.05). This means that we did not confirm the H4 hypothesis.

Table 3: Results of hypotheses tests

| Hypothesis | Dependent variable | Independent variable | F      | Statistical Characteristic |
|------------|--------------------|----------------------|--------|---------------------------|
| H1         | Quality of life    | Physical satisfaction | 0.991  | 0.374                     |
|            |                    | Physical health       |        |                           |
| H2         | Quality of life    | Mental health         | 6.840  | 0.010                     |
| H3         | Quality of life    | Social relations      | 2.746  | 0.100                     |
| H4         | Quality of life    | Physical environment  | 1.590  | 0.195                     |
|            |                    | with living space     |        |                           |
|            |                    | with free time        |        |                           |
|            |                    | Financial satisfaction|        |                           |

4. DISCUSSION

This study confirms previous evidence that mental health is the most critical factor influencing the quality of life in older adults (Xie et al., 2014). Quality of life is based on own individual assumptions and depends on time and life situations, and describes the personal satisfaction of desires and needs that affect factors such as health status, physical activity, learning opportunities and social interaction (Blazun, 2013). Reducing loneliness is an essential factor in the recovery process and in prevention. One method of reducing the level of mental distress could be to increase resilience, which contributes to improving the perceived quality of life on a physical and psychological status (Gerino et al., 2017). The quality of life is mainly reduced by depression, polymorbidity and life without a partner, so it is necessary to create opportunities for older adults to develop and maintain social contacts and include older adults in leisure activities (Soosova, 2016).

ICT is becoming an essential medium through which people establish and maintain relationships and which offers them new ways of expressing and communicating (Wyn et al., 2005). The use of ICT in older adults has a positive effect on their mental health (Nycyk & Redsell, 2006), on quality of life and wellbeing (Nedeljko et al., 2021) and reduces social isolation (Kim, 2008). With the use of ICT, older adults have an individual choice regarding the use of various applications and thus an impact on their own quality of life (Blazun, 2013), which preserves their autonomy and independence.

This study also has some limitations regarding the methodology used and the sample size. The biggest constraint in the study was the accessibility of older adults living in an institutional setting due to measures taken to contain the COVID-19 epidemic. Some institutions did not allow the survey at all, and some did so under particular conditions. Therefore, the sample is not representative, and the study results cannot be generalised to the whole population. The following limitation is in terms of methodology - the scope and understanding of the questionnaire. Respondents could not answer questions on their own and needed some assistance. Despite the limitations, we believe that this study contributes to improving the quality of life of older adults living in an institutional environment during the COVID-19 epidemic.

5. CONCLUSION

The authors of this study found that, during the COVID-19 epidemic, the quality of life of older adults in the institutional environment is most affected by the factor of mental health. The use of ICT by older adults has a beneficial effect on their mental health, which is an essential factor in the quality of life. In the future, it would be sensible to repeat the research on a larger sample and supplement it methodologically so that older adults can respond as independently as possible.

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