Tools for Identifying and Preventing Loneliness in Older Adults

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Abstract. Loneliness among the older adults is a pressing problem worldwide. The deaths of loved ones, deteriorating health, the anticipation of one's own death, and the absence of a person one could rely on result in people experiencing loneliness in older age. The goal of the European project "Digi-Ageing" is to combat age-related loneliness through digital tools and training for healthcare professionals. These tools include a digital loneliness identification tool (screening tool) to identify loneliness and a digital loneliness intervention tool (reminiscence tool), supported by a dedicated curriculum for user training. This paper's primary objective is to discuss the research methodology followed to address the issue of loneliness in the context of the Digi-Ageing project, and introduce the Digi-Ageing platform and its two novel tools designed to assess the degree of loneliness among elderly individuals, as well as steps to address them. The paper explores the tools' innovative features and potential applications across various countries. Furthermore, it aims to initiate a discourse on the tools' future prospects, particularly regarding their implementation with diverse vulnerable groups.

Keywords: Loneliness Identification · Loneliness Prevention · Screening Tool · Reminiscence Tool · Digital Tools

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1 Introduction

In every EU member state, the share of the population aged 65 and over is already noticeably increasing and accounts for over 20%. As per Eurostat forecast, the proportion of EU residents aged 65–79 is expected to rise to 17% by 2100, compared to the 15% recorded in 2022. The anticipated change is quite significant, as the share of seniors aged 80 years and above is projected to more than double, surging from 6% to 15%. Loneliness among the older adults is a pressing problem in many countries around the world. The deaths of loved ones, deteriorating health, the anticipation of one's own death, and the absence of a person one could rely on provide an essential context for people to experience loneliness in older age. Loneliness can be described as a feeling that arises when there is a perceived difference between the desired and attained levels of social relationships [1]. The quantity (available and reliable for helping social ties) and quality (degree of intimacy and understanding) of social relations are two dimensions of loneliness that is subjectively experienced by an individual [1, 2]. Experiencing loneliness has a great impact on a person's physical and mental health.

Digi-Ageing is a European project funded by the EU's Erasmus+ program and its goal is to combat age-related loneliness through digital tools and training for healthcare professionals. These tools include a digital screening tool to identify loneliness and a digital intervention tool, supported by a dedicated curriculum for user training [3].

Collaborating across five partner countries, each with distinct expertise in gerontology or nursing science, the consortium strives to create a comprehensive solution to a growing issue. The importance of the project lies, not only in its immediate aim to enhance the quality of life for the elderly, but also in raising awareness and establishing an engaged, solution-oriented network.

This paper's primary objective is to discuss the research methodology followed to address the issue of loneliness in the context of the Digi-Ageing project, as well as introduce its two novel tools designed to assess the degree of loneliness among elderly individuals, as well as steps to address loneliness. The paper explores the tools' innovative features and potential applications across various countries. Furthermore, it aims to initiate a discourse on the tools' future prospects, particularly regarding their implementation with diverse vulnerable groups.

The paper is organized as follows: Sect. 2 discusses the research methodology and Sect. 3 describes the related work from the aspect of similar available digital tools. Section 4 presents the Digi-Ageing platform and digital tools from a technical perspective and discusses how caregivers and patients can use them. Section 5 presents the evaluation of the two tools conducted in the context of the Digi-Ageing project, and the paper closes with conclusions and future work.

2 Research Methodology

Concepts for detecting loneliness are categorized into uni- and multi-dimensional scales. Uni-dimensional approaches focus on a single dimension of loneliness, such as a lack of social support or social contacts. These treat loneliness as a distinct phenomenon reflected in this one dimension. Conversely, multi-dimensional concepts view loneliness as a

complex and multifaceted phenomenon, consisting of various dimensions like emotional loneliness, social isolation, and a lack of belonging. This approach acknowledges the complexity of the loneliness experience and allows for a more detailed and differentiated analysis. However, there is limited evidence for multi-dimensional scales as they have been used sparingly in studies [4, 5].

In a clinical setting, the best-established instruments are the Berkman-Syme Social Network Index (SNI) for measuring social isolation for ages 18-64 and the short version of the UCLA-LS for measuring loneliness [6].

The design of the Digi-Ageing Loneliness screening tool was the end result of the 3rd work package. Further details can be found in the deliverable IO3-A1: [Deliverable name], that provides the specifications of the Digi-Ageing platform and tools.

The research methodology for the creation of the loneliness identification tool (screening tool) was based on a combination of desktop and field research, aimed at comprehensively understanding all stakeholders and synthesizing data from recent literature. Key factors such as age, gender, personal life characteristics and events, and social parameters were considered to develop a comprehensive profile of the average end-user of the application. To achieve the screening objectives, the instrument utilizes a mix of standardized and unstandardized tools, step-by-step tailoring data collection depending on the user's loneliness risk. By integrating multiple data sources and employing diverse research techniques, the methodology aims to create a holistic understanding of the stakeholders' needs and facilitate the development of an application that effectively addresses loneliness among its target audience.

The Screening Tool was based on the:

1) Identification of the demographic, personal, health, social, financial and other risk factors contributing to the prevalence of loneliness among older adults based on recent research.
2) Exploration of technological instruments and gateways which could be appropriate for older adults with a wide range of characteristics and also their caregivers and healthcare professionals.
3) Consideration of the limitations of the ageing user i.e., decreased attention span, visual and hearing acuity, need for high contrast screens, etc.

The Digi-Ageing screening tool was designed to be used by healthcare professionals and caregivers while assessing the end-user beneficiary (i.e. older adult). The tool includes two identification levels: (1) Risk Profile – Quick Loneliness Check, (2) Standardised Loneliness assessment – UCLA Revised Scale. In case the results of these two first steps indicate that the older adult is at moderate or high risk of loneliness then the professional is encouraged to proceed to step (3), namely, the ECOMAP and the creation of a joint (4) Action plan to assist older adults in implementing changes in their everyday life and engage their network to address the signs of loneliness.

The Risk Profile – Quick Loneliness check was created as a quick and handy checklist containing the major loneliness risk factors as identified by literature, in order for the professional to evaluate the overall risk profile of the individual. These factors can be categorised into four main domains, namely, demographic risk factors (old age, female gender, low income, family status (e.g., living alone), recent retirement), environmental risk factors (living status, low transportation accessibility), physical and mental health

risk factors (visual, hearing impairments, mobility impairments, mental diseases, recent personal losses) and social risk factors (limited access to internet, member of a minority, access to services and products, global/national crisis) [7–10].

Following the initial screening, the tool provides an option to cross-confirm the results using a standardized questionnaire. Upon evaluating the available options (e.g., de Jong Gierveld Scale, UCLA, and more), the consortium opted to incorporate the UCLA revised questionnaire. This decision was influenced by the fact that standardized translated versions were accessible in all consortium countries, and the questionnaire demonstrated ease of use and sound psychometric properties [11, 12]. By integrating the UCLA revised questionnaire, the tool aims to enhance accuracy and consistency in assessing the relevant factors across diverse populations in the consortium countries.

At the third level, the ECOMAP was selected as a tool to initiate discussions between the older adult and the healthcare professional, offering a visual representation and comprehension of the older adult's existing social network and relationships. This internal subjective evaluation allows the older adult to express their feelings of closeness with each person in their life. All three levels of assessment complement each other, culminating in an aggregated average risk level.

The solution aims to provide a risk assessment, indicating the likelihood of the person under the care of the healthcare professional or caregiver developing loneliness. However, it does not confirm whether the person is currently suffering from loneliness. Therefore, the responses gathered should be tailored to this risk-oriented perspective, focusing on understanding and addressing potential risks rather than confirming the presence of loneliness.

3 Related Work

Several digital tools have been developed in recent years, to address the issue of loneliness among older adults from different aspects. Paper [13] discusses existing mobile applications that have the potential to be used daily by older adults, aiming to combat the effects of isolation in their lives. The work, published during the COVID-19 pandemic era, presents 15 apps, divided in 6 categories: (i) Social Networking including popular networking applications like FaceTime and Skype; (ii) Medical app specialised in telemedicine; (iii) Medical apps specialised in prescription management; (iv) Health & Fitness; (v) Food & Drink, and (vi) Visual & Hearing impairment.

Social Networks, communication apps such as Skype or Pinterest and other digital technologies are also discussed as a means of preventing and/or overcoming loneliness [14–16], by preventing social isolation for older adults through increasing communication and connectivity between friends, family, and caregivers. Authors in [17] found in their study group that by using the mobile game app "Gobang", participants were able to network with other players, maintain social contacts and increase their social well-being by 10%. The mobile game app "Gobang" [18] explores in specifics how Whatsapp's basic features can be used by the healthcare ecosystem, aiding remote care and making it more efficient in terms of money and time in addition to improving the quality of life of patients. Whatsapp is perceived as a particularly user-friendly messaging app with a clean and simple to use design – this means that groups that are ordinarily excluded from accessing it, such as older people, are able to use it.

Even though the above studies obtained positive results, it was also shown that problematic use of social media via mobile devices has a negative impact on social isolation among older people with a significant result [19].

While the abovementioned works discuss existing technologies as solutions to loneliness, [20] examines the feasibility of a novel communication technology to enhance social connectedness among older adults in residential care, by developing and evaluating an accessible iPad-based communication app that supports older adults' asynchronous communication with family and friends. Results showed that the technology required an adaptation period but was a feasible communication tool. However, increased social connectedness (meaningful social interaction) was only reported by participants with geographically distant relatives, while the authors did not come to a significant result ($p => 0.5$) in the quantitative study on reducing the experience of loneliness and social isolation.

World Health Organisation's (WHO) ongoing project "+Simple, digital inclusion for older people" offers a platform that groups content (news, procedures, social networks and pages of interest), while older adults were trained to use the tool. The overall aim was to promote elderly adults' social inclusion through a digital literacy process. At the moment, 106,550 tablets with the "+ Simple" platform were delivered to people over 60 years of age. Subsequently the "+ Simple Community app was integrated, seeking to approach older adults through the creation and participation of events, and the possibility to connect with other older adults.

Connect2affect is a new initiative that aims to create an online network of resources and support that meets the needs of anyone who is isolated or lonely, including older adults. It provides an isolation self-assessment for understanding the visitors risk level and providing the most helpful information and recommendations based on their results.

We observe that most works discuss the usage of existing technologies and applications in combating loneliness in older adults, while a few novel tools were suggested; however, all aim to establish communication or build communities with other older adults as the means for preventing or fighting loneliness and isolation. Our approach aims to offer a new direction for caregivers to work with each individual, analysing in depth their situation through established scientific tools, allowing them to recognise their level of loneliness and to work on fighting loneliness with specialised sessions assisted by the technology, tools, and resources offered by our platform.

4 The Digi-Ageing Digital Tools

In the context of the Digi-Ageing project, two tools have been designed and developed: a loneliness identification tool (screening tool) and a loneliness prevention tool (reminiscence tool). In this section we will describe them, focusing on technical and User Interface (UI) related aspects.

Both tools were developed using state-of-the-art web technologies and were integrated on a web-platform that uses WordPress as the basis for development. The Digi-Ageing database (DB) was designed and implemented in MySQL. The two tools and their modules were developed as plugins on the WordPress (WP) web-platform, utilizing the capabilities and power of this platform in terms of user management, content

management, privacy, usability and UI design (usage of themes). More to the point, an empty installation of a WP web-platform was set up where it was used by the Digi-Ageing development team to design the Digi-Ageing platform's UI, as well as develop the two tools and their related modules as WP plugins.

Figure 1 shows the software architecture of the Digi-Ageing platform. The Dashboard allows the caregiver to select between using one of the two tools, or access the training. The training provides access to the Digi-Ageing blended learning training course, where the caregiver may receive useful information about the training, as well as navigate through the complete curriculum of the blended learning training course.

For using the screening tool or the reminiscence tool, the caregiver needs first to select one of his/her registered patients. Patients registration is being managed via the patient management module.

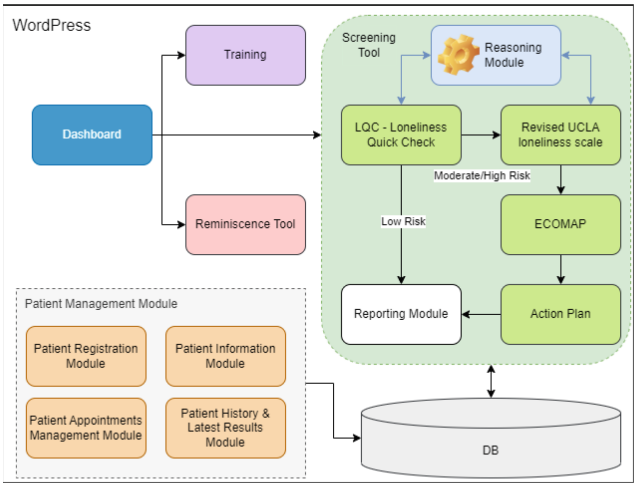

Fig. 1. The Digi-Ageing Platform Architecture.

The patient management module includes 4 modules: the patient registration module is responsible for the patient registration that is conducted by the caregivers. To register, the patient selects a login name that could be their real name or not, while their birthday and sex is also requested. Other than this, no patient private data is requested for registering as a patient. A patient being registered is automatically assigned under the organization of the caregiver. The patient information module stores and retrieves the information of the patient, while the patient history and latest results module stores the scores of the patient for LQC, UCLA, ECOMAP, Action Plan, and any other data generated that concern the patient. Displaying and printing the latest results for the patient is also a responsibility of the patient history and latest results module. The patient appointments management module manages the appointments (see reminiscence tool below) of the caregiver with his/her patients via a dashboard. The caregiver may visit his/her past appointments and read any notes or resources saved.

4.1 Screening tool

After patient registration, the caregiver may proceed to use the Digi-Ageing tools together with the patient. Firstly, the screening tool will be used. Figure 2 shows the workflow for the tool. The screening tool's first step is to conduct the Loneliness Quick Check (LQC), where the 15 questions are projected to the user in the form shown in Fig. 3. The patient should answer explicitly with a "yes" or "no" to avoid any ambiguity. The caregiver takes care of the interaction with the tool. The tool does not allow for any question to remain unanswered. Depending on the patient's LQC score, the caregiver will be prompted with an informative message with the patient's level of loneliness (low, moderate, or high), as well as the proposed next steps for the patient. In the case of low risk of loneliness, the patient should proceed to access the patient prevention report provided by the reporting module (see Fig. 2), which provides a list of recommendations that may help the patient feel more active, socialized, and tackle the feelings of emotional or social loneliness. If otherwise the patients' risk of loneliness is estimated to be moderate or high (see Fig. 4), the patient should proceed with the revised UCLA loneliness scale.

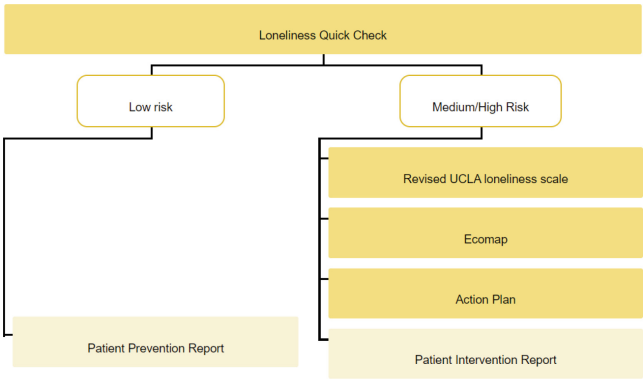

Fig. 2. Screening tool workflow.

Instructions: Please tick when the statement applies to the person you are assessing.

	LQC - LONELINESS QUICK CHECK	YES	NO
1	The person has recently retired or became unemployed (max two years)	○	○
2	The person does not have close family or friends/social network	○	○
3	The person does not have an intimate relationship	○	○

Fig. 3. LQC - The questionnaire.

With the revised UCLA (20 questions) loneliness scale (Fig. 5) the patient indicates how often a set of the statements are descriptive of themselves. The patient may reply using the statements: Never, Rarely, Sometimes or Often. The caregiver fills-in the questionnaire and submits. Figure 6 shows an example of the results when a moderately-high degree of loneliness is detected: the tool suggests proceeding to the next tools, but

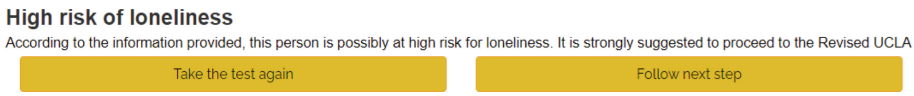

Fig. 4. LQC - The results.

it is important to note that the final decision is left on the caregiver's clinical judgment. The reasoning module is a reasoning engine that computes the patients' scores for the LQC and UCLA that are next being stored in the DB.

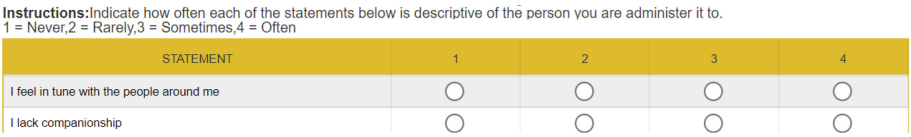

Fig. 5. UCLA - The questionnaire.

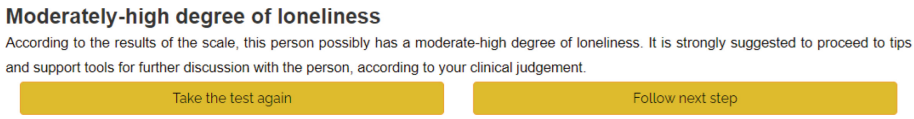

Fig. 6. UCLA - The results.

Following, the caregiver guides the patient through the ECOMAP tool. ECOMAP allows the patient to position his/her friends, family members, caregivers, social contacts and others as colourful figures upon a canvas that includes three concentric circles, such that the distance of each of these figures with the patient (grey figure in the middle) denotes how important their relationship is: the shorter the distance (i.e., placed in the inner circles) the closer the relationship, see Fig. 7. The positioning of the figures on the canvas is being done by the caregiver by using "drag and drop". The ECOMAP was developed using open-source libraries that allow for dragging and dropping items on a canvas.

Next in the screening tool palette of tools is the action plan. The action plan is an appropriately designed web form where the caregiver can report his/her ideas about the steps the patient should take in order to arrive at the desired results, i.e. reducing the patient's levels of loneliness. The action plan is stored in the DB and can be updated with the progress of the patient.

It is important to note that all Digi-Ageing modules mentioned store the patient's data in the DB and thus, when revisited, the carer and patient may continue from the point they left their session the previous time. This provides the caregiver the flexibility required to stop a session with a patient at any time and be able to continue at a later point in time without any data to be lost.

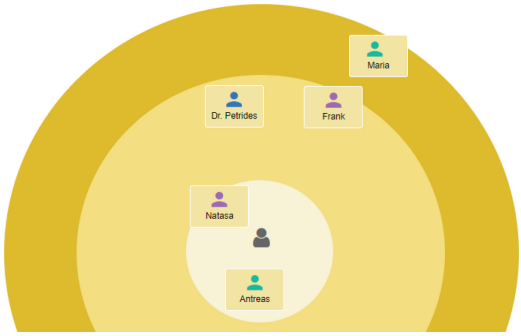

Fig. 7. ECOMAP.

4.2 Reminiscence tool

Reminiscence is the process of recalling to mind personal memories, involving not only positive, but also negative memories, as well as what a memory means to a person. The loneliness prevention tool or reminiscence tool uses modern technology to allow the caregiver and patient to initiate a discussion between them on a subject relevant to a patient's memory. Reminiscence guidance is intended to empower older adults to overcome loneliness and to find hope, value, and meaning in their lives. Caregivers benefit from improved knowledge of their patients, foster bond between professionals and patients and from a reduction in stress.

The reminiscence tool defines a guided videoconferencing session between the caregiver and the patient, during which the reminiscence takes place. The videoconferencing session is being conducted via ZOOM technology. The reminiscence session can be done face-to-face or even remotely, as the Digi-Ageing platform defines an easy way for the patient to sign-in to the ZOOM session: the caregiver contacts the patient and provides him/her with a link to the platform (e.g., via an SMS). At the time of the reminiscence session, the patient clicks on the link to access a webpage with a text box and a button. The patient enters their login name (alias) and clicks on the button. The following page provides the ZOOM link which he/she can click to access the reminiscence session. The above process assumes that the patient has a computer/mobile device with internet access and the ZOOM software installed (should be done by the caregiver or a family member). Then, the caregiver shares his/her screen and the reminiscence session starts.

The reminiscence process supported by the reminiscence tool is consisted of 4 stages that must be performed sequentially, but can be paused and be continued at any point in time as all data are being stored in the DB. The 4 stages are: stage 1 onboarding and planning stage: the caregiver is being instructed to inform the patient about the aims of the reminiscence session, and that he/she should set a warm, friendly tone, listen actively without rushing or forcing, creating thus positive emotions to the patient. The caregiver should identify themes of interest with the patient, creating thus positive emotions using pictures, short videos and music from suggested topics such as: favourite places/music/food, first day at school, first toy, and first job. Stage 2, elicit memories by using PROPS planning stage: in this stage the caregiver shares his/her screen to help the patient revisit his/her memories by using digital resources like favourite

places/music/food. The reminiscence tool provides a plethora of such digital resources created by the project consortium available to be used during reminiscence sessions (Fig. 8).

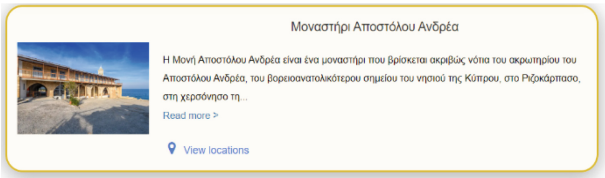

Fig. 8. Reminiscence tool: resources for favourite places.

Stage 3 includes the expression and sharing of memories by the patient. The caregiver is instructed by the tool to support the patient by actively listening, establishing trust and rapport, giving the choice to choose memories to share and not to share. Where the patient decides to share a difficult memory, the caregiver has the responsibility to ensure that hurtful feelings are properly listened, as well as to give support and genuine empathy to the patient. The fourth and final stage is the closing stage, where the patient should complete his/her story satisfactory. The caregiver is instructed by the tool to reflect on the positive outcomes and feelings that have been achieved, and to motivate the patient to move on to new projects (sharing memories) and activities. Moreover, the tool enables the caregiver to make notes and evaluate the session by writing text or uploading notes to the appointment's page.

5 Evaluation

The Digi-Ageing project's evaluation design, concentrating on the empirical pilot-testing of a newly introduced screening tool, employed qualitative evaluation research principles. These principles aimed at scientifically substantiating shifts in practice while revealing their subsequent impact, thereby following the guidelines outlined by Mayring [21]. The adherence to Prigge et al. [22] comprehensive evaluation guidelines fortified the design's foundation, assuring meticulous operationalization of the project's goals and objectives. This approach was robust, guaranteeing conformity to pivotal criteria such as utility, feasibility, fairness, and accuracy.

Hypothesis generation, integral to the evaluation process, was constructed on four foundational target levels: technical preconditions, applicability, and desired outcomes. These hypotheses underwent empirical examination using questionnaires. Subsequent data analysis in conjunction with iterative feedback loops yielded actionable recommendations. The continuous interaction with project partners across the project's lifespan ensured a shared understanding and consistent refinement of the project's processes and outcomes. The conclusions of the evaluation, formulated as actionable recommendations, were presented at the final conference in Lithuania in May 2023, providing a comprehensive, nuanced view of the project's achievements.

In parallel, the EU project Digi-Ageing conducted a data analysis for the validation of the Loneliness Quick Check (LQC) developed within the project. The LQC aimed to

identify loneliness risk factors as predictors of scores on the UCLA Loneliness Scale, used to gauge the severity of loneliness. The pilot phase data were compared against anonymized test subject data from the LQC and the UCLA. With both test results available for 135 individuals, a descriptive analysis showed the LQC predicting a moderate to high presence of loneliness risk factors in over 85% of subjects. In contrast, only 51.8% of subjects ranked their perceived loneliness as moderate or high according to UCLA. Initial analysis indicates the LQC tends towards overestimation of loneliness risk, which might be beneficial in a multi-stage screening process to avoid overlooking potentially affected individuals. However, further statistical analyses employing a binomial logistic regression model didn't show significant predictive power of LQC for UCLA outcomes. Therefore, based on the data set, it cannot be conclusively shown that overall LQC scores or their categorical interpretation could predict actual loneliness as diagnosed by UCLA. However, the statistical calculations of the predictive validity of the LQC are based on an international convenience sample. This sample was neither internationally nor nationally representative for the participating countries. Therefore, it is a further goal to conduct studies on the validation and cultural adaptation of the LQC based on valid national and international data.

6 Discussion and Future Work

Researchers [23, 24] point out that using a digital platform to identify and predict loneliness in older people could help to identify a trend, recognise loneliness as a risk factor and/or correlate, make a meaningful contribution to the allocation of resources to where they are needed most, and optimize interventions. According to [25], it is essential that people are willing to record their information, that the information is used in a meaningful way, and that users are able to interpret any results. If users are unwilling to accept the system, the system cannot be effective. Therefore, it is necessary to ensure that the tools/platform are sufficiently inclusive and effective. For platforms to be appealing over the long term, it is important to involve, not only the older adult, but also his/her support network such as family, friends, care workers and others, including the needs/requirements of different stakeholders [26, 27]. The integration of digital health tools to identify and mitigate age-associated loneliness signals a promising trajectory, inviting additional intervention avenues. This study unveils the potential applicability of these tools within domains such as community care, mobile nursing, and integrated care, where the interplay between age-associated loneliness and digital health approaches could offer enriching perspectives. A comprehensive training mobilization targeting healthcare professionals in effectively leveraging these tools and addressing loneliness is deemed crucial in responding to impending challenges. Incorporating nursing students and incumbent personnel may stimulate an intergenerational knowledge exchange, fostering pragmatic implementation. Initiatives such as Digi-Ageing play a crucial role in heightening societal cognizance towards loneliness repercussions, fostering collaborative problem-solving endeavours. Loneliness is an intricate phenomenon, indiscriminately affecting individuals across age brackets and social tiers, a relevance amplified amidst the COVID-19 pandemic onset. Despite this study's concentration on age-associated loneliness, digital health tools possess potential applicability across varying demographics, fortifying the fight against loneliness. Future work should accentuate

the transposability of these findings across other application domains and the cultivation of integrative digital resolutions.

Future investigative pursuits are encouraged to implement ex-ante and ex-post evaluations, facilitating the generation of valid conclusions, and ensuring the inclusion of an expanded participant cohort. Moreover, the forthcoming Erasmus+ project, [Forthcoming project name] manifests significant potential in addressing the intricate challenges presented by an aging demographic.

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