Development of a Mobile Application for the Integral Care and Attention of Elderly People

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Abstract. In recent years, the number of people reaching stages of ageing has increased considerably, reflecting a serious public problem. It is not enough to reach long ages, but to guarantee the integral care and attention of each individual. Thus, taking into consideration the difficulties faced by the elderly, States implement social security programs that seek to support their development. Ecuador follows this trend and presents proposals that address a number of fundamental rights, which are considered priority health care services. Although the measures implemented maintain the health, this reality changes when moving from an urban to a rural scenario. This is justified by the fact that in Ecuador, specialists who care for the elderly constantly change their location and, therefore, their patients, rather than maintaining a non-standardized data record on paper, causing inefficiency and waste of time. For these reasons, this article explains a proposal for a mobile application that seeks to standardize and digitalize the collection of medical data from the elderly in rural areas in order to increase the efficiency of current medical processes.

Keywords: Elderly care · Information and communication technologies (ICTs) · Multi-disciplinary work · Medicine · Nursing · Dentistry

1   Introduction

The world's population is ageing rapidly. This demographic change presents both opportunities and challenges, as many people yearn for a long and healthy life. While ageing is likely to be associated with a declining workforce and a growing demand for health care, older adults can become valuable economic, social, cultural and family resources depending on their role in society [3]. This depends on their abilities and aspirations, since some want constant participation in social and occupational activities, while the unhealthy require medical assistance, which translates into a limitation in accepting commitments. On the other hand, despite the fact that life expectancy in old age is increasing in almost all countries, there is no assurance that the quality of these years will be adequate, making this stage the propitious context for long periods of morbidity [16].

Hence, while there are age-related difficulties such as walking or climbing stairs, the real deterioration begins with retirement, where the lack of work stands out [6]. The old man, in this life period, projects a negative self-concept of himself, and, having too much free time, experiences accelerated physical and psychological exhaustion, requiring activities that strengthen confidence. Therefore, it is essential to support the creation of continuous routines or work ventures that intervene in the exploitation of various skills and provide the right motivation to cope better every day. In summary, the role assumed with retirement could describe a scenario in which the holistic well-being of the elderly is undermined, generating feelings of worthlessness and little social recognition [2].

Consequently, based on Maslow theories [14], the needs of each elder can be grouped into 5 hierarchical levels [17]: (i) physiological, related to biological functions and attended by different areas of the Health Sciences (medicine, dentistry, nursing and gerontology); (ii) safety, which reflect a concern to maintain their own savings and have health insurance; (iii) love and relevance, aimed at stimulating social relationships with friends, family and partner; (iv) esteem, which focus on improving self-esteem and creating indifference to any negative opinion; and (v) self-realization, which lead physical experiences towards a spiritual dimension. When one level is satisfied, it is possible to move on to the next without forgetting that lower needs represent a physiological deficit (priority) and higher needs are related to requirements of rational development [4].

As can be seen, the needs of the elderly were described in a general way. However, transferring this situation to a rural environment gives rise to complications related to abandonment: a large part of the family, which has traditionally taken care of the elderly, does not live in the town as a result of emigration to the city; the remaining family still has other types of responsibilities; the neighbours, who were a source of care and support, change their residence in search of better opportunities; and the government's healthy services do not reach high levels of efficiency because of problems of access to remote areas. Then, as a derivative effect, it is observed that aging in a small town entails significant differences with respect to what happens in the urban environment, causing a marked perception of insecurity, loneliness and isolation [15].

In addition to the above, it is important to note that the main causes of death and disability in old age, for both urban and rural environments, are non-transmissible diseases [5]. Although many of them can be prevented or delayed thanks to strategies for the development of healthy behaviours, it is normal to find limitations when monitoring basic health habits in the elderly [3]. In that sense, an effective response to ageing must take into account the wide diversity in the health, social and economic circumstances of the population, relying on a multidisciplinary team that includes trained personnel [11,13]. However, within the country it is common for health professionals in rural areas to rotate or change patients after a certain period of time, causing difficulties in obtaining paper medical records, repeated measurements of vital signs and loss of time in any critical or care situation. In addition, adequate protocols and standards have not been established to correctly treat the data recorded in each visit, which leads to inadequate knowledge management on the part of health entities.

Based on this, a working group of four higher education institutions was formed in the city of Cuenca: Universidad Politécnica Salesiana with its research group GITEL, Universidad de Cuenca with its Dentistry career, Universidad Católica de Cuenca with its Nursing career, and Instituto Superior Tecnológico American College with its gerontology career, together with the support of Grupo de Telemedicina of the Corporación Ecuatoriana para el Desarrollo de la Investigación y la Academia (CEDIA), whose main objective is to design and implement technological solutions focused on improving the quality of life of the elderly. This article describes a proposal that seeks to solve many of the problems described through the development of a mobile application for digital data collection for the Integral Care and Attention of Elderly Person, known as ICAEP. Thus, its main contribution is based on providing a mobile tool that seeks to improve medical processes through timely management of clinical data of older adults living in rural areas, which are digitized to ensure integrity and easy access, to become a source of knowledge to predict risk scenarios and increase opportunities for efficient care and optimization of resources.

This article is organized as follows. Section 2 summarizes the policies that the government of Ecuador has implemented to ensure the well-being of older adults. Section 3 describes in detail the creation of the working group and the standardization of clinical data. In Sect. 4, the technical foundations of ICAEP and its expected functioning are presented. In Sect. 5, the main conclusions are presented.

2 Elderly Reality in Ecuador

The Consejo Nacional para la Igualdad Intergeneracional de la República del Ecuador defines older adults as those citizens who are 65 years of age or older, who represent 7% of the country's total population[1]. It also ensures that the aging process differs according to social, educational, cultural and economic conditions. Some elderly people enjoy a retirement and receive pensions that

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[1] https://www.igualdad.gob.ec/personas-adultas-mayores-situacion-y-derechos/.

allow them to live with dignity; others still work or have their own businesses, so they are economically independent; some collaborate with the care of their family, especially granddaughters and grandchildren; and, the most active, carry out sports, recreational or cultural activities, return to their studies to update their knowledge and even lend themselves to community work as volunteers. For its part, the Constitución del Ecuador considers older adults as a priority care group, which means that they must receive quality specialized care[2]. As a result, they are entitled to various benefits such as exemption or refund of tax payments, payment of reduced fares for public shows and transportation, and preferential access to various health services.

Although the above shows a generalized reality regarding ageing in the country, there are some cases, especially in rural areas, of elderly people who do not have a decent income and, as is characteristic of age, have diseases that threaten their health. Consequently, they suffer mistreatment and abandonment by their families, or they give up living accompanied because they do not feel useful, exposing themselves to scenarios of violence and begging. This stems from the fact that social security, whether public or private, is not a privilege enjoyed by the entire population. As a solution, the Government has defined the specific rights that guarantee the comprehensive well-being of the elderly, the following being particularly relevant:

- Free and specialized health care, as well as free access to medicines.
- Paid work, according to their abilities, for which limitations will be taken into account.
- Universal retirement.
- Discounts on public services and private transport and entertainment services.
- Exemptions in the tax system.
- Exemption from payment of notary and registration fees, in accordance with the law.
- Access to housing that ensures a dignified life, with respect for their opinion and consent.
- Right to receive food from relatives.

Currently, in order to comply with the aforementioned rights, the mission "Mis Mejores Años" and the integral care plan for the elderly person have been designed, which are briefly described in the following subsections.

2.1 Mission "Mis Mejores A nos"

In order to achieve active and healthy aging, the Ecuadorian state implemented the mission "Mis Mejores Años"[3]. Thus, it seeks to improve the quality of life of older adults, particularly those who are in conditions of vulnerability, extreme

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[2] https://www.oas.org/juridico/mla/sp/ecu/sp_ecu-int-text-const.pdf.

[3] https://www.todaunavida.gob.ec/wp-content/uploads/downloads/2018/12/BrochureMisMejoresAn%CC%83os_L5.pdf.

poverty and who, if not for state action, would lack a minimum level of social security. Hence, the coverage of access to basic services is being expanded according to the chronological, physiological and cultural characteristics of the population. In fact, the aim is to increase the well-being of the elderly from a holistic perspective that recognizes their individual and social requirements.

In that sense, the pillars on which the mission is based are four:

1. Favourable environments and care services: shows that health, more than being understood as the absence of disease, refers to strengthening and preservation at the physical, mental and social level, satisfying vital needs such as autonomy, joy and solidarity. To this end, it is essential to implement policies and programs aimed at improving the interaction environments of older adults, contemplating systems of support and promotion of old age from a perspective of rights and active and healthy ageing that motivates participation in activities that dignify them.
2. Income security: the objective of the mission is to improve the quality of life of older people, especially those in conditions of extreme poverty and lack of social security. As a result, a cash transfer programme, known as "Bono Mis Mejores Años", is being implemented to help cover minimum requirements.
3. Skills and employability: education is one of people's fundamental rights. In addition, different approaches to ageing regard learning as a positive social determinant and require training. Therefore, Ecuador has policies to promote permanent education processes for older adults through the programs "Campaña Todos ABC" and "Alfabetización y Educación Básica Monseñor Leonidas Proaño", which seek to mobilize society to complete basic education and provide continuity to training throughout life. With respect to employment, activity rates remain high even after reaching retirement age, a reality specific to the peoples of Latin America and the Caribbean.
4. Health status: it is important to keep in mind that during old age there are variations in health conditions, so it is normal to find an increase in degrees of dependency and care. Added to this, dealing with the increased risk of having more than one chronic condition at the same time cannot consider the impact and treatment of each condition separately. Faced with this scenario, health systems must start from a health promotion and disease prevention approach, providing specialized care, long-term care and support mechanisms, with the objective of improving the quality of life. To this end, a package of services has been deployed for the care and follow-up of older adults, which considers two aspects: an initial assessment that identifies vulnerabilities and assigns a specialist physician according to the clinical picture; and an annual assessment by the geriatrician or the assigned physician.

2.2   Integral Care Plan for the Elderly Person

According to the technical norm for the implementation and provision of geronto-logical services in Ecuador[4], comprehensive care is an intervention aimed at older adults through promotion, prevention, recovery and rehabilitation activities at three levels: individual, family and community. Thus, based on the recommendations of the Pan American Health Organization (PAHO), three specific areas of action have been formulated for the creation of health programs and services:

1. Comprehensive community programs to provide a range of healthy ageing environments, supporting family care and dignity protection activities to avoid unnecessary institutionalization.
2. Programs designed to strengthen the technical capacity of social-sanitary services.
3. Programmes designed to provide incentives to encourage self-reliance, socially productive activities and the establishment of sources of income.

Punctually, in order to enjoy the service, a care unit must apply the card of acceptance and admission of each elderly person, verifying their identification data. In this way, it is possible to draw up an individual care plan that contains personal information, comprehensive assessment, intervention proposals, personalised support and recommendations for the elderly to acquire a greater degree of self-management over their lives. Based on the plan designed, the care unit organizes monthly activities that influence the achievement of established goals. Likewise, the family should be encouraged to start strengthening actions in the home, taking into account parameters such as health, care, rights, education and instrumental, cognitive and affective activities. Definitively, the integral evaluation is a systematic and dynamic process to stratify the users, taking into account multiple domains: health, functional state, mental, nutritional, social and economic, in addition to considering their resources and social-family environment. This assessment is carried out every six months, using the pillars that affect the life of the elderly: functional, cognitive-affective, social and physical.

From the proposals described, the country's intentions to meet the needs that arise during aging and ensure a proper development of life are evident. However, from a practical point of view, there are problems related to the management of information for older adults. Firstly, due to public processes, doctors, dentists and specialists visiting rural areas or GADs (from the Spanish "Gobiernos Autónomos Descentralizados") make notes on symptoms, diagnoses and treatments on paper, causing the data not to be immediately available. For example, a dentist may require certain studies that were previously performed by a general practitioner, but since there is no access, he repeats them wasting time and resources. Finally, a model for knowledge management has not been implemented, making it impossible for artificial intelligence algorithms to come into

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[4] https://www.inclusion.gob.ec/wp-content/uploads/2018/12/Norma-T%C3%A9cnica-para-Espacios-Activos.pdf.

play to optimize work and resource allocation. In order to face these inconveniences, the ICAEP application was designed, thanks to the joint work of several higher education institutions, which will be explained in the following section.

3   Working Group and Data Standardization

The Corporación Ecuatoriana para el Desarrollo de la Investigación y la Academia (CEDIA)[5], is an entity made up of universities, institutes, colleges and companies that seeks to foster, promote and coordinate the development of scientific research and academia, offering services related to information technologies focused on scientific, technological, innovative and educational progress in the country. Its members include the Universidad Politécnica Salesiana with its Grupo de Investigación en Telecomunicaciones y Telemática (GITEL), the Universidad de Cuenca with its Grupo de Investigación en Rehabilitación Oral (GIRO), the Universidad Católica de Cuenca with its Career in Nursing and the Instituto Superior Tecnológico American College with its Career in Gerontology, which noted the difficulties reflected in medical care protocols for older adults, especially in rural areas, which lead to inefficient data management. This gave rise to the idea of initiating a project to ensure the holistic well-being of the elderly.

After several meetings of the work teams of each institution, the specific objectives to be covered in a first phase of the project were established: (i) design and deploy a mobile application for the remote recording of medical data, known as ICAEP (Integral Care and Attention of the Elderly Person) and (ii) offer courses that cover topics related to living with the elderly. The first seeks to standardize the forms and protocols used by each area of Health Sciences (medicine, nursing, dentistry, psychology and gerontology) in order to digitize and optimize the management of each patient's information. Thus, any specialist can access examinations and diagnoses that their colleagues have made in past visits, in addition to implementing artificial intelligence algorithms that help predict risk scenarios. On the other hand, the second is based on the fact that families and some caregivers are unaware of the actions they should take in certain situations that an older adult may go through. Then, by taking the courses they will be able to train themselves on current issues of care and attention, improving their capacities and, therefore, the quality of life of themselves and of the people they care for. However, this article covers only the first objective, describing in the following subsections the standardization of data and the development of the mobile application.

3.1   Data Standardization

From a biological point of view, ageing occurs because of an accumulation of molecular damage influenced by genetic and environmental phenomena, a product of the passage of years [7]. This determines the appearance of multiple

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[5] https://www.cedia.edu.ec.

alterations in health as progressive and non-lethal chronic-degenerative diseases, deteriorating the functionality of each individual and impacting their family environment and social participation [10]. For this reason, it is necessary that the assessment of the older adult be thorough, multidimensional and interdisciplinary to establish a follow-up and treatment plan. Thus, the measurable dimensions of geriatric assessment are grouped into four axes: physical health, functional state, psychological health and parameters, and can be measured with various instruments: social support networks, economic base and environmental safety [9].

First of all, it should be borne in mind that one of the key concepts for the assessment of older adults is their state of fragility, determined by a reduced functional reserve, increased risk of adverse events and mortality, as a consequence of the alteration that occurs at the cellular level and that affects the physiology of the systems, generating a lack of adaptation to internal and external stressors [1,8]. Another aspect to examine is functionality, which refers to a group of domains that interfere in the performance of daily activities to live independently and autonomously, the loss of normal functional skills affects social aspects. Finally, there are pluripathological patients with at least two chronic non curable diseases that generate progressive deterioration and gradual loss of functional autonomy with the risk of suffering new comorbidities and complications, causing important repercussions [12,18].

Taking into consideration the mentioned points, the variables to be determined include the following protocols:

1. Socio-demographic variables: age, gender, place of residence, employment situation and academic level.
2. Socio-family and/or caregiver-related variables: age, gender, and relationship to the primary caregiver.
3. Functional Dependency: Barthel Index, Pfeiffer, Lawton-Brody, Functional Gear Classification and Short Series of Physical Performance.
4. Socio-family risk measured by the Gijón scale, Yesavage index depression and family APGAR.
5. Clinical evaluation: general condition of the patient (anamnesis and physical examination), Charlson Index, Gohai Index, other comorbidities, falls in the last year and hospital admissions, risk of falls and mini nutritional.
6. Anthropometric variables: weight, height, body mass index, waist circumference, hip, waist hip index and blood pressure.
7. Complementary examinations.
8. Pharmacological variables: number and type of chronically prescribed drugs and new drugs after hospitalizations.
9. Fragility Variables: Frail screening tool y Gérontopôle Frailty screening tool.

Once the standardized parameters that will be registered in the visits to each elderly adult have been understood, the following section explains the architecture and operating mode of the ICAEP application.

4 ICAEP Application

The mobile application is focused on health professionals. Although its main objective is to intervene in the improvement of care processes for the elderly, only doctors, dentists, nurses, gerontologists and specialists in general will be able to access registers, medical records and other tools. For this first development, being the pilot of the research proposal, a modular architecture has been thought of that is hosted in a public cloud, in such a way that functionalities are added or eliminated without significantly modifying the structure of the application. Thus, initially there are 5 modules that are delivered under the Platform as a Service (PaaS) model. On the other hand, the core of the system complies with the characteristics of Infrastructure as a Service (IaaS), as an Ubuntu Server 16.04 will be deployed to host the HTML server, the database, the Web services and the VPN. The components and modules mentioned are specified in the following subsections and can be seen in Fig. 1.
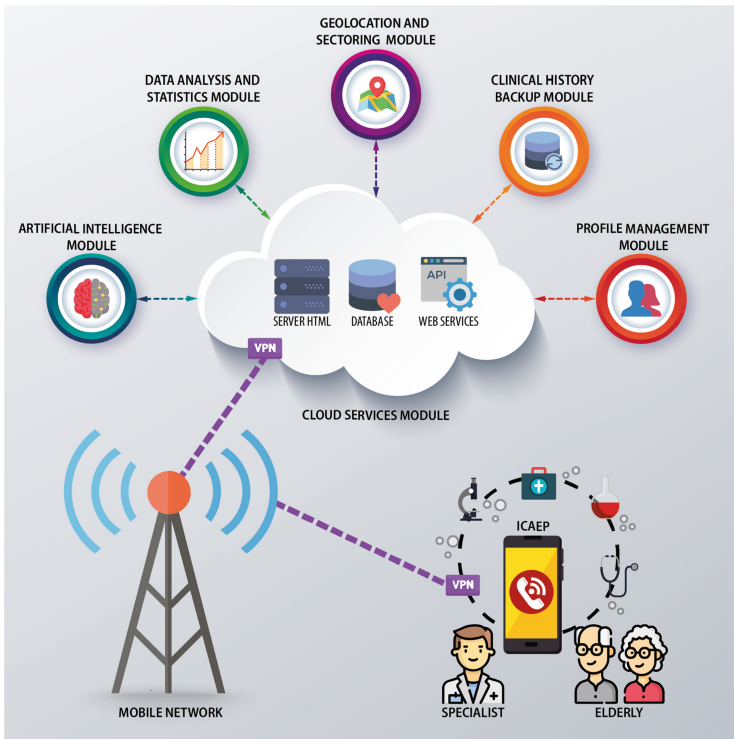

Fig. 1. Modular architecture of the ICAEP application.

4.1   Cloud Core

As it is a first implementation, it will work with a public cloud because of the facilities and flexibility it represents when installing servers and databases, in addition to the modular tools it offers. It should be noted that the core of the application is understood as IaaS and is conformed in a static way by 4 components: (i) an HTML server that keeps an informative Web page about the working group, mission, vision, projects, scientific articles and contact; (ii) Web services, known as REST API, that intervene in the handling of the data, both those sent from the application for storage and those that are requested to interact with the specialist; (iii) a database used to store information on the elderly, from the coordinates of their location to the medical histories of diagnosis and past treatments, following the defined standards; and (iv) a VPN to maintain privacy during the consumption of Web services, because it works with critical variables.

With respect to the initial modules, there will be PaaS tools to improve the efficiency of the health professionals in rural areas or municipal GADs. Although 5 modules have been chosen for this phase, future tests will evaluate their performance to continue or for use and rely on other alternatives. In addition, bearing in mind that each cloud service provider has countless options to perform any task, it is expected to form a community cloud, where the best options of each converge.

4.2   Profile Management Module

ICAEP is intended for health professionals. Therefore, it will be impossible to open it to the general public and therefore only one service administrator will be able to create profiles for each specialist. On the other hand, general users will have access to the patient data assigned to them, highlighting among their functions the consumption of Web services to record vital signs, symptoms and diagnoses, as well as to review any situation of interest that the elderly person could keep in the medical history. At this point, it is essential to highlight that the entry of data into the application follows the established standards, so that if the forms submitted are not filled in completely, they will be prevented from being loaded into the database.

4.3   Clinical History Backup Module

The information stored in the database is extremely important, as it forms the clinical history of older adults. In the event of any inconvenience with the nucleus, these records should not be compromised. Hence, to ensure high availability and persistence, a backup database will be established that can be deployed locally or through the services of another cloud provider. Users will then record the results of their visits in the kernel, which will automatically replicate them in the backup.

4.4   Geolocation and Sectoring Module

Considering that within the country rural areas cover large spaces, it is essential to optimize the specialists assigned to older adults. This module is responsible for analyzing the location of each patient and the distance it keeps from its peers to create a sector that helps better manage the time required to cover the planned visits and the number of staff who should do so. In this way, it is essential to consult the database before any assignment to check for changes in residences or transfers that reflect a new sectorization.

4.5   Data Analysis and Statistics Module

The intent of this tool is to predict any scenario that might arise based on the historical records of the elders. This is justified by the fact that, for example, during some months certain areas of the country experience low temperatures or the amount of rain increases, causing common symptoms. Then, knowing that there is a vulnerable group in a certain period of time, it is possible to reschedule the visits of specialists and allocate a greater amount of drugs. Likewise, communities could be found that due to their lifestyles develop special conditions that could be detected in time to prevent their propagation during the ageing of younger populations.

4.6   Artificial Intelligence Module

Finally, this module focuses on detecting specific problems in an older adult. Consequently, it is desired to group the historical symptomatology to find any pattern that could mean the development of a critical condition in time. To this end, based on the standardized variables, the entries that could produce a chronic disease will be defined so that a classification algorithm evaluates the possibility of complicating the state of health, threatening the patient's life.

5   Conclusions

Aging is a natural process that means a significant change in the lives of the people who go through it. In a physiological way, high probabilities of presenting a greater number of illnesses are reached, which reduces notably the quality of life. For this reason, States implement policies that try to address the problems that the elderly may face. Ecuador has implemented a series of proposals that include fundamental rights, including access to priority medical services. However, it does not take into account the difficulties of access that are found in rural settings, more than an inadequate handling of the information of each patient. As a solution, this article presented an application, known as ICAEP, which gives specialists the opportunity to standardize data collection, allowing continuous access to whoever requires it. In addition, by managing a modular design based on cloud computing technologies, functionalities can be added or

removed without modifying their overall structure. Finally, for a first instance, 5 modules have been thought that intend to optimize the management of the profiles, support the clinical histories, group the elderly according to their location, predict temporary illnesses to provide resources and classify according to risk illnesses.

References

1. Amblàs-Novellas, J., Martori, J.C., Brunet, N.M., Oller, R., Gómez-Batiste, X., Panicot, J.E.: Índice frágil-vig: diseño y evaluación de un índice de fragilidad basado en la valoración integral geriátrica. Revista Española de Geriatría y Gerontología **52**(3), 119–127 (2017)
2. Ayala Híjar, L.C.: Necesidades prioritarias de los adultos mayores según su percepción en un club del adulto mayor, Lima, Perú (2017)
3. Beard, H.P.J.R., Bloom, D.E.: Towards a comprehensive public health response to population ageing. Lancet (Lond., Engl.) **385**(9968), 658 (2015)
4. Bharti, R., Chandra, A., Tikku, A.P., Arya, D., Gupta, R.: Oral care needs, barriers and challenges among elderly in India. J. Indian Prosthodont. Soc. **15**(1), 17 (2015)
5. Bone, A.E., et al.: What is the impact of population ageing on the future provision of end-of-life care? Population-based projections of place of death. Palliat. Med. **32**(2), 329–336 (2018)
6. Chen, S., Cui, Y., Li, X., Ding, Y.: The unmet needs of activities of daily living and influencing factors among disabled older adults in Nanjing's elderly care agencies. J. Nurs. Sci. **32**(11), 70–73 (2017)
7. Cravens, D.: Comprehensive geriatric assessment for non-geriatricians. Mo. Med. **103**(2), 157–160 (2006)
8. García, C.E.: Evaluación y cuidado del adulto mayor frágil. Revista Médica Clínica Las Condes **23**(1), 36–41 (2012)
9. González-Domínguez, R., Castillo-Feliciano, L.M., Avilés, A.G.P.: Valoración gerontogeriátrica integral: comparación diagnóstica entre el módulo gerontológico y la consulta externa. Atención Familiar **21**(1), 2–6 (2014)
10. Jiménez-Aguilera, B., Baillet-Esquivel, L.E., Ávalos-Pérez, F., Campos-Aragón, L.: Dependencia funcional y percepción de apoyo familiar en el adulto mayor. Atención Familiar **23**(4), 129–133 (2016)
11. Lopreite, M., Mauro, M.: The effects of population ageing on health care expenditure: a Bayesian var analysis using data from Italy. Health Policy **121**(6), 663–674 (2017)
12. Loredo-Figueroa, M., Gallegos-Torres, R., Xeque-Morales, A., Palomé-Vega, G., Juárez-Lira, A.: Nivel de dependencia, autocuidado y calidad de vida del adulto mayor. Enfermería universitaria **13**(3), 159–165 (2016)
13. Majumder, S., et al.: Smart homes for elderly healthcare–recent advances and research challenges. Sensors **17**(11), 2496 (2017)
14. Maslow, A.H.: A theory of human motivation. Psychol. Rev. **50**(4), 370 (1943)

15. Pastor, M.Á.R., García, I.P., Serrano, V.O.: ICT solutions for elder people: manifested preferences in Spanish rural areas. Voters Change Profile Spain: Eur. Elect. 20D Gen. Elect. **6**(2), 137–177 (2017)
16. Ridgway, V.: Elderly persons health and wellbeing (2018)
17. Rowe, N., McMicken, D., Newth, T.: Dancing in the setting sun: performance, self-actualization and the elderly. In: Bond, K. (ed.) Dance and the Quality of Life. SIRS, vol. 73, pp. 527–544. Springer, Cham (2019). https://doi.org/10.1007/978-3-319-95699-2_30
18. Yépez-Ramírez, D., Jacinto-Becerra, B.F., Méndez-Bravo, E.G., Muñoz-López, D.E., Osornio-Mendoza, E.P., del Carmen Soria-Navarro, M.: Clinimetría geriátrica: propuesta de un instrumento integral en medicina familiar. Atención Familiar **20**(4), 106–110 (2013)