

Smart Ageing: Digital Solutions for Future Care

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Abstract. We propose a framework for discourse on digital solutions to support consumers and carers in delivery of health care and services for aged persons, based on a major needs analysis conducted across 56 diverse business entities in Australia. The resulting framework was based on two major identified domains: "Ageing in Place" for independent living situations, and "Ageing with Care" for managed aged care facilities. The paper describes the process used and the intermediate outcomes which enabled the framework to be synthesized. It is anticipated that the framework could be used to inform future scoping studies and to enable collaborative design, implementation and delivery of appropriate smart ageing digital solutions.

Keywords. Ageing, health services delivery, models of care

1. Introduction

It is well established that the age profile of world population is shifting rapidly towards a significantly higher proportion of aged persons than previously. The World Economic Forum has estimated that by 2050 more than 20% of world population will be aged 60 years and older [1]. In Australia (typical of developed countries) the proportion is even higher: it has been estimated that by 2046, 22% of the population will be aged 65 years and older, and that average life expectancy will be 85 years with 19% of older people (i.e. over 4% of population) being aged 85 years or older [2].

This change in the essential nature of our population will have profound impact, stimulating transformational changes underlying health care mechanisms. Today's older citizens wish to remain living in their own homes and to pursue an active lifestyle as long as possible, with appropriate support where necessary [3]. Those who require assisted living and clinical management through the health care system, expect that services reforms which will ensure optimal quality of life can be enjoyed in those circumstances [4]. We need to develop a variety of approaches to deal with this transformation, some of which will undoubtedly incorporate digital technologies.

Prior work has provided landscape commentary on opportunities for technology-delivered health care support for ageing citizens by appropriate technologies [5] and from clinical perspectives [6]. A common emphasis in these domains is the maintenance of independence and quality of life for subjects of care [7]. The consequential impact of these trends on health technology markets has also been characterized [8].

The research study summarised here was intended to provide a qualitatively validated clarification of major health services delivery needs for individuals of a future

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ageing society which can be potentially addressed by digital solutions. These major needs may be identified by the subjects-of-care themselves, or may be known to the providers of care services who deal directly with individuals: both groups constitute a body of end-users for the needs-derived solutions.

Before developing such solutions as these, it is important to understand their scope and to leverage common elements of them to derive the best outcomes. This could be expediently achieved by using a high level framework for considering approaches to developing digital solutions such as these: the major end-user needs identified here provide a basis for describing such a framework. We do not claim uniqueness for the framework but we believe that if similar exercises were undertaken, there would likely be a degree of commonality due to the diversity of the stakeholder sectors represented.

2. Methods

During February to October 2017 structured interviews were conducted with 56 Australian business entities representing a wide cross section of organisations involved with services for ageing. These included companies and not-for-profits engaged in community and aged care, hospital and acute care, primary care, nursing and allied health, finance, insurance, technology, software, built environment and urban design. Further consultations involved local and state government departments and peak professional bodies operating in the ageing sector, as well as ageing consumers directly.

Interviews were commenced with a short description of the context and purpose of the study. Interactive interviews followed, with a conversational approach adopted to enable free ranging inputs to be collected. Interview durations ranged from 30 mins to 2 hrs, and in most cases were conducted 1-to-1 between one of the authors and an informed senior executive representing the participating organisation. In some cases a second interviewee was present but in all cases the vast majority of responses were obtained from the primary participant.

A pro forma interviewing instrument based on prior work was developed to elicit problem statements and responses. The instrument contained the following discussion prompts:

- alignment of organisation with Ageing population sectors and situations;
- perceived major business problem statement and significance to organisation;
- actions currently being considered or already taken to address the problem;
- success criteria and need for collaboration and resources to progress solution;
- potential adoption and deployment settings within the organisation portfolio;
- strategic perspective on business impact of solving problem (2-5-10 years).

Conversational responses were captured verbatim from participants in written format. These were subsequently independently summarised using a simplifying terminology derived by a commonly used wordcloud formulation method, which extracted essential and repeated content from the conversational records. These condensed responses were subjected to topic clustering using concept-distance measures associated with the terminology, to extract common themes.

3. Results

From the topic clustering process, three distinctive end-user sectors were identified, which constitute domains of mutual interests spanning the overall ecosystem for a future ageing society:

Individual consumers and their personal circle of other persons, who are self-managing their ageing with support from both informal (e.g. family or friends) and professional (e.g. allied health workers) carers and the wider community within which they are situated (e.g. religious or social groups).

Community and aged care provider organisations and numerous associated service delivery agencies who are addressing and managing the needs of ageing clients, through services delivered in the home (e.g. cleaning, excercise), or through services delivered in residential managed care settings for those clients unable to care for themselves (e.g. feeding, medication).

Corporate or Government organisations, including clinical professionals, suppliers of health systems and technology solutions, developers and funders/payers responsible for business and infrastructure design and planning, and policy makers/influencers (e.g. bureaucracies, consultancies).

Two major thematic areas cutting across all three domains were discerned for development of digital technology solutions, from categorisation of the problem statements and significant recurring content descriptions from the interviews:

Ageing in Place, where consumers wish to continue living independently, in their own accommodation setting and maintaining responsibility for their own health status by accessing external sources of support. This will contribute to extending the years of healthy ageing and quality of life, as well as retaining longer engagement of ageing persons generally in economic and societal activities.

Ageing with Care, where it is necessary for consumers to live in conditions of clinical management, within specialised ageing facilities having associated inhouse health care professional support. This will provide platform systems for enhancement of key business processes and capabilities, improving consumer orientation of the current community and aged care business landscape, and aligning with needs to operate in a digitally informed knowledge environment.

For Ageing in Place, the dominant needs for solutions were identified as follows:

- Personal Wellness, with information gathered from about daily health related lifestyle habits of an individual, as well as summary data from digital monitoring sources and records of health check events.
- Community Connections, with a social networking online environment to enable individuals to establish and maintain a personalised set of community based group interactions and event participations.
- Adverse Event Reduction, using a “Health Smart Home” platform system for continuous surveillance of occupants, with multimodal sensing and pattern analysis to prompt alerts if anomalous situations are detected.

For Ageing with Care, the dominant needs for solutions were identified as follows:

- Personal Health Trajectories, representing and modelling of an individual’s ‘health trajectory’ based on health records and contributed data, mapping their advance through the ageing life course.

- Consumer Care Portal, a software system integrating information across service providers aligned with health data derived client profiles, and sharing health history and choices with clients/carers. Chronic Disease Management, via a generic software system including data collection and management, analysis of trends and recommendations on actions related to health condition self-care.

These findings are summarised in Table 1 below. While there could have been further less prominent topic areas extracted, to perhaps constitute a secondary layer of minor elements in the framework, the strength of consensus achieved by those identified here was sufficient to confirm them as dominant.

Table 1. Ageing digital technology solutions framework

Domain	Ageing in Place	Ageing with Care
Individual / Patient	Personal Wellness	Personal Health Trajectory
Community / Carers	Community Connections	Consumer Care Portal
Corporate / Clinicians	Adverse Event Reduction	Chronic Disease Management

4. Discussion

The focus of this work was an approach to enable us to identify and describe the needs and issues of older people and care providers, and which allows us to work collaboratively to design, implement and deliver solutions to those who need to apply them or use them. Through the coordination of research and development activities addressing these needs across diverse disciplines, organisations and sectors, innovative solutions can be developed which will create impact at scale.

This framework approach provides a set of channeled elements through which can be addressed the challenge of selecting and developing appropriate digital technology solutions to achieve the following high value benefits which participants indicated:

- Optimise the health and support the independence of older people, and thereby reduce the cost burden of care, by designing integrated solutions that focus on the person and their individual health circumstances.
- Empower older citizens to self-manage their health while ageing, to the greatest extent possible, with improved wellness and enablement while living independently and in communities, and provide for their eventual care in health facilities by equipping the clinical sector with integrated and comprehensive toolsets for appropriate and timely care.
- Address the business transformation needs of aged care and services providers, using living laboratory co-design models, to ensure solutions are appropriate, usable by customers and the workforce, and able to be integrated into wider systems, and validate their effectiveness at population scale such that they can be deployed widely.
- Develop transformational ‘ageing well’ approaches across the continuum of wellbeing, health and care services, which will improve the quality of life for ageing individuals and more generally enrich communities through the increased engagement of a previously excluded sector in the ageing population.

Feedback from interviewees included some broader aspirational elements as well as the specific needs analysis, which could not be categorized as precisely. These included adopting holistic viewpoints on health, living meaningful and purposeful lives, balancing increasing consumer expectations against diminishing services and choice, difficult to navigate the health system, complexity of integrating technologies.

5. Conclusions

The abovementioned benefits are consequential on the provision of appropriate technology solutions in the particular care setting. In the case of Ageing in Place, the wide range of potential technologies [9] must be tempered by their careful selection and application, to ensure success in their adoption and achievement of utility for purpose [10]. Further consideration will be necessary to address the challenges of data management and systems architecture [11] in this type of setting, as these are still far from being standardised. In the case of Ageing with Care, the overarching issue of integration and interoperability of component sub-systems and data flows [12] must be solved, harmonizing new solutions and current systems to enable care collaboration [13]. The Australian focus of this research may be seen as a limitation, but should nevertheless be comparable with the situations of many other high-income countries. Constructing a framework distilled from many lengthy and detailed interviews was seen as a beneficial way to provide scaffolding to support repetition of the process elsewhere. This approach should be of strong interest to the community and aged care sector to enable high level strategic planning and prompt social and economic flow-on impacts to its supporting sectors, to the health care system broadly, and finally to society at large.

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