The specification of new technology to support assisted living (AL) from a biopsychosocial, stakeholder relationship and ethics perspective

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Abstract—**This paper reports on early stage human factors research undertaken as part of an industry/academia collaboration to advance new assisted living technology for elders aged between 55 and 90 years. It is argued that the provision of person centered assistive living (AL) technology – predicated on (1) biopsychosocial models of well-being, (2) necessary transformations in the social, information and healthcare process relationships between seniors and relevant actors in their personal and professional community and (3), rights based frameworks (ethics), has the potential to improve an older person's life physically, socially and psychologically. The proposed technology will be optimized for different contexts, including private/smart homes, residential/care homes, palliative care and assisted living communities.**

Keywords— assistive living, wellness, biopsychosocial, person centred technology, self management, human factors, ethics

I. INTRODUCTION

Medical and psychological factors, family and social factors are some of the different determinants impacting on a person's health and well-being [4] [5]. Recently, there has been considerable growth in the development of information systems facilitating in-patient access to health related data and other functions (for example, education/engagement and entertainment). In addition, several home based systems supporting medication monitoring/clinical indicators monitoring, telecare, patient engagement/education, appointment booking and health related communications have been advanced. Presently, these systems are being extended to the aged care market. Such systems will enable relevant real-time health management functions for (1) seniors, (2) formal carers, and (3) other relevant actors in the social/community support networks of seniors. In relation to (1), this includes: medication monitoring, clinical markers monitoring, emergency alerts/notifications, fall prediction, nurse triage, pain management, diet and sleep monitoring and motion/wander management.

Primarily these systems focus on the bio and social pillars of well-being. Overall, there is less of a focus on the third pillar – the 'psychological'. In addition, many of the available technologies pose fundamental questions in relation to ethics and user acceptability.

II. RESEARCH OVERVIEW & METHODOLOGY

The objective of this research is to advance new Assisted Living (AL) technology enabling independent living and quality of life for elders aged between 55 and 90 years. Overall, this research is underscored by several key principles:
1. Technology use/function is predicated on biopsychosocial models of well-being.
2. Independence for seniors is linked to interdependence (i.e. support from other actors in personal and professional community).
3. Technology will be developed from the perspective of understanding, modelling and transforming the social, information and healthcare process relationships between seniors and associated stakeholders.
4. The research will pay specific attention to issues of ethics and user acceptability (rights based framework), ease of use, and adaptability in relation to age and condition.

The human factors design approach is premised on the assumption that the solutions for seniors and other actors are necessarily interrelated. As such, human factors research will involve active and ongoing participation of end users/seniors and other key stakeholders. Overall, the methodology involves a blend of person centered design approaches; specifically, 'Stakeholder Evaluation' [3], 'Participatory Design' [1], and 'Scenario Based Design' [2]. As part of this, a 'Community of Practice' [6] will be developed comprising both internal and external stakeholders. Internal stakeholders include human factors researchers, software developers, clinicians, and user experience designers. External stakeholders include seniors and relevant actors from their personal and professional community, and where possible existing company customers (i.e. staff and residents at residential homes). Requirements specification and system development will follow several iterative activities pertaining to (1) personae specification, (2) requirement elicitation, (3) design and prototyping and (4) evaluation. Evaluation will include (1) ongoing participatory

design/evaluation and (2) discrete evaluation using an 'Aged Care' Living Lab.

III. CURRENT STATUS OF RESEARCH AND FINDINGS

The following is a summary of progress so far:

1. Evaluation of existing systems and approaches (biopsychosocial, ethics, information flows)
2. Advancement of biopsychosocial framework in the context of delivering person centred care
3. Definition of states to be achieved/lived experience and expected benefits for seniors and other stakeholders (see Table 1)
4. Advancement of stakeholder map – taking into account social, information and process relationships
5. Specification of ethics framework
6. Specification of specific personas (see Table 2) – taking into account user contexts (home, residential home etc)
7. Specification of provisional user requirements
8. Specification of provisional scenarios and prototypes

Table 1: Seniors (States, Lived Experience & Benefits)

Promote/Support	Manage/Mitigate & Reduce	Avoid
Quality of life	Loss of identity	Deception
Wellness	Loss of physical liberty	Infantilization
Independence	Loss of privacy	Isolation
Social participation	Physical discomfort	Elder abuse
Privacy	Communication difficulties	Objectification of the dementia patient
Communication	Boredom	
Safety	Sense of fear and powerlessness	
Ability	Difficulty with change	Unsafe behavior
Identity	Feeling lost	Reduction in human contact
Empowering person	Overstimulated	
Dignity/respect	Stress	
Purposeful activity	Apathy/loss of interest	Neglect
Active and healthy living	Frustration	Other…
Sense of belonging	Confusion	
Acceptance	Negative thinking	
Resilience/coping	Aggression/anger	
Self-management of health	Sleep disturbances	
Engagement	Suspicion/delusions	
Calmness	Self-neglect	
Awareness		
Citizen participation		

Table 2: Stakeholder Map & Personae's

Stakeholder	Category	Persona
Senior (primary end user)	Active and healthy senior	Richard
	Senior with early stage functional decline	Anne
	Frail elderly/senior	Lucy
	Senior with early cognitive decline and medical condition	Frank
	Memory care patient (level 4: early stage dementia)	Tom
	Memory care patient (level 5: middle stage dementia)	Patricia
	Memory care patient (level 6: middle stage dementia)	Zena
	Memory care patient (level 7: late stage dementia)	Edward
Personal	Spouse 1 (male)	Alan
Community	Spouse 2 (female)	Emily
	Family/daughter	Jane
	Neighbor	Paul
	Other residents (care home)	Jenny
	Buddy school/community	Peter
Professional Community	Formal carer	Angela
	Community Nurse	Sandra
	GP	Kate
	Emergency Room Doctor	Mike

Arguably, future AL systems development might address all three pillars of well-being, and the interrelationship therein. Future AL systems should be characterized by an 'ability' philosophy – supporting social participation, addressing stress, mood and engagement, providing entertainment functions and promoting self-management and purposeful ageing. Such systems should respect a senior's privacy and choice (i.e. option to opt in/out of the use of sensors). For carers and family, systems should support relevant care/monitoring tasks along with enabling empathy and social connection. The emerging design will take into account age-related changes & characteristics. It is intended that design interactions will be natural and engaging. Seniors and other actors might access relevant software using their phones, tablet, television and bedside displays. Hardware will be specific to the context and may include wearables, passive sensors in the environment, and electronic signage. It is not likely that mid to late stage memory care patients, will have significant interaction with Tablet/TV systems. Here the focus will be on delivering smart and emphatic solutions for carers and family. Critically, solutions for these actors will yield benefits for memory care patients.

IV. NEXT STEPS & CONCLUSIONS

Following ethics approval, field research will be undertaken with end users and other stakeholders to understand the specific end user need in more detail. Participatory evaluation of the provisional prototypes will enable problem solving around user need and issues pertaining to acceptability/ethics. Importantly, the research effort will focus on gathering requirements in relation to specific states/benefits/lived experience (see Table 1), and personae's (see Table 2), and validating these.

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