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Designing housing decision-support tools for resilient older people

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ABSTRACT

Our ageing populations make it critical that older people continue to live and participate in their communities. 'Ageing in place', rather than in residential care, is desired by older people themselves and promoted as policy in many countries. Its success, both as policy and practice, depends on housing. House performance, resilience, functionality and adaptability are all essential to maintaining independence. Three New Zealand research programmes have worked with older people to investigate issues around housing, 'ageing in place' and how older people and communities can become resilient to adverse natural events. Using participatory research techniques, those programmes have generated evidence-based decision-support tools to help older people maintain independence. These tools have been co-designed and widely tested with older people and others. Designed to help older people identify priorities and information requirements, assess diverse factors determining thermal performance and dwelling resilience as well as repairs and maintenance needs, the tools help improve decisions around: repairs and maintenance assessment and solutions; dwelling and location choices and housing options. Various organizations have adopted the tools. This work demonstrates how research outputs can be used to facilitate older people's housing choices while also giving architects and designers guides for meeting older people's housing needs.

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Ageing-in-place; housing; resilience; decision-making; participatory design; older people

Introduction

Architects have no easy task, centred as they are at the nexus between those who own, procure, build, provide materials and technologies for, service, and occupy buildings and the regulations and decision makers that control our design and building practices. Notably, the demands of these different actors in the system frequently deflect the attention of architects away from the issue of 'Place'. In New Zealand's residential building industry, regulatory requirements show little variation across a long, narrow country with diverse climatic conditions and topography. There is some recognition of differential wind-loadings on a geographic basis and similarly some climate related requirements around thermal performance, double glazing and insulation. New Zealand's homes, however, have a uniformity of construction irrespective of place, reflecting the dominance of group home builders. They commission standard designs from architects and designers that typically vary to accommodate prevailing fashions rather than the specific conditions associated with place. Few designs exceed basic performance requirements in New Zealand's Building Code. Consequently, building design is largely decoupled from Place, although any building itself operates in a specific location. Moreover, while home owners seek comfort, protection and resilience in their dwellings, the building industry and the design fraternity that supports it are distanced from the people using those dwellings. Users' ability to leverage what they want and need from designers and the building industry is limited in New Zealand (James et al. 2018). Yet the location and design of homes are both critical to people's ability to retain and afford their independence and allow them to be socially, culturally and economically active members of their communities.

The importance of the dwelling as a platform for well-being, independence and social connectedness increases as people age. Now architects and designers are operating in a world of ageing societies in which they need to re-focus attention onto the needs of older people. If the structural conditions in which architects and designers practise mean that they are distanced from the needs of building users, other feedback loops must be created, either by way of building regulations, or supporting older people to differentiate between and choose dwellings that are likely to be safe to occupy, affordable, functional and easily maintained over the long-term. In a country like New Zealand which is subject to adverse natural events including severe earthquakes, flooding, coastal inundation and storms, house resilience is fundamental to older people's resilience. Resilient dwellings are positioned to mitigate the impacts of adverse natural events. They are designed to protect their occupants and allow them to operate independently when electricity and water supply is compromised. Resilient dwellings can be recovered and restored quickly and affordably.

This paper reviews four research-based tools developed in collaboration with older people and their communities and directed to enabling older people to make better decisions around their housing. For architects and designers these tools provide an insight into the diversity of older people's needs, the choices available to them, and opportunities to expand those choices. In the case of the tools around resilient homes and site selection, these tools provide a feedback loop and indicate some

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of the design and performance characteristics of homes that can support people throughout their life stages and into old age.

Older people, vulnerability and ageing well

New Zealand, along with many other countries, is experiencing rapid structural population ageing (Khawaja and Boddington 2010). Fourteen percent of the population is aged sixty-five and over, rising up to a projected twenty-four percent by 2036 (Statistics New Zealand 2013). Homes that are warm and in good repair can weather adverse events and enable residents to function safely, a crucial factor in ageing well and enabling older people to live independently. Older people tend to be more at risk, or vulnerable to harm from adverse natural events, such as storms, floods, bushfires, land erosion, coastal surges and earthquakes (Greenberg 2014). In normal times, too, the home can pose a threat to safety and wellbeing. Poor home repairs and maintenance can exacerbate older people's vulnerabilities to harm in good times and bad (James and Saville-Smith 2010). Equally, poor choices by older people around the siting and design of the dwelling they live in can expose them to both risk and expense. Housing that fails to meet older people's needs can increase their personal vulnerability and consequently can reduce older people's independence. However, little attention has been paid to building age-friendly, resilient housing in New Zealand or enabling older people to make good housing choices.

New Zealand's Positive Ageing Strategy promotes the goal of older people living independently in their homes, rather than in residential care (Office for Senior Citizens 2015), as is consistent with New Zealanders' preference for ageing in their familiar home environment. But New Zealand's dwellings have been associated with excess winter mortality rates for people aged sixty-five and over, due to deficiencies around heating, thermal performance and indoor air pollution (Davie et al. 2007). In New Zealand, as elsewhere, dwellings in poor repair, or lacking accessibility features are implicated in injury and premature entry into aged residential care (Bridge et al. 2006; Keall et al. 2017). In addition, older people are more likely to die, be injured, or suffer worsening chronic conditions during or after disasters (Gibson and Hayunga 2006; Carswell 2011; Greenberg 2014). Moreover, in New Zealand, older people are overrepresented in the populations living in the coastal margins of the country that are susceptible to coastal flooding, king tides and tsunamis (Bell and Wadwha 2014). Under tho se conditions, the performance, materials, design, and location of older people's dwellings becomes critical to older people's ability within their often limited financial resources to 'bounce back' and maintain their independence and connections with Place. Those considerations together drove three research programmes directed at improving older people's housing decisions and living environments.

The research programmes

The research programmes dealt with in this paper are:

1. Ageing in Place: Repairs and Maintenance
2. Community Resilience and Good Ageing
3. Finding the Best Fit

The *Ageing in Place: Repairs and Maintenance* research addressed the role of poor house performance and the burden of repairs and maintenance (Saville-Smith, James, and Fraser 2008). It involved:

- A national survey in 2008 of sixteen hundred homeowners aged sixty-five years and older, on their repairs and maintenance practices.
- Comparison of data from the 2008 survey with national repairs and maintenance surveys and house condition surveys conducted in 2004 and 1999.
- In-depth interviews with eighty-four people aged sixty-five years and over about their living environments, repairs and maintenance practices and community supports and connections.

The *Community Resilience and Good Ageing* research investigated how older people can be supported to help themselves and their communities to manage and recover from adverse natural events (Saville-Smith and Fraser 2013; Bell and Wadwha 2014; James and Saville-Smith 2014). It involved:

- A national survey of six hundred and thirty-one people aged sixty-five years and older who had experienced an adverse natural event.
- A national survey of three hundred adults aged under sixty-five years who had experienced an adverse natural event. Of those, over a third also had a significant relationship with an older person who had experienced an adverse natural event within the previous five years.
- Hazard risk mapping to establish the vulnerability of the population aged sixty-five years and over to river flood and coastal inundation.
- In-depth interviews with twenty-eight older people affected by floods, and focus groups with over one hundred older people living in natural hazard-affected communities.

The *Finding the Best Fit* research focused on the realities, costs, risks and benefits of housing downsizing for older householders (James 2016; Saville-Smith, James, and Rehm 2016). It involved:

- A national survey of five hundred and seventy-one people aged sixty-five years and older about their residential movement, housing decisions and housing intentions.
- A survey of six hundred and seventeen people who had moved to a retirement village.
- Interviews and focus groups with over two hundred older people and over seventy providers of services for older people.
- Regional housing market analyses.

Participatory research methods

These programmes used participatory research and design methodologies to develop tools for older people living independently to assist them in making decisions about their living environment. Using participatory approaches, the research actively engaged the users, their experiences and knowledge, to understand everyday activities, co-interpret the research results

and use that interpretation to shape the design of products, services or systems (Spinuzzi 2005). Consistent with international research trends, this research recognized that research about older people should not only include them meaningfully in the research process (Doyle and Timonen 2010), but also that they should be included in domestic design processes in general. Examples where older people have engaged with researchers, designers and technicians, are evident in the design of software (Dewsbury et al. 2006), bathroom products (Bridge, Demirbilek, and Mintzes 2016), universal kitchen design (Afacan and Demirkan 2010), housing accessibility screening tools (Haak et al. 2015), and design guidelines for affordable and accessible housing (Shin 2018).

These programmes involved older people in the research, in reviewing findings and in design and testing of tools based on the evidence and outputs of the studies. Older people were involved in the research process as experts on their own living environments, with their knowledge, experiences, needs and aspirations reviewed, valued and used. Firstly older people and representatives of community organizations and providers of services for older people engaged in identifying issues of significance to them and assisted in defining the research questions. Secondly, feedback sessions with research participants were used to discuss the research results. This was an opportunity to test the results of the first stage against the diverse experiences of participants. Their insights into the Stage One findings enabled additional issues and gaps to be identified or refined.

Thirdly, older people were engaged in the design and testing of enabling tools. This stage also included service and advocacy organizations, such as Age Concern, Grey Power, University of the Third Age and Citizens Advice Bureaux. Typically, those organizations involve older people not only as users of their services, but also as paid workers and volunteers. A range of participants were involved at this and subsequent stages to ensure different experiences were drawn on to develop and test the tool's usefulness and applicability in various situations. The age of participants ranged from those in their fifties through to those into their nineties and included people with disabilities, different household types (living alone, as a couple, or with other family) and living in cities, towns and rural locations.

All tools were designed, developed and tested over a three-stage charrette process involving:

- Brainstorming sessions with older people. The researchers had not formed a fixed view about tools that might be developed. Instead participants were instrumental in generating ideas. Their pre-occupations, concerns and priorities were of primary importance in guiding the development of a tool relevant to the user.
- Prototype development. Older people were less involved in this stage, due to technical and design requirements. The researchers worked with designers and relevant technological experts to develop the tool prototypes, while still ensuring they were based on the research findings and participant feedback.
- Tool testing and refining. Participants iterated different drafts of the tools. In charrettes participants were presented with an early prototype of the tool and all aspects of it were intensively workshopped over two-three hours. Then participants tested successive versions of the tools in their homes or applied them to real-life situations and provided feedback. These activities were essential in improving the relevance and user-friendliness of the tools.

Older people's housing and resilience: key findings on needs

Some key findings from the *Ageing in Place: Repairs and Maintenance* research programme, which fed into tool development, were that owner-occupiers aged sixty-five years and over were even more likely than younger age groups to under-invest in repairs and maintenance (Saville-Smith, James, and Fraser 2008). Even if they could pay, older people often delayed repairs and maintenance. Certain components of older people's houses were in worse condition than the dwellings of younger householders, including: inferior ceiling insulation and poorer condition of windows, roof claddings and steps/ramps. Notably, these components are implicated in cold, damp and unsafe dwellings. Sometimes older people's physical limitations prevented the identification of needed repairs. They often over-estimated the costs of repairs and were frequently overwhelmed by managing the process of procuring repairs and maintenance. They also under-estimated the impacts of failing to undertake repairs and maintenance.

The *Community Resilience and Good Ageing* research found that an adverse natural event can be a 'tipping point' for an older person to remain living independently. Damage to house or property, or having to move residence, are likely to increase older people's needs for support, decrease their sense of well-being, and potentially make them worse off financially (Saville-Smith and Fraser 2013). Research participants, while reporting stress and disruption, also reported that they learned new skills and gained confidence in managing challenging situations. They were critical of a lack of information about emergency preparation tailored to older people's needs and inadequate information to enable older people to make informed choices about residential sites, resilient building design and materials (James and Saville-Smith 2014).

The *Finding the Best Fit* research programme found that for most who downsize, the amount of equity release is modest, if any. This is because the supply of small, affordable dwellings is constrained, and most people move within the same housing market. Furthermore, often realized equity is used to deal with debt or everyday living costs (Saville-Smith, James, and Rehm 2016). Clear housing preferences were expressed for a home that maintains independence, is warm and easy to maintain, easy to move around in, affordable to buy or rent, has cheap running costs, is compact but has sufficient space for activities and visitors, is close to services and has an outlook (James 2016; Saville-Smith and James 2016).

What older people want in their housing

The programmes identified consistent themes and issues concerning what older people want in their housing. In particular, participants wanted their home to support and maintain their

Table 1. What older people want in their housing.

	Findings	Participants' Comments
Dwelling amenity and performance	Low-maintenance Warm in winter, cool in summer Dry Safety of appliances Keep safe, heat and cook in emergency Affordable running costs	*'I know a lot who have had to move because they haven't been able to afford maintaining their homes and the rates and power.'* *'The lowered bench is very helpful. I also have all cupboards easy to reach . . . and a rail near the toilet . . . lever taps, I have arthritis, so this makes it easier.'* *'It's really important to be able to get about . . . I hope I can stay independent . . . where I am now, it's so convenient.'* *'Don't wait until a disaster, make the effort to say hello to your neighbours.'*
Dwelling design	Solar orientation Outlook Privacy Storage Resilience Accessibility	
Dwelling size	Smaller dwelling/section Space for visitors, hobbies or carer	
Location	Close to family, friends Close to retail, services, recreation Flat terrain Safe neighbourhood Green spaces Views	
Help and support	Transport Shopping Home-based care Housework Gardening Medication reminder Companionship Nutrition, meals Personal security Disaster preparation	

Table 2. Information needs identified by older people.

	Findings	Participants' comments
Products	Home heating Insulation Resilient materials	*'People need information about efficient heating.'* *'There's information out there, but the wording is too technical for people to understand all the terminology.'* *'Getting information about who to contact for help with repairs is a big thing. This is especially important for people who are new to the area or who don't have family'* *'I'm not aware of any resource we could tap into to help us through this situation.'* *'People don't think of asking what they're entitled to.'*
Dwelling design	Universal design Resilient design	
Dwelling and location characteristics	Property prices Tenure Natural hazards Planning regulations Building regulations	
House Services	Repairs and maintenance assessment Commissioning repairs and maintenance Property management Legal services Financial advice Home modifications	
Other services	Home-based care Transport Funding, benefits and subsidies Insurance Emergency preparation and response	

independence as they age. Housing affordability for both homeowners and renters was a key issue, as were home running costs. Table 1 summarizes findings.

Accessing information and advice

A common theme across the programmes was the strong desire among older people to be actively involved and to maintain control over decisions around their housing and home-related needs (James, Saville-Smith, and Jaques 2012; James and Saville-Smith 2014; James, Rehm, and Saville-Smith 2016). Participants identified a number of challenges. First, home-related decisions are complex. It is not only about whether to stay or to move. It is also about the performance and standards of household products, dwelling materials, natural hazard risks, location and support services. The long- and short- term financial implications of investment decisions need to be understood, as well as the long-term implications of decisions that could limit future options.

All the research programmes found that older people did not have sufficient information to understand the range of options available to them, on which to base informed choices. Information sources tend to be fragmented, sometimes confusing, conflicting and hard to access. There is poor coordination across different agencies and sectors regarding such choices. It is often difficult to access impartial information about housing products, services and materials, and information is seldom available in age- and disability-friendly formats. Older people appear to rely strongly on word-of-mouth and friends and family for advice, rather than using professionals. The reasons for this are complex. There is a deep distrust of professionals and confusion around the boundary between the independent 'expert' and an individual pursuing a sale. In some cases it may reflect a lack of awareness of the potential severity of the impacts of wrong choices over the longer term. While some older people are comfortable with using computers and the internet, not all older people have access to, or can use, digital technologies. This becomes a barrier to accessing information about products or services, as well as information needed in emergencies. The information needs identified across the programmes are set out in Table 2.

Enabling tools

The tools that emerged from the research and the collaborative participatory method established within the three research programmes varied. Tables 3, 4 and 5 set out the tools generated by each programme, including a summary of each tool, coverage, target audience and format.

Ageing in place: repairs and maintenance tools

The *Ageing in Place: Repairs and Maintenance* tools were based on an idea from the research participants for an assessment and planning tool to support older people to be more confident and prepared to assess and manage their home repairs and maintenance needs. Older people said that they did not only want a checklist to identify problems; they wanted solutions included, so that they can maintain their homes as safe and comfortable environments in the short, medium and longer term. Prototype development was led by a building scientist, supported by research team members. Three different prototypes were developed for different users including a:

Table 3. Ageing in place: Repairs and maintenance tools.

Tools	*Householder Repairs and Maintenance Assessment and Planning*	*Service Providers Repairs and Maintenance Assessment and Planning*	*Housing Providers Repairs and Maintenance*
Summary	Booklet of checklists and solutions to identify and help manage repairs and maintenance needs, safety issues, the best person to do the work (e.g. if a registered tradesperson is needed) and the priority of the job.		A robust set of home diagnostics, which identify solutions, prioritize work needing to be done, and indicative costing information.
Content	Key components inside and outside the dwelling such as outdoor and indoor lighting, pathways, ramps and steps, decks/balconies, roofs, walls, windows, piles, doors and handles, floors and coverings, ceilings, plugs, hot water and heating systems. Components are assessed room-by-room by type, such as kitchen, bathroom and bedroom.		Covers the same dwelling components as the householder and service provider tool, with more detail.
Target audience	Older householder and their family	Service provider supporting older people to age-in-place	Housing providers, property managers, repairs and maintenance services
Format	Hard copy printed from website	Hard copy printed from website	Hard copy and electronic spreadsheet
Access	GoodHomes website, tools available free-of-charge http://repairsandmaintenance.goodhomes.co.nz/tools/		

Table 4. Community resilience and good ageing tools.

Tools	*Resilient Homes*	*Selecting a Site for Your Home*
Summary	Booklet providing guidance to the older householder on identifying dwelling design, materials and systems features that pose a risk in storms or floods.	Booklet enabling a quick assessment of a residential site.
Content	Covers what to look for in relation to design and materials for roofs, skylights, verandas and decks, windows, walls and wall cladding, exterior doors, wiring and electrical systems. The guide also covers resilient lighting, heating, cooking and water features. Uses photos and low-risk to high-risk descriptions to aid assessment.	Covers wind, flooding, landslides and changing land use. Includes information about where to find out about site vulnerability to natural hazards, and site-related questions to ask the local council, vendor, developer and insurer. Provides diagrams and descriptions of site vulnerability indicators.
Target audience	Older householder and their family.	Older householder and their family.
Format	Hard copy printed from website.	Hard copy printed from website.
Access	GoodHomes website, available free-of-charge http://resilience.goodhomes.co.nz/wp-content/uploads/2017/06/Homes-and-Heavy-Weather-Resilience-Tool.pdf	GoodHomes website, available free-of-charge http://resilience.goodhomes.co.nz/wp-content/uploads/2017/06/Sites-for-Resilient-Homes-Selection-Tool.pdf

Table 5. Finding the best fit tool.

Tool	*My Home, My Choices – Ngā Kete o te Whare*
Summary	A hard-copy and web-based interactive toolkit to help older people assess their current housing situation and living environment, and possible future housing options.
Content	Describes over sixty options for making changes to the living environment, including advantages and disadvantages of each option. Examples of information covered: buying and selling a house, renting, having a boarder, using the home for income, home-based services, home modifications, improving dwelling performance, repairs and maintenance, home safety, benefits and subsidies, housing options.
Target audience	Older people and their families; service providers.
Format	Hard copy and web-based interactive tool
Access	Hard copy available for purchase: https://downsizing.goodhomes.co.nz/tools/ Web tool free-of-charge: http://mychoices.goodhomes.co.nz/home.html

a) Householder Repairs and Maintenance Assessment and Planning Tool, a self-help tool for older householders
b) Service Providers Repairs and Maintenance Assessment and Planning Tool to help providers of social and support services assess the safety and state of repair of their older clients' homes
c) Housing Providers Repairs and Maintenance Tool, a technical tool for providers of housing for older people.

An early version of the householder tool was trialled by older people in their homes. An early version of the tool for providers of housing for older people was workshopped by staff of a community housing provider experienced in housing assessment. Feedback from those trials was used to improve the tool designs for trialling at three charrettes, where participants worked through the tools in detail. Charrettes involved older people, health and social service providers, older people's advocacy groups, repairs and maintenance providers, housing providers, councils, Māori organizations, church groups, and service clubs. After revising the tools in response to charrette feedback, over one hundred and fifty older people trialled the revised householder tool by themselves at home or were helped by a service provider to use the tool. Eight housing providers tested the housing provider tool on their properties. Written feedback from those testers was used to further refine the tool.

The *Householder Tool* is written in plain language with step-by-step instructions. Diagrams and pictures illustrate technical terms where required. The tool encourages older householders to feel confident about assessing their home by explaining that the room-by-room assessment can be done as time permits and with the help of others if needed.

The *Service Provider Tool* was designed specifically to help organizations that support older people, to assess whether their clients' homes need repairs and maintenance, and if there are other safety issues to address that could cause falls or other injuries in the home. The technical *Housing Providers Tool* provides a robust set of home diagnostics. This tool comes in a hardcopy and an accompanying electronic spreadsheet, which prioritizes the work needing to be done by providing solutions to remedy each issue, and each is accompanied by indicative costing information.

Community resilience and good ageing tools

In the *Community Resilience and Good Ageing* research many research participants who had experienced floods or landslips believed they had exercised due diligence when they bought their property yet were subsequently exposed to risks of which they were unaware (Saville-Smith 2014). Two tools were developed: *Resilient Homes* and *Selecting A Site for Your Home*. These tools were developed through workshops with experts in natural hazards, engineering and building technology, taking into account the information gaps that the participatory research process had identified. There was considerable debate among those experts about how to compile guides for the lay person, and the several prototypes produced reflected those tensions.

The challenge in developing the resilience tools was to ensure that the guides were easily understood and relevant to the needs of older householders. Three workshops with sixteen older people were used to test the prototypes developed by the technical experts. The responses of workshop participants resulted in considerable rewriting of both tools, to make them simpler to understand, with more pictures, and an easier checklist to record potential hazards. The *Resilient Homes Tool* provides guidance on identifying dwelling design, materials and systems features that pose a risk in storms or floods. The *Selecting a Site for Your Home Tool* enables a quick assessment of a residential site and provides information about where to find out about site vulnerability to natural hazards.

Finding the best fit tool

The *Finding the Best Fit* research participants wanted a tool that would help them find and organize information to support a structured decision-making process about their housing situation, living environment and possible future housing options. As background to the design process, the research team conducted a review of five overseas tools: the Silverlinks programme, Care and Repair England; HOOP (housing options for elderly people), England; Which? United Kingdom; European InnovAge Project; and Senior Housing Net USA. A workshop with an expert advisor was also held, in which the overseas tools as well as research results and research participants' feedback were used to design the tool.

My Home, My Choices - Ngā Kete o te Whare - emerged as a tool to help older people identify what is important about their home environment, and decide whether to stay in their current home, to make changes to their home, or move. The tool describes over sixty options for making changes to the living environment, including advantages and disadvantages of each option. Individuals can work through the tool at their own pace and compare different options. The 'answer' is not provided, instead suggestions are made about where individuals can find information on the issues and options they wish to investigate.

My Home, My Choices was first developed as a hard-copy and subsequently developed into an interactive website, in response to participants' feedback that some older people prefer to work with written information in hard-copy, while others are comfortable with using the internet. Service providers involved in testing the tool expressed a preference for both versions, seeing the potential of using the hard-copy with their client while they could use the web version simultaneously to locate additional information for their client.

The hard-copy prototype was tested with over one hundred people in eight charrettes. Older people, health and social service providers, home care providers, advocacy organizations, housing providers, Māori organizations and policy agencies were among those involved in testing. Over eighty suggestions were received from the tests. Over two-thirds of those suggestions were used to refine the tool. The web version of the tool enables the user to choose the topics they wish to explore, access other web-based material, save and print information. This was tested by three women and three men in their late sixties and seventies who used the interactive version in their own homes. Based on their feedback about ease of use, further adjustments were made to both the hard-copy and web-based tool.

Impacts, learnings and implications

Can we develop and implement processes that result in well-designed housing for older people in the Places they actually live in? Over the last decade the three research programmes discussed here have worked with older people, community service providers and housing providers to investigate issues around housing, ageing in place and resilient communities. Although concerned with New Zealand dwellings, the research findings and tools provide key lessons for the design and the research communities in the context of ageing societies and changing environmental conditions. One of the most fundamental lessons resides in the importance of ageing in place in ageing societies, at least ageing within existing communities and places and often within the dwelling in which an older person lives. Ageing in place is not simply a preference among older people; it reduces the costs of institutionalization and dependency, and retains the social, cultural and economic value of older people in their communities. Meeting the challenge of integrating the needs of older people into the design response to place involves three important elements. First, researchers and designers need to be committed to understanding and valuing the lived experiences and perceptions of older people within their built environments. Second, research supporting built environments that better meet older people's needs must be multi-disciplinary bringing together social scientists, natural hazard scientists and building technologists. Finally, research integrating place and older people must be solutions focused and oriented to enabling older people.

The tools generated by these research programmes continue to have an impact on older people and the service providers that assist people in the later stages of their lives. The *Ageing in Place: Repairs and Maintenance* tools, available since 2012, have been picked up by over fifty organizations. Implementation pathways through local organizations and media as well as national bodies, resulted in six national stakeholders placing the tools on their websites or referring to them in publications, dissemination of the householder tool to older residents by three councils, use of the tool by three neighbourhood repairs and maintenance programmes, endorsement of the tool as a way of reducing falls at home, and one district health board (DHB) integrating the tool into its public health programme. The DHB evaluation of the tool found a high level of interest among older householders as well as volunteers supporting them to use the tool. That evaluation found that the tools allowed householders to identify maintenance and repairs needs and tradespeople reported improved clarity of communication with clients. Jobs completed with the help of the tool included painting of steps, cleaning out gutters and water pipes, making a fire/emergency plan, checking and installation of smoke detectors, repairing doors, installing hand rails and pruning overgrown trees. Service providers noted their clients' confidence in managing their home had improved through using the tool.

Interest in the two resilience tools, launched in September 2014, has been mainly from organizations concerned with improving dwelling quality, such as the Building Research Association of New Zealand and community housing providers. The My Home, My Choices tool was launched in August 2016. To date, over one hundred and seventy tools have been taken-up by local councils, Age Concern offices, Māori health providers, Iwi organizations, Community Advice Bureaux, budget advice services, legal services, financial advisors and an organization supporting older people to age-in-place. Researchers have provided training sessions in using the tool.

Together the three research programmes show how using a participatory design approach can contribute to improving older people's housing and living environments. The older people involved in those programmes identified critical aspects of housing related to their safety, comfort and wellbeing. They reinforced the way in which their homes linked them to their communities. Research and the process of decision-tool development facilitate older people's participation in building their own and their community's resilience. Solutions-focused research addresses the persistent information asymmetry found within the design and delivery of the built environment and enable older people as consumer sovereigns. While these tools are for older people, they also, and the research that underpins them, offer architects and designers an insight into the practical needs of older people that goes beyond the narrow standards and specifications often associated with approaches found in disability and accessible housing design guides. These research programmes embrace older people as decision-makers and experts in their own needs, which must be transformed into design solutions. In a building industry, in which dwellings are typically designed without reference to specific householders and the place in which they live, these tools give architects and designers an insight into the needs of older people and the opportunities to support their independence and well-being in Place.

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