

DEVELOPMENT OF A NATIONAL SURVEY ON AGING AND THE DOMESTIC BATHROOM: THE LIVABLE BATHROOMS SURVEY

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Abstract

A national survey on older Australians and their domestic bathrooms has been designed and implemented to collect a large-scale dataset on older Australians relating to their needs and abilities within bathroom environments. This survey is the first of its kind, in terms of its focus and its scale. It was mailed out to a stratified random sample of 16,524 people over the age of 60, using the Australian Electoral Roll. This survey has developed a core set of items to measure the suitability of older people's bathrooms in order to provide useful information and insight to design better bathrooms for ageing in place. Older people participated in the survey development to provide insight and advice using their personal experience and expertise. This paper describes the strategies and processes used to develop the content of the survey, in order to overcome existing data limitations. Survey development was carried out in three phases: development, testing and finalising. The data gathered has since been used to develop new bathroom products and underpins better policy and design standards to support population ageing and the domestic bathroom of the future that better enables 'ageing in place'.

Keywords: Collaborative design, Inclusive design, User centred design, Ageing in place, Bathroom design

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1 INTRODUCTION

The development of the Livable Bathrooms survey to gauge the suitability of older people's home bathrooms is important as the built environment is significant in reducing barriers and supporting older people's abilities to continue to live at home independently. Livability is a term which has been used to encompass a wide set of attributes necessary to describe living spaces fit for humans. The concept of Livable Bathrooms draws on this in the context of spaces designed for bathroom specific activities of daily living necessary to remain at home.

The importance of the physical environment for ageing is well documented. Indeed, the International Classification of Functioning, Disability and Health (ICF) classify health, functioning and disability in context, which includes the physical environment (World Health Organization, 2004). As the majority of older people wish to remain living at home, supportive environments are essential to maintaining quality of life and independence (Hellström and Hallberg, 2001; de Jonge et al., 2011; Gitlin, 2003; Hwang et al., 2011). Inaccessible, difficult and hazardous environments, like bathrooms (Gitlin et al., 2001, Carter et al., 1997), can compromise older people's ability to carry out activities of daily living. Designing bathroom environments that suit the needs and abilities of older people can help reduce barriers to functioning and allow more people to age-in-place for longer periods.

Despite the importance of the environment for ageing, few studies focus on the bathroom environment as a whole, mainly concentrating on specific tasks, namely bathing (Naik, Concato, and Gill, 2004; Zingmark and Bernspång, 2011) and toileting (Molenbroek, Mantas, and De Bruin, 2011). There are limited data available regarding older people's physical dimensions and abilities in the context of their domestic bathrooms. Collecting large scale national data describing the diversity of older people, their capabilities and needs is essential for designing better products and environments (Clarkson, 2012).

Currently, research and data on prospective users and their capabilities, behaviour and needs, usually comes from the fields of health, disability (Coleman et al., 2012) and ergonomics (Marshall et al., in press; Nickpour and Dong, 2011). However, the data are insufficient for this research, as they do not take into consideration the diversity of users, their capabilities and the domestic environments they use. In order to address existing data limitations, a questionnaire was developed to establish some basic standards required for improving design practice. This article documents the initial development and validation the Livable Bathrooms Survey for distribution to a national Australian sample of people over 60 years. The survey is a major component of the Livable Bathrooms for Older People research project which has been established to determine the design fundamentals needed for the development of more flexible, innovative and safer bathroom fixtures and domestic bathroom environments for older Australians.

This paper outlines the development of the Livable Bathrooms survey. Based on survey objectives founded on deriving a more statistically rigorous understanding of variation amongst a representative cohort of so called *healthy older people* is central to design that enables function and redesign that enables or provides better prosthetic support (Velde & Fidler, 2002). This is because sensory modalities and physical abilities are subject to variation with age and define both normal ability and any qualifiers of human impairment (Koncelik, 2003). To capture this variation in health, ability and bathroom design, our survey items and the survey design were carried out using a three-phase strategy of development, testing and implementing.

2 THEORETICAL FRAMEWORK

Understanding the environment in gerontology has traditionally drawn on ecological theories (Wahl, Iwarsson, and Oswald, 2012; Gitlin, 2009; Satariano, 2006) and this is especially so where the person ages in an active and dynamic environment that is interconnected with the individual (Lawton and Nahemow, 1973). In Australia, nearly half of all people with disabilities report aid and equipment usage (48%); usage is greatest for older persons with 65% of persons with disability over the age of 65 reporting usage (Australian Institute of Health and Welfare, 2003). A framework for associating personal attributes and environmental attributes is illustrated in Figure 1. This illustration places activity at its centre and uses activity to capture the transactional dynamism between people and their environments (Bridge, 2010).

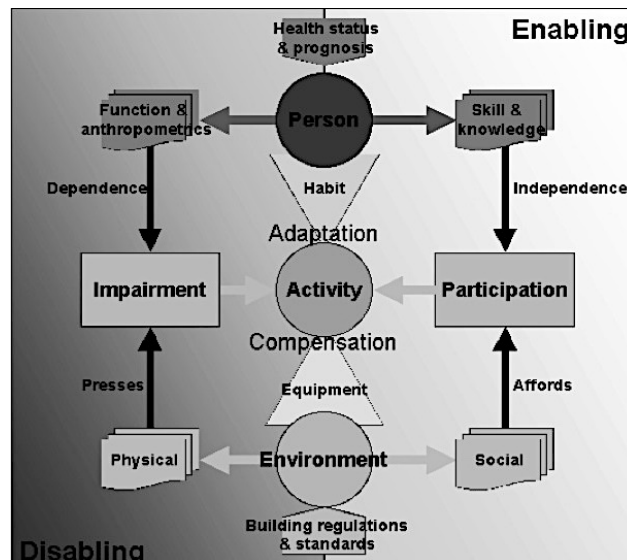


Figure 1. Activity centric dynamic between the person and the environment (Bridge, 2008)

The Person-Activity-Environment model that underpins our survey, views individuals as having body function and anthropometrics in conjunction with socially acquired skill and knowledge. An individual's ability to perform activities is shaped, on the one hand, by their health status and activity forms or preferred performance habit/routines while on the other hand, by the environmental setting shapes activities by application of building conventions that define activity spaces and the equipment availability, type and quality required for optimal activity performance. For instance, it is activities like toileting, bathing, showering and tooth brushing etc., which underpin functional performance and in conjunction with the presence of impairment determine the level of independent participation. Individuals carrying out activities have a human body with particular functional potentials and human measurements (i.e. anthropometrics) in conjunction with socially acquired activity relevant skill and knowledge. An individual's ability to perform is shaped, on the one hand, by their health status and their performance of preferred habit/routines. While on the other hand, a bathroom setting shapes the activities afforded by defining the activity spaces and the products available. From this theoretical perspective, it is the interaction between individuals and their environmental setting that enables the development, practice and fulfilment of personally valued activities (Schkade & McClung, 2001). Moreover, the interactions between the person and the environment include the activity being undertaken, which has an impact on the resulting performance (Bridge, 2006, Law et al., 1996). For this research the person-activity-space theory developed by Bridge (Bridge, 2010) (Figure 1) was used because it incorporates the activity carried out as well as the role of equipment and technologies and behaviours as mediating activity performance. The relationship between the person, their environment, the activities undertaken and their resulting *fit* sets the scene for this research.

2.1 Objectives

Three main objectives for this questionnaire were developed based on the human-activity-space theory to gain knowledge about the person, their bathroom environment, and the activities undertaken within it (Table 1). These encompass objective and subjective dimensions important to facilitating a best possible *fit*.

Table 1. Survey Objectives

1: Person:	Gain knowledge of older Australian's health, functional abilities, views, preferences and concerns in order to design bathroom environments that meet subjective as well as physical needs.
2: Activity:	Gain knowledge about what types activities older people undertake in their bathrooms and at what frequency in order to better understand behaviours, modification and compensation.
3: Environment:	Gain knowledge about current bathroom environments of older Australians living at home in order to understand which features, configurations and characteristics function well and which don't.

3 METHODS

Throughout the survey development, literature on questionnaire design, particularly on specific elements, such as response rates (e. g. Dillman, Sinclair, and Clark, 1993; Edwards et al., 2002) and delivery methods (such as Dillman, 2006; Krause, 2002; Dillman, 1991) was consulted. Design considerations were based on the Australian Bureau of Statistics (ABS) to guide the questionnaire design and development (Australian Bureau of Statistics, 2010) due to the Australian content, sample size and national health content of the survey. The delivery method was chosen due to the health related content, which allows more privacy in filling in a written questionnaire than in face-to-face or phone interviews, large sample size in dispersed locations (Edwards et al., 2002) and the older age of the respondents.

A range of strategies were used to test comprehension and to ensure coverage of the full range of domains of relevance to bathroom design in relation to older people's abilities and patterns of use. These strategies were: a) using the input of potential respondents, to provide valuable insight and improve the validity of questionnaires (Smith et al., 2011), and b) using multiple methods of testing to overcome individual method limitations (Krause, 2002).

Survey development was carried out in three phases such as follows:

- Development - the content and structure were developed in consultation with a participatory older people co-design group.
- Testing - cognitive interviews and pilot testing were used to test comprehension, reliability and validity of the questionnaire.
- Finalising - further revisions and refinements were made to the survey design, content, questions, layout and structure.

3.1 Phase 1: Development

This phase involved the development and refinement of the draft questionnaire. Based on the objectives, survey items were devised by the research team (n=8), based on extensive literature review which included representatives from the design industry, architecture, ergonomics, architectural computing and industrial design. Additionally, the input of potential respondents has been shown to provide valuable insight into personal perceptions and experiences, assist in the creation of items to empirically measure them and improve the validity of questionnaires (Smith et al., 2011). Consequently, a participatory co-design group, consisting of six healthy older people, was used for the survey development phase to actively work in collaboration with the research team. Co-design workshops were held to explore important aspects of home bathrooms and provide advice and feedback on the survey development using personal experience and expertise. Additionally, four of the above mentioned co-designers provided feedback on an initial draft of the questionnaire. This collaboration led to revisions to survey items, which were then reviewed for structure, question bias, relevance and adherence to survey objectives.

3.1.1 Item generation

Issues and particular themes that were perceived as important to the co-design group and of importance to the survey objectives were incorporated into the questionnaire for further development. For example, the topic of accessing help or assistance after a fall was brought up on several occasions. Several of the co-designers recounted stories of older people not being able to get up or get help for hours after a fall in the bathroom due to being alone, not being heard or falling in a position where they blocked access. As a result, a subjective survey item on concerns for bathroom safety was added. The co-design group also provided valuable feedback on the preliminary survey and behaviours in the bathroom. For example, a question on frequency of bathroom cleaning was deemed too simplistic and didn't take into consideration the different sub-tasks and areas involved. The feedback made it apparent that bathroom cleaning involved multiple tasks that were often completed separately and at different frequencies, such as wiping down the basin after use (often) or washing the floor (less often). As a result, a completely different question and response options was required.

Using the co-design group's experience helped differentiate survey items from health and disability research where activities of daily living are often considered as one activity, not a series of subtasks with varying levels of difficulty (Naik, Concato, and Gill, 2004).

3.2 Phase 2: Testing

Phase 2 was conducted to test the reliability and validity of the refined survey items developed in Phase 1. In order to ensure validity of the questionnaire and quality assurance, testing of the Livable Bathrooms Survey was carried out using both cognitive testing and a pilot survey.

Cognitive interviews were used to identify and reduce non-sampling errors due to question comprehension, information recall, answer formation and response editing (Australian Bureau of Statistics, 2001). The purpose is to ensure the questionnaire produces reliable, valid, sensitive, unbiased and complete results (Collins, 2003). Cognitive interviews were conducted with 5 older people – two men and three women, aged 60 to 90 years. Only a selection of questions were tested based on their importance to the questionnaire and concerns with comprehension as intended. These were also used to test the rating scale and response categories.

A pilot survey was sent out to 30 older people from a previous study on downsizing (Judd et al, 2012), of which 25 completed surveys were returned (83%). It was used to test responses to the questionnaire as well as all stages of the process including data collection, processing and analysis. Through responses to the pilot, issues with layout, inability or unwillingness to answer questions, or any necessary additional response categories were uncovered (Statistics Canada, 2003).

3.2.1 Item Cognitive interview results

The cognitive interviews were very useful in providing more understanding as to how people read, understood, retrieved information and answered the questions. Some particular issues dealing with question ambiguity were also discovered. For example, a question regarding the respondents concerns about asking for help was interpreted in a variety of ways from concerns about whether anyone would hear them call for help to the logistics of getting help. Testing for ambiguity and interpretations of the questions was very useful as these can not only create errors in the data, but also confuse people and increase the burden of answering the questionnaire.

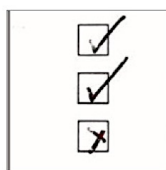


Figure 2. Use of ticks and crosses to explain answers

The interpretation of instructions on how to answer questions were also not always clear to the interviewee, particularly when the instructions were to ‘tick all that apply’ where a ‘no’ option was not included. One solution used by several interviewees was a tick for ‘yes’ and an X for ‘no’ (Figure 2). Another advantage with the cognitive interviews was the ability to discover more activities, difficulties and issues with home bathrooms. This was valuable because the ‘other (please explain)’ category was not always used in the pilot survey.

3.2.2 Pilot survey results

Further changes to the questionnaire were made from the results of the pilot survey. Questions were analysed for their response options and difficulty based on responses not being fully filled in. This indicated issues with the question length, activities listed, as well highlighting issues with the response categories (also discussed in the cognitive interviews). As a result, questions were modified through grouping or simplifying survey items and response options.

Some questions, when crosschecked with other questions or comments showed errors in question comprehension. These questions were modified to be less ambiguous in order to reduce error. For example, confusion with including separate toilets was often noted in comments as well as by non-responses to toilet-related questions within general bathroom questions. Changes were made to include ‘separate toilets’ in the question or notes, thus reducing the chance of misinterpretation.

Further information gained from the pilot survey related to the ease and speed of data entry. Revisions were made to reduce difficulty in recording answers (such as removing open-ended questions) and using a format that allowed responses to be scanned for automated data entry. Completion of the survey took 30 minutes to one hour.

Besides survey questions, the pilot survey provided several open-ended questions to allow for additional feedback. These were used by over half of the respondents and helped to clarify issues with lack of response options or general comments about bathrooms and abilities. The qualitative information was compared to the cognitive interviews and co-design results and provided insight from a larger and more diverse group of older people.

3.2.3 Comparing results

Results from the pilot survey and the interviews were compared and, where applicable, used to validate changes. Some particular issues observed during the interview were evident in the pilot survey, such as ambiguity of questions and response categories not fully capturing information. Most recorded problems in the interviews manifested themselves in the pilot survey through a lack question completion, choice of a *neutral* response category, different response markings or notes/comments left.

3.3 Phase 3: Finalising

Based on the results of the testing phase, further revisions were made to the questionnaire content and layout and structure for ease and speed of data entry. Based on the testing phase, revisions to the survey items, structure, layout and content were made and reviewed by the research team.

To enrich the survey data and provide a nuanced understanding of the quantitative data, the research team also planned for a series of in-depth interviews as a follow-up from the survey, with a final question asking whether participants would volunteer for it. The survey was then finalised for national distribution to a random stratified sample from the Australian Electoral Roll of 16,524 older Australians, ending up being the first of this scale.

Table 2. Overall sections, themes and content of the Livable Bathrooms Survey

Survey section	Themes	Content
1. Current bathroom environment	Environment	Physical environment (type, size, fixtures)
2. Bathroom Activities	Activity/Person/Environment	Types and frequency of activities, subjective assessment of environment for activities
3. Bathroom Safety	Person/Activity/Environment	Safety concerns, falls
4. Bathroom Abilities	Person/Environment/Activity	Physical abilities, personal assistance needed and given
5. Assistive Devices/Fixtures	Environment/Person/Activity	Types and use of assistive devices
6. Your Health	Person/Activity	Health and medication
7. About You	General context	Demographic, income and dwelling situation

4 DISCUSSION

Supportive domestic bathrooms are pivotal to ageing in place yet there is no national data on what they are like, how they are used and how they are perceived by older Australians. The objective of developing the Livable Bathroom survey was to create survey items necessary to collect the first large-scale dataset on older Australians and their domestic bathrooms. The survey was part of a wider study undertaken with funding from the Australian Research Council through an Industry Linkage Grant with an industry partner (GWA Industries). There was a 27 % response rate to the survey and the achieved sample of nearly 4500 respondents was broadly representative of the wider population. There were some minor differences between the sample and the wider population, and some questions in the survey were either fully or partly unanswered, thus limiting responses to those from a somewhat smaller group. Nevertheless, the survey provides a good basis overall for understanding the characteristics and circumstances of people of this age group, the kinds of bathrooms they have, their uses of them and various aspects of their bathrooms' *livability*.

Content validity and relevance was addressed by developing survey items with the input and advice of a co-design group of older people. This helped to ensure that the content addressed the issues, concerns and domestic situations of actual older Australians, as opposed to relying solely on the literature. The survey was tested to ensure validity of the questions through cognitive interviews, and piloted with 25 older people to assess usability, ease of response, coding efficiency and relevance.

The survey included mostly closed questions with listed response categories as they are less burdensome for respondents and allow for easier data collection and analysis (Australian Bureau of Statistics, 2010; Statistics Canada, 2003). Although this helped to create a respondent-friendly questionnaire, which can increase response rates (Dillman, 2006), it limits the amount of insight and detail obtained. To address this limitation, in-depth interviews with a stratified sample of 80 people from the survey respondents has also been carried out; to enrich the survey information by providing a nuanced understanding of the quantitative data, clarifying current bathroom experiences, abilities, aspirations, values, and preferences.

The results of the carefully developed Livable Bathroom survey are now contributing to the development of a better understanding of the relationship between Australian people, their bathroom environment and activities. The information from this survey has provided a list of key issues that have been used by GWA Industries, a major bathroom furniture-manufacturing firm, to develop a range of better products and guidelines to support older people in the bathroom environment and facilitating ageing in place.

5 CONCLUSION AND NEXT STEPS

The results of the carefully developed Livable Bathroom survey are now contributing to the development of a better understanding of the relationship between Australian people, their bathroom environment and activities. The survey data was analysed with SPSS and the resulting information has provided a list of key issues that have been used by GWA Industries, a major bathroom furniture-manufacturing firm, to develop a range of better products and guidelines to support older people in the bathroom environment and facilitating ageing in place. For instance, some of the issues for bathroom design and government policies towards older people identified by the survey included fall related injuries within the bathroom.

While the proportion of people reporting falls in bathrooms within our survey was fairly small overall, it is larger amongst the oldest groups and represents a substantial number when scaled up to the population. This suggests that attention needs to be given, in both the design of bathrooms and policies towards older people's housing, to the factors that might contribute to, or prevent falls. Bathroom design features in themselves do not figure as major predictors of falls or of concern about safety, compared with broader health factors, but many older people clearly have difficulty with getting in and out of baths, moving around in small bathrooms and picking up items from the floor. There is significant concern about falling and not being able to get up and call for help.

We also found that the bathrooms presenting the most difficulties tend to be located in older, separate houses or in some of the more marginal types of dwellings. A substantial proportion of the oldest groups of people also have bathrooms that have not been renovated for many years, especially those in older, separate houses. This suggests a need for financial assistance to help people on lower incomes upgrade bathrooms and install assistive devices.

Further work needs to be done but the wide range of activities carried on within bathrooms suggests the need for design that can accommodate these uses, including sufficient accessible surfaces for people to put things on and devices to hold onto as they move around within the bathroom.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

HUMAN RESEARCH ETHICS APPROVAL

The University of New South Wales Built Environment Human Research Ethics Panel has provided ethical approval for this project.

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