



McLean Care®



# Intelligent Home Solutions for Independent Living

## Intelligent Home Solutions for Independent Living

Summary project report and preliminary findings

## Project Team

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### PARTICIPANT ACKNOWLEDGEMENT

We appreciate the time and contribution of all the householders who participated in this research, who welcomed us into their homes and shared their valuable insights and data.

### ACKNOWLEDGEMENT OF COUNTRY

We wish to acknowledge the people of the Kulin Nations, on whose land the Monash and Deakin university teams work; and the people of the Kamilaroi/Gomeri Nations, on whose land the McLean Care team work and on whose land this project was undertaken.

We pay our respects to their Elders, past, present, and emerging.

### LAYOUT AND DESIGN

Kerrie-Anne Bennett, Harvest Community Sector Consulting

### PHOTOGRAPHY

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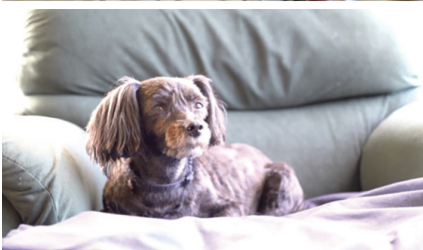
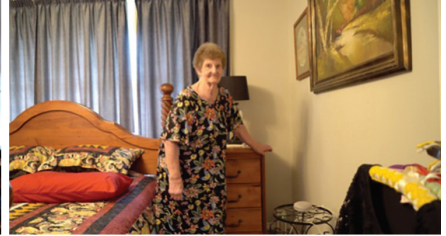


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# Meet the Participants





# Meet the Team



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A hand is shown interacting with a white, cylindrical smart speaker. The speaker's top surface features a circular array of small, glowing white LEDs. The background is a blurred kitchen scene with a banana and red tomatoes on a counter. A green geometric shape is overlaid on the top left of the image.

# Introduction

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**The Department of Health's Commonwealth Home Support Programme (CHSP) helps senior Australians access entry-level support services to live independently and safely at home.**



**Aged care provider, McLean Care, received a CHSP Innovation grant from the Department of Health. In partnership with Deakin University and Monash University, the trial explored the use of easily installed smart devices in the homes of older people living independently in regional New South Wales. The devices included smart power plugs, digital voice assistants, smart light bulbs and robotic vacuum cleaners. These are 'plug and play' smart home technologies that are easy to remove if needed.**

The smart device trial and research activities were conducted between November 2019 and June 2020. The process and outcomes of this trial are summarised in this report, covering data collection and analysis completed up to early June. A detailed evaluation report will be released later in 2020.

The aims of this project were to:

- Understand how smart home devices can support older people in improving wellness outcomes and living independently in the home.
- Evaluate the benefits, opportunities and challenges of incorporating smart home devices into older people's homes and lives.
- Understand the usability challenges, expectations, hopes and anxieties older people have of smart home devices in assisting them to live more independently and improve their wellness and wellbeing.

The trial involved four key components.

1. McLean Care recruited 22 older households and provided them with a wide range of commercially available 'off-the-shelf' smart home devices from different vendors and with diverse functionalities.

2. Deakin University collected electronic data from the different devices to analyse what was used and how.

3. Monash University undertook ethnographic research (interviews, home visits, video tours and technology demonstrations, observations, follow-up phone calls) to document and understand participants' experiences with the technologies.

4. McLean Care collected reviews from the participants on the devices that were trialled and published them on a user review website. This is intended as a reference for other older Australians who may be considering using similar devices in their own homes.

The project delivers significant insights for older Australians, the Department of Health, aged care service providers, smart technology designers, and researchers by capturing the experiences of older Australians' use of emerging smart home technologies.

# Prior Related Research

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**Contemporary research confirms that technology can support positive ageing and create increased opportunities to age in place without loss of independence.**

Smart devices are expected to be used as preventative health measures, to address social isolation, reduce and respond to accidents, support the work of both formal and informal carers, improve access to health services, and reduce caring costs<sup>123</sup>. To date, the majority of research has focused on barriers to technology adoption or user attitudes towards particular technologies.

Affordable and reliable smart home device technologies have only been available in recent years. As these new technologies have become more widely-available, there is a growing interest in understanding how people use smart home technologies in their everyday lives. For example, researchers have explored how the use of new technologies might depend on the support of family or friends who help to install or fix new devices<sup>4</sup>. This research suggests that with appropriate assistance, smart home devices can support older people around the home and provide the potential to allow them to live independently in their own homes for longer.

<sup>1</sup> Demiris, G. & Hensel, B. K. 2008. Technologies for an aging society: a systematic review of "smart home" applications. Yearbook of medical informatics, 17, 33-40.

<sup>2</sup> Liu, L., et al. (2016). "Smart homes and home health monitoring technologies for older adults: A systematic review." International Journal of Medical Informatics 91: 44-59.

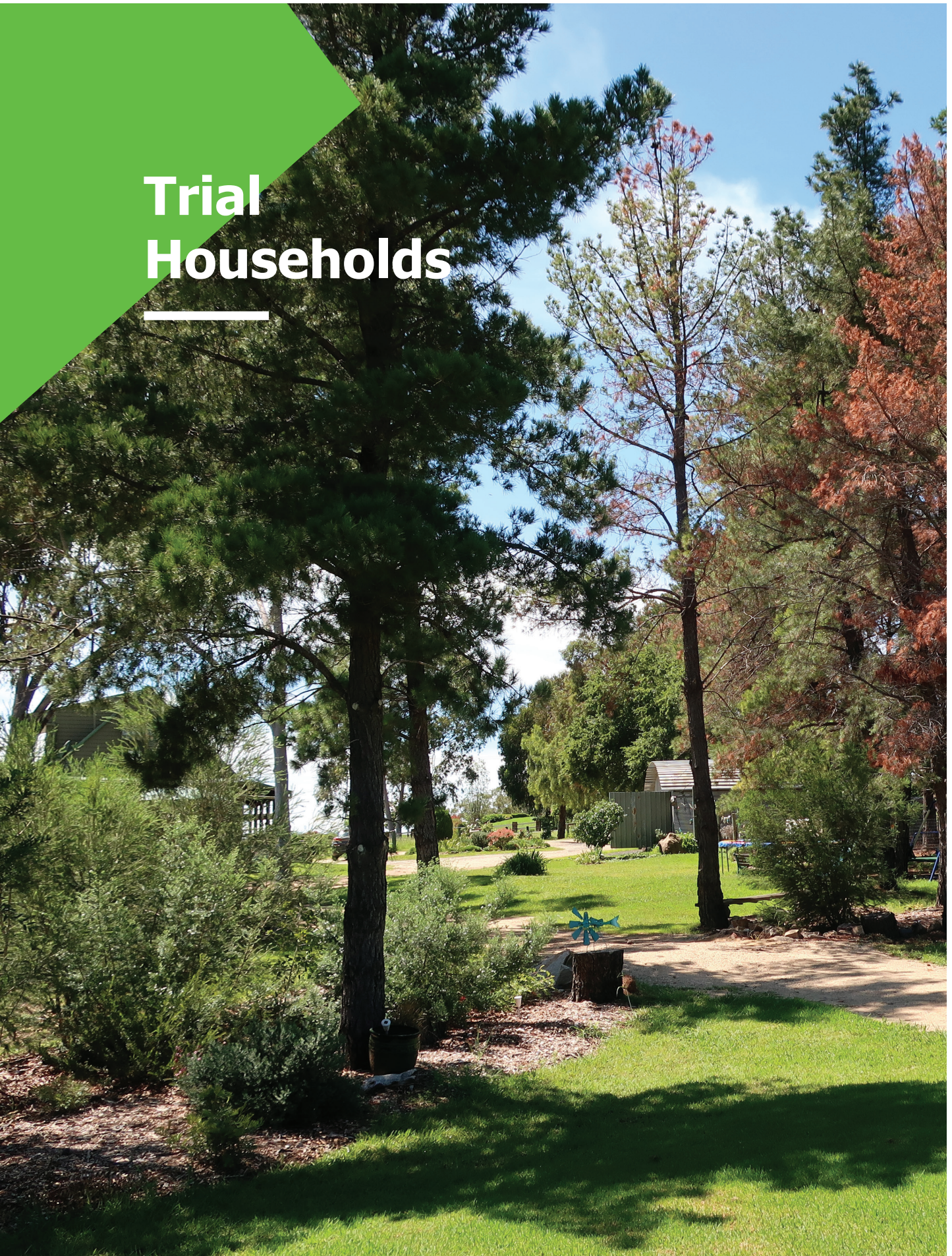
<sup>3</sup> Deen, M 2015, 'Information and communications technologies for elderly ubiquitous healthcare in a smart home', Personal and Ubiquitous Computing, vol. 19, no. 3-4, pp. 573-599.

<sup>4</sup> Greenhalgh, T., et al., What matters to older people with assisted living needs? A phenomenological analysis of the use and non-use of telehealth and telecare. Social Science & Medicine, 2013. 93: p. 86-94.



# Trial Households

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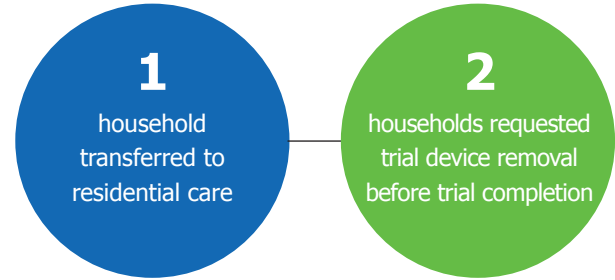


# Summary of Trial Participants

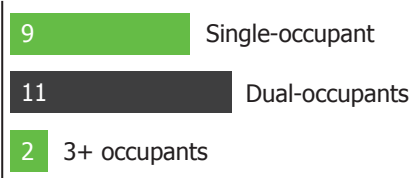
## Total participants



## Partial trial participation



## Household composition

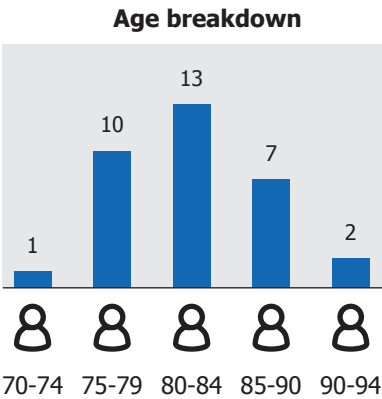


## Gender

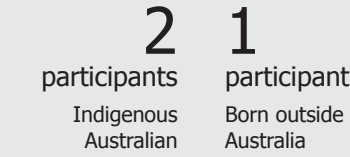


## Age

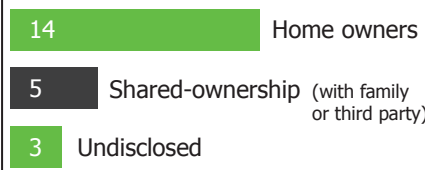
Average age: 81.8  
Age range: 73-93



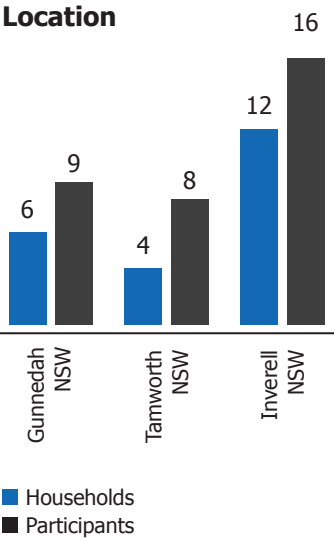
## Cultural and linguistic background



## Home ownership



## Location



# Recruitment, Participant Training and Support

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**Participant households were recruited by McLean Care from their existing CHSP client base in the regional NSW communities of Inverell, Tamworth and Gunnedah.**



**The original scope of the project had also included Toowoomba in Queensland, however the planned organisational partner in this region had to withdraw shortly before installation commencement. Target participant numbers were therefore made up in the other locations to ensure the project timeframes and deliverables could still be achieved. Potential participants were randomly selected and telephoned by the McLean Care project manager. During the phone call, further information was provided about the project and its aims.**

Potential participants were given the opportunity to ask any questions, including what their participation would entail at a practical level. All participants were advised that participation in the project was voluntary and would have no bearing on the services they receive from McLean Care. Possible impacts of the project, such as slight variations in the participant’s household energy consumption and power bills were also discussed.

Table 1 below summarises the number of prospective households that were directly contacted by the project manager in each project location and the recruitment rate (the number of households who then signed up to participate). This table does not include households where indirect contact was made (e.g. where messages were left on voicemail machines or with other household members but direct conversations were not held with the project manager).

**Table 1.** Participant recruitment

	Number of recruitment conversations	Final number of households recruited	Recruitment rate based on direct conversations
Gunnedah	11	6	55%
Tamworth	11	4	36%
Inverell	37	12	32%

The primary reasons people gave for wanting to participate in the project were:

- Being part of something innovative;
- Trying new technologies (for example, a couple of participants observed that they had seen the robotic vacuum cleaners advertised and were interested in trying them out);
- Expressing their gratitude for the services and support they received from McLean Care;
- Giving back to the community by taking part in the research (for example, some participants commented that they were still quite independent themselves, but could see the value in having the information available for other older people with more limited mobility).

When potential participants provided a reason for declining to participate in the project, these predominantly related to:

- Having other commitments such as planned holidays away with family or known hospital stays that clashed with key project dates;
- Having recently returned home from hospital or recovered from an illness or injury and not wanting any additional considerations to factor in to their daily routines during recovery;
- Concerns that they did not have sufficient technology skills to participate (despite reassurances provided by the project manager that prior knowledge and skills were not a prerequisite for participation);

- Concerns that using the technologies may actually diminish their independence or impact on their levels of physical activity; and
- Concerns about the safety of the technology itself (e.g. one prospective participant commented “I’ve read all about the 5G network and it’s not safe, I don’t want anything to do with it”).

Participants were deemed eligible for the project if they:

- Were a CHSP recipient (aged 65+ or 50+ for Aboriginal and Torres Strait Islander people); and
- Were not living full-time with anyone under the age of 65 (or 50 for Aboriginal and Torres Strait Islander people) as this may have caused interference with the devices and impacted the reliability of results about older Australians; and
- Had reliable mobile phone reception in their home (required to operate the devices); and
- Did not have any visual or hearing impairments which would impact their ability to operate the devices.

Overall, a total of 33 participants were recruited across 22 households. In some households, both partners were CHSP recipients. This final number of participants exceeded the participation target set for the project by more than 60%.

The research teams received Human Ethics Committee approval from Deakin University and Monash University, respectively. As thanks for their time, each household received a \$50 supermarket gift voucher after completion of the first and last stages of ethnographic research (up to 2 vouchers per household).

Following recruitment, the McLean Care technician initially visited each participating household to further discuss the project, understand the layout of their home and consider which technologies might best meet the household’s needs. Participants were shown

a sample of each of the devices from which they could select their preferred combination.

At the second visit, the selected items were configured and installed and the technician gave participants basic training in how to operate them. Simplified user guides for each device (prepared by the project team) were also provided and left with participants for their reference as required.

Participants could ring the technician for troubleshooting support during the life of the project. For instance, on some occasions, the technician was able to guide participants to re-boot the vacuum cleaner over the phone, highlighting both the willingness and ability of the participants to learn technical fixes over the phone. Remote monitoring of devices also enabled proactive provision of support when a notification was received that a device was offline or dormant for an extended period of time.

Where issues could not be solved over the phone, the technician visited people in their homes, with additional infection control and safety measures implemented during the COVID-19 pandemic.

A Project Steering Committee with key staff from each of the three partner organisations was established to provide oversight and governance for the life of the project. The team met regularly throughout the project term and worked together to track progress against project milestones, to troubleshoot any emerging issues and to actively monitor and mitigate risks. This was particularly important as the project was impacted by both the summer bushfires of late 2019/ early 2020 and the global COVID-19 pandemic. Both events required the team to adapt their approach to travelling in the regional communities where the project was undertaken. Overall, the combined expertise, knowledge and contribution provided by the three partner organisations was considered to be a fundamental aspect to ensuring the project’s success.



# Installed Devices

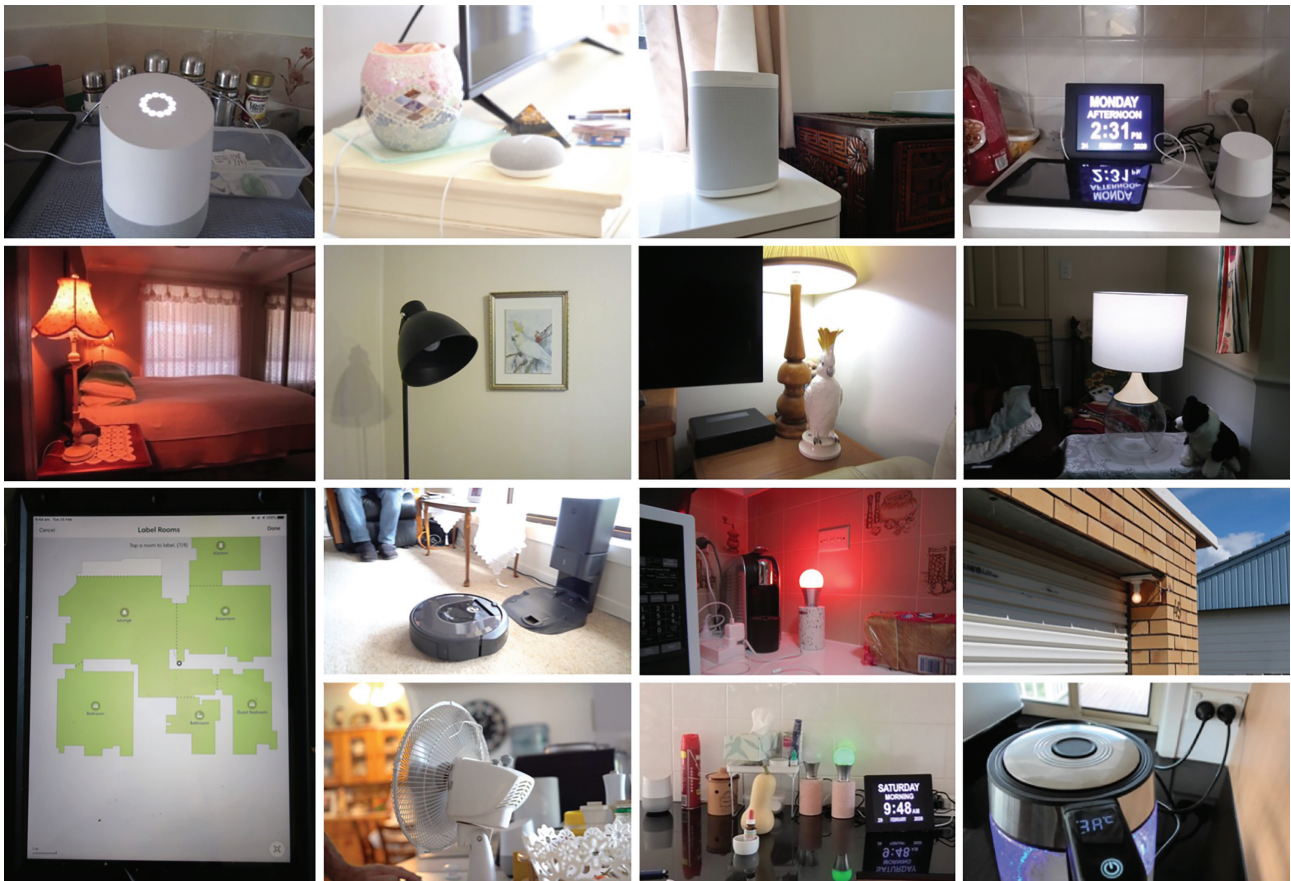
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The project team undertook an internal selection process to identify smart home devices that would be used throughout the trial.



The selection process looked at functionality, capability (e.g. communication protocols, proprietary technologies, closed or open systems) and connectivity (internet, network and other requirements) of a range of commercially available smart home devices. Stock availability also influenced the final selection of

devices; and only “plug and play” devices that could be easily removed if required and did not require hard-wiring or permanent modifications to participants’ homes were used. The devices selected for inclusion in the trial are listed in Table 2.



**Table 2.** List of smart home devices able to be selected by participants in the trial.

Device	Functionality	Number of devices installed across the trial	Number of homes where the devices were installed
Google Home (standard, Mini and Max)	Allows voice requests to control smart devices or access internet services such as playing music or reporting the news	69	22
Aeotec Smart Light	Smart lights in this trial were configured to be controlled via a mobile device, voice requests (via Google Home), smart button or according to a schedule	52	20
Aeotec Smart Switch	Smart 240V switches in this trial were configured to be controlled via mobile device, voice requests (via Google Home), smart button or according to a schedule	16	9
Aeotec Tri Sensor	Detects motion as well as measuring light levels and temperature, and in this trial were configured to turn on smart lights when motion was detected	1	1
Fibaro Smart Button	Physical button to control smart device(s), and in this trial were configured as a button to control smart lights and switches	55	18
Fibaro Keyfob	Physical buttons to control smart device(s), and in this trial were configured to control smart lights and switches.	3	3
Fibaro door sensor	Detects door activity and is able to activate smart devices. In this trial sensors were configured so that door activity would turn smart lights on or off	5	4
Fibaro flood sensor	Placed on the floor to detect the presence of water	2	1
Netamo weather station	Monitors temperature, humidity, air quality, CO2 and noise levels (dB)	2	2
Remotec Aircon IR Controller	Interfaces with existing split system heating and cooling units to control temperature via smart devices. In this trial these controllers were configured to be controlled via Google voice requests, mobile devices and smart buttons	4	4
Sonos Speaker	High quality smart speaker used to play music via Google voice requests	2	2
Roomba Vacuum	Robotic vacuum cleaner and in this trial were configured to be controlled via mobile devices or voice requests to Google Home devices	13	13
Kogan Smart Kettle	Smart kettle controlled via voice requests to Google Home devices	13	13



# Process and Research Methodology

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## Research team in action during fieldwork visits



Mick checking the bathroom lights in Shirley and John's home. Melisa behind the camera recording this moment.



Sarah watching a video that Edna is showing from Andrew Riu on her tablet. Melisa photographing this moment.



Melisa video recording Hilda and Owen's interview, while Rex is behind the camera photographing this moment.



Larissa interviewing Robert while the kettle is boiling. Melisa behind the camera video recording this moment.

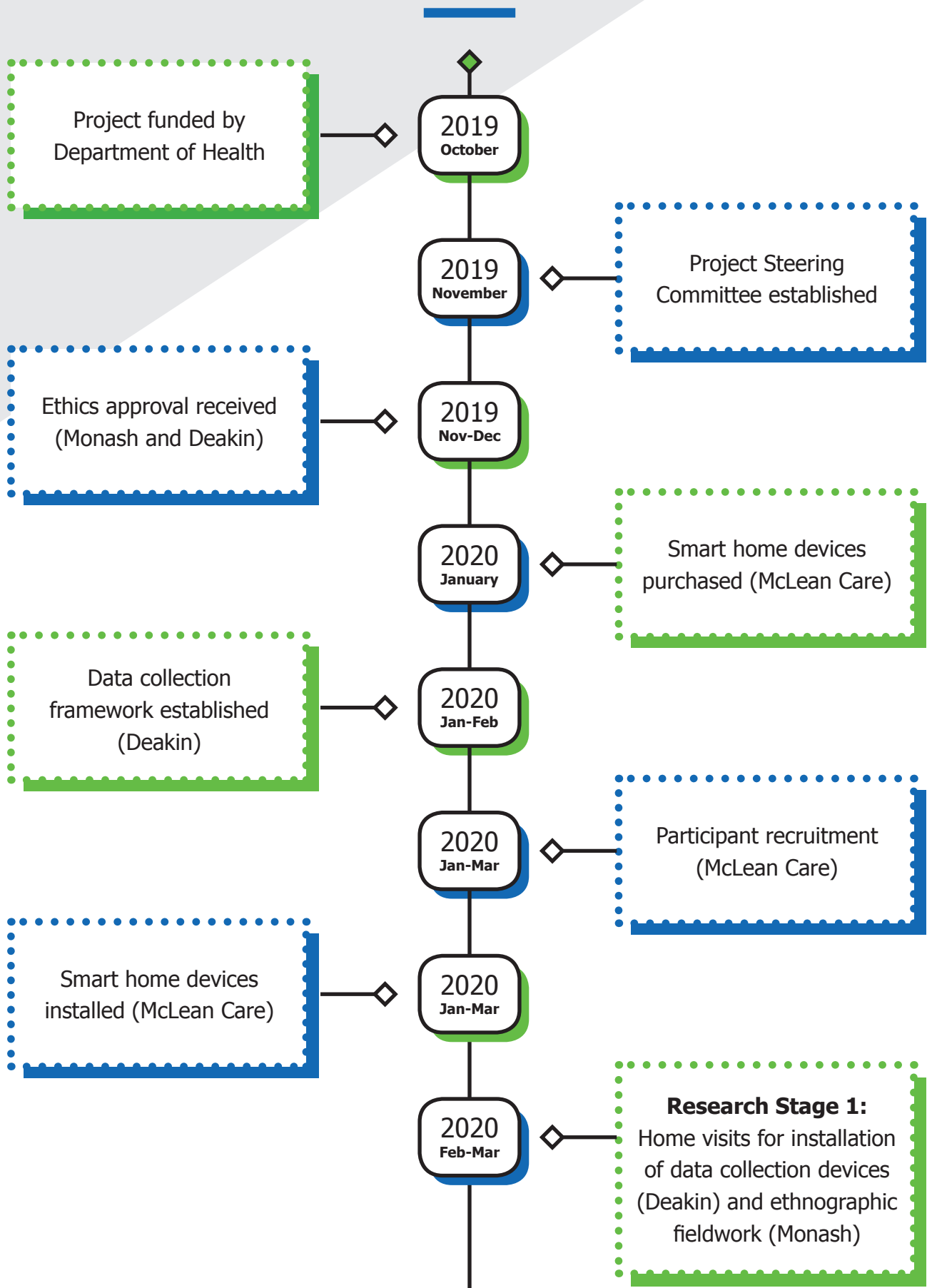


Mary explaining to Rex how the lights work. Melisa behind the camera video recording this moment.



Ross showing Rex and Melisa the videos he made to demonstrate the uses of technologies to research participants.

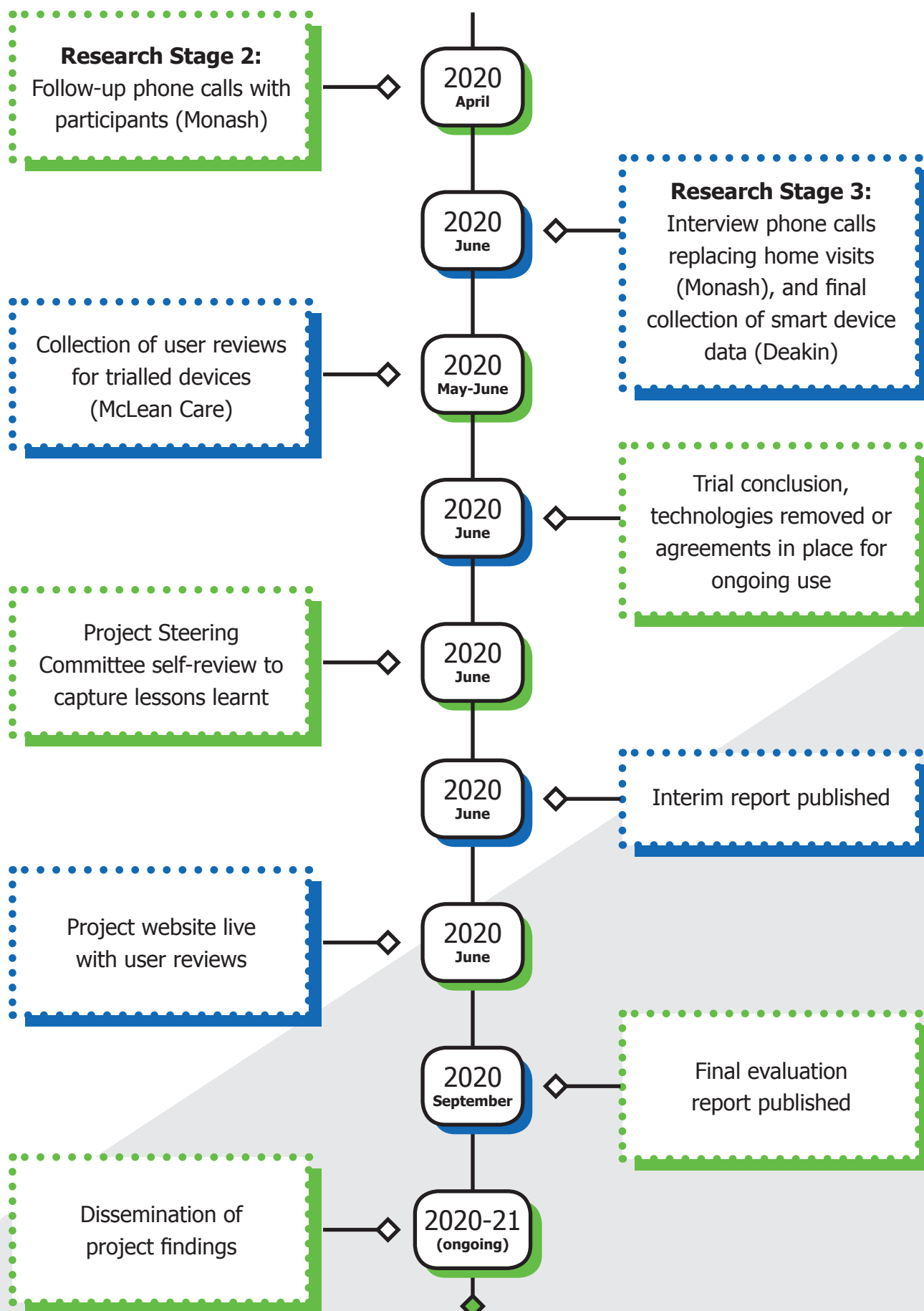
# Project Timeline



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## Project timeline

...continued





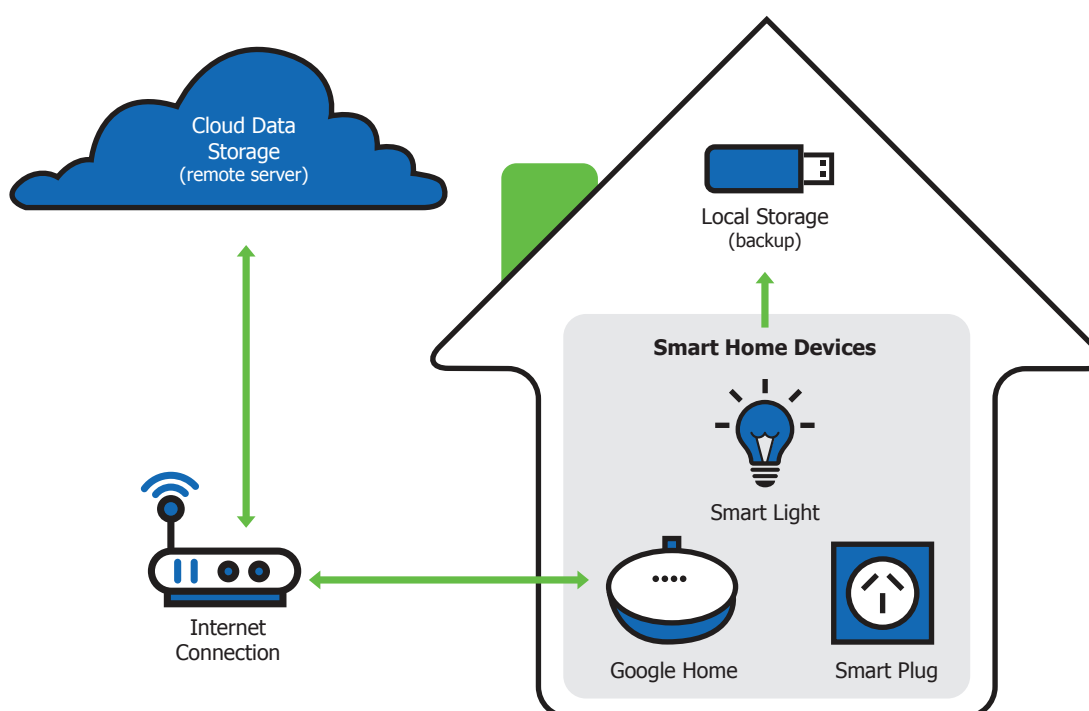
# Smart Home Data Collection and Monitoring

**To support the operation and monitoring of the smart home devices as well as the corresponding data collection activities, the Deakin University team developed a bespoke data collection framework as shown in Figure 1.**

The framework was designed specifically to monitor the operation of the smart home devices and to report on issues affecting its operation such as a loss of internet connection or whether a device was not operating as intended. If the internet connection within a home was interrupted the home would be detected as being offline and an email would be sent to the research team highlighting the issue. Possible problems with the smart devices were also flagged if there was no activity detected for an extended period of time.

The framework also supported the research team in acquiring, collating and analysing research data from the smart home devices in participants' homes. Such data included when a smart light was used, or when a voice command was made to

a Google Home device. The acquisition of data was achieved by monitoring all smart devices for changes and then storing information when a change occurred. The data collected was then collated into a standardised format and stored both locally and in the cloud. This meant that data could be logged when the internet was unavailable and there was also a backup of collected data. Collated data was then analysed using business intelligence tools to investigate smart device usage.



**Figure 1.** Smart home monitoring and data collection configuration used during the trial

# Ethnographic Research

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**Monash University used an ethnographic research process designed to take researchers into the everyday lives and worlds of participants, and to reveal otherwise invisible aspects of their sensory, emotional and practical experiences of using the devices.**

The research was undertaken in three stages, and was complemented by the device data collection undertaken by Deakin University.

**Stage 1:** The Monash research team undertook video ethnography which involved a series of face-to-face activities with participants in their homes, all of which were video and audio recorded, and transcribed. During these home visits, a Deakin researcher was troubleshooting technical issues, and then worked with participants to ensure that they could continue to use the technologies. Before leaving the Monash team invited participants to keep a diary of their experiences with the technologies, which we would review with them at the next stages in the research process.

**Stage 2:** Monash researchers made a series of short follow-up phone calls (10-20 minutes) with representatives from each participating household. Where possible, participants also used and experimented with the devices during these calls. The impact of COVID-19 was covered in relation to any changes in use of the devices due to spending more time at home.

**Stage 3:** The third and final round of Monash fieldwork was undertaken remotely due to COVID-19 restrictions and that the participants belonged to a vulnerable group. Virtual home visits involved using digital tools such as mobile phones and tablets for voice and video calls. Diaried experiences were discussed with the research team where available.

**Ethnographic analysis:** The video and interview materials were analysed by the Monash research team for each participating household, as cases. Each case was analysed in two ways. The first was to use a set of questions developed by the Monash research team corresponding with the aims of the project; and the second was to derive additional recurring themes and corresponding insights from the case materials. These findings were aggregated to detect patterns and overall findings and insights.



The Monash team interviewed Edna and her husband, Bob at their kitchen table.



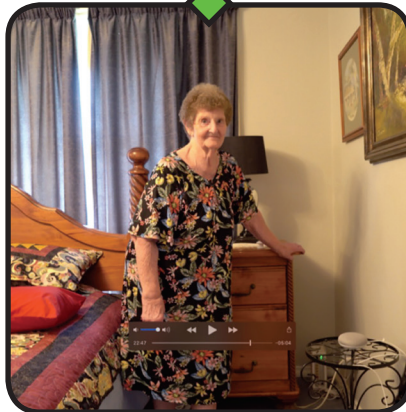
As Edna got up to take us on a tour of her house she started to discuss her experience of the technologies with us further...



...in conversation with Bob who showed us how he had encountered using the fan.



We worked in teams of two researchers, one video recording and the other audio recording. Here we are discussing Bob's successful use of the smart bathroom light with Edna.



Our tour of the home included Edna and Bob's bedroom, where Edna demonstrated to us how she used Google Home to play her favourite music by Andre Rieu, while she made the bed during her morning routine.



Our tour ended in the living room, where Edna sat in her favourite chair from which she could give voice commands to Google Home. She asked the smart kettle, which she told us she only used for guests, to boil some water so she could make us a cup of tea.



Finally, we sat down with Mick from the Deakin research team (who was in the background setting up the technologies for remote data collection) so that Edna and Bob could discuss the challenges they had encountered with the technology and how these might be resolved.

Note: Real names are used where participants gave permission, pseudonyms are used for all other participants.

# User Reviews

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**At the end of the trial period, participants were collaboratively engaged by the McLean Care project team in a process of co-design, to determine how the devices should be reviewed and what the most user-friendly design would be for displaying this information on the website.**

The resultant surveys examined how easy each device was to use, its look and feel, its reliability (how well it worked), the perceived overall benefit and an overall rating. These reviews were then published on a dedicated project website, with the intention of providing other older people with a useful point of reference when potentially considering the use of similar devices in their own homes.

Participants rated the devices on their ease of use, look and feel, reliability, and overall benefit. Each device was also given an overall rating. Participants also gave each device an overall rating. All of the devices were rated at least 4 out of 5 overall by the participants, indicating a high rate of user satisfaction. The only exception was the Fibaro Keyfob (referred to by some participants as a "Smart Pendant"), which received an overall rating of 3.3 out of 5. The highest scores in the Overall Rating category went to the Kogan Smart Kettle and the Aeotec Smart Switch.

The most popular item based on the user reviews was the Kogan Smart Kettle. It also received the highest rating in the Look and Feel category and the Overall Benefit category. It received the second highest rating for Reliability and Ease of Use (shared with the Aeotec Light Bulb).

The Aeotec Smart Switch received the highest ranking for Ease of Use and Reliability. It also received the third highest ranking for Overall benefit.

In order, the most beneficial devices were considered to be the Kogan Smart Kettle, the Aeotec Smart Switch and the Sonos Speakers.

These scores have been published on the User Review section of the project website, along with additional comments from participants about the individual devices, including how the devices could be improved for use by older people and about their experiences and use of the devices in different contexts and configurations.

The Aeotec Smart Switch received the highest ranking for Ease of Use and Reliability. It also received the third highest ranking for Overall benefit.

In order, the most beneficial devices were considered to be the Kogan Smart Kettle, the Aeotec Smart Switch and the Sonos Speakers.

These scores have been published on the User Review section of the project website, along with additional comments from participants about the individual devices, including how the devices could be improved for use by older people and about their experiences and use of the devices in different contexts and configurations.

## Fibaro Smart Button

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.3	4.5	3.5	4.0	4.0

### User Reviews

Worked well. Occasionally had to press again.

Does not work all the time.

The more you use it the more you get better at using the item.

I used to [have to get up and] turn on bed light and bathroom light but with Smart button, I only have to press on and off.

I used to [have to get up and] turn on bed light and bathroom light but with Smart button, I only have to press on and off.

Used red Smart button mainly for fan – very good



## Fibaro Keyfob “Smart Pendant”

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
3.3	4.3	3.3	3.6	3.5

### User Reviews

Pendant requires more suitability for people with arthritis.

Hardly use.

Great for use when needing to attend the bathroom in the middle of the night.



## Google Home Mini

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.2	4.2	3.6	4.0	4.1

### User Reviews

Can be useful as a bedroom radio, weather information etc. [It only] takes up small space on table.

Tell google to behave. All she gives me sometimes is angina with frustration.

Google Becomes frustrating at times when replying that you need to this or that is not programmed yet soon after without altering anything it works on the first command. Some of her Jokes are very dry. But news and weather of a morning are great

Enjoyed talking to google.



## Google Home Standard

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.4	4.3	3.9	4.1	4.2

### User Reviews

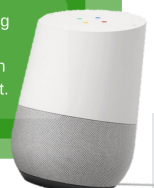
Mostly reliable but wording for request must be word perfect or I will get a long-winded reply and request denied.

When working, great. Play music often and ask for information for songs. Also to settle arguments for friendly banter.

Google music and news was something very different and we enjoyed nice music at night and voice control.

Enjoyed being able to play music on google.

The Google Duo is very good for world news - cooking recipes - making a shopping list - playing music - phone numbers and contacting people and having an on screen image while conversing - also trivial pursuit.





## Aeotec Smart Bulb “Smart Light”

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.6	4.7	4.1	4.2	4.2

### User Reviews

To be able to turn the light on in ensuite bathroom or the living room through the google hub is good. Especially late at night

Electrical storms affected use and reliability.

Very useful.

The light is tranquil, not glary.



## Aeotec Smart Switch “240V Smart Switch”

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.7	4.6	4.7	4.5	4.7

### User Reviews

Used this one all the time for bedroom lights.

Used for fan. Very useful.



## Roomba Smart Vacuum

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.2	4.3	3.7	3.9	4.1

### User Reviews

Excellent. Would love one.

Disappointing. Reduced me to tears at times.

Don't believe suction is as good as it could be.

There are some areas we don't use Roomba because it doesn't do a good job. The carpet Pile is different -it is good on low pile industrial carpet which we have in the living room and hallway - it is ok on interlocking vinyl - sometimes I need to use the iPad to send it out to clean - overall it is a great labour saving device and can clean hard to reach areas e.g. underneath beds.

Vacuum cleaner was great – like having a maid. I find that job hard-going [otherwise].

Brilliant



## Roomba Smart Vacuum

### User Reviews

Found it vacuumed some areas a number of times and missed others completely. Did best job in kitchen with no obstructions to work around.

This does a wonderful job but our house is too big and too many chair legs etc. Didn't use it to full capacity.

Can be a bit of a worry when it does things different to what is expected. A great cleaner, Appreciated most of the time.

Very good.

We're in love.

Smart vacuum was [of] great assistance to me. I like [that] you do not have to do the whole house and can be selective.

The smart vacuum would be ideal for single persons in smaller area or anyone who was unable to attend to their home cleaning.

Visitors who saw vacuum in action wanted one.





## Kogan Smart Kettle

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.6	4.8	4.6	4.6	4.7

### User Reviews

The Smart Kettle is good, it works efficiently and saves legwork.

Quite heavy for elderly people making it harder to pour.

Often tells us to reset - so used manual switch at this time.

It's too heavy otherwise great to turn on from the bedroom.

Very nice jug.

Opening lid failed towards end of time. Took several attempts to get it open.

So simple but so efficient.



## Kogan Smart Kettle

### User Reviews

A bit temperamental to use.

I found the smart kettle very useful.

Jug has been great.



## Remotec Aircon IR Controller

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.0	N/A	4.0	4.0	4.0

### User Reviews

Haven't used much as we don't use the air conditioner unless extreme of hot and cold. Mainly because [of the] costs involved in running. [In] winter we use accordingly.



## Sonos Smart Speaker

Ease of Use	Look & Feel	Reliability	Overall Benefit	Overall Rating
4.5	4.5	4.5	4.5	4.5

### User Reviews

I have enjoyed the sonos sound which we use to play music selected on the iPad. e.g. Jazz or classical piano.

Just amazingly wonderful.



# Preliminary Findings

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# Use and Uptake of Trial Devices

**Uptake and usage of each trial device varied widely between households, and shifted over time within households.**

## **Participants hoped that participating in the trial would:**

- Enable them to learn, understand and use 'technology'
- Maintain and diversify their social connections
- Improve their sense of safety, comfort and convenience
- Facilitate ageing at home, autonomy and preparation for their future
- Provide peace of mind (including for their families)
- Help others who may need more assistance by demonstrating the value of the technology

Initial visits and conversations during installation provided little indication of which trial devices each household would use on an ongoing basis. It took time for households to work out which devices they could confidently operate and which ones were useful. Devices with little initial interest could later be embraced, while in other situations devices that were initially used slipped into disuse once the novelty had passed.

While each home had a different set of smart devices installed, all homes had access to at least one Google Home device enabling comparative usage across participant households to be considered. The most common uses of the Google Home devices (voice activated) were to operate smart lights (18%) and smart kettles (15%) as shown in Figure 2 on the next page.

Participants also enjoyed easy access to a variety of music via Google Home, which was the third most common use of these devices (12%). In some households, music was used to manage chronic pain and emotional distress.

Less frequent uses of the Google Home devices included accessing the news (6%) and smart vacuum (5%). Features such as asking for the time or requesting a joke were only used 2% or less of the time.

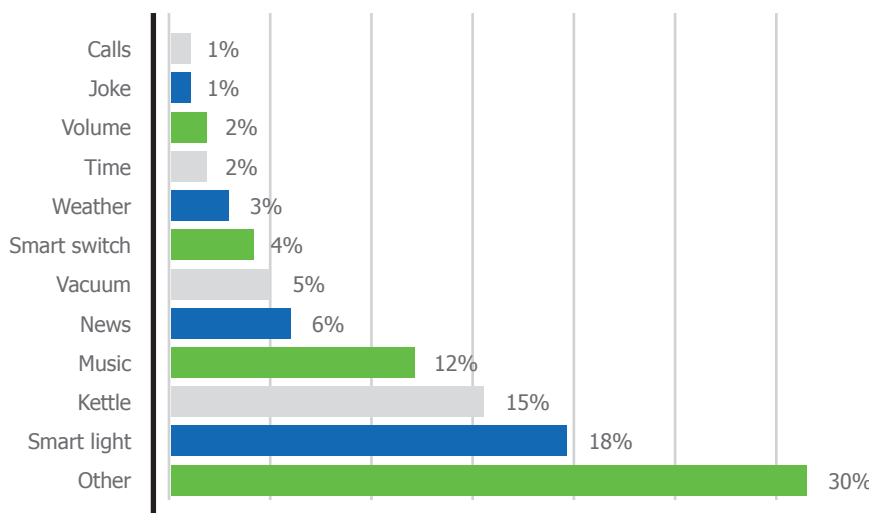
*"Well, if you don't give it a go, you'll never know. So I thought, 'Well, nothing gained, nothing lost.' You don't know until you have a go, do you?" - BARBARA*

*"Well it probably gives me more confidence in myself to know that I can do these things and the technology will help in a lot of things." - JANE*

*"We like to stay at home and be more independent and if we can get more technology like this into our homes, that will make life so much easier for us." - HILDA*

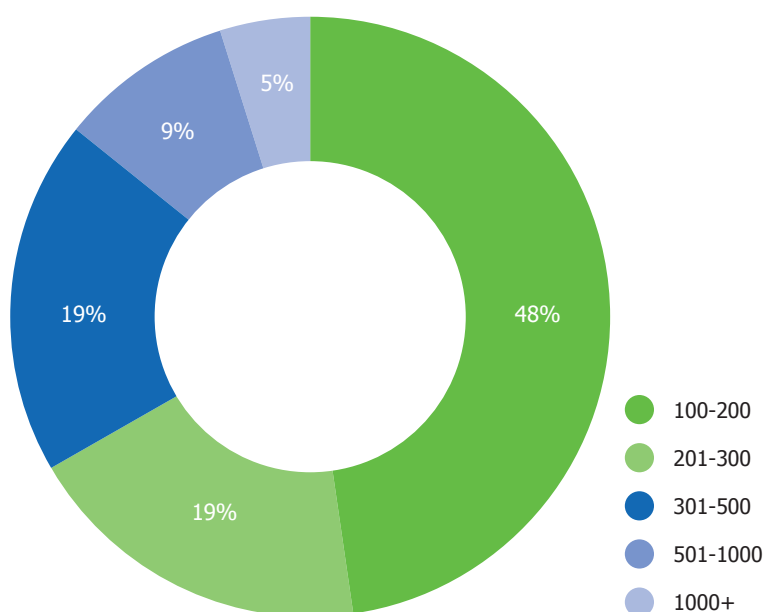
*"I thought, you know, if we're going to do a trial, we might find out something for other people as well." - JOHN*





**Figure 2.** Google Home voice requests

Note: The functionality to make calls using Google Home was added part way through the trial



**Figure 3.** Number of different voice requests made to Google Home devices by participating households

As Google Home devices respond to spoken voice commands they support a very wide variety of different requests. Figure 3 shows the number of different voice requests made by participant households. It is worth noting that due to the nature of voice requests, the same request can be made in multiple ways using different phrases and these may be represented in the data.

The number of different phrases spoken to Google Home devices by participant households varied widely. The largest number of different voice requests made by one household was 1498, whereas the least was only 109 different requests. **Approximately half of the participant households made between 100 and 200 different voice requests** to their Google Home devices while **a third of the households made over 300 different voice requests.**



# Impact on Health and Wellbeing

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To better understand the role that technologies could play to improve the wellbeing of people living independently in their homes, we asked participants what was important for them in life to feel content. The following list presents some of the most important aspects they mentioned, which are illustrated with related quotes about the trial and technologies.



## Aspects of wellbeing for participants in relation to technology trial

*"Wellness is health. Wellness is visitors, family coming to visit, and with us having our own home, and a big enough home to accommodate our family, they come as often as they can, which is quite often, and we're very blessed that they can. And that is what home is, home is love." (Beryl)*

### Physical health and mobility

(including being able to exercise, manage pain and maintain hobbies)

"I was most interested in ... the vacuum cleaner because I only had the cleaning once a fortnight. Sometimes you know, floor does get a bit gritty and I could sweep up the kitchen floor with the hair broom with difficulty. Not so much the sweeping up but picking it up off the floor you know, getting it into the dustpan afterwards, that was a bit ticklish." (Francis)

### Independence and confidence

(e.g. being able to do things for themselves, drive their car, do their shopping, tend their garden)

"I think for enabling ageing people to be able to stay at home. I think it [the smart technologies] could be really, really beneficial, especially when our aim is to try and stay at home as long as we possibly can to try and keep our independence and still feel like you're a part of a community instead of feeling like you're segregated in a residential care facility. I like the way that it is adaptable so it can be adapted to each person's individual needs." (Daughter of participant)

### Ageing at home

(together with their partner/ wife/ husband)

"Well, we hope to live in our home forever, sort of thing, and medical of course, might do something different to that, but we would like to stay in our home, and when I was asked to do it [the trial], I thought it was a good opportunity to help keep people in their homes, if possible, as long as possible." (Beryl)

### Community participation and interactions

(including volunteering, going to the gym, sports and other club activities, talking in the street, taking care of others)

"I'll use it [the tablet] for – I'm going to get myself an email and just about practically everything, like you can make phone calls out of them and do notes, especially emailing. I'm in on a lot of things. I've got to get the emails because they go crook on me all the time "You haven't got the email". No, but I will have one... We've got a lot of connections outside of Inverell with other people and towns and like they live in other towns where we lived, and we can talk to them. It's mainly just that in that area. Talking with other groups of people, Elders there, because they live in different towns and we don't get together much, so we connect through Facebook." (Hilda)

**Mental activity,  
learning, and  
purpose**

(including to avoid conditions  
such as Alzheimers)

"I don't know whether I need it [Google Home] at the moment but maybe, it keeps your mind active I suppose to a certain extent" (Susan)

**Nature and 'the  
country'**

"I love the sun and the flowers and the birds and the kangaroos. I'm really lucky [to live in the country]." (Rose)

**Family**

"They [my family] could see the adjustments we've got to get because where we are with our age. They don't mind [us participating in the trial]. They help us. They support us well." (Hilda)

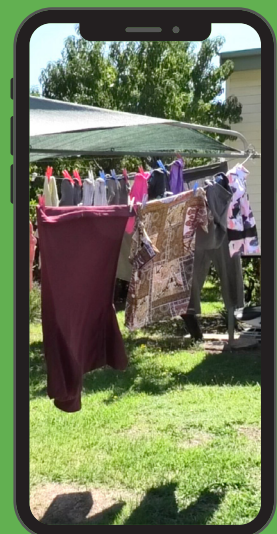
**Financial security,  
minimising problems  
and worries**

"It's all right [to keep using these smart technologies in the future] if you could afford it, put it that way... Yes. It's a matter of how much it'd cost." (Mary)

**Routines and  
planning**

"I said, 'hey Google, what's the weather going to be like?' And he said it's going to be sunny. And so that was good. I did my washing because it wasn't going to rain. So, I got my washing dry." (Shirley)

"I think the older you are the more regimented you get. Things go to schedule. Now if anything goes out of sync that makes me unhappy." (Rose)





Participants appreciated **convenient access to news, weather, time and other information via Google Home** which could **help with daily planning and organisation, and keeping up with current events**, e.g. COVID-19 and extreme weather events.

**Google Home was unable to understand 15.4% of all voice requests from participants.** Some households experienced **frustration or a sense of failure** when the smart home devices were difficult to operate, unreliable, didn't recognise participants' language commands, or were insufficiently sophisticated to source desired, specific information (e.g. 'local' information).

**Smart lights provided extra convenience, safety and health advantages for households**, especially for getting up during the night and assisting with consistent medication schedules.

The **robotic vacuum cleaner helped participants maintain a sense of adequate home cleanliness** in between visits from McLean Care, but did not diminish the importance of fortnightly visits by McLean Care's cleaning staff.

*"I think it's good fun, you know. I'm sorry that I'm not younger and can enjoy it more" - SHIRLEY*

*"Well, I think we were using the wrong terminology." - JOHN*

*"See, I think that's rude to say, 'Hey Google'. I'd rather say, 'Excuse me, Google. Could you do this?'... 'Hey, you, do this'. Well, that's not a language that we normally use." - EDNA AND BOB*

*"It's a bright light and you do need bright lighting in the bathroom, at our age, because you can't afford to have anything on the floor because you easily tripped over. So the light's very bright which is excellent... At night-time it lights up beautiful." - OWEN*

*"[Smart lights are] a great idea, to stop falls, anything to stop falls" - MARIE*

*"I have a light for telling me if I've left the garage door open and another one that reminds me early in the morning and late in the evening that it's medication time. As soon as I close the door on the medication cabinet, it goes out, which is magic." - ROBERT*

*"I was just so grateful actually, I was thinking, oh, isn't this marvellous, he's [the robotic vacuum] cleaning the place up and really cleaning" - MARIE*





**Undesirable and unforeseen robotic vacuum cleaner activities**, e.g. randomly vacuuming during the night or potentially posing a tripping hazard, **caused distress for some participants. This was continually followed up by the three teams throughout the trial.** McLean implemented additional safety reviews. The Deakin team made technical adjustments in the home visits and the Monash team discussed participants' sentiments during the interviews.

The **smart kettle increased visibility of heating and temperature but was too heavy** for some participants. **Distant activation of the kettle was mostly seen as unnecessary** but a few households considered it useful.

**Participants expressed concerns about excess convenience from smart devices** replacing reasons to do things themselves and the associated exercise and routine benefits.

Participants often viewed the technologies as **not 'necessary' for themselves but potentially useful for others** (older or more physically restricted households) and therefore their participation was a contribution to the community and potentially improving services available to older people.

Most participants appreciated being part of the trial and **embraced the opportunity to experience and learn about new technologies.** As such, it was difficult to fully isolate positive impacts of the smart devices used in the trial on wellbeing from the positive impacts of trial participation. Most participants clearly **enjoyed the opportunity to learn, discuss, contribute and interact with the trial and project team.**

Learning to use the trial devices **built participants' 'digital living skills'** in ways that had wider **positive impacts on their social connectedness and wellbeing**, e.g. facilitating video-based communications with friends and family during COVID-19 social isolation.

*"I get cross especially when it's late at night and 'he' [robotic vacuum] decides he wants to vacuum the whole house."* - MARIE

*"I thought, for someone in senior years, that is much too heavy a kettle... You need something that probably only holds about three cups or four cups, nothing more."*  
- EDNA

*"Well, I have the smart kettle, which I love because I've realised now that when I wake up in the morning, I go, 'Hey kettle. Turn on'. It's ready for a cup of tea or coffee when I walk out to the kitchen."* - ROBERT

*"I think it's [the smart technology] a good thing to have if you're not very mobile or if you – I think it would be a good thing to have if you weren't that well."* - ROBIN

# Challenges and Risks

Installing and keeping devices working required high levels of remote and on-site technical support on an ongoing basis (provided by the project team and some of the participants' family members). The trial experienced blackouts and several internet outages in research locations that caused technical challenges due to loss of services that often required additional technical support from the project team.

Due to the complexity of smart devices, **participants could rarely resolve technical problems on their own.** Some participants turned to family members for technical support and the detailed manuals provided to participants were often not used.



**Coreen: Now what if I use these devices and become reliant on them and then they refuse to cooperate, what do I do then?**

**Melisa: Then you call a human and tell them to help you.**

**Coreen: Thank goodness, there's some humans. You're not all robots."**

Due to the complexity of smart devices, **participants could rarely resolve technical problems on their own.** Some participants turned to family members for technical support and the detailed manuals provided to participants were often not used.

**Smart devices made some home activities more complicated and dependent on access to other technologies and services,** e.g. reliable home internet and sufficient data. This could increase regular costs for households post-trial, or contribute to vulnerabilities when relied upon technologies no longer work when needed.

**Smart devices may generate new privacy or security vulnerabilities for older households.** Some participants mentioned concerns about privacy and security in relation to technology use - not just in relation to the trial smart devices but other newer technologies that have become widely used, e.g. smart phones, online banking etc. Participants often put these concerns aside for the trial, perhaps because it was delivered by a trusted provider (McLean Care), and/or because they received personalised technical and security support from the project team. Despite some participant awareness of privacy and security risks, the findings from this trial indicate that older households are likely to remain under-equipped to manage privacy and security issues for safe and satisfactory outcomes in this complex environment if acquiring and using these devices on their own.

*"I still think that my little touch light was a lot easier, and my torch."* - FRANCIS

*"Like when we're sitting here having a conversation that [Google Home is] an ear. That it's listening, that's what I'm worried about..."* - ANN







# Opportunities and Enablers

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## Technologies for wellbeing

The technologies trialled in this project could enhance health and wellbeing for older people ageing in place when provided as optional extras alongside their in-home services, which remain of high importance for the sense of community connection and social interaction.

## Integrated service provision

Beyond simply deploying technology, delivery of smart home projects with older people will benefit from integrated and sustained service provision. Shared assessment and review of suitable devices for each household, personalised training and support, combined with professional technology service and troubleshooting, will better enable older people to integrate smart home devices into their lives.

## Participation and learning

Wellbeing, health and independence benefits are derived from the opportunity to contribute to a valued initiative for older people, learn digital skills, and use smart devices.



## Digital inclusion

Wider access to affordable and reliable internet services will allow more older people to use smart home technologies to support ageing in place.

## Tailored technology design

Smart devices to support independence and ageing in place may require design modifications. These could include more flexible and suitable language (for requests and responses), increased button and text size, higher levels of colour contrast, lighter weight, and capacity to be fixed in place to maintain function, and reduce the likelihood of device under-use and associated unnecessary wastage.

## Product verification

Independent testing of all smart devices intended for older people, including for technical and social reliability under a wide range of conditions, will improve outcomes and reduce waste in smart home technology service provision.

## Flexibility, confidence and navigating the future

This research was conducted leading up to and during the COVID-19 pandemic Australian 'lockdown'. These unique circumstances provided an opportunity to understand participant experiences and use of smart technologies during imposed social isolation. Increased digital technology confidence gained using the trial devices can assist older households to adapt to future disruptions that restrict activities outside the home and/ or their access to health services in the home. For example, during COVID-19 one participating household opted to postpone in-home cleaning and instead rely on the robotic vacuum cleaner.

*"Supposing I passed out, get this virus that's going or something like that, if I can't get up, can I call on her for help. Like 'Hey Google, ring the ambulance.' Can I do that?" - COREEN*

*"I think some knowledge of technologies is going to help people to stay at home in their homes rather than nursing homes... we will enjoy our house for as long as we can" - KEN*

*"If you are introduced to a new technology it can be daunting until you get familiarised with it..." - HILDA*

