



Brightwater



# Understanding the Impact of Socialisation Robots on the Social Engagement of Older Adults with Cognitive Decline

June 2017



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Williams, E. & Pratt, K. (2017). Understanding the Impact of Socialisation Robots on the Social Engagement of Older Adults with Cognitive Decline. Brightwater Care Group, Perth Australia.

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## Executive Summary

This report comprises an investigation into the outcomes of resident social engagement and staff attitudes when a humanoid socialisation robot was incorporated into residential aged care facilities in Western Australia.

**Purpose:** This project aimed to investigate the impact of a socialisation robot on the social engagement of older adults with cognitive decline, with two main objectives:

- The **primary** objective of this study was to investigate the impact of a socialisation robot on the social engagement of older adults with cognitive and functional decline living in a residential aged care facility in Australia compared to standard activity programs.
- The **secondary** objective of this study was to explore staff attitudes to the use of socialisation robot technology within the Australian residential aged care context through qualitative methods.

**Methods:** Data was collected from both staff and residents at two intervention facilities and two control facilities across the nine month study period using a variety of qualitative and quantitative data collection tools for Residents (Pool Activity Level (PAL) Outcome, Frequency of attendance, Clinical information, Semi-structured interviews) and Staff (Pre and Post focus groups and Surveys).

During the intervention phase of the study data on social engagement of residents was collected across three, eight week interventions. Intervention 1: Standard facility activity programs without Zora; Intervention 2: Standard facility activity programs with Zora incorporated; Intervention 3: Zora specific activity programs, created new for the project.

### Synopsis of findings

**Residents:** Social engagement was highest in intervention 3 when groups were created specifically for Zora. At facility two average resident attendance was higher for standard activity programs when Zora was not incorporated. Whilst at facility one attendance at standard activity programs with Zora incorporated was higher. Intervention 3 with Zora had the highest average attendance and steady attendance levels throughout the 8 week intervention.

Interviews with residents revealed they found Zora 'amazing' and developed feelings of 'company' and 'companionship'. Residents especially enjoyed songs and group singing with Zora and stated they were 'honoured to be with Alice'. Residents said that Zora will be beneficial in aged care and they would like her to be a part of the family. Residents had difficulty understanding Zora at times and suggested that she needed improvements in communication and timing.

**Staff:** Prior to the intervention phase of the study staff attitudes towards robots were varied. Following the project intervention, staff attitudes towards robots improved slightly and responses became less varied. There was a significant change in staff responses to 'humanoid robots can create new forms of interactions between humans and between humans and machines' ( $p=0.048$ ) following involvement in the study, suggesting staff had seen the potential for Zora to create new interactions. Post intervention, 67% of staff responding to the survey believed Zora would be beneficial to aged care.

In focus groups prior to the inclusion of Zora in facility activity programs staff revealed they had concerns for resident outcomes and questioned the use of a robot instead of human to human interaction. Staff also believed Zora may be more of a novelty for residents and agreed responses to Zora would be dependent on each individual. Staff also expressed a need for preparation time and training for staff to be able to utilise the new technology successfully.

Following the intervention staff participated in focus groups once more and expressed frustrations from a technical and timing perspective, regarding issues operating Zora and Zora's difficulty being understood and understanding residents. Staff also discussed the positive environment created from using Zora in activity programs and the observations they made of residents laughing and talking to each other about Zora.

### Key Findings

- Creating new activities that were run solely by Zora using staff expertise was more effective in increasing social engagement compared to including Zora in existing site activities
- Residents enjoyed interacting with Alice and developed connections previously not seen with other therapy tools
- Residents had difficulties understanding Zora at times, whilst Zora's challenging voice recognition and occasional technical failures also contributed to a difficult user experience
- Average attendance levels at activities run solely by Zora were consistently high, whilst average attendance levels at the majority of activities where Zora was incorporated into existing activities decreased
- With time and exposure to socialisation robots staff confidence and ability to utilise the technology increased
- The majority of staff believed Zora was beneficial to aged care following their involvement in the project and staff attitudes towards robots improved after being involved in the study
- Greater resources in terms of time, training and staff numbers need to be applied to ensure the potential smooth transitioning of robot technology (if required), into the workplace
- Humanoid robots as a different technology, have the potential to also increase engagement levels in clients with cognitive decline
- The socialisation robot is as effective as its user and is reliant on the creativity and ability of staff members operating the robot
- Improvements in the speech, reaction time and movements of the robot are required to ensure its usability for staff and residents in residential aged care
- IT support is critical to ensure technical issues are dealt with in a timely manner and staff are not burdened with issues outside of their expertise

### Conclusion

The use of a humanoid robot in an aged care setting, can influence social engagement amongst adults with functional and cognitive decline. The uses at this junction are narrow but provide a platform for further examination of activity where using a humanoid robot such as Zora, could further engage these adults on a social level. The type of activity that is successful in increasing social engagement appears to be one in which the robot has full control over the activity. There is also evidence to suggest that there could be other unexplored and existing activities that Zora could

become a part of whilst having a positive impact on the social engagement of those affected by cognitive decline. Staff experiences of working with and/or being exposed to a humanoid robot in the workplace were mixed. Staff reported increased work stress and job dissatisfaction, however staff attitudes towards robots became more positive throughout the project. Residents expressed a general positivity towards Zora, but offered concern (along with staff), regarding technical and basic voice recognition issues. Further work in the area of training, allocation of time and staffing levels would be advised.

A humanoid robot provided a different method of encouraging social engagement that may be a welcome change for some residents. This study describes another tool to help increase social engagement in adults with cognitive and functional decline in the Australian aged care workplace.

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## Acknowledgements

This project was funded by the National Health and Medical Research (NHMRC) Partnership Centre for dealing with cognitive and functional related decline in older people (CDPC). The CDPC received funding from the NHMRC and partner organisations including Alzheimer's Australia, Brightwater Care Group (WA), HammondCare (NSW) and Helping Hand Aged Care (SA) (<http://sydney.edu.au/medicine/cdpc/>).

The RM Harken Fund kindly donated a socialisation robot – a Zorabot named Alice, to enable this study to proceed. It is with many thanks that Brightwater Care Group and residents' acknowledge the RM Harken Funds' generous donation. Appreciation is also extended to the steering committee, core working group, participating facilities, staff and residents at Brightwater Care Group for their contribution to the growth and development of the project. We extend particular thanks to the staff and residents that worked closely with the Zorabot and facilitated the project within their workplace, homes and activity groups.

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# 1. Introduction

No longer the realm of science fiction, robotic aids designed for domestic duties and in support of the elderly, have been successfully implemented and tested in a number of countries worldwide (Robinson, MacDonald, & Broadbent, 2014). The impact of robots, such as Paro the companion seal, and Giraff the telepresence robot, on people with cognitive decline has been the subject of significant investigation within Australia (Moyle et al., 2013; Moyle et al., 2016).

The increased sophistication of robotic engineering and the corresponding counterintuitive ease of access to such robots have led to the development of the next generation of robotic support for people with cognitive decline and low social engagement levels. Although these robots can perform complex tasks they are becoming simple to program and more affordable.

Throughout the project and this report, the socialisation robot was and can be referred to as 'Zora', 'Zorabot', 'Alice' and also described in the third person as 'her'. Zora is a NAO robot, designed and developed in Japan by Softbank a company specialising in software solutions and robots. Initially programmed for use in schools and universities, ZORA has been adapted by Belgium company QBMT, for use in the hospitality, health and retail sectors. The robot used in this study was programmed by QBMT to fit the healthcare industry. The acronym Zora stands for Zorg – Health, Ouderen – Elderly person, Revalidatie – Rehabilitation and Animatie – Animation. Zora was specifically selected for this project because of its potential benefit as an interactive socialisation robot. Zora is humanoid in appearance, has a head, eyes, arms, hands, a torso, legs and feet etc. Zora is small (57.4cm tall) and 7kgs in weight, (an image of Zora attesting to her humanoid appearance can be found in the Appendix), capable of speaking many different languages and able to initiate conversations and respond verbally within conversations. Zora is also proficient in a wide variety of movements including walking, dancing, lying down and sitting up. Zora is controlled by a human at all times using a tablet and is unable to make any decisions on its own.

This project had two main objectives:

- The **primary** objective of this study was to investigate the impact of a socialisation robot on the social engagement of older adults with cognitive and functional decline living in a residential aged care facility in Australia compared to standard activity programs.
- The **secondary** objective of this study was to explore staff attitudes to the use of socialisation robot technology within the Australian residential aged care context through qualitative methods.

The project aligns to the following Cognitive Decline Partnership Centre (CDPC) objectives:

1. 'Undertake collaborative new research to improve health and health care using methods that are cross-sectoral, inter-disciplinary, and trans-national in scope'.

This study involves collaboration between residential aged care and the technology and innovation sector aimed to improve care provided to older adults with cognitive and related functional decline.

2. 'Build capacity within the research community to do applied research and within the system to use research as part of change management'.

Working directly with residents and the technology industry, researchers will be actively engaged in all elements of the study implementation and can monitor, document and manage change management processes for current and potential future implementations.

## 2. Method

### 2.1 Research Design

In order to evaluate the resident outcomes and staff attitudes of the Zorabot assistive technology in residential aged care, a mixed methods convergent parallel design utilising both qualitative and quantitative data collection methods was conducted. This included surveys, focus groups and semi-structured interviews. Dual perspectives from both residents and staff were gathered to help understand the impact of socialisation robots on older adults with cognitive decline, specifically with regard to social engagement.

Data was collected across an 11 month period, August 2016 to June 2017 from four Brightwater Care Group Facilities. An overview of the data collection tools utilised across the 11 month period is shown in Table 1, the collection sites and the timeframe of data collection are described below. Please refer to the Appendix for a copy of all data collection tools and consent forms. For the purposes of this report facilities one (1) and two (2) were the project intervention sites, facilities three (3) and four (4) formed the control group site. Due to small numbers the control group site was formed from facilities three (3) and four (4) and is referred as “facility three (3)” or the control group throughout the remainder of this report.

#### **Stage 1 – Development:**

- Develop training package for staff about how to use Zora
- Conduct pre staff survey and focus group
- Develop Zora’s participation in Intervention 2
- Train staff how to use Zora

#### **Stage 2 – Intervention:**

The intervention consisted of three stages outlined below. Concurrent to these interventions, therapy staff were trained how to use Zora. Throughout all interventions the frequency of resident attendance and social engagement of residents in each therapy group was captured weekly using the social interaction subsection of the PAL tool. A full PAL outcome was recorded at the beginning, middle and end of each intervention. The intervention stage of the project is shown graphically in Figure 1.

##### *Intervention 1: Standard Activity Program (SAP)*

- Conducted at facility 1, 2 and 3.
- Each of the 3 facilities conducted group therapy programs throughout the week, targeted at increasing resident social engagement and the treatment of specific disease states. These were run by the facility’s usual therapy staff. Programs in this intervention phase included:
  - Exercise
  - Reminiscence
  - Poetry
  - Bingo

- Golf
- Each program had 1 session per week at the respective conducting facility
- Residents took part in the nominated sessions as per their usual routines
- Each session ran for between 45 -60 mins
- This intervention ran for 8 weeks

*Intervention 2: Standard Activity Program (SAP) facilitated by Zora*

- Conducted at facilities 1 and 2
- 2 SAP sessions per week at each facility were conducted by Zora under control of the therapy staff
- The sessions were the same group therapy programs used in Intervention 1
- Each session was between 45 and 60 mins
- The total intervention time was 8 weeks
- During this period new activities were developed for intervention 3 in conjunction with residents, staff and the Dementia Consultant

*Intervention 3: A Zora-specific activity program facilitated by Zora*

- Conducted at facilities 1 and 2
- 1 session per week at each facility was conducted by Zora under control of therapy staff
- The sessions were completely unique to Zora and unrelated to the group therapy programs in Intervention 1 & 2. The programs ran in intervention 3 were:
  - Singing Group
  - Games Hour
- Each session was between 45 and 60 mins
- The total intervention time was 8 weeks
- Additional actions included:
  - Conducting resident interviews at the end of the time period
  - Collecting resident data at the end of the time period
  - Conducting Staff focus groups
  - Conducting Staff surveys

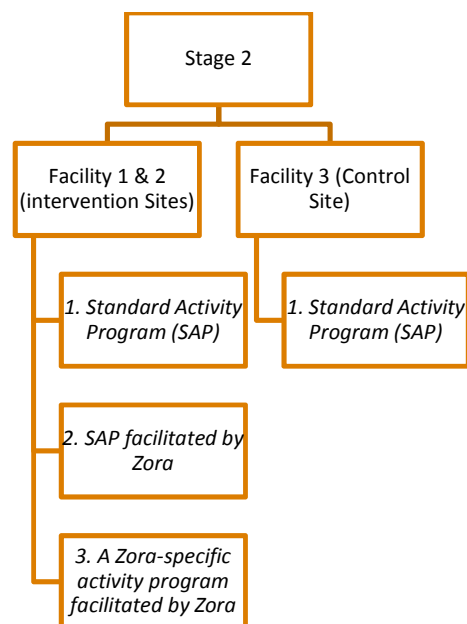


FIGURE 1. STAGE 2 – INTERVENTION.

### Stage 3 – Dissemination and Report Writing:

- Completion of all data collection
- Completion of the final analysis and related report writing
- Seeking of opportunities to disseminate findings across the aged care sector

### Evaluation Tools

Data was collected from residents and staff using a number of different tools outlined in Table 1. Each tool is described in the section following.

TABLE 1. DATA COLLECTION TOOLS USED FOR RESIDENTS AND STAFF

Data Collection Tool	Residents	Staff
Pool Activity Level (PAL) Outcome		
Frequency of attendance		
Clinical information		
Semi-structured interviews		
Pre focus groups		
Pre Survey		
Post focus groups		
Post Survey		

## 2.2 Resident Participants and Data Collection

Residents living at four residential age care facilities in Perth, Western Australia were included in this project. Exclusion criteria for this group were residents who were unable to participate in group activities. The Brightwater residential aged care facilities used for this study were Redcliffe, Madeley, Huntingdale and South Lake. The combined resident population of these sites was 225. Seventy eight residents with cognitive decline were involved in the study across the four facilities.

Data was collected throughout each intervention, in both the intervention and control groups. Additional data was collected at the conclusion of the intervention stage of the project and included clinical information and interviews.

### 2.2.1 Pool Activity Level Outcome

The 'Pool Activity Level Outcome' (PAL) tool was developed in 2013 ([www.dementia-pal.com](http://www.dementia-pal.com)) as an observational quantitative tool widely used in the aged care sector for measuring activity levels of older adults with cognitive decline during an activity. The PAL was used to gain information on residents' level of engagement and participation within the groups. The PAL has four domains;

- Cognitive abilities
- Physical abilities
- Social interaction
- Emotional wellbeing

Social interaction was recorded for each resident at every activity group, while every domain (activity data), was collected at the beginning, middle and end of each intervention (weeks 1, 4 and 8). The Project Officer and Brightwater Dementia Consultant provided training to project staff. Pilot groups were conducted to test for internal validity and reliability helping to ensure all project staff were able to use the PAL to the same standards. To further ensure reliability and objectivity of PAL use, the same staff members completed the tool each week .

### 2.2.2 Frequency of Attendance

The number of residents attending each therapy program was collected to help determine if residents were more or less likely to attend activity programs if Zora was present.

### 2.2.3 Clinical Information

Clinical information was collected from residents to gather a more in depth understanding of the cohort being studied. This included diagnosis of dementia/cognitive decline, other relevant diagnoses, age, gender, and number of medications. The Cornell Scale for Depression (Alexopoulos, Abrams, Young, & Shamoian, 1988) was also utilised to help gather clinical information on participating residents.

#### 2.2.4 Semi-Structured Interviews

Residents were invited to participate in individual interviews. Resident perspectives on their involvement in the Zorabot wellbeing programs, the personal impact of the program on themselves and other residents as well as suggestions and areas for improvement were gathered.

### 2.3 Staff Participants and Data Collection

Focus groups and surveys were conducted with staff at the commencement and conclusion of the study to explore staff attitudes towards the use of socialisation robot technology within the Australian residential aged care context.

The Brightwater residential aged care facilities used for this study were Redcliffe, Madeley, Huntingdale and South Lake. The combined staff population of these sites is 317. Seventeen staff members were directly involved in the study across the four facilities. Staff were recruited to participate by the Project Officer.

#### 2.3.1 Surveys

Staff were invited to complete a pre and post project survey to develop an understanding of their attitudes towards the use of a humanoid socialisation robot within residential aged care facilities. The survey provided the opportunity for staff members to give feedback about their attitudes and identify areas of attitude change across the timeline of the project.

The survey consisted of the 30 item Frankenstein Syndrome Questionnaire (FSQ) T. T. Nomura, Syrdal, and Dautenhahn (2015) and the 14 item Negative Attitudes towards Robots Scale (NARS) T. Nomura, Suzuki, Kanda, and Kato (2006) (included in Appendix). Additional survey questions gathered demographic information such as gender, age and occupation. Staff were also asked if they thought Zora would be beneficial to aged care and if they thought Zora would positively affect their job satisfaction.

#### 2.3.2 Focus Groups

To gather a more in-depth understanding of the staff experience of the Zorabot technology and the effects on residents, staff participated in semi structured focus groups at the commencement and conclusion of the study. Focus groups explored staff attitudes towards the use of socialisation robot technology within the Australian residential aged care context. This provided an opportunity to raise any concerns and suggestions for improvements and to be involved in the development of the program. The focus groups were semi-structured and conducted onsite by the Project Officer.

#### 2.3.3 Core working group

To ensure Alice the Zorabot was utilised to her full potential for Brightwater residents a core working group was constructed. The core working group was made up of staff directly involved in assisting with the implementation of the wellbeing groups, PAL data collection and manual construction. Members of this group included Madeley, Redcliffe, South Lakes and Huntingdale facility staff, a Madeley resident as well as the Zorabot Project officer, consumer representative, volunteer and Educational Program Developer/Document Assistant.



The group met for a 90 minute period to discuss what worked well in the first eight week block of using Alice to co-facilitate activity programs and what didn't work well. This group met again after the second block of using Alice to discuss this further and fine tune the groups' ideas. Following these meetings the group used their different perspectives to brainstorm ideas on how to utilise Alice best when running the Alice specific resident therapy programs. These ideas and examples were constructed into a user manual on the use of Alice and how to best use her as a therapy tool to increase social engagement for our residents.

Manual is available on Brightwaters Intranet for staff and the main webpage for other aged care providers to access.

<https://www.brightwatergroup.com/research/research-publications-and-papers/>

## 2.4 Data Analysis

### 2.4.1 Quantitative Analysis

Data analysis was conducted using SPSS version 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to summarise the quantitative data. Non-parametric statistical analysis was conducted as appropriate to explore differences pre- and post- and between interventions.

### 2.4.2 Qualitative Analysis

The semi-structured interviews and focus groups were conducted by the Project Officer. All focus groups and interviews were conducted on site, audio recorded and transcribed verbatim. Transcriptions were checked for errors against the tape versions to ensure accurate and authentic reproduction and de-identified to ensure confidentiality. Thematic analysis was undertaken for all qualitative data. Each transcript was reviewed several times to acquire a sense of flow and to generate a list of key ideas by two researchers independently. Key ideas were brought together and preliminary categories developed with the assistance of the software package NVivo 10 (QSR International Pty, Ltd, Melbourne, Vic. Australia). Categories and codes were reviewed by the researchers for relevance and from this meaningful themes were developed.

## 2.5 Ethics

All participants were provided with an information sheet outlining the project and were invited to participate in the study. All involvement was voluntary and participants could choose to withdraw from the study at any time. Any personal information was only available to the researchers, and all identifying information was removed from the surveys, interviews and focus groups.

Human Research Ethics committee approval was obtained from The University of Western Australia (RA/4/1/8600).

### 3. Results

Results are presented in two separate sections, residents and staff. Additionally the staff section presents results relating to the impacts of the project on residents as well as staff attitudes towards robots.

#### 3.1 Residents

Across the intervention stage of the project 78 residents were involved in therapy programs with Zora. Intervention number, therapy program and the number of attendances for that program are detailed in Table 2.

TABLE 2. NUMBER OF RESIDENTS ATTENDING EACH THERAPY PROGRAM THROUGHOUT THE INTERVENTION STAGE

Intervention	Therapy Program	Number of Residents that attended at least once
Intervention 1	Exercise	18
	Poetry	16
	Bingo	17
	Happy Hour	15
	Bingo (control)	12
	Golf (control)	11
Intervention 2	Exercise	17
	Poetry	15
	Bingo	17
	Happy Hour	16
Intervention 3	Singing Group	18
	Games Hour	14

##### 3.1.1 Pool Activity Level Outcome (PAL)

For every therapy group, residents had their social engagement levels recorded using the PAL measure, already described. At weeks 1, 4 and 8 the full PAL was recorded. On all other weeks only the social interaction sub group of the PAL was recorded, hence the results for weeks 1, 4 and 8 are displayed separately.

The results below also display the difference in average social engagement levels each of the eight weeks, for each therapy group, those with Zora and without Zora as well as groups exclusively run by Zora.

**Intervention Facilities**

All therapy group PAL scores for weeks 1, 4 and 8 recorded across both facilities are displayed in Figure 2. When comparing intervention one to intervention two, the Poetry therapy group displayed the biggest difference in average total PAL scores. When Zora was included an average score of 37.5 was recorded compared to an average score of 32.6, when Zora was not part of the Poetry group. The therapy group with the highest engagement levels were observed in the Bingo without Zora group at 39.9. The Exercise group with Zora recorded the lowest average total PAL score of 32.4. Engagement levels of residents involved in the Bingo with Zora group steadily rose throughout the intervention from 34.5 to 39.6 almost in linear form.

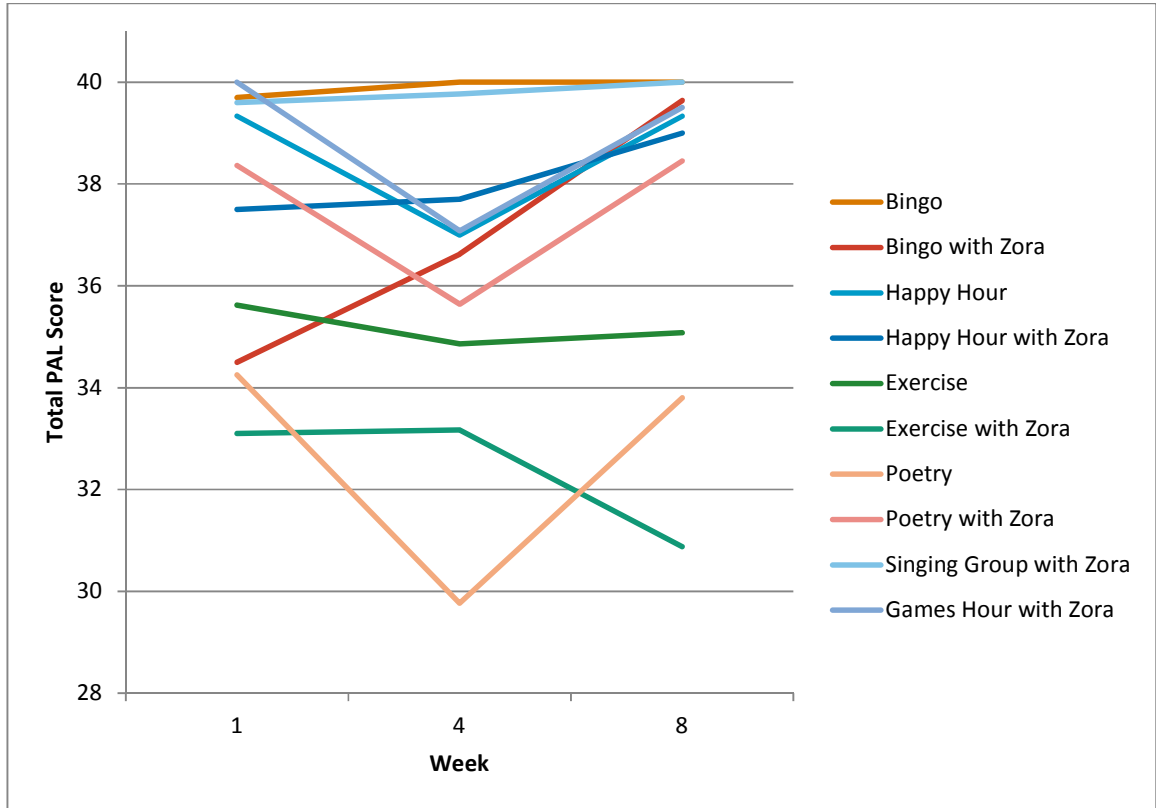


FIGURE 2. TOTAL PAL SCORES FROM WEEKS 1, 4 & 8 OF EACH INTERVENTION.

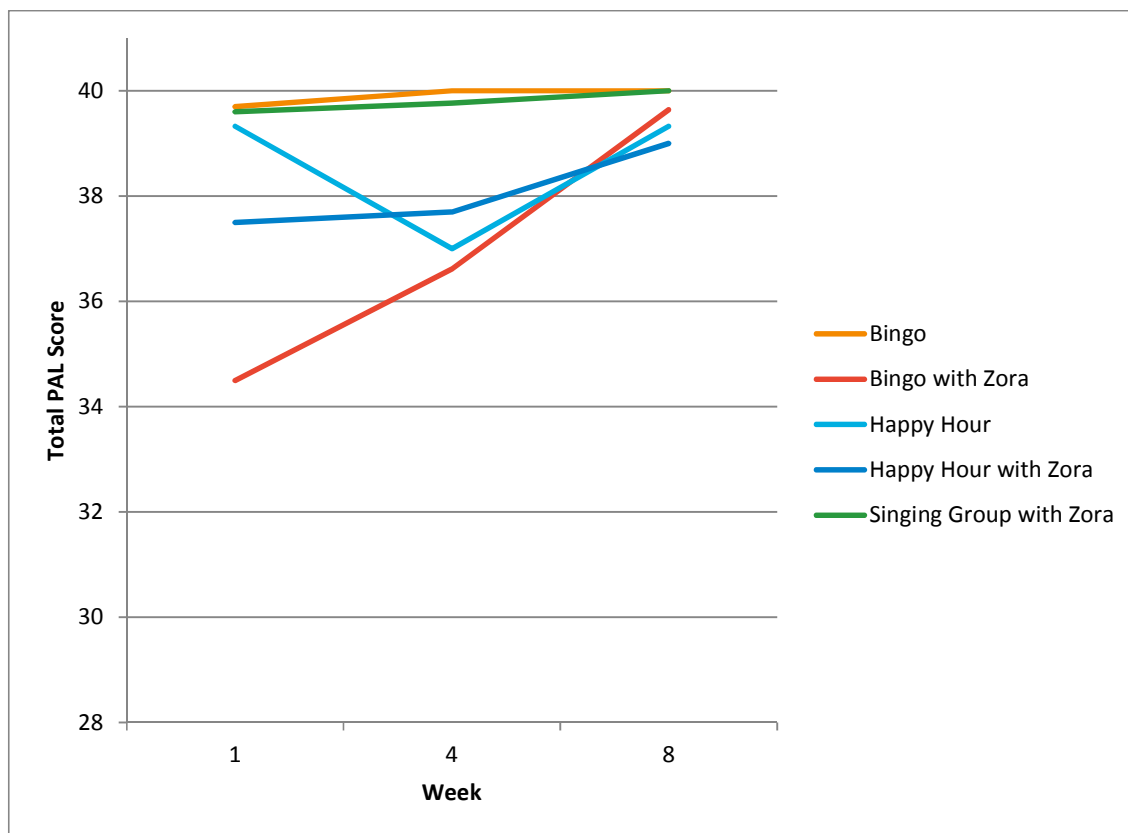


FIGURE 3. TOTAL PAL SCORES FROM WEEKS 1, 4 & 8 OF ALL INTERVENTION GROUPS AT FACILITY 1.

The total average of social interaction at facility one (Figure 4), noted an average score decrease when Zora was introduced into an existing activity. Average social interaction at Bingo therapy group decreased from 7.8 to 7.4 and within the Happy Hour Group the average social interaction score started at 7.8 and declined to 7.23. The range of measured social interaction in the Singing with Zora Group was between 7.1 and 8, whilst across all therapy group the average social interaction PAL score ranged from 6.5 to 8.

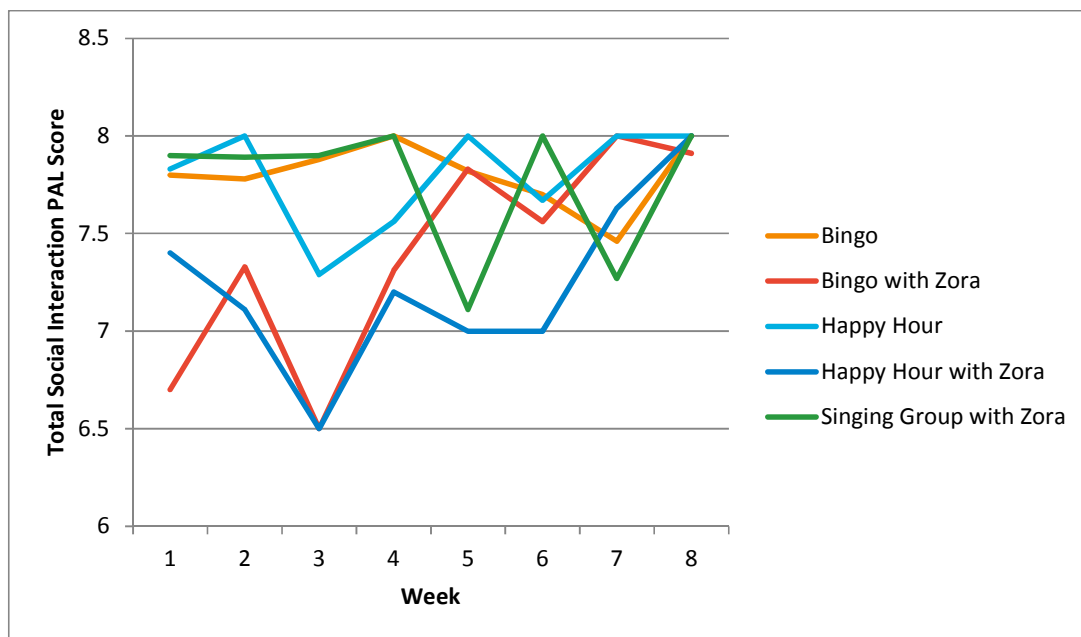


FIGURE 4. TOTAL SOCIAL INTERACTION SUBSCALE PAL SCORES OF ALL INTERVENTION GROUPS AT FACILITY 1.

Total PAL scores for facility two are shown in Figure 5. Poetry with Zora (37.5) and the Games Hour created for and ran by Zora (38.9) had the highest levels of average PAL scores of residents at facility two. The lowest average total PAL scores were found in the Exercise group with Zora (32.4) and the Poetry group without Zora (32.6). Scores ranged from a low of 30.9 (Exercise without Zora) to high of 40 (Games hour with Zora).

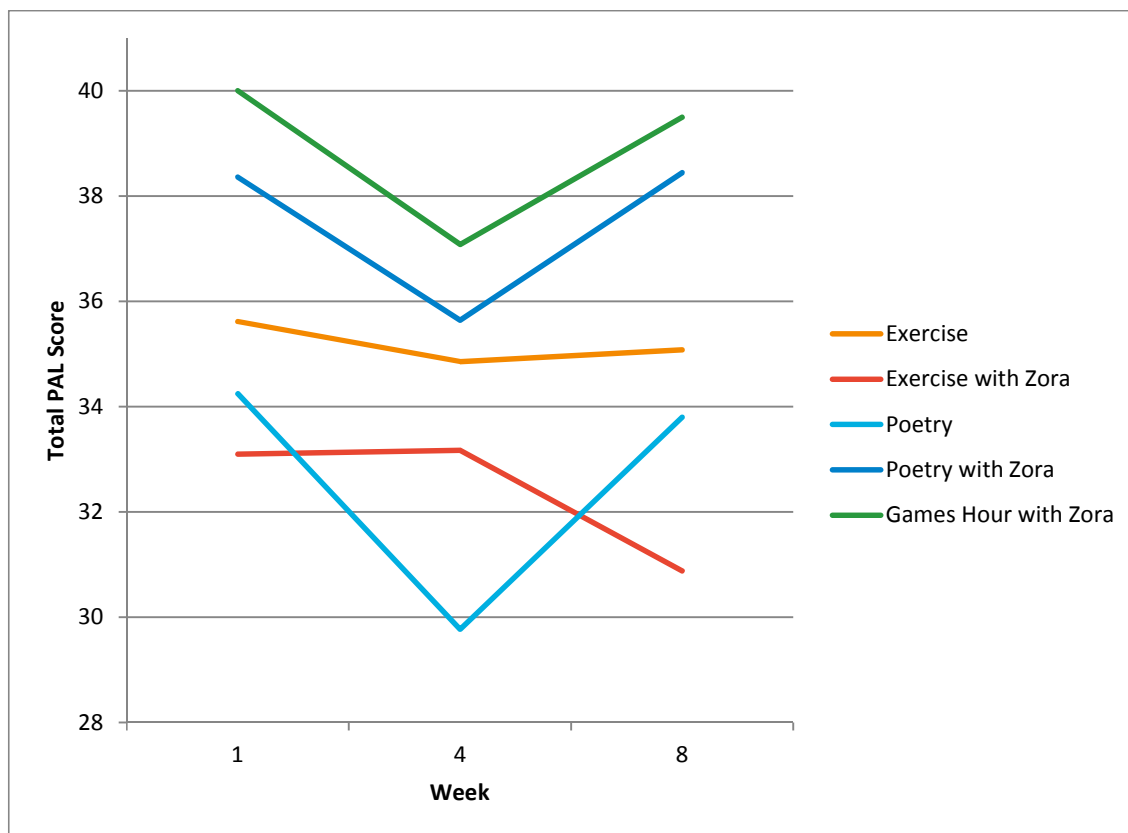


FIGURE 5. TOTAL PAL SCORES FROM WEEKS 1, 4 & 8 OF ALL INTERVENTION GROUPS AT FACILITY 2.

Figure 6 reveals that residents generally experienced lower levels of social engagement in Exercise groups with Zora (6.7) than when Zora was not present (7.1) at the Exercise group. Conversely, residents experienced higher levels of social engagement when participating in Poetry sessions with Zora (7.9) compared to when participating in Poetry group without Zora (6.8). Figure 6 demonstrates that there was no change in the average level of social engagement by residents when participating in the Zora specific Games Hour, rather a consistent score of 8 was recorded. Residents participating in the Games hour group at facility two had the highest average Social Interaction scores for the whole project.

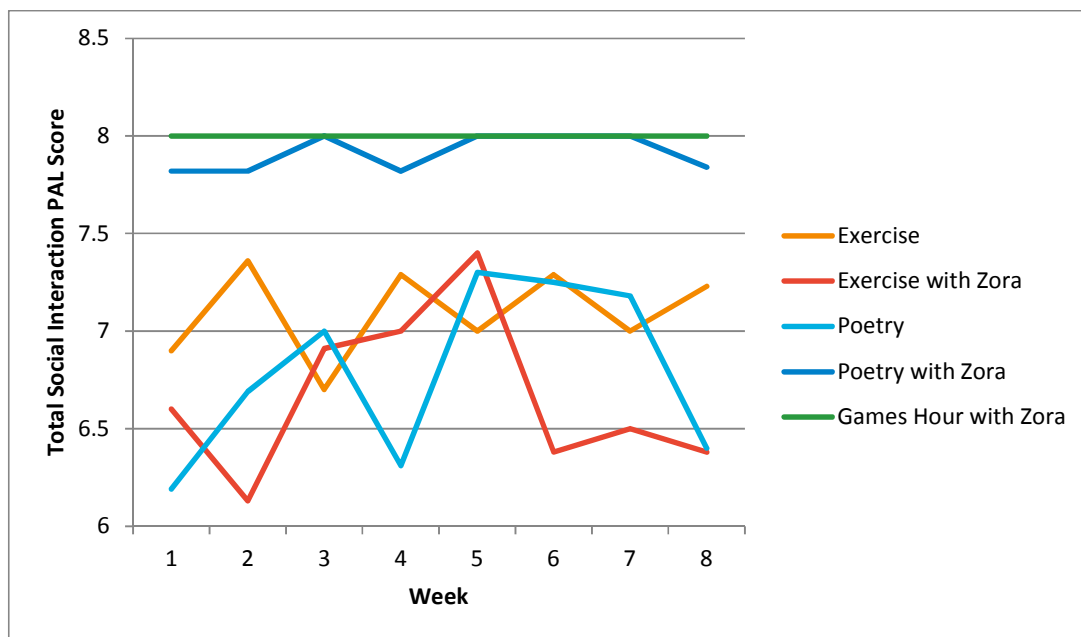


FIGURE 6. TOTAL SOCIAL INTERACTION SUBSCALE PAL SCORES OF ALL INTERVENTION GROUPS AT FACILITY 2.

### Control Facilities

The average total social interaction PAL score at the control facilities demonstrates the small variation between both the Golf and Bingo activities. Social interaction between residents was close to being the same with Golf recording an average score of 7.9 and Bingo recording a social interaction score of 7.6. Figure represents intervention one scores on the subscale of Total Social Interaction for the control facilities.

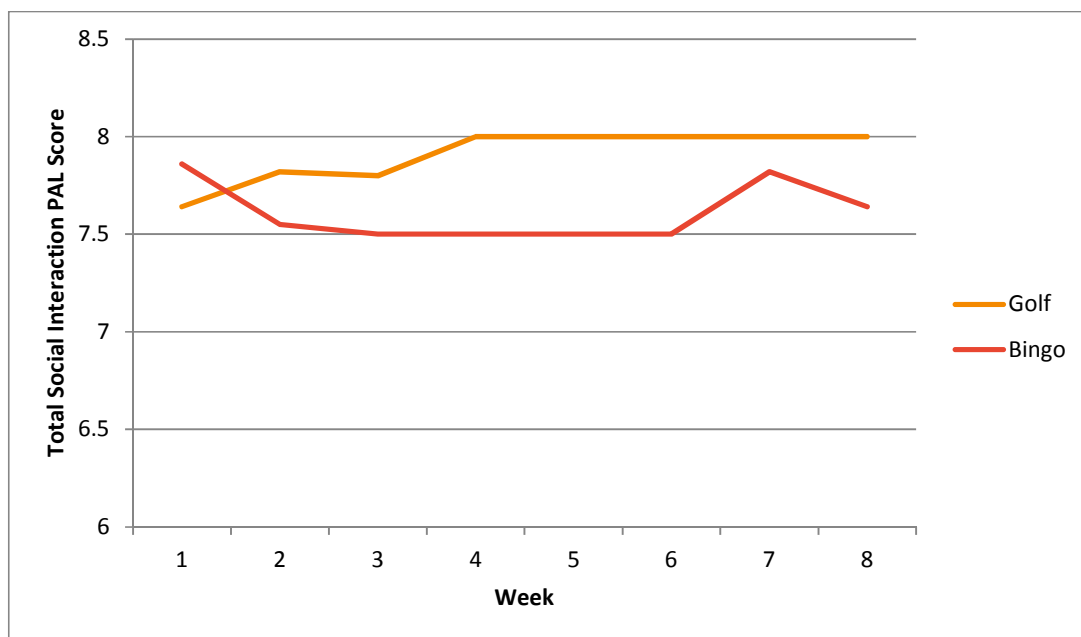


FIGURE 7. TOTAL SOCIAL INTERACTION SUBSCALE PAL SCORES FOR THE CONTROL FACILITIES (INTERVENTION 1 ONLY).



Figure 8 shows the total average PAL Scores from weeks one, four and eight. Slight variations in these average scores are evident for the control facilities. The overall average PAL scores for each activity at the control facilities were Golf 38.4 and Bingo 38.6. Both the Golf activity (36.55) and Bingo activity (38.2) observations were at lower levels in week 4 than in either weeks one (Golf 39.4, Bingo 38.7) or eight (Golf 39.4, Bingo 38.9).

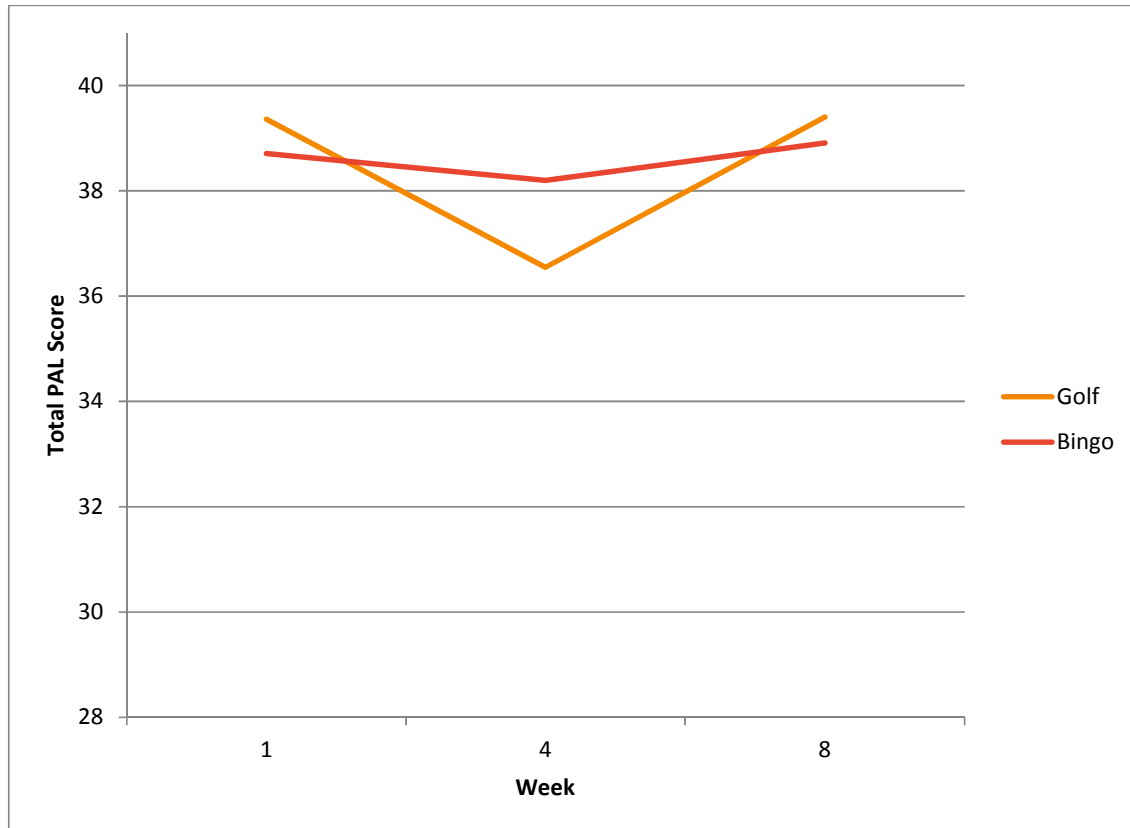


FIGURE 8. TOTAL PAL SCORES FROM WEEKS 1, 4 & 8 FOR THE CONTROL FACILITIES (INTERVENTION 1 ONLY).

### 3.1.2 Frequency of Attendance

The numbers of residents attending each therapy group were recorded throughout each project intervention.

#### **Facility 1**

Facility 1 conducted Bingo and Happy Hour (reminiscence) groups in intervention 1. Bingo and Happy Hour with Zora were also incorporated within intervention 2. Additionally a Singing group was created for intervention 3 and ran solely by Zora. The Singing group created specifically for Zora had steady group attendance levels and the highest average attendance of 10.8. Average attendance levels in both therapy groups with Zora present (Bingo – 10.4 and Happy Hour – 9.1), were higher, than when Zora was not present at these therapy groups (Bingo – 9.9 and Happy Hour 7.4). The attendance levels for each week at the different groups are displayed in Figure 9.

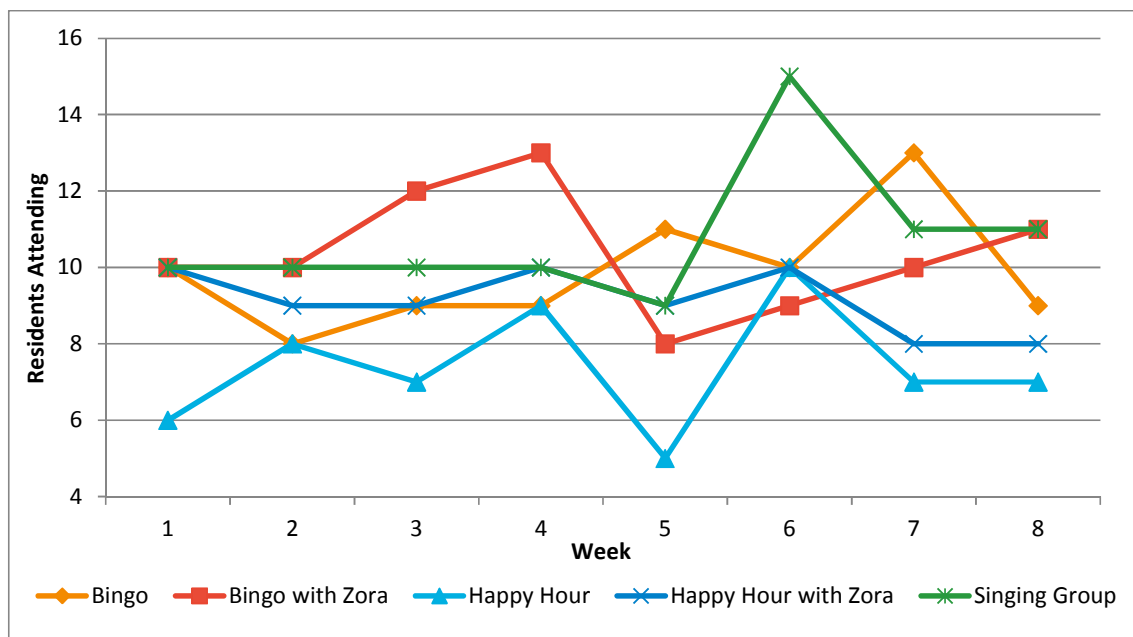


FIGURE 9. WEEKLY ATTENDANCE NUMBERS AT THERAPY GROUPS THROUGHOUT EACH INTERVENTION AT FACILITY 1.

### Facility 2

Facility 2 conducted Exercise and Poetry groups during intervention one, with Exercise and Poetry groups with Zora incorporated in intervention 2. A Zora specific 'Games Hour' group was created for intervention 3. Average resident attendance at both the Exercise (13.5) and Poetry (12.6) groups was higher without Zora compared to incorporating Zora in these groups (Exercise 10.8 and Poetry 11.6). The average attendance to the Zora specific Games Hour (9.5) was lower on average compared to all the other therapy groups. The level of attendance for each intervention can be seen in Figure 10.

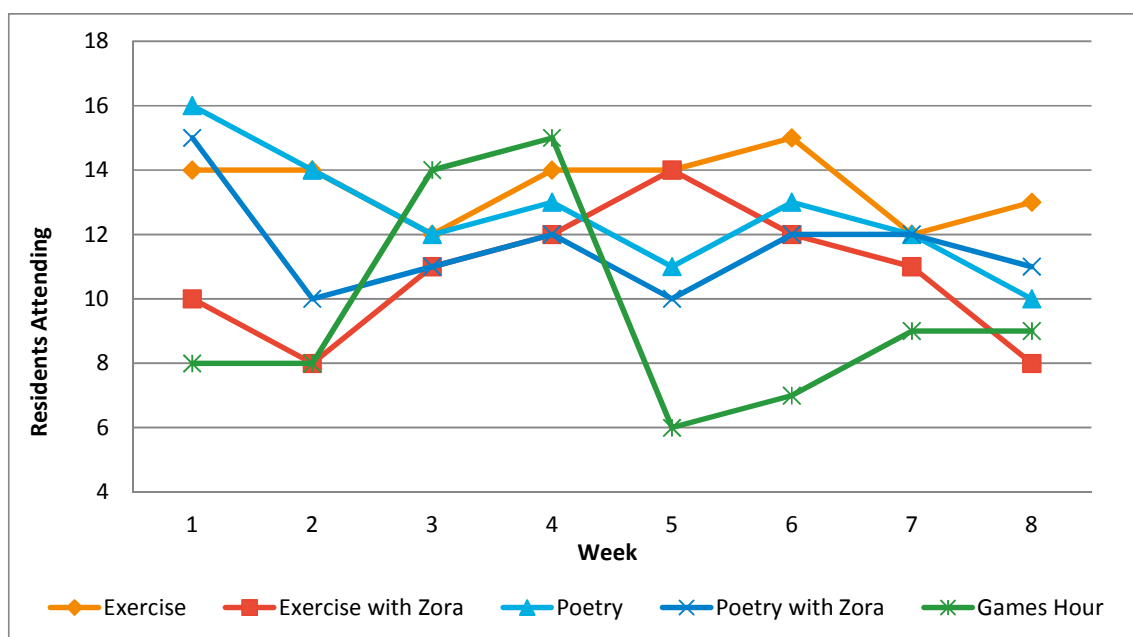


FIGURE 10. WEEKLY ATTENDANCE NUMBERS AT THERAPY GROUPS THROUGHOUT EACH INTERVENTION AT FACILITY 2.

### Control Facilities

Records of attendance at therapy groups from control sites show that fluctuation in numbers from week to week is common, ranging from 8 to 11 participants for Golf and 7 to 12 participants for Bingo. Although there is variation between the groups on a weekly basis the average difference are small between Golf (Average of 10) and Bingo (Average of 9.8) therapy groups (see Figure 11).

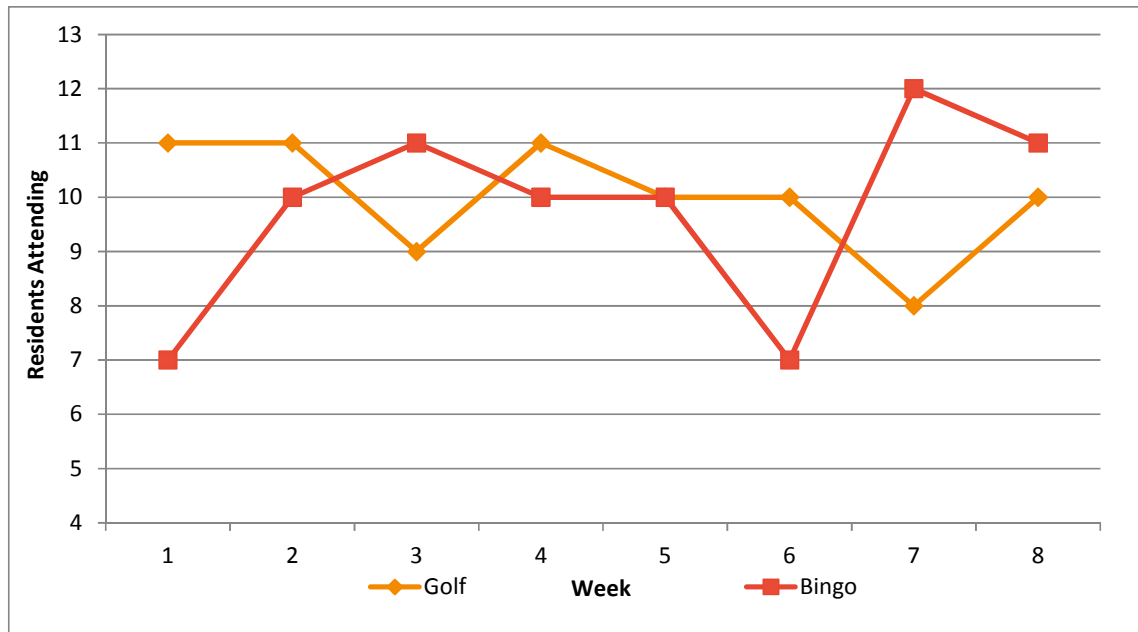


FIGURE 11. WEEKLY RESIDENT ATTENDANCE AT GOLF AND BINGO AT THE CONTROL FACILITIES.

### 3.1.3 Clinical Information

Table 3 presents a range of demographic data collected for residents at the intervention sites and residents at the control sites. Similar age and gender distribution was seen across all facilities. A higher proportion of residents participating at the control sites had a diagnosis of cognitive impairment compared to those at the intervention sites.

During interventions two and three 69 residents consented to have their demographic and clinical information collected. Seventy one percent of these respondents were female with 68% of the total number participating residents having a diagnosis of cognitive impairment. The average age of residents involved in the intervention part project was 81 with a range from 53 to 96.

TABLE 3. RESIDENT DEMOGRAPHICS AT INTERVENTION AND CONTROL FACILITIES

	Intervention (n=48)	Control (n=21)
<b>Diagnosis of Cognitive Impairment</b>	62%	81%
<b>Gender</b>	71% Female	67% Female
<b>Age</b>	Mean: 81 years old Range 53 to 96	Mean: 80 years old Range 57 to 97
<b>Number of Regular Medications</b>	Mean: 11	Mean: 7

Residents participating in the intervention group had their signs and symptoms of major depression assessed once using the Cornell Scale for Depression (Alexopoulos, Abrams, Young, & Shamoian, 1988). Residents had an average Cornell score of 10.3, indicating 'probable major depression'. An average of 48% of residents had an absence of depression followed closely by an average of 46% of residents who had 'probable major depression'. Only 6% of residents displayed symptoms of 'definite major depression' according to the Cornell Scale for Depression (see Figure 12).

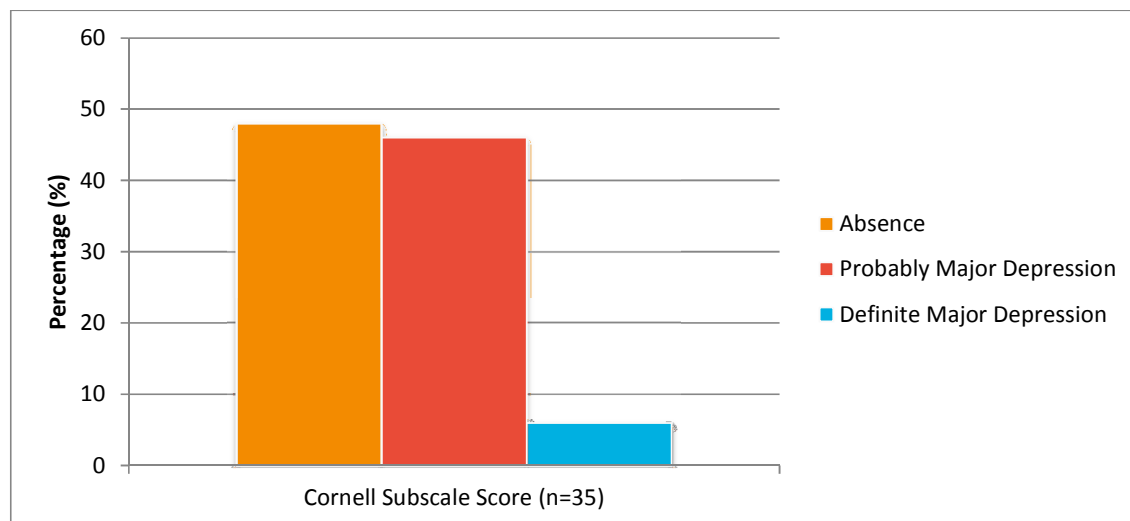


FIGURE 12. RESIDENT CORNELL SUBSCALE SCORES FOR DEPRESSION (N=35), INTERVENTION PARTICIPANTS ONLY.

### 3.1.4 Semi-Structured Interviews

To further the understanding of resident attitudes toward socialisation robots, intervention group residents at two Brightwater residential aged care sites were invited to participate in focus groups post project implementation. Interviews were held at the two residential sites with the time totalling 1 hour and 18 minutes for all interviews. Eleven (n=11) residents were asked 8 semi-structured questions designed to elicit information on the use of Zora, covering their observations, interactions,

perceptions, thoughts, and any feedback they had gained from their personal experience and activities with a socialisation robot in the facility.

Analysis of these interviews and responses by residents indicate a high level of positive reflection on, and use of the socialisation robot Zora in activities provided for and utilised by residents at these aged care sites run by Brightwater. Residents were able to adapt easily to having a robot as part of their activities. This has produced many positive outcomes including making residents feel excited, providing companionship and fun times, as well as having another family or group member to relate to. Many residents applied human like characteristics to Zora as a method of making Zora human. This is also as a sign of the socialisation and companionship provided by Zora, with the addition of Zora becoming very personable and endearing to those interacting with Zora. This occurred even though the application of Zora had some technical issues such as slow reaction times, hardware/software issues where Zora turned off and residents having trouble understanding Zora's voice. These results indicate the overall positive effect on residents and the associated activity programs

### ***Resident Outcomes***

Some residents initially thought Zora was a novelty and very different to what they had previously experienced and were often amused by her presence or activities. Residents also indicated the need for Zora to have a variety of activity and speech in the groups to maintain a level of interest for participants. Many found Zora "amazing" and were very impressed by her ability to run classes, greet them individually by name and thought she was intelligent.

Zora was used in several residential activities including quizzes, games, bingo, exercise classes, poetry and dancing. The interviews suggest that most residents enjoyed her classes, especially the individual songs and group singing. These activities with Zora led participants to feel good and resulted in a closeness of person and feeling of "company". These feelings of closeness and company were noted by four of the interviewees, whilst other residents noted a feeling of companionship when interacting with Zora. It was observed that people really enjoyed themselves as a result of engaging in activities with Zora.

Residents had issues hearing, understanding and interpreting Zora's voice. They have indicated that Zora needs software or hardware upgrades so that there are smoother speaking speeds, and also to reduce the long reaction times so that pauses and gaps are no longer evident. Another problem noted was that sometimes Zora would speak too fast making Zora hard to understand. A common observation was that Zora has a strong accent which also makes Zora hard to understand, additionally making instructions unclear and difficult to interpret.

Residents reported that they were "honoured to be with Alice" (Zora's secondary name), enjoyed having her around, were amazed at her ability to turn herself off and with her ability to find another group if people did not want her around. They thought Zora was "wise" and something to definitely look forward to. The interviews overwhelmingly indicate that residents think that Zora would produce positive outcomes for other residents, but with the caveat that Zora was working properly and staff were fully trained in the use of Zora.

That residents likened Zora to a person and attached very human like traits and characteristics to Zora, shows a very high level of connectedness and potential socialisation in this setting. The endearing and very personable attributes residents attached to Zora are borne out by observations that residents felt

they could relate to Zora, found Zora absorbing and described her as “getting you in”. It was also observed that they enjoyed speaking with her and seeing her whilst admiring her stubbornness (another human trait), talking about her ability to tell the residents what “she thought” and “that you knew where you stood with her”. This may indicate that the staff controlling Zora might feel another degree of freedom when using Zora as an outlet for their own personalities. Residents also feel comfortable with and accepting of Zora and her ways including her “sulking” and when “she was having a bad day”.

Residents indicated that they felt better about themselves and were very happy with most interactive aspects of Zora including her ability to greet them and found her fun to be around. Residents overall enjoyment was rated highly as a result of actively engaging with Zora. With regard to potential changes for Zora approximately half of the residents being interviewed recommended changes including but not limited to suggesting a dedicated environment/chair for Zora to operate from, the need to make Zora more inclusive and having better articulation with her hands. Comments also centred on Zora being able to be confused and therefore confuse others, needing a variety of activity programs to prevent boredom in users, more training for staff and instructors, and more software updates so that a greater variety of activity can be achieved. Some indicated that Zora was “lovely just as she is”.

Specific downsides (verbalised by residents), to Zora were the slow reaction times, software and hardware issues (Zora could turn herself off and would not talk as an example), and an increased staff effort being disproportionate compared to the outcomes for residents. This caused staff to focus on Zora and not on residents when things did not go to plan. Another area of concern is that when Zora did not work properly this created a negative view of Zora amongst residents. One resident indicated that they felt as though Zora could talk, at times to residents as if they were children and not adults. Zora’s behaviour was at times also noted as being childish.

When asked if Zora would be a good permanent addition, ten out of the eleven interviewees indicated that it would be beneficial and they would prefer Zora to be there and that she becomes part of the family. Other comments were that Zora added something special and that she could help people to learn. Some residents referred to staffing issues as having an impact on Zora’s efficacy with the perceived lack of time and Zora not being autonomous as being a threat to the ability of Zora to be a socialisation agent.

Other potential uses for Zora presented by residents include happy hour, with the choir, for residents who are incapacitated or bed ridden and one on one interaction. Residents suggested that Zora be programmed to ask “layers” of questions and different questions in order that Zora be able to make “real” conversations. An additional suggestion was that the requirements of residents be matched to what Zora is capable of doing (or the reverse of this), so that better socialisation outcomes can be achieved.

### ***Summary***

Residents were able to participate with and become involved with a variety of activities that used Zora, both as the main activity coordinator and or as an adjunct to the activity. As a result of this participation residents were able to overcome their initial hesitation, but more often build upon their interest and attribute human like qualities to Zora. Residents had mainly positive comments thoughts and interactions, with only a few negative observations and comment. The main negative issue that residents had with Zora involved her voice and not being able to understand instruction from Zora and

Zora not being able to hear responses correctly. Other issues included a lack of variety in some activities and also the stop/start nature and technical issues associated with using Zora to run or help run activities.

Overall the reaction from residents was very positive with nearly all interviewees recommending Zora for other people in their situation. Residents perceive Zora to be in part “human” and their responses and anecdotes bear this out. This is also an indication of the fondness and high levels of relatedness and socialisation that Zora created during this project. For the residents this has been a largely positive experience where residents with cognitive decline or dementia are able to choose their level of interaction with a socialisation robot. Residents indicated that further consideration be given to appropriate training, staffing levels and available staff time as well as the resolving of various technical issues such as Zora’s voice, are areas that need attention if Zora is to become a permanent resource.



## 3.2 Staff

Staff working at the residential aged care facilities, both those that worked directly with Zora and those performing various occupational roles were invited to participate in a survey and focus group (pre- and post- intervention). The goal was to evaluate staff attitudes towards robots and gather further information on the perceived effects of Zora on residents.

### 3.2.1 Survey

To gain an understanding of staff attitudes toward socialisation robots, staff at facilities one, two and three completed a survey before and after the implementation of Zora the socialisation robot. Two different surveys examined staff attitudes towards robots, the 'Frankenstein Syndrome Questionnaire' (FSQ) and the 'Negative Attitude towards Robots Scale' (NARS). In addition to basic demographics (age and occupational description), further questions relating to the use of Zora in the workplace and the effect of Zora on job satisfaction were also asked of staff.

In total 52 surveys were completed pre implementation, a 22% response rate. This response rate decreased post implementation to 36 surveys (11%). In both pre and post surveys the majority of respondents were female (90%). Pre survey, the average age of respondents was 47 years old (ranging from 20 to 71) and post survey the average age of respondents was 50 years old (ranging from 27 to 67). Care workers made up the majority of respondents for both pre and post surveys. A variety of staff responded to the pre and post survey. Respondents' occupations are displayed in Figure 13 and 14.

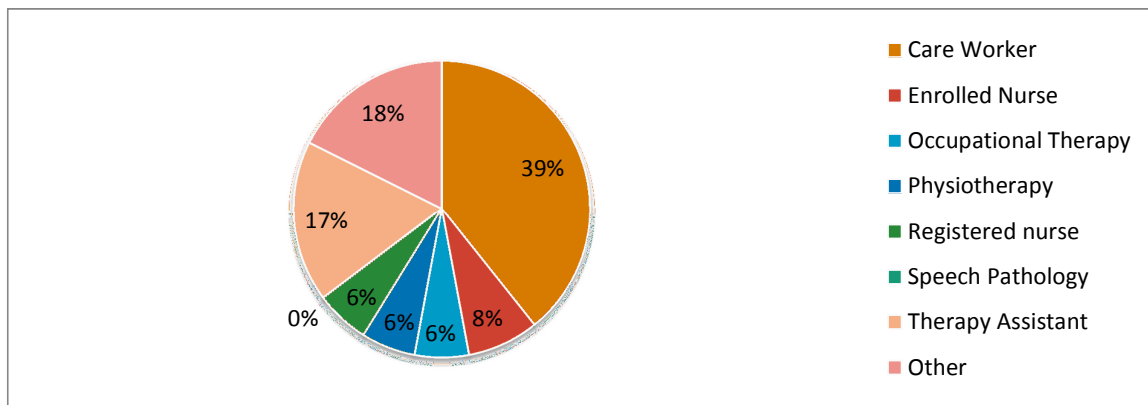


FIGURE 13. OCCUPATION OF STAFF COMPLETING THE PRE-IMPLEMENTATION SURVEY (N=51).

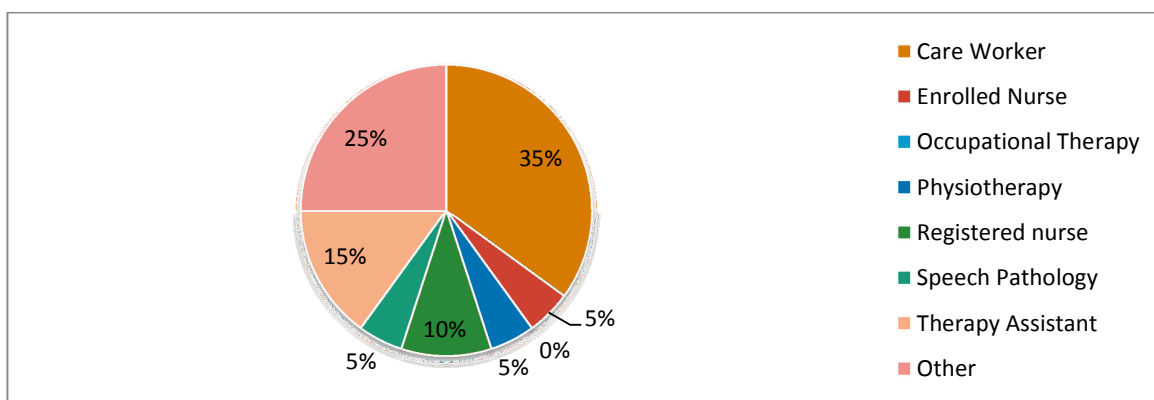


FIGURE 14. OCCUPATION OF STAFF COMPLETING THE POST-IMPLEMENTATION SURVEY (N=20).

Overall pre-survey responses to both the FSQ and NARS displayed great variation in staff attitudes towards robots. Following the use of Zora the socialisation robot in the surveyed facilities, staff responses became less varied and attitudes towards robots appear to improve slightly. Pre and post-survey responses were tested for significant differences using Mann-Whitney independent samples t-tests.

### ***Frankenstein Syndrome Questionnaire (FSQ)***

There was a significant change in staff responses to 'Humanoid robots can create new forms of interactions both between humans and between humans and machines' (see Figure 15) from pre to post intervention ( $p=0.048$ ). All responses to this statement on the post survey were positive.

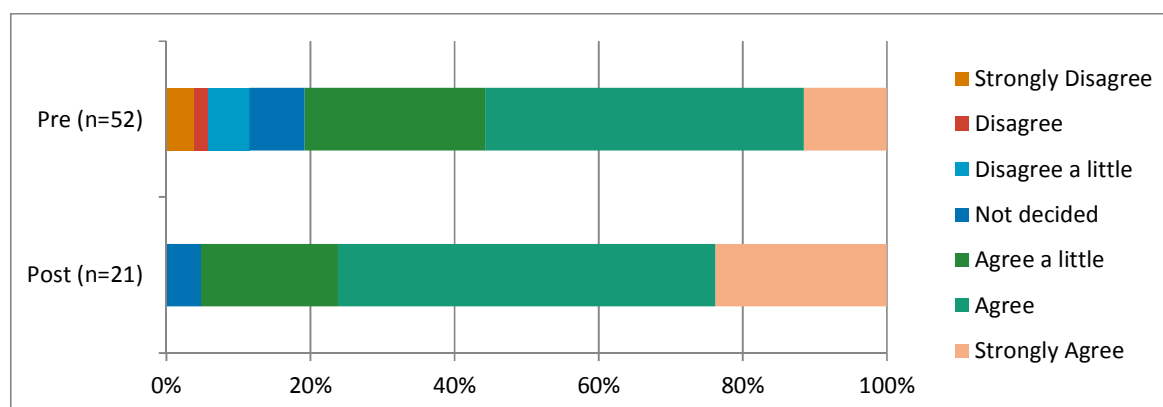


FIGURE 15. STAFF RESPONSES TO 'HUMANOID ROBOTS CAN CREATE NEW FORMS OF INTERACTIONS BOTH BETWEEN HUMANS AND BETWEEN HUMANS AND MACHINES' ( $p=0.048$ ).

Staff responses to 'persons and organisations related to development of humanoid robots are well-meaning' changed significantly ( $p=0.047$ , see Figure 16) with a stronger 'agree' and 'strongly agree' response (81%) in post surveys than pre (56%).

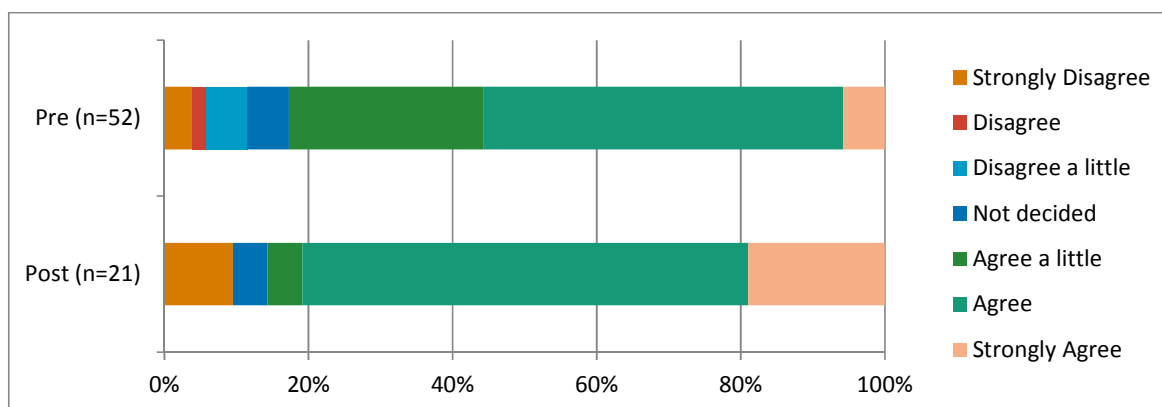


FIGURE 16. STAFF RESPONSES TO 'PERSONS AND ORGANISATIONS RELATED TO DEVELOPMENT OF HUMANOID ROBOTS ARE WELL-MEANING' ( $p=0.047$ ).

After being exposed to or directly involved with the use of socialisation robot technology at their facility, staff responses to 'people interacting with humanoid robots could sometimes lead to problems in relationships between people' significantly changed ( $p=0.016$ ). As seen in Figure 17, 23.8% of respondents 'strongly disagreed' with this statement post intervention and those choosing 'strongly agree' decreased from 11.5% to 4.8%.

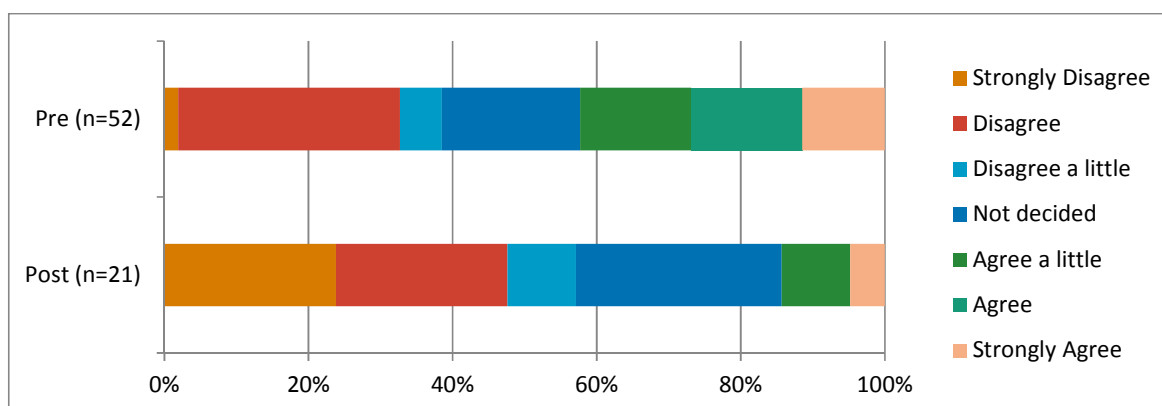


FIGURE 17. STAFF RESPONSES TO 'PEOPLE INTERACTING WITH HUMANOID ROBOTS COULD SOMETIMES LEAD TO PROBLEMS IN RELATIONSHIPS BETWEEN PEOPLE' ( $p=0.016$ ).

Staff responses to 'I don't know why, but I like the idea of humanoid robots' significantly changed from pre- to post-survey ( $p=0.035$ ). A greater proportion of respondents had a positive ('agree a little', 'agree', 'strongly agree') response when asked post intervention (see Figure 18).

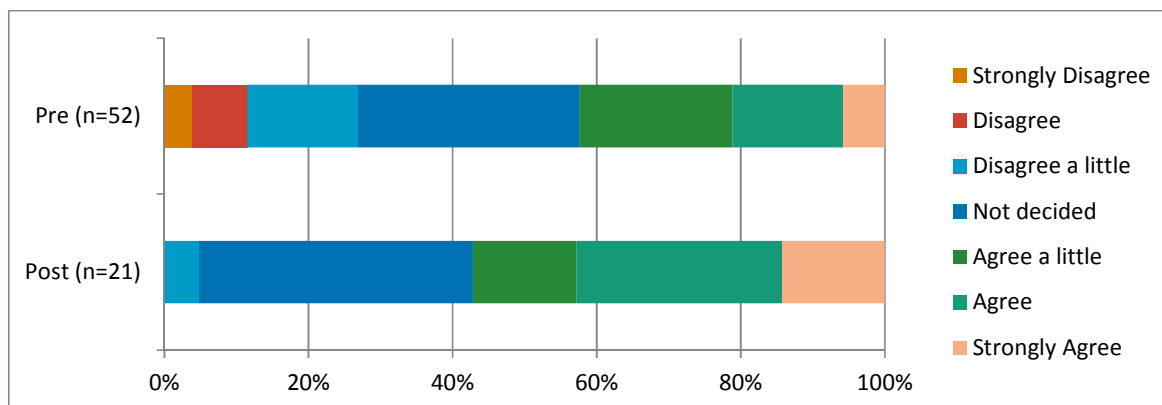


FIGURE 18. STAFF RESPONSES TO 'I DON'T KNOW WHY, BUT I LIKE THE IDEA OF HUMANOID ROBOTS' (P=0.035).

### ***Negative Attitudes towards Robots Scale (NARS)***

Staff were surveyed with the NARS tool at the start of the project and at the finish of the project. An analysis of staff responses to the NARS survey reveals a diverse range of responses and resulting attitudes. Question 3 – 'I would feel relaxed talking with Robots' revealed that only 2% of staff 'strongly agreed' with this statement prior to the beginning of this project. This had changed to 15% at the end of the project. Additionally 17.6% of staff 'disagreed' with this statement prior to the start of the project. 'Disagree' responses to this question fell to 10% at project completion. Figure 19 demonstrates these responses.

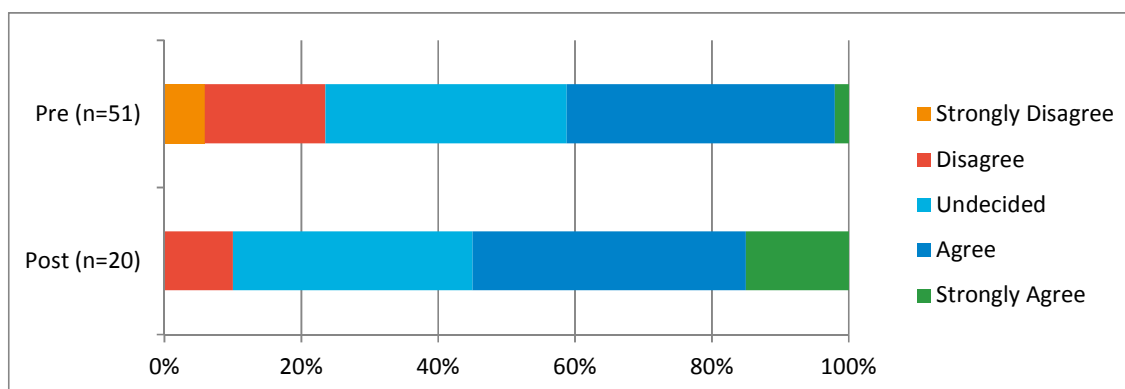


FIGURE 19. STAFF RESPONSES TO 'I WOULD FEEL RELAXED TALKING WITH ROBOTS'.

When staff were asked if they would feel uneasy if given a job where it would be necessary to work with robots, 18% 'agreed' with this statement prior to the start of the project. This percentage of 'agreement' fell to nearly half (9.5%) after 16 weeks of working with Zora. The percentage of staff 'strongly disagreeing' to this statement rose from 6% to 9.5% post project. These responses are demonstrated in Figure 20

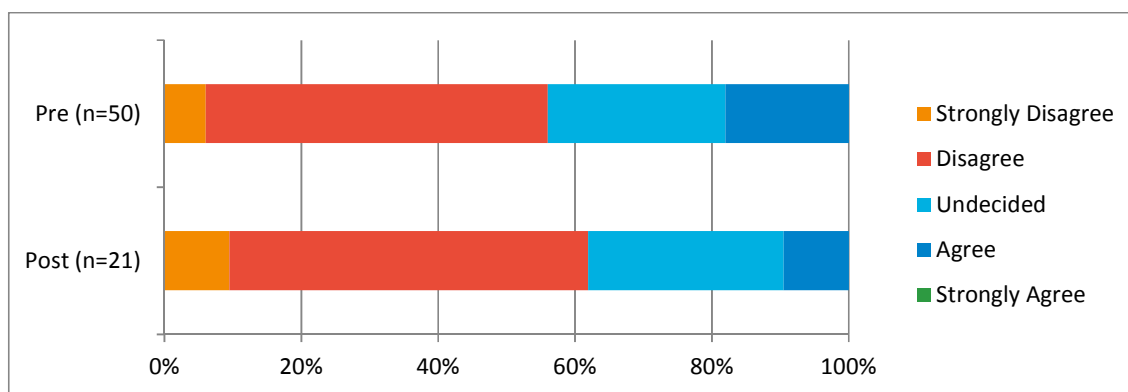


FIGURE 20. STAFF RESPONSES TO 'I WOULD FEEL UNEASY IF I WAS GIVEN A JOB WHERE I HAD TO USE ROBOTS'.

Staff responses to 'I feel comforted being with robots that have emotions' changed significantly from pre- to post-survey ( $p=0.012$ ). As seen in Figure 21, the proportion of staff responding 'strongly disagree' or 'disagree' decreased from 48% to 19% and no respondents selected 'strongly disagree' following the use of a socialisation robot in their facility.

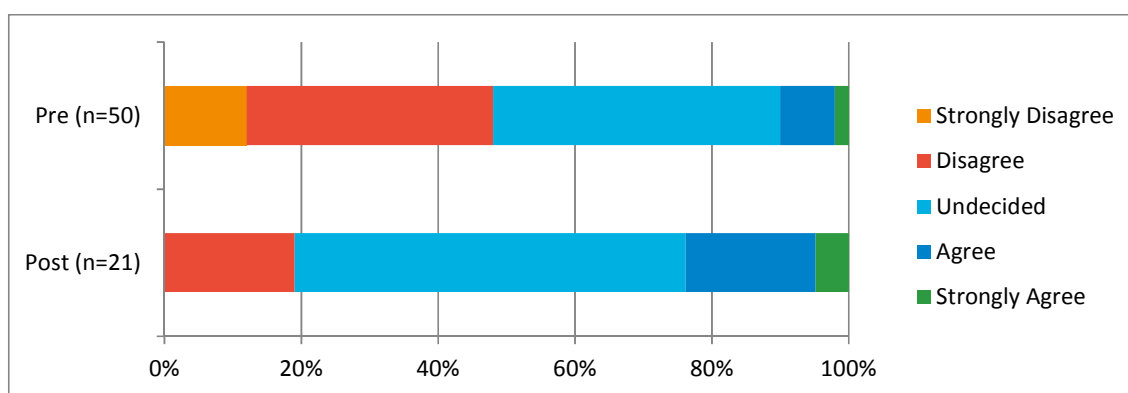


FIGURE 21. STAFF RESPONSES TO 'I FEEL COMFORTED BEING WITH ROBOTS THAT HAVE EMOTIONS' ( $p=0.012$ ).

When staff were surveyed with 'I would feel paranoid talking with a robot', 10% of staff agreed with this statement prior to the project implementation (see Figure 22). The percentage of staff agreeing with this statement more than halved to 4.8% when the project was completed. Ten percent (10%) of staff 'strongly disagreed' with this statement pre project. Nineteen percent (19%) of 'staff strongly disagreed' that they would feel paranoid when talking with a robot after 8 weeks of project implementation.

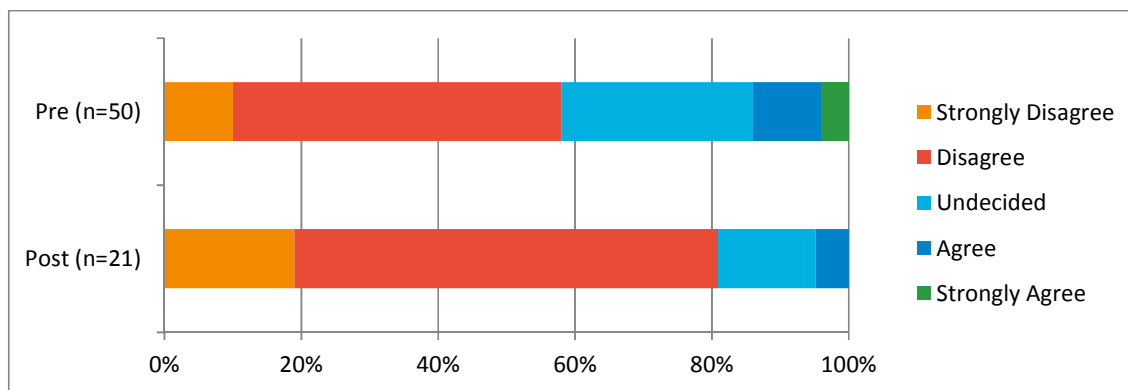


FIGURE 22. STAFF RESPONSES TO 'I WOULD FEEL VERY PARANOID TALKING WITH A ROBOT'.

### Further Questions

Staff were asked an additional three questions. The first question was 'Do you think Alice will be beneficial to aged care?' The majority of staff surveyed pre-implementation stated they were 'unsure' (58%), 36% stated 'yes' they thought Alice would be beneficial and 6% said 'no' (see Figure 23). Following the intervention 67% of staff responding to the post survey said 'yes' Alice would be beneficial to aged care while 28% responded 'unsure' and 5% said 'no' (see Figure 24).

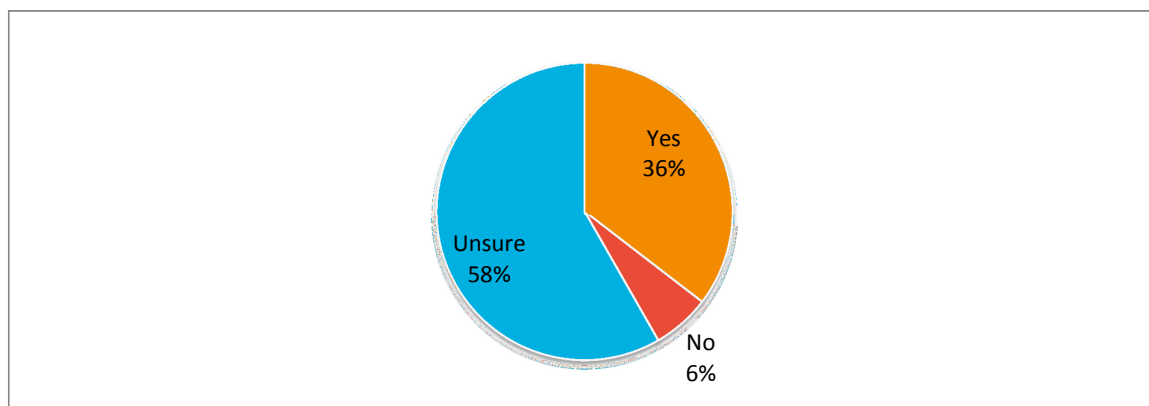


FIGURE 23. PRE STAFF SURVEY RESPONSES TO 'DO YOU THINK ALICE WILL BE BENEFICIAL TO AGED CARE?' (N=48).

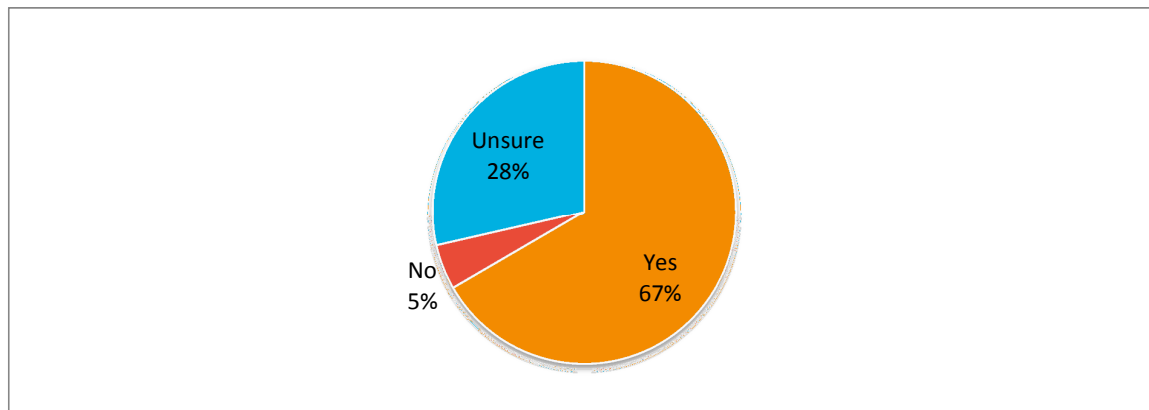


FIGURE 24. POST SURVEY STAFF RESPONSES TO 'DO YOU THINK ALICE WILL BE BENEFICIAL TO AGED CARE?' (N=21).

Twenty-four respondents provided comment on the pre-survey question/s regarding why they did or did not think Alice would be beneficial to aged care.” Included themes were: Alice’s potential to contribute to higher quality of care (7); reserving judgement (as staff haven’t seen Alice in action – 6); and the potential for residents to respond in mixed or unpredictable ways (6). Other themes mentioned were the novelty of robot technology (4) and concerns about losing human interaction or a human-centred approach to care (4).

Post intervention, 14 staff members responded to the question ‘why they did or did not think Alice would be beneficial to aged care’. Elicited themes were: the positive interactions observed between residents and Alice (9); using Alice as an added therapy tool (3); new and early use of technology (4). Specific comments regarding residents included: ‘Because I witnessed the interactions between some of residents and the robot - was pleasantly surprised’, ‘The residents talk about her constantly’, ‘Some residents “loved” Alice, as did the staff’ and ‘Alice made the group fun’.

The second question was ‘Do you think Alice will positively affect your job satisfaction?’ Pre and post the intervention the majority of respondents said they were ‘unsure’ (56% and 38%, respectively) if Alice would increase their job satisfaction (see Figure 25 & Figure 26). Post intervention those responding ‘yes’ decreased and those responding ‘no’ increased from 17% to 31%.

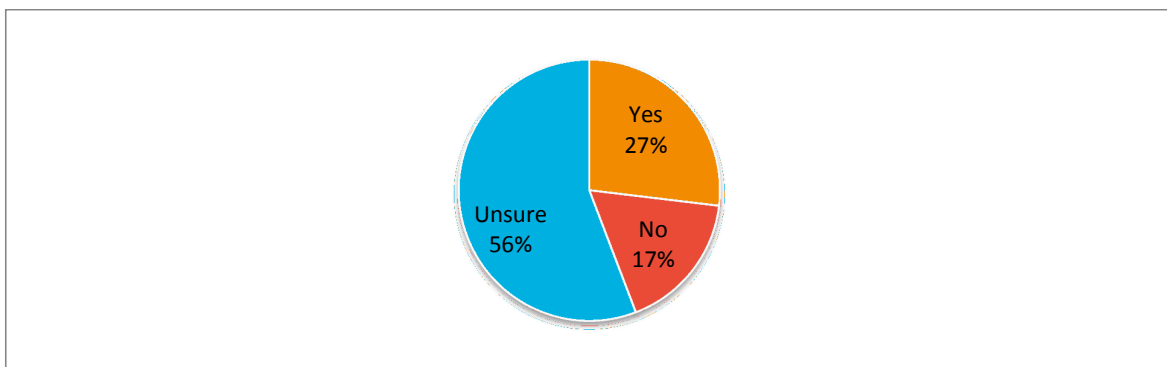


FIGURE 25. PRE STAFF SURVEY RESPONSES TO ‘DO YOU THINK ALICE WILL POSITIVELY AFFECT YOUR JOB SATISFACTION?’ (N=52).

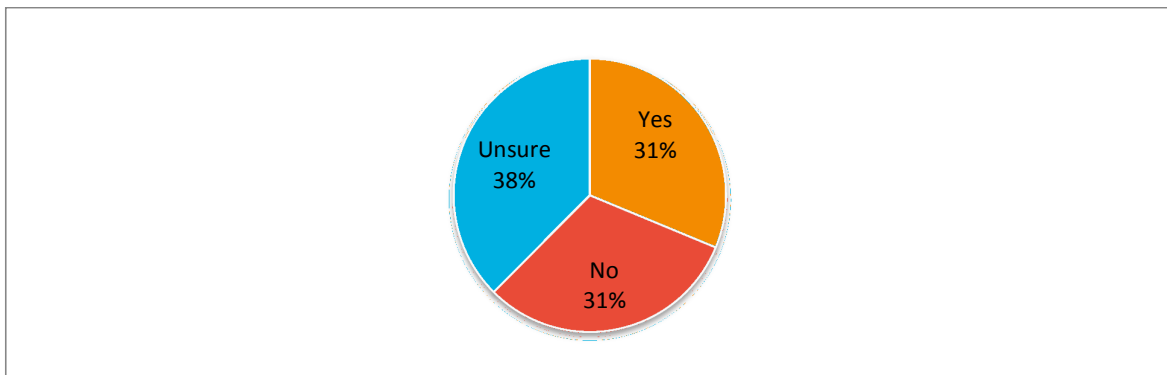


FIGURE 26. POST STAFF SURVEY RESPONSES TO ‘DO YOU THINK ALICE WILL POSITIVELY AFFECT YOUR JOB SATISFACTION?’ (N=16).

Twenty-three staff provided comment as to why they thought Alice would or would not positively affect their job satisfaction prior to the intervention. Several distinct themes were revealed including: reserving judgement due to uncertainty about Alice’s impact on staff role or workload (7);



reserving judgement depending on outcomes for residents (6); and the limitations of robot technology in 'replacing' human care and human interaction (4). Others saw Alice as an opportunity to learn or innovate (3), while others expressed concern about Alice increasing their workload (1) or taking their job (2). Finally, some staff noted that they will not be directly involved with Alice in their current role (2).

Ten staff members provided comment as to why they did/didn't think Alice would positively affect their job satisfaction following the intervention. Common themes included: not having direct involvement with Alice (4); seeing residents' positive satisfaction/reactions (4) and others believed it was too time consuming (2). Specific comments were: "Our residents were excited to be with Alice, it was pleasing to see their satisfaction", "Responses from people were good to see", "Too time consuming/the research project took most of the time as she was here weekly".

Finally staff were asked to provide any further comments they had in relation to Alice. Fifteen respondents provided comment on the pre-survey, of these comments four were expressing a positive attitude towards Alice and/or an interest in the outcome of the research project, and two stated they needed more information about Alice before commenting. Some respondents envisaged positive outcomes for residents (4), while others were concerned that Alice could not meet residents' needs, especially for human care and interaction (4). Other themes that arose were: the cost (time and money) of using robot technology (2); the opportunity to relieve pressure on staff (2); and the fear that robot technology will replace staff jobs (2).

When completing the post survey five staff members provided further comment; three were positive, requesting more visits from Alice, whilst one respondent wrote they had no involvement in the project and therefore couldn't comment. One staff member commented on the nature of the questionnaire. In summary, staff attitudes towards robots before a socialisation robot was incorporated into therapy programs at their respective facilities were varied. Staff appeared to be apprehensive of Alice due to the technology being unknown and not previously used in Australia. Following the intervention staff attitudes towards robots improved and responses became less varied. Some staff observing resident behaviour and reactions to Alice believed Alice could be beneficial in aged care.

### 3.2.2 Focus Groups

#### ***Pre Intervention Focus Group***

To gain an in-depth understanding of staff attitudes toward socialisation robots, staff were invited to participate in focus groups pre intervention. Focus groups were held at facilities one, two and three and lasted approximately 30 minutes. Seventeen (n=17) staff were asked ten semi-structured questions broadly addressing their knowledge of socialisation robots, thoughts and attitudes towards using the socialisation robot (Zora) in their workplace, and the benefits and challenges they envisioned for residents who experience Zora.

Analysis of the focus groups found two major themes: (1) outcomes for residents; and (2) staff needs and support. Each major theme contained sub-themes that further described staff attitudes. The main sub-themes relating to outcomes for residents were communication issues, human care and

interaction, individual needs and responses, novelty vs. familiarity and potential uses and settings. Sub-themes for staff needs and support were information and assistance, training, time and preparation, open-minded approach and the need for a cultural shift.

Overall, the results from the focus groups demonstrate that staff understanding of using socialisation robots in the aged care workplace varied and the impact on staff and clients could be both positive and negative.

### *Outcomes for Residents*

Staff were clearly concerned with the outcomes for residents relating to the use of socialisation robots. These were categorised in the analysis as communication issues, human care and interaction, individual needs and responses, novelty vs. familiarity and potential uses and settings.

### *Communication Issues*

Many staff raised questions about whether Zora will aid or impede residents' communication. The practicalities of communicating with a robot were frequently raised, (this information is discussed in post intervention) participants also raised the potential for error and misunderstanding when translating text to speech. Conversely, one group agreed that Zora's ability to translate English into 19 different languages would be a "huge plus" for staff, given past difficulties and experiences of working with an interpreter.

### *Human Care and Interaction*

A shared concern emerged that Zora would reduce or replace human contact, human care and face-to-face interaction with residents.

Staff widely endorsed a resident-focused approach to care, prompting discussions about the limitations and purpose of robotic technology (and particularly socialisation robots) in the aged care setting. Many participants expressed that they "... would hate to see that robots take over and ever replace that human contact"; that robot technology could not fulfil the role of human carers - "it's never going to replace a human".

Zora's role in helping care for residents was also unclear to some participants: "So my first initial thing... is why have a robot? If there's somebody there having to do stuff with the robot, the robot's just a middle person to me, and personally I think it's better to have humans rather than robots." In contrast, some participants felt that a lack of human connection might not be an issue for some residents: "...if you've got something like a robot, once they're developed to a point of being able to recognise people and stop and say hello, that's often what, someone with dementia that's what they want. It doesn't need to be a hugely deep connection, it's just that personal, it's that somebody paying attention."

### *Individual Needs and Responses*

A related theme captured a widespread emphasis on individualised care, summarised by one participant in the statement "I think it depends on the person really doesn't it, as opposed to having people in a box". According to participants, individualised care meets different needs of different residents, and in the case of Zora, managing different – and sometimes unpredictable – responses. Staff anticipated positive and negative reactions equally, noting the potential for Zora both to lift

someone's mood and or draw an insular individual out of their shell, while flagging the risk of aggression, anger, confusion or disinterest. As a participant noted, "I think it's possible we could get mixed results, like responses from the residents in that some will think 'oh she's really cute' and others will think 'this is a bit silly'."

No focus group reached outright consensus on which residents would respond best to Zora. For example, one participant couldn't categorise those residents who respond positively to Zora: "I couldn't really say it's a set group, there's just individual people that I come across". Others highlighted that individual differences make individual responses to Zora unpredictable: "Dementia's a big word... It's not just one thing. You can have someone with dementia and the same dementia really in the same stages, but, totally two different people."; "See we know a lot of the triggers for the residents with dementia, we know what might trigger them in an adverse way but this is something we don't know." Staff agreed that to "know your residents" and tailor Zora's use to their individual needs is key to the project's success.

#### *Novelty vs. Familiarity*

A recurring discussion point was Zora's potential to provide interest and intrigue for residents, and a "new avenue" for intervention. However, attitudes towards this prospect were mixed. Many participants felt that Zora's "novelty factor" would be fun, attention grabbing, different and stimulating – as well as "another tool in your toolbox" for staff. Other participants acknowledged that with novelty comes the challenge of managing residents' responses to an unfamiliar experience, especially given that many residents are "not really from the computer age". One participant captured this concern about a lack of familiarity with technology amongst the older generation: "I think that a lot of people won't really understand because of the generation they haven't had a lot to do with that kind of technology. There's only a handful of people here, well less than that really, that operate iPads or a computer." A further issue raised by some participants was whether Zora's usefulness would wane as the novelty wears off: "I'm just wondering whether the response has been because it's a novelty so it'll be interesting to see if it's as interesting for them after they really get to know her."

#### *Potential Uses and Settings*

Staff saw potential for Zora to assist in both one-on-one and group settings. This included joining in group activities such as exercise and dance, as well as reading stories, reciting poetry, or being a medium for some residents to open up to: "There might be residents who feel they can talk to the robot, the robot's listening, they might be able to tell the robot something that they wouldn't tell you know an employee, or someone they live with they might not feel comfortable saying it, but they might feel comfortable saying it to the robot as a middle man". Some staff members suggested future uses for Zora, such as taking group walks, or interfacing with 'iCare' to allow access to individualised and up-to-date resident information. However many staff members were unfamiliar with Zora's functions, making it difficult to make informed suggestions and envisage how Zora could assist. One participant responded to this issue by stating "It will be interesting to see what aspects of interaction it can effectively be involved in. Whether there's some things it can do, some things it can't do".

### *Staff Needs and Support*

Findings highlighted that ‘staff needs and support’ were a priority. Importantly that staff were provided with ‘information and assistance’ and ‘training’, ‘time and preparation’ via an ‘open-minded approach’. Recognised was the need for a ‘cultural shift’ in understanding and using technologies.

#### *Information and Assistance*

Along with training, various staff members requested that information, guides and troubleshooting help be available when using Zora. Suggestions included an easy-to-read guide with frequently asked questions, technical support should things go wrong, and a Plan B to keep residents engaged through malfunctions. Another suggestion was to gain “I think it would be nice to see an example of where other countries that have tried using the Zorabot within aged care”, and other participants agreed that sharing information and ideas through networking – and even having an annual “Alice (Zora) party” – would assist them to feel more confident in using Zora. In particular, networking and sharing ideas may assist staff who feel uncertain about how to use Zora effectively in an aged care setting (see Human Care and Interaction).

#### *Training*

Staff sent a clear message that comprehensive Zora training would be required. Fear and apprehension about using Zora’s technology was a common sentiment, with many participants expressing anxiety about not being “tech savvy”, technology malfunctioning, making mistakes, or losing residents’ interest. Related was the additional weight of responsibility in caring for an expensive piece of equipment: “How much she costs if you break her is sort of scary.” Training was widely called for as a way of remedying this anxiety, and increasing staff confidence. For example, one participant stated “I’m not a big fan of technology but I’m happy to learn, and as long as somebody gives me the right training then I’m quite happy to use the tools.” According to staff, good training should include plenty of (hands-on) practise.

#### *Time and Preparation*

Many staff expressed concerns about the extra time and effort involved in “programming, learning how to use [Zora], using her, as opposed to me just doing it myself” – although as one participant noted, “it’s gonna be a lot of work to get used to using her, but once she’s up and running it will probably flow”. This sentiment was echoed by others who felt that the time commitment to initial training and practise was important – “enough time for preparation is really important” – but a burden nonetheless – “having the time to incorporate that into your work load as well is gonna be quite tricky for a lot of us”, especially given the workload staff already have.

#### *Open-Minded Approach*

Many staff noted that they had little experience or familiarity with Zora, and the way in which she can be used or integrated into aged care settings. As a result, many took a ‘wait and see’ approach to the project. This open-minded attitude emerged as a crucial aspect of the project’s success as viewed by many participants, with one stating “I think that’s the biggest thing, we need to have an open mind over it.” Indeed, a majority of participants expressed openness to using Zora and discovering her

capabilities: “It’s just hard to get your head around at the moment whether it can do any more than what we can, a person can do, really, because we don’t know do we?”

### *Cultural Shift*

A number of staff suggested the need for a cultural shift in their workplaces, in order for Zora to truly have an impact in an aged care setting. Participants described this cultural shift as having all staff on board, fully embracing the challenge, and putting in some effort. According to one participant, “It’s gonna require kind of a cultural shift everyone’s gonna have to be on board, if you’ve got people that are against it it’s gonna be hard to get it off the ground I think, it’ll be interesting we need all the staff to get on board with it otherwise it’s not going to have the effect.”

### *Summary*

Prior to the trial commencing, staff in the focus groups identified likely challenges of introducing robot technology to their work. These centred on the potential outcomes for residents, both positive and negative, and the need for staff to manage the varying responses of residents. They also expressed uncertainty about Zora’s functions specific to their work setting, which might be targeted through training, sharing information and ideas, and providing enough time for staff to adapt to the change – as well as hands-on experience of Zora in their work.

### ***Post Intervention Focus Group***

To further the understanding of staff attitudes toward socialisation robots post project intervention, focus groups were held at the three residential sites (including 1 control site), with the addition of one telephone interview. Total time of focus groups was 2 hours and 27 minutes. Staff were asked 17 semi-structured questions designed to elicit information on the use of Zora, covering their observations, interactions, perceptions, thoughts, and any feedback they had gained from using the robot in the workplace.

Analysis of these interviews and responses by staff members indicated that staff were initially concerned about how Zora would fit into their workplaces and if Zora would be able to socialise and interact with residents. As the project unfolded staff found themselves increasingly under time pressures, technology issues and having the need for more training and time to understand the ability of Zora. This was counter balanced whereby Zora became a valued member at the facilities, broke down barriers within individual residents and groups and elicited positive behaviours not seen before. In addition residents became attached to Zora, with Zora taking on human like qualities and descriptors whilst enabling a sense of wellbeing and purpose not previously seen before in some residents.

### *Control Group Outcomes*

As the control group (facilities 3 &4) had no direct experience with Zora it should be noted that many of the questions and resultant answers asked to the control group staff relied on supposition, speculation and some guesswork, rather staff were relying on second hand information gained from other sources to build their answers.

Initially staff were hesitant about using robots in aged care and a dementia based setting, while some thought that robots would only be good for a novelty value and others indicating that Zora would be

good as a one off and not having value in a daily or weekly routine. As staff have had time to think about this idea, some appeared more open to the idea of incorporating Zora into their workplace and using it as a socialisation tool, to a point where staff could see that it may become more common place for robots to be used in the workplace.

Staff indicated that if Zora was to become a regular feature in the workplace, further detailed and targeted training would have to occur in order facilitate this change. Staff also noted that pre-planning (in the use and programming of Zora), would have to occur in addition to balancing existing workloads and time allocations. The ease of use of Zora including lack of durability, potential miscommunication due to Zora's delay times were also raised as potential negatives that would need to be addressed.

Staff in the control group indicated that the effectiveness of Zora at a site is dependent on many factors such as the individual themselves and how they react to different stimuli. The general consensus was that Zora would be a positive addition to the site and could be used to complete individual tasks such as bingo calling, as a motivational tool, reading the newspaper, story- telling, running exercise groups and for one on one interaction with residents who may be bed bound.

Most staff in the control group site spoke enthusiastically about residents' feedback in terms of observing residents making eye contact, enjoying activities with and talking a lot about their personal experiences with Zora. Staff thought these reactions with Zora were not surprising and believed that residents were already familiar with the idea of robots through being exposed to futuristic science fiction media throughout their life-spans. Many agreed that Zora would be good to have around on a day to day basis, greeting residents, with residents generally fascinated and interested in Zora.

Staff also commented that Zora was a positive influence and residents were happy to interact with the robot, seeing Zora not as surprising, but instead were really happy to have Zora present. Staff noted the positive reactions observed on residents' faces. Staff had initially a somewhat reserved reaction to the idea of Zora being a part of their workplace, with a notable positive shift occurring, as a result of time and processing of information.

#### *Project Group Outcomes*

Most of the initial comments by staff about Zora were of a negative nature, due to the unfamiliarity of Zora and what she was capable of. Some staff were nervous and did not know what to expect, whilst others thought that the project could be positive or negative. Some staff thought that the use of Zora would not be as good as what a real person would be able to achieve. One staff member questioned why you would need a robot when you have people available. As the intervention progressed staff were much more positive towards Zora and her usefulness in the workplace, with positive interactions by residents, their family members as well staff being observed.

One of the more prominent themes raised by staff relates to Zora's voice. It was noted that residents struggled to hear and to therefore understand what Zora was saying. This could have a negative impact on resident's ability to effectively interact and socialise with other residents and staff and Zora. Staff indicated that Zora sometimes spoke too fast or there were very long delays in response from Zora. This had the effect of the residents and staff not hearing her responses or communication clearly, in addition it also increased staff embarrassment and frustration, whilst diverting attention away from the residents themselves as staff were trying to control for these technical issues. Zora's tone of voice and intonation were also issues that were raised by staff and were seen to be having negative impact

on the activity being completed at the time. However staff also noted that although residents were frustrated with Zora's voice and interruption of communication, this did not alter their attendance negatively. The suggestion here is that Zora would need to have a voice change to sound like a real person in order that this does not further negatively affect the socialisation potential of Zora.

From a staff perspective, the focus groups yielded many frustrations from a technical and training perspective for Zora in their workplace. Staff indicated that using Zora was very time consuming and needed extra effort and energy to successfully implement the use of Zora. Staff felt that their job roles already place large demands on their time and energy budgets, and described themselves as being time poor in the current workplace setting. They felt Zora and the use thereof was a large consumer of the available resources especially in the initial stages of implementation. This situation was further exacerbated by the low initial understanding of what Zora could do, technology failing such as WIFI and internet related issues. Of note was the large time requirement needed to learn to operate Zora and associated waiting time when Zora was "loading up". This has led to an increase in stress levels in some staff with a corresponding increase in job dissatisfaction. Staff were often frustrated and indicated that they needed more time to unlock the potential of Zora. Spending time with Zora will require that staff spend less time elsewhere.

Other concerns raised by staff about the use of Zora include some residents being fearful of Zora, Zora being seen as a doll or toy like figure and some residents not being able to understand if Zora was a real person or not. Concern was raised that this may have a harmful effect on some residents. Staff also raised concern about the ergonomics of Zora, indicating that Zora was heavy and could fall or be dropped leading to an expensive problem. An additional issue raised was the requirement to supervise Zora whilst in operation.

It was noted during the focus groups that Zora could work with individuals or with groups, but that Zora worked better in her own group rather than being an additional part of an existing group or trying to fit into an existing activity. Suggestions of potential areas of where Zora could be used included speech therapy, Autism, CALD (Culturally and linguistically Diverse), one on one with residents, storytelling, reducing social isolation and greeting residents in their homes each morning. Staff generally rated Zora above other comparative therapies saying they thought residents reacted very differently because Zora was more human like, able to break down barriers and able to elicit reactions not seen before with other therapy.

Residents were able to build a relationship with Zora, with residents using very endearing and personal terms to describe Zora. In addition residents showed a higher degree of engagement and focus on Zora not otherwise apparent with other therapies. Examples included being protective of Zora and engaging in activities where no previous engagement was visible. Other observable positive behaviour included smiling and interacting with other residents, triggering a not previously seen awareness of their environment, socially engaging with Zora whilst previously being introverted and non-English speaker. Other residents watched and cared for Zora until she was packed away. Staff also observed personal relationships being developed between several residents as a result of attending activities run by Zora.

There were many positive outcomes observed by staff as a result of the interventions. One of the main themes here was the very positive environment and atmosphere that resulted from using Zora. Residents and staff became open and welcoming to Zora, with residents talking and socialising more with each other. Indications of increased wellbeing, sense of purpose, positive attitudes, and an

increase in group cohesion for residents have resulted from Zora's use. Residents were observed smiling and laughing with Zora, and wanting to know when Zora was coming back. Residents accepted Zora and had increased interaction levels compared to other media with staff noting that residents saw and related to Zora as human and childlike. This has had the result of "capturing" the dementia imagination. Some residents reacted better than others, with personal differences changing the effectiveness of Zora.

General banter between Zora and Residents was also observed, with Zora creating lots of laughter through her "mood swings", going to the "naughty corner" and "having a mind of her own". Staff and residents saw Zora as good team member, with residents reacting positively towards her "hissy fits" whilst causing residents to talk to each other and overcoming anxiety. Residents and staff have placed human qualities/feelings, attitudes and expectations onto Zora. The secondary name for Zora is Alice and suggests humanness or human like qualities - a pervasive theme throughout the interviews. In addition human specific verbs have been used to describe "her" thereby making Zora easy to accept and creating a personality for Zora. This and the activities Zora is able to perform including the other positive outcomes noted above make Zora a very appealing addition to help older adults engage socially when used specifically with people affected by cognitive decline and dementia.

### *Summary*

From this set of focus groups with staff that have experienced Zora during the three intervention phases of the project, several major themes appear evident. The first is that Staff and some residents were initially hesitant about the use of Zora and her ability to effect positive change in older adults with dementia or cognitive decline. Secondly there was a large amount of evidence that was presented relating to the negative impacts that Zora has had on the staff, and workplace, with staff indicating that Zora increased their workloads, stress levels and in some cases adversely affected their job satisfaction. In particular it should be noted that Zora's voice and the ability of people to understand her voice is of major concern and needs to be addressed in order to increase Zora's efficacy in this or future situations.

This is in contrast to the third major theme that has become evident, that of the positive impact on the residents as a result of being involved in activities with Zora, and or around other residents who have been impacted positively as well. Any future decision about the use of Zora in residential aged care and specifically for those affected by dementia and cognitive decline would do well to examine and take into account these differing but related outcomes. These interviews demonstrate that although there are large and tangible positive outcomes from using socialisation robots there is also a corresponding set of negative outcomes.



## 4. Discussion

The objectives of this study were to investigate how the social engagement of older adults with cognitive and functional decline living in residential aged care facilities varied with the introduction of a socialisation robot. Observations of social engagement were investigated with and without the presence of the socialisation robot, Zora. The secondary objective of this study explored staff attitudes to the use of socialisation robot technology within the Australian residential aged care context through quantitative and qualitative methods. Staff attitudes and behavioural observations were surveyed and examined, before and after the end of this study. Broadly, two categories of results were examined that of Residents and Staff.

### 4.1 Residents

The results for Pool Activity Level Outcome (PAL), suggest that of all the four activity groups tested with and without the use of Zora only one of them (Poetry with Zora) revealed an increase in PAL as a result of Zora being present. This indicates that having Zora, as part of an existing activity group, in order to try and increase engagement levels in older adults with cognitive decline is only marginally effective (25% of the time). An examination of the groups where an activity was specifically designed for and run solely by Zora shows relatively high average levels of engagement. The Singing group recorded an average of 39.79 and the Games Hour group an average of 38.9, the second and third highest average total PAL scores. These findings demonstrate a potentially effective use of Zora in increasing the number of different activities specifically for Zora to help change engagement levels of residents with functional and cognitive decline.

Detailed examination of residents' social engagement levels (as a subscale of PAL) across facilities one and two, reveal that in all but one group – Poetry with and without Zora in Facility two – average levels of social engagement decreased when Zora became part of the activity group. This difference is similar to that already described in the overall PAL scores for the Poetry groups and suggests that having Zora as part of groups that are already operating has only a small beneficial outcome to altering social engagement levels in adults with cognitive and functional decline. However, the Games Hour group in facility two, a Zora specific activity produced the highest and most consistent average levels of social engagement for all facilities.

This indicates that there are activities in which Zora is very good at facilitating social engagement in older adults who are declining cognitively. This result should be interpreted with the caveat that it was care facility specific. It should also be noted that other activities that do not involve the use of Zora are also able to produce high and consistent levels of social engagement similar to those produced in the Games Hour with Zora at facility 2, (average of 8). The control group Golf activity produced social engagement levels at an average of 7.9, demonstrating that Zora does not have to be present in order for quality social engagement to occur. Further to this, activity programs should be tested and developed in depth to ensure that high and consistent levels of social engagement are elicited from residents in aged care facilities.

The project additionally sought to understand the social engagement of residents through the use of Zora by the measurement of weekly attendance at the different therapy groups. Facility one average attendance levels increased as a result of Zora being a part of the therapy group. This result was observed in both the Bingo and Happy Hour results, where a lower average attendance level was

recorded when Zora was not part of the activity. The opposite of this result occurred at facility two where the presence of Zora was associated with a decrease in attendance levels (for both the exercise and poetry groups). When groups with just Zora, (the Games Hour (9.5) and Singing group (10.75)), averages are compared to the control facility groups similar average attendances are visible. The control group activities of Golf (10) and Bingo (9.75) demonstrate there are only small differences in attendances compared to those groups run solely by Zora. The use of Zora can be a catalyst for increasing attendance at various activities and thereby increasing the potential for social interaction, but it appears that it is not inherently any more effective at doing so than other activities that do not use Zora as an integral component of the activity or as use as the sole activity.

Semi structured interviews with residents revealed a growing confidence and affinity with Zora over the length of the project. Resident's increasing familiarity and a perceived increase in participation rates by residents were common themes arising from these interviews. Comments by residents were both positive and negative. Negative comments centred on various technical issues that arose from Zora's use. Various issues raised included the voice, with residents at times not being able to hear and clearly understand Zora, and the interruption of activities where technical issues stopped or stalled an activity. Nearly all residents indicated that they would recommend Zora for other people in their situations.

Many of the residents interviewed described a fondness for Zora and attributed human like qualities, descriptors and anecdotes to Zora, with some even noting feelings of companionship. Some residents observed the enjoyment and social engagement of other residents involved in the various activities when Zora was present. The interviews with residents displayed many of the positive interactions they had whilst engaged in the project activities. Training in the use of Zora, staffing levels, available staff time and overcoming technical issues were other themes noted in resident interviews as areas requiring further attention.

## 4.2 Staff

Interviews prior to the intervention revealed staff concerns for residents around Zora's ability to communicate and the potential for error in this activity. The ability for language translation was seen as a positive for Zora. Other concerns for residents were summarised under the headings of Human Care and Interaction, Individual Needs and Responses, Novelty versus Familiarity, and Potential Uses and Settings. Concerns for staff were reported under the headings of Information and Assistance, Training, Time and Preparation, Open Minded Approach and Cultural Shift.

As the project progressed through the intervention phase, staff (although initially hesitant about the introduction of a robot into care facilities), identified various positive outcomes to residents. Outcomes observed of residents were Zora's ability to increase social interaction through directly relating to and engaging with residents on a personal and group level. Additionally residents were observed relating to Zora's apparent human characteristics such as her naughtiness and childlike demeanour. Negative themes explored by staff during the focus groups included the increase in workload, increase in stress and a negative impact on staff job satisfaction. In addition to residents' concerns surrounding Zora's voice and the ability of people being able to clearly understand Zora, technical issues and appropriate training were also raised by staff. Interviews with staff revealed a perceived positive change with regards to resident social engagement and resulting negative issues for staff throughout the project.

The Frankenstein Syndrome Questionnaire (FSQ) Negative Attitudes towards Robots Scale (NARS) was used to survey staff attitudes towards robots at the start and end of the study. Analysis of these attitudes revealed that staff were more accepting of robots and had an increase in positive attitudes towards the use of robots in the workplace compared to the start of the project. T-tests revealed that staff were more accepting of the idea that organisations and those developing humanoid robots were well meaning ( $p=0.047$ ), and that humanoid robots could create new forms of interaction ( $p=0.048$ ). Staff also had significantly ( $p=0.035$ ) increased positive response to 'I don't know why, but I like the idea of humanoid robots'.

Responses to the NARS scale revealed a change in negative attitudes towards robots over the project life. Staff were more likely ( $p=0.012$ ), to feel comforted being with robots that have emotions at the end of the project then at the start. Staff also felt more relaxed at the idea of having to work with robots (question 4 of the NARS) with 18% agreeing to this idea at the end of the project compared to only 9.5% at the start of the project.

When questioned at the end of the project (compared to the start), a larger proportion of staff, indicated that they thought Zora would be more beneficial to their workplace. Staff comments also showed that staff thought that Alice would have less of a positive impact on job satisfaction. To the question, Do you think that Alice will positively affect you job satisfaction? Seventeen percent (17%) said 'No' pre project with this increasing to 31% after the project. This appears to be in conflict with the first of these "Further Questions". This discrepancy could be a result of staff being able to see Alice as being beneficial to their client's wellbeing and social engagement, whilst also having a negative impact on their job satisfaction. Overall, staff displayed signs of less variability in their responses along with an increase in positive attitude towards working with and using robots in the workplace.

The staff observation of an "increase in attendance levels" when Zora was present at activities, is a discrepancy for this study. The data presented indicate facility two had a decrease in attendance when Zora was included in its two therapy groups. This discrepancy could be caused by the use of different staff to run the activities at each of the facilities and or caused by the fact that Zora is only effective within certain types and categories of therapy group.

Implications for this study include that Zora is only partly effective at changing engagement and more specifically social engagement levels in older adults with cognitive decline. The use of humanoid robot did not reliably increase attendance levels across all activity groups as a marker of residents' engagement and resulting social engagement during those activities. Activity groups where the group was specifically designed for Zora showed consistently high attendance levels. Staff and residents both comment that having Zora present in groups and or having a Zora specific group, results in both positive and negative outcomes for staff and residents. Staff felt more stressed and under pressure leading to an increase in job dissatisfaction and indicated they required more training and time to use Zora. Residents became frustrated at the time delays and the sometimes less than smooth operation and use of Zora, specifically the noted technical, voice and speech issues.

Positives for residents included a sense of amazement and levels of interaction not previously felt before. Residents were generally in favour of Zora as a member of the staff and as part of further activities at their facilities. Residents developed human like relationships with Zora as demonstrated by the affectionate language used to describe their interactions with and around Zora.

With regard to decreasing negative attitudes towards robots, the exposure of staff to 16 weeks of therapy groups requiring the use of and resulting interactions with robots has led to a positive change in staff attitudes. Prior to the start of the study staff were in part apprehensive and cautious about implementing and using robots within their workplaces. At the end of the study staff attitudes had shifted to being more positive compared to their initial responses.

Practical applications for this study include a contribution to the limited amount of data and associated implications for the use of robots in the aged care industry in Australia and worldwide. Specifically this study can aid decision makers in deciding if there is a business case for the use of humanoid robots in helping adults in aged care facilities with functional and cognitive decline increase their levels of social engagement and related sense of wellbeing. Possible questions to be asked include 'does the use of a humanoid robot add a greater and or different level of social engagement than past, current and future methods?' At a broader level this study offers insights into how humanoid robots as an emerging technology can possibly help humans. Examples include the services industry, specifically areas such as education, retail and hospitality.

Several limitations of this study have become apparent. The first relates to the design where the activity groups, for intervention two and three, could have been kept consistent across the study sites. This would have enabled a direct comparison of different activity groups between each facility and provided a more robust data set. Additionally interviewing residents prior to the project would have enabled a better comparison of the change in attitudes towards humanoid robot use by residents. Pre and post analysis of comments, attitudes and observations would then be possible.

## 5. Key Findings

### Residents:

- Creating new activities that were run solely by Zora using staff expertise was more effective in increasing social engagement compared to including Zora in existing site activities
- Residents enjoyed interacting with Alice and developed connections previously not seen with other therapy tools
- Residents had difficulties understanding Zora at times, whilst Zora's challenging voice recognition and occasional technical failures also contributed to a difficult user experience.
- While Zora elicited social engagement from residents, equivalent levels of social engagement can occur in residents without the use of a humanoid robot
- Average attendance levels at activities run solely by Zora were consistently high, whilst average attendance levels at the majority of activities where Zora was incorporated into existing activities decreased.

### Staff:

- With time and exposure to socialisation robots staff confidence and ability to utilise the technology increased
- Staff experienced increased pressure on their time when preparing for therapy groups involving Zora
- The majority of staff believed Zora was beneficial to aged care following their involvement in the project
- Staff felt that their job satisfaction levels decreased whilst having to work with Zora.
- Staff attitudes towards robots improved after being involved in the study

### Residential Aged Care Facilities:

- Greater resources in terms of time, training and staff numbers need to be applied to ensure the potential smooth transitioning of robot technology (if required), into the workplace.
- Humanoid robots as a different technology, have the potential to also increase engagement levels in clients with cognitive decline

### Socialisation Robot Technology:

- The socialisation robot is as effective as its user and is reliant on the creativity and ability of staff members operating the robot.
- This study contributes to the wider set of knowledge of the interaction between human and robots in the workplace
- Improvements in the speech, reaction time and movements of the robot are required to ensure its usability for staff and residents in residential aged care
- IT support is critical to ensure technical issues are dealt with in a timely manner and staff are not burdened with issues outside of their expertise

## 6. Conclusion

The use of a humanoid robot in an aged care setting, can influence social engagement amongst adults with functional and cognitive decline. The uses at this junction are narrow but provide a platform for further examination of activity where using a humanoid robot such as Zora, could further engage these adults on a social level. The type of activity that is successful in increasing social engagement appears to be one in which the robot has full control over the activity. There is also evidence to suggest that there could be other unexplored and existing activities that Zora could become a part of whilst having a positive impact on the social engagement of those affected by cognitive decline. Staff experiences of working with and/or being exposed to a humanoid robot in the workplace were mixed. Staff reported increased work stress and job dissatisfaction, however staff attitudes towards robots became more positive throughout the project. Residents expressed a general positivity towards Zora, but offered concern (along with staff), regarding technical and basic voice recognition issues. Further work in the area of training, allocation of time and staffing levels would be advised.

Finally it is evident that Zora, and by inference a humanoid robot, does not have to be present in order for social engagement to increase amongst older adults with cognitive and functional decline. This study demonstrates that whilst a humanoid robot can have positive influence in this area there are existing activities that are able to produce similar levels of social engagement. A humanoid robot provided a different method of encouraging social engagement that may be a welcome change for some residents. The project presents information that the presence of a humanoid robot can also have negative impact on attendance, social engagement as well as staff attitudes and job satisfaction, indicating that staff training and awareness should be made a priority. This study describes another tool to help increase social engagement in adults with cognitive and functional decline in the Australian aged care workplace.

## 7. Dissemination & Communication Outputs

### **Conference Presentations:**

Lawrence, J, Williams, E, Pratt, K, & Martini, A. Using a Socialisation Robot to Increase the Social Engagement of Older Adults in Residential Aged Care. Information Technology in Aged Care, 21-22 November 2017, Gold Coast, Australia.

Pratt, K, Williams, E, & Martini A. Increasing Social Engagement in Aged Care Using a Socialisation Robot. 50<sup>th</sup> Australian Association of Gerontology Conference, 8-10 November 2017, Perth, Australia.

Seaman, K, Pratt, K, Williams, E, Robertson, B, & Robertson, A. Understanding the impact of social engagement of older adults with cognitive decline. 32nd International Conference of Alzheimer's Disease International, 26-29th April 2017, Kyoto, Japan.

Seaman, K, Pratt, K, Williams, E, & Robertson, A. Understanding the impact of social engagement of older adults with cognitive decline. Aged and Community Servicers Western Australia state Conference, 30-31 March 2017, Perth, WA.

### **Organisational:**

Brightwater Care Group (2016). In the Spotlight: Brightwater's most popular resident. Brightlife newsletter, Issue 1, September 2016. Available from <http://www.brightwatergroup.com/about-brightwater/publications/>

Social Media:

Facebook - Brightwater Care Group (1,133 likers as of 27.02.2017) Facebook mentions of Zora/Alice, Alice the Zorabot: 13th February 2017. Available from <http://ow.ly/18Wy308WBeb>

Twitter - Brightwater Care Group (83 followers as of 27.02.2017) Twitter mentions of Zora/Alice, Alice the Zorabot – helping determine if robot socialisation enhances the wellbeing of people living with dementia Available from [ow.ly/18Wy308WBeb](http://ow.ly/18Wy308WBeb)

### **External:**

Channel 9, Perth, National Nine News (Weekend), Louise Momber. Perth seniors at the Brightwater Aged Care Facility in Madeley are tapping into new technology to deal with dementia – 6pm News. 27<sup>th</sup> May 2017. Available from <https://www.youtube.com/watch?v=FZegHxMimMk>

CDPC Newsletter (2017), Edition 7. Innovative technologies helping people with dementia. 23rd May 2017. Available from [http://sydney.edu.au/medicine/cdpc/news-events-participation/ipeac\\_toolkit.php](http://sydney.edu.au/medicine/cdpc/news-events-participation/ipeac_toolkit.php)

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## 9. Appendix

### 9.1 Resident Evaluation Tools

#### 9.1.1 Pool Activity Level (PAL) Outcome

**Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline**

<b>The Pool Activity Level (PAL) Engagement Measure</b>	
Copyright Jackie Pool (2013) all rights reserved	
<b>Participants Name:</b>	
<b>Date:</b>	
<b>Activity:</b>	
<b>Completed by:</b>	

<b>Score: 0 Points – Not observed during activity</b> <b>1 Point – Observed at times but not consistently</b> <b>2 Points – Engaged consistently in keeping with the activity</b>		Date									
COGNITIVE ABILITIES	Goal aware - <i>Has an end result in mind, can plan how to achieve this and can work towards this</i>										
	Initiates - <i>Independently starts an action toward another person or object</i>										
	Attends - <i>Notices and focuses on a sensation</i>										
	Concentrates - <i>Sustains attention on the activity, person or object</i>										
	Adjusts - <i>Adapts actions to meet the demands of the activity</i>										
	Explores - <i>Shows interest in and seeks to engage with environment &amp; objects</i>										
	Responds - <i>Reacts to sensations, verbal requests or prompts</i>										
PHYSICAL	Stabilises - <i>Maintains balance and posture whilst moving, standing or sitting</i>										
	Manipulates - <i>Uses tools and objects to achieve an end result. Handles an object in response to the sensation it generates</i>										
	Coordinates - <i>Moves smoothly while negotiating obstacles or handling objects</i>										
	Grips objects - <i>Uses appropriate strength to hold objects securely</i>										
	Releases objects - <i>Independently and appropriately lets go of objects</i>										
SOCIAL	Aware of others - <i>Notices and responds directly or indirectly to the presence of others</i>										
	Shares - <i>Offers and accepts objects to/from others</i>										
	Vocal interactions - <i>Uses vocal sounds to make a connection with others</i>										
	Non-vocal interactions - <i>Uses body language to make a connection with others</i>										
EMOTIONAL	Hope - <i>Has a sense of meaning and a positive attitude to the activity</i>										
	Agency - <i>Has a sense of purposefulness in carrying out the activity</i>										
	Self-confidence - <i>Has a sense of empowerment and autonomy when carrying out the activity</i>										
	Self-esteem - <i>Has a sense of fulfilment when carrying out and on completion of the activity</i>										
	<b>TOTAL</b>										
	<b>Initials of person completing the tool</b>										

<b>Week 1 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 2 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 3 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 4 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 5 Comment/Observations:</b>	
Completed by:	Date:

<b>Week 6 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 7 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 8 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 9 Comment/Observations:</b>	
Completed by:	Date:
<b>Week 10 Comment/Observations:</b>	
Completed by:	Date:

9.1.2 Frequency of Attendance

Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline

Resident Frequency of Attendance

Date	Activity Program	Residents Attended

### 9.1.3 Clinical Information

#### Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline

##### Resident Clinical Information

Date	Resident	Site	Diagnosis of Dementia Y/N	Type of Dementia	Cognitive capacity to consent Y/N	Other Diagnosis	Age	Gender	Number of Behaviours (last 2 months)	Number of Falls (last 2 months)	Number of medication	PAS Score	Cornell Score

#### 9.1.4 Semi-Structured Interview

### **Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline**

#### **Resident Interview**

##### Introduction

Provide a brief introduction of the Zorabot called Alice. I would like to talk to you today about Alice; about what you like and or don't like about Alice. (If possible it would be good to have Alice present for the interview).

1. Could you tell me what you currently do with Alice?
2. How did Alice make you feel?
3. Do you enjoy the class and her company?
4. Do you prefer the activity program with or without Alice? Please explain why?
5. In what other ways could we use Alice?
6. Would you recommend Alice to other residents?
7. How would you feel if Alice was here all the time?
8. If you could change anything about Alice what would it be?



## 9.2 Staff Evaluation Tools

### 9.2.1 Pre Semi-Structured Focus Group

#### **Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline**

##### **Pre Semi-Structured Focus Group with Staff**

###### INTRODUCTION

Provide a brief introduction on Zorabot called Alice. Explain to the participants the aim of the focus group today is to understand your initial thoughts of using socialisation robots in RAC.

1. What do you know about socialisation robots?
2. What are your initial thoughts on using robots in RAC?
3. How do you think they can be used in aged care?
4. How could socialisation robots be beneficial to residents? Which residents would it be better for?
5. In what ways could a socialisation robot increase resident engagement?
6. Do you think using Alice the robot will be a helpful addition to your work in RAC?
7. What are some things to consider to be careful of when using Alice the robot?
8. How do you feel about using a robot technology?
9. How do you feel this will impact on your overall job satisfaction?
10. Does anyone have any further comments?

### 9.2.2 Pre Survey

## Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline

### Staff Pre Survey

Alice the Zorabot, is a humanoid robot being trialled in two residential aged care facilities to investigate the impact of socialisation robots on the social engagement of older adults with cognitive decline. This study will also explore staff thoughts and views of using socialisation robots within aged care facilities.

The purpose of this survey is to develop an understanding of how you feel about the use of Alice the humanoid robot within residential aged care facilities.

All results from this survey are ANONYMOUS and will be presented as de-identified, aggregated data with no individual respondent named or responses presented in any way that could identify any individual.

1. Please tick your Gender: ☐ Female ☐ Male ☐ Other

2. What is your Age? \_\_\_\_\_

3. Please tick which Occupation you belong to: ☐ Care Worker ☐ Enrolled Nurse

☐ Occupational Therapist ☐ Physiotherapist ☐ Registered Nurse

☐ Speech Pathologist ☐ Therapy Assistant ☐ Other (please specify): \_\_\_\_\_

4. Please tick (✓) the response that most closely matches your beliefs about each statement		Strongly Disagree	Disagree	Disagree a Little	Not Decidable	Agree a Little	Agree	Strongly Agree
1	I am afraid that humanoid robots will make us forget what it is like to be human.							
2	Humanoid robots can create new forms of interactions both between humans and between humans and machines.							
3	Persons and organisations related to development of humanoid robots are well-meaning.							
4	Humanoid robots may make us even lazier.							
5	Humanoid robots can be very useful for caring the							

	elderly and disabled.							
6	Humanoid robots should perform repetitive and boring routine tasks instead of leaving them to people.							
7	People interacting with humanoid robots could sometimes lead to problems in relationships between people.							
8	I am afraid that humanoid robots will encourage less interaction between humans.							
9	The development of humanoid robots is a blasphemy (a violation against god or sacred things) against nature.							
10	I don't know why, but I like the idea of humanoid robots.							
11	I would feel uneasy if humanoid robots really had emotions or independent thoughts.							
12	If humanoid robots cause accidents or trouble, persons and organisations related to development of them should give sufficient compensation to victims.							
13	I can trust persons and organisations related to development of humanoid robots.							
14	Widespread use of humanoid robots would mean that it would be costly for us to maintain them.							
15	Humanoid robots can be very useful for teaching young kids.							
16	I am concerned that humanoid robots would be a bad influence on children.							
17	I would hate the idea of robots or artificial intelligences making judgements about things.							
18	Humanoid robots are a natural product of our civilisation.							
19	Humanoid robots can make our lives easier.							
20	I feel that if we become over-dependent on humanoid robots, something bad might happen.							

21	I don't know why, but humanoid robots scare me.							
22	I feel that in the future, society will be dominated by humanoid robots.							
23	Humanoid robots should perform dangerous tasks, for example in disaster areas, deep sea and space.							
24	Many humanoid robots in society will make it less warm.							
25	I trust persons and organisations related to the development of humanoid robots to disclose sufficient information to the public, including negative information.							
26	Technologies needed for the development of humanoid robots belong to scientific fields that humans should not study.							
27	Something bad might happen if humanoid robots developed into human beings.							
28	Persons and organisations related to development of humanoid robots will consider the needs, thoughts and feelings of their users.							
29	The development of humanoid robots is blasphemous (a violation against god or sacred things).							
30	Widespread use of humanoid robots would take away jobs from people.							

Syrdal et al. 2011.

<b>5. Please tick (✓) the response that most closely matches your beliefs about each statement</b>		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	I would feel uneasy if robots really had emotions.					
2	Something bad might happen if robots developed into living beings.					
3	I would feel relaxed talking with robots.					

4	I would feel uneasy if I was given a job where I had to use robots.					
5	If robots had emotions, I would be able to make friends with them.					
6	I feel comforted being with robots that have emotions.					
7	The word “robot” means nothing to me.					
8	I would feel nervous operating a robot in front of other people.					
9	I would hate the idea that robots or artificial intelligences were making judgements about things.					
10	I would feel very nervous just standing in front of a robot.					
11	I feel that if I depend on robots too much, something bad might happen.					
12	I would feel very paranoid talking with a robot.					
13	I am concerned that robot would be a bad influence on children.					
14	I feel that in the future society will be dominated by robots.					

Nomura et al. 2006.

**6. Do you think Alice will be beneficial to aged care?**

a. ☐ Yes ☐ No ☐ Unsure

**b. Why/Why not?**

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**7. Do you think Alice will positively affect your job satisfaction?**

a. ☐ Yes ☐ No ☐ Unsure

**b. Why/Why not?**

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**8. Please write any further comments in relation to Alice below.**

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### 9.2.3 Post Semi-Structured Focus Group

## Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline

### Post Semi-Structured Focus Group with Staff

#### INTRODUCTION

Provide a brief introduction on the Zorabot called Alice. Explain to the participants the aim of the focus group today is to understand your thoughts of using socialisation robots in RAC after having experienced it and seen her in action.

1. What were your initial thoughts on using robots in RAC and how have these thoughts changed since Alice was introduced at your site?
2. Describe how Alice was used in RAC?
3. What did you observe in relation to using Alice in Activity Groups? Was it better to use Alice individually with residents?
4. How did the residents react to Alice? Did some residents react better? Why?
5. Were the reactions of residents to Alice surprising to you? Why?
6. Did using Alice as a therapy tool bring out new reactions/engagement from residents that you hadn't seen before? Can you describe this?
7. Do you think residents engaged more with Alice than other therapy tools i.e. Paro?
8. Was Alice beneficial to your facility? How/why?
9. Was using Alice the robot a helpful addition to your work in RAC? In what way did you find Alice useful/not useful? Was Alice difficult to use? If so how?
10. What would you change about Alice if you could?
11. Will you continue to use Alice? Why/why not? How would you feel if Alice was here all the time?
12. Has your confidence in technology changed as a result of using Alice?
13. How else could Alice be used in residential aged care?
14. What did people say about the Alice?
15. How did having Alice present make you feel?
16. Has having Alice present change your job satisfaction level? If so how?
17. Any other comments?

#### 9.2.4 Post Survey

### Understanding the impact of socialisation robots on the social engagement of older adults with cognitive decline

#### Staff Post Survey

Alice the Zorabot, is a humanoid robot being trialled in two residential aged care facilities to investigate the impact of socialisation robots on the social engagement of older adults with cognitive decline. This study will also explore staff thoughts and views of using socialisation robots within aged care facilities.

The purpose of this survey is to develop an understanding of how you feel about the use of Alice the humanoid robot within residential aged care facilities.

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1. Please tick your Gender: ☐ Female ☐ Male ☐ Other

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3. Please tick which Occupation you belong to: ☐ Care Worker ☐ Enrolled Nurse

☐ Occupational Therapist ☐ Physiotherapist ☐ Registered Nurse

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2	Humanoid robots can create new forms of interactions both between humans and between humans and machines.							
3	Persons and organisations related to development of humanoid robots are well-meaning.							
4	Humanoid robots may make us even lazier.							
5	Humanoid robots can be very useful for caring the							



	elderly and disabled.							
6	Humanoid robots should perform repetitive and boring routine tasks instead of leaving them to people.							
7	People interacting with humanoid robots could sometimes lead to problems in relationships between people.							
8	I am afraid that humanoid robots will encourage less interaction between humans.							
9	The development of humanoid robots is a blasphemy (a violation against god or sacred things) against nature.							
10	I don't know why, but I like the idea of humanoid robots.							
11	I would feel uneasy if humanoid robots really had emotions or independent thoughts.							
12	If humanoid robots cause accidents or trouble, persons and organisations related to development of them should give sufficient compensation to victims.							
13	I can trust persons and organisations related to development of humanoid robots.							
14	Widespread use of humanoid robots would mean that it would be costly for us to maintain them.							
15	Humanoid robots can be very useful for teaching young kids.							
16	I am concerned that humanoid robots would be a bad influence on children.							
17	I would hate the idea of robots or artificial intelligences making judgements about things.							
18	Humanoid robots are a natural product of our civilisation.							
19	Humanoid robots can make our lives easier.							
20	I feel that if we become over-dependent on humanoid robots, something bad might happen.							

21	I don't know why, but humanoid robots scare me.							
22	I feel that in the future, society will be dominated by humanoid robots.							
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24	Many humanoid robots in society will make it less warm.							
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26	Technologies needed for the development of humanoid robots belong to scientific fields that humans should not study.							
27	Something bad might happen if humanoid robots developed into human beings.							
28	Persons and organisations related to development of humanoid robots will consider the needs, thoughts and feelings of their users.							
29	The development of humanoid robots is blasphemous (a violation against god or sacred things).							
30	Widespread use of humanoid robots would take away jobs from people.							

Syrdal et al. 2011.

<b>5. Please tick (✓) the response that most closely matches your beliefs about each statement</b>		Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
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13	I am concerned that robot would be a bad influence on children.					
14	I feel that in the future society will be dominated by robots.					

Nomura et al. 2006.

**6. Do you think Alice will be beneficial to aged care?**

a. ☐ Yes ☐ No ☐ Unsure

**b. Why/Why not?**

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**7. Did Alice positively affect your job satisfaction?**

a. ☐ Yes ☐ No ☐ Unsure

**b. Why/Why not?**

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**8. Please write any further comments in relation to Alice below.**

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