(Ⓓ) CABI Human–Animal Interactions

RESEARCH

Using PARO, a robotic seal, to support people living with dementia: 'what works' in inpatient dementia care settings?

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Abstract

Introduction: The robotic seal PARO has received increased attention as a new technology to support people living with dementia in terms of emotional and physiological outcomes. However, little research has been conducted to improve understanding of how and why PARO may work within inpatient dementia care. We investigate for whom PARO works best in this setting, and why PARO may work. Methods: Informed by principles from realist methodology, qualitative interviews were conducted with healthcare professionals, participants with dementia and their relatives to explore experiences related to the delivery and receipt of an intervention using PARO in an inpatient dementia ward in the United Kingdom (UK). Observations of PARO intervention sessions were conducted to gain further insight into provision and implementation of sessions using PARO in 'real time'. Data were analysed using thematic analysis, and using the process of configuration mapping, we constructed a visualisation of our findings framed within the Intervention-Context-Actor-Mechanisms-Outcomes (ICAMO) model. Results: The visualisation of our findings framed within the ICAMO model suggests that PARO may result in positive outcomes within inpatient dementia care due to a range of potential mechanisms, including enhancement of social interactions, developing a sense of attachment, evoking emotive memories, physical interaction, and perceiving the robotic animal as a live being. For these mechanisms to be activated, the sessions should be structured but participant-led, and be delivered as needed in a one-to-one setting by a skilled facilitator. Conclusion: Using PARO in an inpatient dementia care context appeared promising and well-received in this small observational study. This study explicitly considers the context and mechanisms of using PARO within inpatient dementia care settings, presenting findings in a structured visualisation framed within the ICAMO model and offering a theoretical basis for future intervention research.

Keywords: PARO, robotic seal, dementia, inpatient dementia care

Introduction

As technology advances, the use of social robots has received increased attention (Kang *et al*., 2020). Of many interventions available using social robots, PARO, a therapeutic pet-type robot modelled on the features of a baby harp seal, has shown the potential to support people living with dementia (Moyle *et al*., 2019). PARO is now commonly used as a substitution for interventions with live animals within dementia care (Petersen *et al*., 2017), and research has indicated that interaction with PARO can result in emotional and physiological benefits for people with dementia (PwD) (Moyle *et al*., 2015, 2017; Soler *et al*., 2015; Moyle *et al*., 2018; Abbott *et al*., 2019; Hung *et al*., 2021; Chen *et al*., 2022a). Using PARO in particular populations may circumvent potential safety risks associated with interactions with live animals and diminish concerns related to allergies, hygiene concerns, and fear of animals (Bert *et al*., 2016; Preuß and Legal, 2017). However, despite their increased use (and related substantial expense), evidence of effectiveness is mixed, and ethical considerations surrounding the concept of infantilisation have been raised (Sharkey, 2014; Gustafsson *et al*., 2015; Abbott *et al*., 2019). This concept may damage acceptability for the person with dementia, their relatives or the healthcare professionals involved in the intervention, particularly if they perceive PARO as a plush toy (Robinson *et al*., 2013). Infantilisation may be seen by some as congruent with the idea of a second childhood, being dispiriting and deficit-based, rather than empowering and strength-based (Sharkey and Sharkey, 2011; Sharkey and Wood, 2014).

Most of the research on PARO in dementia care reports on scenarios based in care home settings (Petersen *et al*., 2017; Mervin *et al*., 2018; Moyle *et al*., 2019; Chen *et al*., 2022a; 2022b).

There are challenges in translating these findings for PwD who are cared for in hospital settings and are likely to have different or additional care needs. Additionally, existing reviews exploring social robot interventions in dementia contexts (including PARO) identify a major research gap: although the existing evidence base is improving, there is largely an absence of rigorous methodology to demonstrate benefits in different settings, and findings are mixed (Hirt *et al.*, 2021; Riches *et al.*, 2022). For example, studies have reported interventions involving PARO significantly reduced agitation (Jøranson *et al.*, 2015) and apathy (Valentí Soler *et al.*, 2015) compared to usual care in people with mild, moderate, or severe dementia. Conversely, contrasting findings have been reported that indicate there are no benefits of interacting with PARO on agitation (Liang *et al.*, 2017) or apathy (Moyle *et al.*, 2013) in people with mild, moderate, or severe dementia compared to usual care or a reading control activity, respectively. This variability has been attributed to the factors such as small sample sizes and inadequate research design, including insufficient reporting of intervention content, context, and implementation (Kang *et al.*, 2020; Hirt *et al.*, 2021; Yu *et al.*, 2022). In practice, complex interventions such as those involving PARO are often implemented in a diverse manner by various stakeholders in different settings, all of which can potentially affect intervention outcomes (Council MR, 2006).

While existing research has used qualitative methods to outline recommendations to aid the delivery of interventions involving PARO in practice, these findings have been based on PwD living in long-term care facilities (Moyle *et al.*, 2019). A more thorough understanding of the theoretical underpinnings of PARO within inpatient dementia care contexts is crucial to better understand the potential mechanisms and outcomes and guide the use of PARO in practice within this setting (Scoglio *et al.*, 2019; Hung *et al.*, 2019a). Current evidence gaps in provision and best practice of psychosocial interventions within dementia care mean there is a need to conceptualise, evaluate and test implementation in a context-specific way (Vernooij-Dassen *et al.*, 2010). An inpatient dementia care setting was selected for this study as there are commonly cited barriers around the delivery of psychosocial interventions within these environments as part of planned care for people with moderate to severe cognitive impairments (Edmans *et al.*, 2021).

To address current limitations in the field, this study used principles from realist methodology to explore aspects of an intervention using PARO that work, for whom, under what circumstances, and how (Wong *et al.*, 2016). The use of this methodology is particularly suited to investigating real-world use and effectiveness of staff-mediated complex interventions (Windle *et al.*, 2017; Handley *et al.*, 2019). In doing so, the findings have real and practical implications for delivering the intervention in an 'every day' context (Lawrence *et al.*, 2012). Therefore, the overarching aim of the current study is to contribute insights into for whom PARO works best in the inpatient dementia care context, and what the change mechanisms involved in this context might be. Specifically, the research questions were:

1. What are the core components of an intervention involving PARO in an inpatient dementia care context?
2. By what contextual factors do outcomes of using PARO appear to be influenced within inpatient dementia care?
3. What are the proposed mechanisms underlying any potential impact of PARO within inpatient dementia care?
4. What are the likely psychosocial outcomes (intended and unintended) of PARO within inpatient dementia care?

Methods

METHODOLOGICAL APPROACH
Realist methodology is a theory-driven approach (Wong *et al.*, 2016) that assumes an outcome (O) is generated by a mechanism (M) being activated in a specific context (C) through an actor (A) when an intervention (I) is implemented. This conceptualisation captures how, why, for whom, and in what circumstances an intervention may work (Pawson and Tilley, 1997; Pawson and Manzano-Santaella, 2012; Mukumbang *et al.*, 2018a). Generating realist theories is achieved through the formation of Intervention-Context-Actor-Mechanism-Outcome (ICAMO) configurations (Van Belle and Mayhew, 2016).

The current study was designed to expand the current understanding of the use of PARO in an inpatient dementia care context. In order to explore potential ICAMO configurations specific to PARO in dementia inpatient care, observations of these sessions and interviews with healthcare professionals (HCPs), PwD, and their relatives were conducted. First, we thematically analysed the qualitative data. Second, using the process of configuration mapping (Pawson and Tilley, 2004; Mukumbang *et al.*, 2018b), we created a visualisation of the findings framed within the ICAMO model to explain why PARO works in this setting.

ETHICAL APPROVAL
Ethical approval was granted by Wales Research Ethics Committee 6 (Reference: 22/WA/0128).

An initial capacity assessment was undertaken by the Clinical Psychologist in accordance with the Mental Capacity Act (GOV.UK, 2020). If the participant was deemed to have capacity to consent to participate, their written consent was obtained. If participants were assessed as lacking capacity, a personal (relative/friend) or nominated (staff member independent of research) consultee was appointed to provide advice on their wishes.

INTERVENTION CONTEXT
PARO is designed to resemble a baby harp seal and is equipped with tactile sensors, including sound, light, temperature, and touch (Chen *et al.*, 2022b). PARO responds to physical and social interaction and can exhibit lifelike emotional responses (Chen *et al.*, 2022a). For example, PARO has a swivelling head and tail, speakers that make the authentic sounds of a real baby harp seal and can recognise voices and respond to repeated words (Jøranson *et al.*, 2016). Sensors in the fur create interactivity between participants and the robot as it responds to repetitive motions, such as stroking (Jøranson *et al.*, 2016).

In the present study, the participating NHS inpatient dementia ward in the UK had recently purchased PARO and was beginning to deliver therapeutic sessions involving PARO at the point the study started. The sessions are delivered by Clinical Psychology staff, in line with local clinical guidance developed by their senior Clinical Psychologist. PARO is used as a purposeful, person-centred clinical intervention which takes into account a person's psychological needs and preferences. The sessions are delivered on a one-to-one basis for a time-limited period and involve introducing PARO and encouraging the participant to interact with PARO in any way they wish to do so (e.g., talking to or grooming and petting PARO). Each session ends by encouraging the participant to say goodbye to PARO and reminding the participant they will see PARO again. All Clinical Psychology staff who delivered sessions involving PARO were trained by the senior Clinical Psychologist who developed the local clinical guidance. Full details of the intervention are described using the TIDieR Checklist (Hoffmann *et al.*, 2014) and presented in Supplementary Material 1.

PARTICIPANT RECRUITMENT
Purposive sampling was used to recruit participants from an inpatient dementia ward at one NHS mental health Trust, serving a population of approximately 2 million people in the North of England. The reason for purposive sampling is the better matching of the sample to the aims and objectives of the current research (Campbell *et al.*, 2020). In our case, we aimed to recruit individuals

who had experience of the delivery or receipt of the intervention to further our understanding of PARO within an inpatient dementia care context. We aimed to recruit at least 5 staff members and 3–4 PwD and their relatives between September and December 2022.

Prior to obtaining their consent, the first author contacted HCPs to confirm they met the inclusion criteria: (Kang *et al.*, 2020) regular involvement in the delivery of care, treatment, or support of people in inpatient dementia care, and (Moyle *et al.*, 2019) have observed/delivered the sessions involving PARO.

Recruitment of PwD began by liaising with the Clinical Psychologist on the ward to identify potentially eligible participants. Inclusion criteria included: (Kang *et al.*, 2020) a dementia diagnosis, (Moyle *et al.*, 2019) present participation in the intervention involving PARO, and (Petersen *et al.*, 2017) the ability to communicate in English if participating in interviews. PwD could opt to take part in an interview, the observations, or both.

Relatives of PwD were identified and contacted by an Assistant Psychologist. Relatives were eligible to be recruited even if their family member with dementia was not a participant. Permission was sought from eligible relatives for the first author to contact them with further information and obtain consent to participate.

DATA COLLECTION

Interviews

A realist interview approach (Manzano, 2016; Mukumbang *et al.*, 2019) was used to collect qualitative data about the ICAMO elements. Realist interviews investigate propositions about how, where, when, and why interventions may work (Greenhalgh *et al.*, 2017). Qualitative evidence is vital to our understanding of how interventions are experienced by those involved in their delivery and receipt, and further our understanding of their motivation to participate in the sessions involving PARO (Poole *et al.*, 2015).

Semi-structured interview guides were developed for HCPs, PwD, and relatives of PwD to explore perceptions of the delivery or receipt of the sessions involving PARO, the contexts that promoted positive outcomes, the potential mechanisms of change, and perceived outcomes. Topic guides were flexible for PwD, and

questions focused on their experience of the sessions and how they perceived PARO. To minimise retrospective recall, interviews were conducted immediately after sessions, or PARO was used as a prompt. All interviews were conducted in designated rooms on-site at the participating Trust. Interviews were audio-recorded and transcribed verbatim. All participants were given ID numbers to anonymise the transcripts.

Observations

Non-participant observations were conducted by the first author to gain further insight into provision and implementation of sessions using PARO in 'real time'. The observer introduced themselves to the participant at the beginning of each session and explained the purpose for their presence, but otherwise did not interact further with the participant until after the session had ended. The observer remained seated at a separate table but within close proximity to the session.

An observation guide was developed based on the ICAMO elements and used to describe the intervention, interactions, context, and the immediate outcomes of participation (Supplementary Material 2). The observer also noted quotes and conversations from and between the PwD and the Clinical Psychologist that referred to their perception of PARO. Fieldnotes were handwritten during observation sessions and subsequently typed up on the same day to aid recall. All participants were given ID numbers to anonymise the fieldnotes.

DATA ANALYSIS

Informed by the ICAMO configuration approach, we conducted thematic analysis, incorporating both the data-driven inductive approach of Boyatzis (Boyatzis, 1998) and the deductive a priori template of codes approach outlined by Crabtree and Miller (Crabtree and Miller, 1999), which allows for codes to be applied as a means of organising text for subsequent information (Crabtree and Miller, 1999). All data (interviews and observations) were analysed to extract meaningful data segments in terms of possible ICAMO elements, following the code template (Table 1).

Transcripts and fieldnotes were systematically coded by the first author, and codes with similar content were collated into preliminary

Table 1. Definition of relevant ICAMO terms and coding template.

ICAMO term	Definition	Coding rules
Intervention	An intervention is a combination of programme components designed to produce behaviour changes or improve health status among individuals or a group.	Intervention characteristics and activities/content delivered during the sessions.
Context	Context refers to salient conditions that are likely to enable or hinder the activation of intervention mechanisms.	Components of both the physical and social environment that facilitate or hinder the expected outcomes.
Actors	Individuals, groups, and institutions who play a role in the implementation and outcomes of the intervention.	Individuals involved (those delivering the intervention and those receiving the intervention). We distinguish between the facilitators of the sessions and the participants with dementia. The influence of any other individual who might play a role but are not directly related to the implementation (e.g., relatives) are seen as indirect actors/part of the context.
Mechanisms	Refers to any underlying element or behaviour that may underpin or explain the expected outcomes of the intervention.	Any explanation or justification why an activity or resource was used by an 'actor' to achieve an expected outcome or considered as a barrier to achieving the expected outcome.
Outcomes	Describes the impact of attending the sessions (including both intended and unintended outcomes).	Perceptions of attendance or delivery and its impact on health and wellbeing. It is important to note that outcomes can occur in sequence allowing for intermediate outcomes to occur (e.g., during the session), which can lead to intended and/or unintended outcomes upon completion of the session.

themes and organised with reference to the ICAMO structure. The fourth author independently reviewed the themes to ensure consensus with the assignment of theme names and illustrative quotes. After identifying the various ICAMO elements from the current qualitative data, we used the process of configuration mapping to construct an ICAMO map to present a graphic of our findings (Van Belle and Mayhew, 2016; Mukumbang *et al.*, 2018a).

Results

INTERVIEW PARTICIPANT CHARACTERISTICS

Interviews were conducted with 13 participants, including 6 HCPs, 4 PwD, and 3 relatives (Table 2).

The average interview length was 37 min (range: 22–61 min) for HCPs; 20 min (range: 16–22 min) for relatives, and 8 min (range: 7–9 min) for PwD.

OBSERVATION PARTICIPANT CHARACTERISTICS

Six sessions with PARO were delivered by the Clinical Psychologist and observed by the first author. Five PwD were observed, three of which had completed interviews (Table 3).

EXPLORING THE ICAMO ELEMENTS

Six main themes with associated clusters of sub-themes related to the ICAMO elements were identified (Table 4).

To illustrate themes and sub-themes, interview data are presented as verbatim quotes. Analysis of observations largely corroborated the findings from the transcripts while also providing some additional details that were not captured in the interviews. Therefore, notes from observations are included within the narrative below. However, we provide an example of one observation in Table 5.

Table 2. Interview participant characteristics.

Healthcare professionals (n = 6)		N (%)
Gender	Female	4 (66.7)
	Male	2 (33.3)
Ethnicity	White British	6 (100)
Job Role	Clinical Psychologist	1 (16.7)
	Trainee Clinical Psychologist	1 (16.7)
	Assistant Psychologist	1 (16.7)
	Activity Coordinator	2 (33.3)
	Occupational Therapist Assistant	1 (16.7)
Length of time in role	1–12 months	4 (66.7)
	5 years +	2 (33.3)
People with dementia (n = 4)		
Gender	Female	2 (50)
	Male	2 (50)
Ethnicity	White British	4 (100)
Mean age (years)	83.3 years (range 69–98)	
Type of dementia	Vascular	1 (25)
	Mixed (Vascular/Alzheimer's)	3 (75)
Severity of dementia *(advised by the Multi-Disciplinary Team, based on diagnoses and formulation)*	Moderate to severe	4 (100)
Length of stay at time of study	1–2 months	3 (75)
	3 –4 months	1 (25)
Relatives (n = 3)		
Gender	Female	2 (66.7)
	Male	1 (33.3)
Ethnicity	White British	3 (100)
Mean age (years)	64 years (range 48–76)	
Relationship to person with dementia	Son/daughter	2 (66.7)
	Spouse	1 (33.3)

Table 3. Observation participant characteristics.

People with dementia (n = 5)		N (%)
Gender	Female	3 (60)
	Male	2 (40)
Ethnicity	White British	5 (100)
Mean age (years)	80 years (range 69–90)	
Type of dementia	Mixed (Alzheimer's and Vascular)	3 (60)
	Vascular	1 (20)
	Alzheimer's	1 (20)
Severity of dementia *(advised by the Multi-Disciplinary Team, based on diagnoses and formulation)*	Moderate to severe	5 (100)
Length of stay at time of study	1–2 months	4 (80)
	3–4 months	1 (20)

Table 4. Themes and sub-themes related to the ICAMO elements.

ICAMO element	Theme	Sub-theme
Intervention	RAI content and delivery process	• Session structure • Promoting autonomy • Intervention duration and frequency • One-to-one delivery
Context	Provision of a safe space to facilitate focused engagement	• The importance of a private space within a busy and medicalised care setting • Providing a safe and caring atmosphere • Infection control
Actors	Delivery and facilitation: skills and training	• Training, experience, and core values
	Receipt: appropriate identification of individuals with dementia	• Influence of individual needs on engagement • History of pet ownership or 'animal lovers'
Mechanisms	Potential mechanisms underlying the impact of interacting with the PARO	• Enhancing social interaction • Working with attachment • Evoking emotive memories • Physical interaction and sensory stimulation • Perception of PARO as a live being
Outcomes	Impact of attending sessions	• Positive impact on mood and verbalisation in the moment • Soothing effect of PARO • Potential negative impacts of session attendance

WHAT ARE THE CORE COMPONENTS OF THE RAI PROVIDED IN AN INPATIENT DEMENTIA CARE CONTEXT? (RQ1)

RAI content and delivery process

Session structure

HCPs felt that the facilitator should carefully introduce PARO, explain what the activity entails and ascertain interest and engagement from the PwD prior to commencement.

> *'The seal is subtly introduced. [Clinical Psychologist] starts with him on his lap and explains the seal. It's initially gauging interest and whether people think it's alive. That's the starting point, it works well. It would be too overwhelming to just put the seal on someone's lap because they may not understand. It's better to gradually introduce the seal.'* (Assistant Psychologist)

HCPs and relatives agreed there should be structured endpoints to end the sessions therapeutically and avoid the seal being taken away abruptly. Where PwD perceived PARO as real, a useful strategy was to inform the participant PARO was tired and needed rest.

> *'We can say, 'the seal is tired and needs to go for a rest now', and people seem to understand and agree. So, the start and the end are*

structured, the middle is different dependent on the patient.' (Assistant Psychologist)

> *'If it's framed, "I'm taking the seal away now because he needs to rest" and he can see the seal being put into bed, that would help knowing that it isn't just being taken away, he can say goodbye and as an animal lover, would accept that it needs to rest.'* (Relative)

Promoting autonomy

HCPs reported PARO should be used as a goal-directed, individualised intervention where sessions should be structured by the facilitator but still promote participants' autonomy. This was evident during observations; sessions followed the same structure and general content, but the facilitator always adopted a flexible, person-centred approach. PwD were encouraged to engage with PARO in any way they wished. The Clinical Psychologist did not impose any goals or values on the participants but displayed respect and support for their autonomy.

> *'We want to see it as a fairly circumscribed intervention that's personalised so that we are bearing in mind the person's needs, identity, and history to make sense of how receptive they might be*

Table 5. Description of an observed session involving PARO.

ICAMO term	Observation
Intervention	When the Clinical Psychologist and participant were seated in the private lounge, the Clinical Psychologist explained he was introducing a new friend to people on the ward. PARO was placed facing forward on the table, and participant became instantly engaged with PARO. The Clinical Psychologist took PARO from the table and asked if he could place PARO on the participant's lap and encouraged the participant to engage with PARO in any way she wished to do so. The participant was immediately tactile and stroked PARO for the duration of the session. PARO was used as a conversation facilitator, as the Clinical Psychologist and participant discussed a variety of topics, such as previous animals, interactions with animals, and favourite childhood toys that were animals. The session was delivered for 30 min, and the Clinical Psychologist ended the session by saying PARO was tired and needed to rest. The participant said goodbye to PARO and that she wanted to meet PARO again.
Context	The Clinical Psychologist delivering the session approached the participant in the communal lounge area and asked her whether she would like to meet a new friend. The participant was immediately intrigued and agreed, so the Clinical Psychologist asked if she would like to follow him into the private lounge area. The private lounge is a large, quiet area off the main corridor of the ward, and the door remained closed throughout the session. The lounge included two big sofa's, one armchair and a table, and the Clinical Psychologist and participant sat on the same sofa together. The atmosphere was extremely positive, with the participant engaging well with PARO and the Clinical Psychologist throughout the session.
Actors	There was a positive relationship between the Clinical Psychologist and the participant. The conversation was continuous throughout the duration of the session, and PARO clearly facilitated multiple conversation topics. The Clinical Psychologist mirrored the participant's language back to the participant and narrated what PARO was doing to highlight PARO was enjoying the time with the participant, for example, 'look, he is wagging his tail, it means he likes you'. This was well-received by the participant as she responded saying, I'm so glad he likes me', and then spoke to PARO directly, 'you like me, don't you? I'd take you home if I could'.
Outcomes	As soon as PARO was placed on the participant's lap, she started stroking PARO and expressed, 'you've got lovely big eyes, you're so lovely, aren't you?' At first, the participant appeared to perceive PARO as a live being, she continued to speak to PARO and mimicked the noises PARO made. However, as the session went on, it became apparent the participant was aware PARO was not a live being, and said, 'it's fascinating what they can make and do nowadays with technology, I used to have a favourite cuddly toy as a child'. The participant's comments appeared to fluctuate between whether she perceived PARO as a live being or a robot. Overall, the participant appeared to enjoy the session with PARO, she typically had PARO pressed against her and continuously stroked PARO throughout. She expressed she would love to meet PARO again and mentioned how much she had enjoyed her time with PARO.

to the seal. What their understanding is and how they engage with him. There are not any pre-determined activities, but more a recommendation for the interaction and then respond with the seal in response to the needs of the person.' (Clinical Psychologist)

Intervention duration and frequency

HCPs believed that 20–30 min was an appropriate duration, including sufficient time for interaction with PARO and a structured end. They saw longer sessions as tiring for PwD, or risking disengagement. Most observed sessions (n=5) ranged from 20–30 min and appeared to be an optimal duration, but HCPs acknowledged it was important to be guided by PwD and end the session sooner if required.

'The guidance is 20–30 minutes. We need to carefully wind down and not just abruptly take the seal away, which takes time as well. Not prescriptive, but guidance, also in terms of the amount of time people can engage and process that information and not be overstimulated.' (Clinical Psychologist)

HCPs agreed that it was unnecessary to have a set frequency, but to deliver sessions responsively in terms of day-to-day wellbeing of PwD, and when they believed participants would benefit from interacting with PARO.

'We are not ever quite sure how someone is going to engage with the seal, as people are fluctuating with physical health, not just cognitively, and issues that can impact on levels of engagement and mood. We've not had set sessions; it's judging how the person is on the day overall.' (Clinical Psychologist)

One-to-one delivery

Individual sessions were delivered to offer a focused interaction, which was deemed as beneficial by all participants and facilitated a positive, shared social experience.

'It may become quite overwhelming and intense in a group. Individually, it's really sweet that people can get close to the seal, singing to it, they're engaging and whispering to it.' (Assistant Psychologist)

'It's been really lovely when you can just sit with the seal like this. Nobody has ever bought me something like this to cuddle, it's been a really lovely day.' (PwD)

HCPs discussed the potential benefits of group sessions but acknowledged the importance of considering individual personalities and needs and the group dynamic.

'In the past, they'd have been a few who definitely would have thought that the seal was their own and wouldn't want others touching it. Relationship dynamics would have to be carefully considered.' (Occupational Therapist Assistant)

'Individually, we think about psychological needs around attachment and comfort. A group would be based on a broader sense of engagement and connection between each other, that we would be fostering, rather than meeting needs that were person specific.' (Clinical Psychologist)

However, one relative expressed their preference for one-to-one sessions: *'I've heard a few times where he's been pushed, he gets too close to people, so there has been a lot of difficulties. I feel more comfortable that it's one-to-one."*

HCPs discussed the possible benefits of inviting a relative to join the session. One session had been delivered to a participant and their spouse and the Clinical Psychologist reported: *'When he is on his own, the seal seems to activate feelings of loss and grief as he misses his dog and his wife. However, with [wife's name] there, it was a really positive interaction, it seemed to mitigate those feelings of grief.'*

BY WHAT CONTEXTUAL FACTORS DO RAI OUTCOMES APPEAR TO BE INFLUENCED WITHIN INPATIENT DEMENTIA CARE? (RQ2)

Provision of a safe space to facilitate focused engagement

The importance of a private space within a busy and medicalised care setting

HCPs highlighted the importance of delivery in a quiet space where PwD can interact with PARO undistracted, as the ward is busy

and medicalised. Sessions were delivered in a private and quiet space (private lounge or participant's bedroom), affording more opportunity to feel comfortable and interact safely. The benefit of delivery in a private space was evident during observations and allowed for a focused interaction.

> *'I've been really clear not to use the seal in a communal space because it gets difficult to control and see it as a purposeful intervention. For some, they have not been able to leave their room or have chosen not to, so we've taken the seal to them.'* (Clinical Psychologist)

A quiet space was also important when considering sensory impairments: *'It's easier to pass on information, even when you're just explaining the seal, because dementia can cause difficulties with their hearing, their vision. It's easier done in a quiet environment.'* (Occupational Therapist Assistant)

Providing a safe and caring atmosphere

HCPs and relatives highlighted the importance of the social environment, and how the facilitator should foster a caring, safe, non-judgemental atmosphere.

> *'There is a lot to think about in terms of how they're experiencing and engaging with the seal, and how we facilitate that, and how we make people feel safe but also present it in a very positive, open way. It's about being fun essentially, and a nice experience.'* (Clinical Psychologist)

> *'Knowing that this is being done on a quiet basis with just one staff member, that's really lovely.'* (Relative)

Infection control

HCPs discussed the importance of infection control, particularly in light of COVID-19, within an NHS inpatient environment. Guidelines have been developed to outline how to effectively clean PARO in-between uses.

> *'We had to work out how we could use the seal at the height of the pandemic, appropriately and safely from an infection prevention point of view, which was not easy.'* (Clinical Psychologist)

> *'We clean him with disinfectant spray and wipes. They were encouraged not to share during Covid, so, anything that was used between patients, had to be thoroughly wiped down and cleaned.'* (Occupational Therapist Assistant)

Delivery and facilitation: skills and training

Training, experience, and core values

HCPs believed that sessions could be effectively delivered without specialist training, as long as the facilitator had the requisite knowledge and expertise about person-centred care and therapeutic delivery, and possessed appropriate core values, such as respect and empathy. These values displayed by the facilitator during observations fostered a compassionate, non-judgemental environment which appeared to promote positive outcomes, and also aligned with the importance of creating a safe and caring space for implementation as outlined above.

> *'Experience in working with therapeutic activities and how they're meant to be delivered, and how to introduce the seal appropriately and positively. To have the experience if someone is getting tearful, talking them through it, reassuring them, trying to re-focus the session, but if they are not engaging or it's negative, draw the session to a close. Focus on their emotions primarily. Empathy is one of the most important things.'* (Activity Coordinator)

The Clinical Psychologist delivered the sessions but offered training to other clinical team members. This included role playing, shadowing, and ensuring they were familiar with the clinical guidelines, which the clinical team perceived as sufficient.

> *'We did role play as an example of how a session may go, which was helpful. I think having that informal training before, shadowing, then moving on to doing it independently, just to have that knowledge beforehand. I think practicing it with somebody there,*

> *who's got experience, would make me feel more comfortable.'* (Trainee Clinical Psychologist)

However, the Clinical Psychologist highlighted the need to build skills and confidence of the multidisciplinary team, so PARO could be utilised in a purposeful, individualised way within a medicalised context: *'The team needs to gain the skills and confidence. Long-term, I want everyone aware of the seal, know what the clinical guidelines say, how they might use them.'*

Receipt: appropriate identification of individuals with dementia

Influence of individual needs on engagement

When identifying participants, there was consensus that severity and type of dementia did not affect engagement, but individual preferences and perceptions did.

> *'One man was limited in what he could do, but he still engaged with the seal. I think the seal can get a wide range of people, it's not about dementia severity in a one-to-one, it's about their personality. They can project onto the seal; the seal can be whatever they want him to be.'* (Activity Coordinator)

HCPs highlighted how sessions could be adapted to suit various needs and cognitive abilities.

> *'We set activities that can be done on many levels. Some are quite functional doing gardening, people who are less functional, it might come down to sensory experiences of holding a leaf. It's similar with the seal, to be as person-centred as possible and the content of the session be guided by the needs and preferences of the patient – whichever level they're at.'* (Occupational Therapist Assistant)

History of pet ownership or 'animal lovers'

HCPs reported they were guided by individual's history when identifying participants. Likewise, relatives expressed that sessions would be beneficial for their family members if they were known to have an affinity to animals.

> *'Mum has always been a big animal lover. She currently feels a lot of sadness around the fact she doesn't have any animals now, so that may well mean she responds well to it.'* (Relative)

HCPs and relatives suggested that previous animal ownership was not necessarily required for engagement, and exclusion criteria should only include those who have shown fear towards animals.

> *'We are mindful of those who are scared of animals – we wouldn't necessarily try it with them. We are not specifically identifying those who have animals or like animals, but we are more confident they will respond to the seal better if we know they have a history of liking animals.'* (Activity Coordinator)

> *'If it's just they've never owned an animal, but like animals, or even can just tolerate animals, then it's good, it's a different activity. Something soft and gentle and I think it would entertain, as long as they aren't scared'* (Relative)

Additionally, a known affinity to animals is not a guarantee PwD will positively engage with PARO, and individual preferences need to be considered beyond that of interest in animals. It was evident that one PwD felt indifferent towards PARO, despite always being an animal owner: *'I like animals. Dogs, cats, horses. He's alright, but this is not my type of animal.'*

WHAT ARE THE PROPOSED MECHANISMS UNDERLYING ANY POTENTIAL IMPACT OF THE RAI WITHIN INPATIENT DEMENTIA CARE? (RQ3)

Potential mechanisms underlying the impact of interacting with PARO

Enhancing social interaction

PARO appeared to act as an 'icebreaker', catalysing communication, and enhancing opportunities for social exchange. Observations also highlighted how the facilitator's use of reflective dialogue

and mirroring communication appeared to facilitate engagement, socialisation, and self-expression.

> *'They have the same conversations every day of their lives. We ask, "how are you, do you want to come and do this?", but the seal can be used as an interesting conversation starter to initiate different topics that we wouldn't usually talk about, which is great.'* (Activity Coordinator)

> *'It's nice to give him that ability to have different conversations. If the conversations can be more focused around the seal, his animals, his dogs, that would be very relaxing to him.'* (Relative)

Social interaction was also enhanced by offering an opportunity for the participant to engage directly with PARO.

> *'He kept singing to him and saying 'do you want some more of this', and he would get up and try to serenade him. That was amazing, and he was whispering in his ear and saying, 'I'll tell you what's happening here', almost gossiping with him.'* (Assistant Psychologist)

One HCP suggested that inviting relatives may be beneficial to facilitate a shared, social experience, especially if verbal communication is challenging.

> *'I like the idea of bringing relatives in with the seal. I think it would give that focus, that way for people to have a conversation about things if conversations are maybe a bit difficult. I think that could make family feel more connected.'* (Trainee Clinical Psychologist)

The Trainee Clinical Psychologist subsequently observed a shared session with a relative and reported: '*it opened up lots of conversations between him and his wife about their dog, pigeons, and previous work with killer whales. It was a very positive interaction with him, his wife, and the seal'.'*

Evoking emotive memories

PARO appeared to evoke past memories (e.g., pet ownership), which was generally perceived as positive, allowing the participant to reminisce about previous experiences.

> *'It's triggered a bit of a life story conversation about previously owned pets – which has been really positive.'* (Clinical Psychologist)

> *'If he can have something sat on his knee that is maybe a bit similar and brings back that feeling of having an animal, that can only be a good thing.'* (Relative)

During one observation, a participant spoke fondly about her dog and frequently made positive references to how PARO reminded her of him.

> *'There's nothing I don't like about him. [To the seal]: You remind me of my lovely dog, and I think you'd get on well with him.'* (PwD)

However, monitoring reactions of PwD when certain memories are elicited appeared important in relation to session outcomes.

> *'We used the seal with a patient who was quite distressed at the time to see if the seal could help to soothe her because she has a close relationship with her cats at home. But she didn't want to see the seal at that point. I think the seal made her think of her cats.'* (Trainee Clinical Psychologist)

> *'It might also remind her more of a dog than a seal and may remind her of things she doesn't have anymore, and things she's lost, so that could be a negative response.'* (Relative)

Despite this, three HCPs indicated tearful responses may not be negative and could be an appropriate expression of emotion, particularly if the individual is harbouring feelings of loss of an animal and has not had the opportunity to express and process these emotions in a safe way.

> *'He was upset thinking about past animals, but that is a normal reaction, so I don't think he was distressed. I think he was upset thinking about people and animals he's missing, which I think was positive that he was able to express that and get a sense of relief after maybe not being able to do that before. I think the seal is beneficial for people, in terms of expressing how you're feeling, and the seal allows you to express that without necessarily having to use words.'* (Trainee Clinical Psychologist)

Working with attachment

HCPs reported the sessions may promote positive outcomes due to the *'sense of attachment and comfort derived from the seal.'* (Clinical Psychologist)

> *'Animals can be our partners, our family, our friends, and when people come here, it's a very big change. People are missing their family, and I think the seal can allow them to project that onto him, that connection, because he is very lifelike. The seal provides a safe space for that connection, and he can be a really powerful tool.'* (Activity Coordinator)

The potential to form a sense of attachment with PARO was generally perceived as positive, particularly for those who had owned animals before.

> *'She had talked about missing her dogs quite a lot and I think the need to have that source of comfort and that attachment to an animal – you could see that playing out with how she's interacted with the seal so far.'* (Clinical Psychologist)

> *'You could tell there was an immediate attachment. She was cradling it and tapping its back and engaging with it really well. Whenever the seal made noises, she'd say, "I'm here for you, I'm your Mum".'* (Assistant Psychologist)

Conversely, one HCP highlighted the risk of the participant becoming 'over-attached'.

> *'The seal may remind them of what they're missing, that love, having somebody to hold. They don't stay here long-term, but the seal can't go with them. Is it going to upset them when they leave if they've got overly attached to him? They're upset when they come here, and they haven't got their pets. So, if the seal becomes like a replacement animal that makes them happy again – are they going to go through that turmoil again when they move on when the place doesn't have the seal?'* (Occupational Therapist Assistant)

However, strategies to avoid the potential of becoming too attached were discussed.

> *'It could be a concern if people become very attached. Having that planned, structured time would be the best way to manage it and phrasing it as the seal 'visiting the ward' to help make it more structured.'* (Trainee Clinical Psychologist)

Physical interaction and sensory stimulation

Physical interaction with PARO was frequently mentioned by all participant groups, and it was evident during observations that physical interaction appeared to facilitate a sense of relaxation. All participants stroked or held PARO for the majority of the session. This even occurred during one observation where the participant was visibly upset due to the absence of her cats but physically interacting with PARO appeared to soothe her.

> *'I think the mechanism for some can be the comfort and the pleasure that's derived from holding and stroking the seal.'* (Clinical Psychologist)

> *'He's so soft and warm and cuddly, he's enjoyed the cuddles as much as I have.'* (PwD)

> *'If he is able to hug it and have it on his lap, that's something that would be really good.'* (Relative)

HCPs also expressed how the seal was beneficial for sensory needs, especially if a participant had shifted to a tactile or sensorial way of relating in dementia: *'We individualise it according to sensory needs as well as psychologically, that sense of immediate contact and something more tactile is particularly beneficial for some.'* (Clinical Psychologist)

Perception of PARO as a live being

The responsive, interactive nature of PARO was perceived as beneficial. Many PwD identified PARO as a live being (e.g., a real animal or a baby), which appeared to lead to a sense of attachment and positive outcomes.

> *'I've heard them say it's cuddly, furry, soft, the eyes are big – all characteristics of what makes an animal cute, the batting eyelashes, how lifelike it is. One had the seal on her lap, the tail was moving, and she could feel it moving, patting him on the back, 'I can feel you wriggling', so it's that movement and that closeness.'* (Assistant Psychologist)

> *'I love him. He's mischievous because he comes and sits near my neck, and he moves his head.'* (PwD)

HCPs agreed that the perception of what PARO was (e.g., live animal or soft toy) did not affect engagement but did influence the way the PwD engaged.

> *'He started implying it was real, then it switched, it became a toy. It was interesting because when it was a toy, it became less about the physical engagement and more about the seal as a conversation topic, which is quite rare to get conversation from this patient. They started talking about whales and seals, and the difference between them.'* (Activity Coordinator)

> *'One knew it was robotic, she said "how amazing technology is now". You're engaging in other conversations because of it being a robot, so it was different, she enjoyed it.'* (Assistant Psychologist)

WHAT ARE THE LIKELY PSYCHOSOCIAL OUTCOMES (INTENDED AND UNINTENDED) OF THE RAI WITHIN INPATIENT DEMENTIA CARE? (RQ4)

Impact of attending sessions

Positive impact on mood and verbalisation in the moment

HCPs expressed that interaction with PARO resulted in improvements to mood and verbalisation. During observations, most PwD appeared to become more relaxed and comfortable, and made positive comments and facial expressions.

> *'He had just had a session because the seal was sat on the table just next to my dad and he was extremely jolly. He was a lot more relaxed than normal.'* (Relative)

> *'It can be really relaxing and remind the person of home, having this type of animal on their lap, stroking this object that feels like an animal, which can really increase their mood.'* (Activity Coordinator)

> *'The patient had defined it in that moment as something to talk about, which is so positive, because at that point, he was non-verbal. The seal was a really beneficial tool to get him to open up.'* (Activity Coordinator)

> *'I can see why a lot of people would like him; he makes you happy.'* (PwD)

Both HCPs and relatives discussed sessions were beneficial even if the positive outcomes were short-term.

> *'Even if it sparks five minutes of joy for her, then it is absolutely worth it.'* (Relative)

> *'We haven't expected general improvements in their quality of life, but I think those benefits in the moment can help the person. What has been evident is the positive emotion that the seal has allowed to bring up. There are elements to that, like curiosity, interest, fun and laughter in the moment.'* (Clinical Psychologist)

Soothing effect of PARO

Participants agreed that PARO could have a soothing impact, and sessions may offer a comforting alternative for when live animals cannot come onto the ward.

> *'He looks at me in a calming way. He's got a very calming atmosphere about him.'* (PwD)

> *'He's like a little dog, very homely.'* (PwD)

> *'A lot of patients absolutely love animals, but it can be hard to bring live animals onto the ward. I think offering the robotic animal is a fun, alternative way to offer animal activities, and can be really soothing to people who miss their own.'* (Activity Coordinator)

> *'He's always busy, its stress related. I feel like he thinks he has to finish certain things before he can rest. The best way to achieve that rest is with animals, with the seal, it's something different that engages him in a different way, a more relaxed way.'* (Relative)

Additionally, the successful introduction of PARO to one participant may have highlighted the potential of introducing other relaxation techniques with soft toys.

> *'There are soft toys on the ward that when she's distressed, that's something she goes to. I don't think that happened before we introduced the seal, but it's great that animals are now something beneficial for her. It's written into her support plan to use the seal when she's distressed, and soft toys if the seal isn't around. That's now a shared understanding that that will work for her.'* (Assistant Psychologist)

Potential negative impacts of session attendance

Despite the perceived benefits, some HCPs and relatives expressed concerns around the concept of 'infantilisation'.

> *'Some people would perceive it just as a toy. I suppose that runs the risk of them thinking it's a bit condescending, being presented with a teddy.'* (Trainee Clinical Psychologist)

> *'It wouldn't be like you're making of a fool of him, would it? He's a grown man – would it be silly? I know he has dementia but he's still my husband, and I think of him as he was. I don't want him to be ruled as daft.'* (Relative)

However, the relative who expressed concern above subsequently attended a session. The Clinical Psychologist expressed how positive this was in terms of alleviating feelings of loss potentially caused by PARO, and how PARO facilitated a shared, social experience beyond that of a normal visit. Afterwards, the relative indicated their thoughts about infantilisation had altered and commented positively on PARO: *'It's so much more sophisticated than I thought, it eased any concerns I had to see it myself, and I had such a lovely visit that day'.*

Some HCPs highlighted that PARO's noises may be perceived as threatening or sound like it is being harmed, which could potentially cause distress.

> *'He emitted a high-pitched wail that might be perceived as you're hurting him and that could be distressing. I'm worried about the noises, although it didn't come up in the session I observed.'* (Activity Coordinator)

Most PwD responded positively to the noises and perceived these as PARO interacting with them. However, during one observation, a participant expressed concern that PARO was in pain, but the facilitator offered reassurance and encouraged the participant to hold PARO so *'they could make sure it was being treated well'*, which was well-received. One HCP suggested this was a useful strategy to reduce participant concerns.

> *'The situation was diffused because [Clinical Psychologist] said, "do you want to take care of the seal?" and reassured them the seal was okay. That worked well.'* (Activity Coordinator)

FRAMING RESULTS WITHIN THE ICAMO MODEL

In line with realist methodology principles (Pawson and Tilley, 2004; Wong *et al*., 2016), the current findings were synthesised into a graphic framed within the ICAMO model (Fig. 1). As illustrated in Fig. 1, our findings suggest that the intervention may promote positive outcomes within an inpatient setting due to a range of potential mechanisms. It is likely that these mechanisms overlap and interact, rather than one mechanism working in isolation. For

Fig. 1. Visualisation of results framed within the ICAMO model.
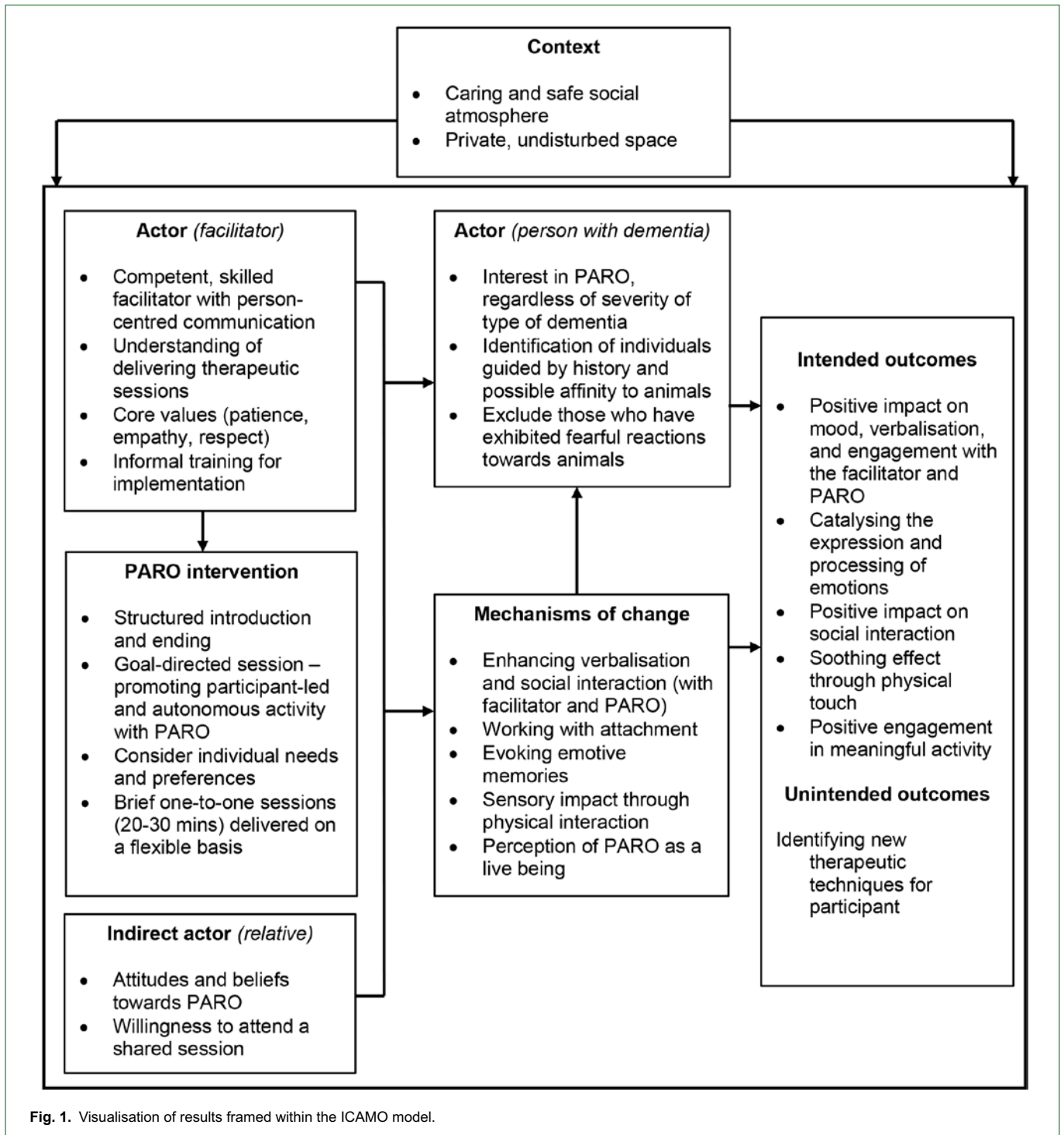
these mechanisms to be activated, we posit that the intervention should be structured but participant-led, promote autonomous activity, consider individual preferences, and be delivered flexibly and responsively according to individual needs, in a one-to-one setting with a skilled facilitator. While these positive outcomes may occur for any PwD who shows interest in PARO regardless of the severity or type of dementia, it is important to consider their levels of cognitive impairment to ascertain interest and guide the activity content.

Discussion

This study aimed to explore how, why, for whom, and in what context an intervention involving PARO may be likely to lead to positive outcomes within inpatient dementia care. We explored HCPs, PwD, and relatives' perceptions to gain a better understanding of their experiences or opinions on the delivery or receipt of these sessions. The current results enabled the development of a visualisation of findings framed within the ICAMO model regarding how this intervention involving PARO may work. This research is an important step towards informing evidence-based protocols for sessions involving PARO to support the care of PwD within inpatient settings, and highlights the importance of conceptualising, evaluating, and testing implementation of psychosocial interventions such as these in a context-specific way. Given the increasing numbers of PwD, the non-pharmacological approaches that help people live well with the condition also have considerable public health implications.

Informed by principles from realist methodology, the visualisation of results was developed according to the ICAMO model, assuming the outcomes followed from various identified mechanisms in the specific context of a dementia care inpatient setting. The potential mechanisms identified in this study align with existing evidence conducted in residential dementia care settings. For example, our findings indicate that PARO can provide an opportunity to facilitate social interaction and increase verbal and non-verbal communication. It has been reported that PARO may serve as a catalyst or mediator of enhanced conversation (Jung *et al.*, 2017; Abbott *et al.*, 2019; Chen *et al.*, 2022a), and this may foster a positive social environment and meaningful activity to improve communication, and participants' sense of belonging and purpose (Chen *et al.*, 2022a). However, it can be challenging to ascertain whether this social mechanism is elicited due to the interaction between actors alone or by the presence of PARO in its own right. HCPs indicated the two may work in tandem; PARO facilitates the social interaction between the participant and the facilitator, and also allows the participant to interact with PARO directly. This suggests the enhanced verbalisation during sessions may be due to these interacting factors, and the combination may help to facilitate successful uptake and implementation. However, conducting a future controlled study, in which a one-to-one socialisation activity (excluding PARO) is used as a control group, is warranted.

Another frequently cited mechanism that underlies potential impacts of live animal-assisted interventions relates to physical touch and sensory stimulation (Kaiser *et al.*, 2002). Research reports that stroking a live animal can provide tactile comfort, decrease tension, and allows participants to feel safe in their environment (McNicholas and Collis, 2006; Walsh, 2009). Likewise, studies evaluating PARO within residential dementia care have indicated physical contact with the robotic seal increased laughter, smiling, and verbalisation (Takayanagi *et al.*, 2014; Koh and Kang, 2018). Similar benefits have also been reported using plush animals which are comparably pleasant to touch, as compared with live animals (Gee *et al.*, 2015). These findings suggest that physical interaction with robotic animals can have beneficial effects similar to those of live animals (Holder *et al.*, 2020). This aligns with our findings in an inpatient dementia care setting, as most participants initiated physical interaction voluntarily or with minimal encouragement, which appeared to offer a soothing effect. However, physical touch and sensory stimulation is one of several identified mechanisms, and the interaction of several mechanisms may be required to achieve what fully makes PARO beneficial to PwD in a range of settings.

Potential mechanisms underlying positive impacts for live animal-assisted interventions also include aspects relating to attachment and the human-animal bond (O'Haire, 2013; O'Haire *et al.*, 2015; Shen *et al.*, 2018). It has been proposed that attachment and the development of the human-animal bond can be generated in interventions using robotic animals despite attachment being unidirectional (as the robotic animal is unable to create a reciprocal bond) (Hung *et al.*, 2019b; Shoesmith *et al.*, 2023). Our findings suggest that PARO appeared to display an appropriate repertoire of core behaviours that bore a sufficient resemblance to those of a live animal, and several PwD perceived PARO as real and appeared to develop a sense of connectedness or attachment. In the context of an inpatient setting where most patients have been admitted under the Mental Health Act (treated without their agreement) (Legislation.gov.uk, 1983) and separated from their families, this mechanism could be particularly salient. However, it is important to consider the possibility that the participant may become 'over-attached'. Previous research has reported that strong attachments to PARO may cause challenges when the sessions end, and suggested additional post-intervention interactions are required to ameliorate potential negative impacts (Chen *et al.*, 2022a). The local clinical guidance developed by the senior Clinical Psychologist in the current study highlighted the possibility of over-attachment should be consistently monitored, and PARO should be introduced as the 'ward's seal' as a strategy to mitigate any negative reactions when the sessions end. Additionally, the Psychology team delivered post-intervention interactions in the absence of PARO to ensure the session ending did not result in any negative impacts and to discuss with the participant how the interaction with PARO made them feel.

The visualisation of our results within the ICAMO model also identifies contextual factors that may underpin effective interventions using PARO in an inpatient dementia care context. Evidence suggests interventions using robotic animals are greatly influenced by the physical and social context (i.e., intervention location and the 'actors' present) (Chang *et al.*, 2013). Our findings highlight the significant impact of the physical and social context during interactions with PARO; specifically, the importance of implementation in a private space which appeared important to facilitate focused engagement. Creating a therapeutic, safe space protected from any disruptions may be challenging within a medicalised hospital environment (Clark *et al.*, 2012; Sorsdahl *et al.*, 2014; Donnelly *et al.*, 2021). However, HCPs also offered sessions in participant's bedrooms when required, as they recognised the ward environment could be a barrier for implementation. Future research should consider the broader social and physical context when evaluating PARO in various settings.

While the visualisation of our results within the ICAMO model shows how the intervention may work, adopting a person-centred approach is important. This is considered in Fig. 1 as the identification of participants should be guided by their history, preferences and needs, and the activity content should be individually tailored. The person-centred approach is particularly important within an inpatient setting as it enables HCPs to understand and provide support for any unmet needs of PwD (Kim and Park, 2017). Our findings suggest that the severity and type of dementia may not affect engagement, but it is important to consider these characteristics to guide the activities and ensure they are appropriate for varying levels of cognitive impairment. These findings also align with previous research exploring the use of PARO in long-term care facilities, as authors have highlighted the importance of a person-centred approach (Moyle *et al.*, 2019). For example, when using PARO, it is important to understand the person's biography, particularly their likes or dislikes of animals (Moyle *et al.*, 2019). Applying the principles of person-centred care is a critical recommendation for the care of PwD, and research focusing on person-centred outcomes is an international priority (World Health Organization, 2017).

LIMITATIONS

Interviews were only conducted with PwD who were able to verbally communicate. Therefore, interviews were not conducted with people with more severe dementia who may have still gained benefit from sessions with PARO. Despite this, observations were conducted with those who were unable to participate in interviews, so insights into these sessions were obtained. Secondly, the findings may not be transferable to other hospital settings or alternative settings (e.g., care or nursing homes). However, this study aimed to fill a research gap as the majority of robotic animal research in dementia care reports on interventions implemented in care home settings. Therefore, the findings add to the current theorising around how these interventions may work within an inpatient context and will provide further evidence to support the design of future intervention studies. Finally, the sample size was small, recruiting 13 participants for interviews. Nevertheless, the findings strengthen the increasing evidence base and offer a direction for evidence-based practice when implementing interventions using PARO.

CONCLUSION

To the best of our knowledge, this is the first study to contribute such insights within inpatient dementia care, by explicitly considering

the context and mechanisms of PARO within this setting, while presenting the findings in a structured visualisation framed within the ICAMO model. It is important for further research to test findings obtained from this small study, with the emerging findings guiding the research design and intervention implementation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

ETHICS STATEMENT

Ethical approval was granted by Wales Research Ethics Committee 6 (Reference: 22/WA/0128). All study participants provided written informed consent to take part.

DATA AVAILABILITY

All relevant data are uploaded to the OSF repository and available via the following URL: https://osf.io/ks5rj/.

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