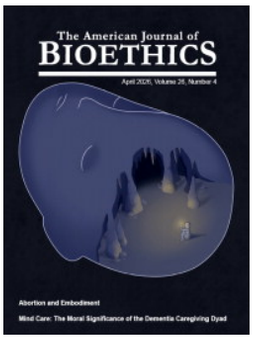

The American Journal of Bioethics

ISSN: 1526-5161 (Print) 1536-0075 (Online) Journal homepage: www.tandfonline.com/journals/uajb20

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To cite this article: Madalena Pamela Liougas, Alisa Grigorovich, Andria Bianchi, Lynn Haslam-Larmer, Leia Shum, Andrea Iaboni & Josephine McMurray (05 Mar 2026): Ethical Tensions in the Use of Real-Time Location Systems in Dementia Care: Balancing Safety, Privacy, and Autonomy, The American Journal of Bioethics, DOI: 10.1080/15265161.2026.2637089

To link to this article: https://doi.org/10.1080/15265161.2026.2637089

Published online: 05 Mar 2026.

THE AMERICAN JOURNAL OF BIOETHICS
https://doi.org/10.1080/15265161.2026.2637089

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Ethical Tensions in the Use of Real-Time Location Systems in Dementia Care: Balancing Safety, Privacy, and Autonomy

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ABSTRACT

With the increased use of technological supports in residential care homes, there is growing interest in the use of real-time location systems (RTLS) to enhance safety and streamline care. However, these technologies raise significant ethical concerns, particularly for vulnerable populations such as residents living with dementia. This paper critically examines the ethical tensions arising from RTLS implementation, focusing on autonomy, beneficence, non-maleficence, and justice. A feminist bioethics critique broadens the discussion, emphasizing relational autonomy and epistemic injustice. A composite case study illustrates the challenges faced by residents, staff, and families, revealing gaps in consent processes, data ethics, and the impact on compassionate care. Recommendations include continuous consent mechanisms, ethical data use policies, enhanced staff training, and strategies to counter epistemic injustice. By integrating principles from feminist bioethics, this paper offers a comprehensive framework for ethically integrating RTLS into dementia care, balancing technological innovation with human dignity and compassionate care.

KEYWORDS

Dementia; ethics; technology; wearables; long-term care; consent

INTRODUCTION

With the demand for residential long-term care (LTC) and workforce shortages rising in healthcare, artificial intelligence and surveillance technologies such as real-time location systems (RTLS) are increasingly being considered or used to enhance quality of care (Haslam-Larmer et al. 2022; Gallistl et al. 2024; Lukkien et al. 2024). This growing interest in data-intensive types of technologies in the care of older adults underscores the need to evaluate their effectiveness and ethical implications, particularly in relation to ensuring that they do not undermine decades of resident focused culture change efforts (Lima et al. 2022).

In LTC homes, RTLS are generally implemented to electronically track and manage the location, movement, and activity of assets (such as medical equipment) and individuals (including residents and care home staff) in real or near real-time (Boulos and Berry 2012). RTLS typically consist of: (i) a wearable device such as a tag, badge or bracelet attached to an asset or individual, (ii) fixed receivers or readers (location sensors), and (iii) software (Boulos and Berry 2012; Oude Weernink et al. 2018). The wearable device emits or returns wireless signals to the receivers/readers, which then communicate with software that relays the location information to middleware and application software. The location of assets or individuals is electronically displayed in real-time, and location information can be collected and visualized to explore patterns over time (Boulos and Berry 2012; Grigorovich and Kontos 2020). Although RTLS offers the potential for enhancing efforts to safeguard residents' physical safety by supporting decision-support and improving operational efficiency (Laplante et al. 2018), the use of this technology has significant implications for individuals and society, which must be considered (van Hoof et al. 2018; Grigorovich et al. 2021). These are particularly important when implementing this technology in LTC homes where almost 90% of residents are living with dementia or other cognitive impairments (Ng et al. 2020; Canadian Institute for Health Information, 2022).

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Although a substantial body of literature exists on the use of surveillance technologies that provide continuous remote supervision of people living with dementia by caregivers (Vermeer et al. 2019), there is no consensus on ethical guidelines for implementing RTLS or similar types of data-intensive technologies with or for this population (Niemeijer et al. 2010). Discussions about the ethical implications of surveillance technologies such as RTLS have largely been framed within Beauchamp and Childress' (2001) principlist approach, which emphasizes balancing the ethical principles of autonomy, beneficence, non-maleficence, and justice (Yang and Kels 2016; Ienca et al. 2018; Khan et al. 2018; Robillard et al. 2019). These discussions are often narrowly focused on the need to balance individual benefits and risks of a technology against perceived tradeoffs between autonomy and safety (Grigorovich and Kontos 2020). As a recent systematic review in this area suggests, such an approach has shortcomings as it does not account for the dynamic and interactive context in which decisions about surveillance technology are made, and thus there is an urgent need to further broaden and enrich ethical analysis by drawing on relational (non-principlist) approaches (Howes and Gastmans 2021). Without this, there is the potential for surveillance technologies to introduce new types of risks and harms that may undermine otherwise good intentions for their use (Grigorovich and Kontos 2020; Berridge and Grigorovich 2022).

Broadening of ethical reflection regarding use of surveillance technologies is particularly needed within LTC settings given their complexities, which include their dual function as a home and place of work and the importance accorded to the promotion of autonomy for residents with cognitive and functional impairment within current quality-of-care standards (Hande, Keefe and Taylor 2021; Lima et al. 2022). As highlighted by Gómez-Vírseda, de Maeseneer and Gastmans (2019), the principlist approach to bioethics limits autonomy to an individualistic and rational exercise, focusing on discrete decisions made by self-interested moral agents. Furthermore, the principlist approach does not fully capture the socio-cultural and systemic factors that may influence decision-making in these settings, particularly in cases where these technologies are used to monitor individuals incapable of providing informed consent. In particular, in both Canadian and United States LTC homes, risk aversion tends to dominate, which leads to an overemphasis on safety and security that can undermine efforts to promote residents' autonomy (Hande et al. 2021; Berridge and Grigorovich 2022).

Feminist bioethics scholarship has the potential to enrich ethical analysis on RTLS (and surveillance technologies more broadly) because it challenges the individualistic interpretation of autonomy within principlism by underscoring the interconnectedness of relationships, social structures, and systemic inequalities that shape ethical decision-making (Ho 2022). Relational autonomy - emphasizes that individuals' decision-making is embedded in social, cultural, and organizational relationships (Gómez-Vírseda, de Maeseneer and Gastmans 2019). When combined with a commitment to social justice rooted in an ethics of care, this ethical perspective can be particularly useful to bridge the gap between ethical principles and their application in practice within technology-mediated care settings because of its emphasis on lived experiences and power relations (Gray and Witt 2021).

Although the discussions around feminist bioethics and surveillance technologies have been described (Ho 2022), this approach has not yet been applied to guide decision-making in the context of implementing RTLS in LTC homes with persons living with dementia. To address this knowledge gap, below we present a composite case study drawn from a recent research project that involved the implementation of a commercially available RTLS for clinical support and care planning in two settings in urban Ontario, Canada—a 20-bed, short-stay inpatient unit at a hospital for people with behavioral and psychological symptoms associated with dementia and a LTC home with 128 beds (https://sticsproject.com/). This case study serves as a foundation for applying the principlist approach to the use of RTLS in dementia care and then expanding it through a feminist bioethics critique.

COMPOSITE CASE STUDY

Mr. Robert Jenkins is an 83-year-old resident at Sunny Meadows LTC home, which is a medium sized home with 100 beds located across three floors. He has lived with moderate dementia for the past three years and experiences short-term memory loss and occasional confusion. Among staff and other residents, he is well known for his independent spirit and love of gardening. He is also known to frequently walk around the building, sometimes visiting floors not assigned to him or going to the balcony, and he often forgets to inform staff of his whereabouts. While he cannot leave the building due to the locked main doors, staff often find it challenging to locate him in the home for scheduled tasks, such as medication administration or participation in group recreational activities.

Sunny Meadows installed a commercially available RTLS that uses ultrawideband technology to collect

2-dimensional location data through wall-mounted beacons and wrist-worn devices (e.g. tracking bracelet). The main organization goal for installing the system is to enhance clinical safety by improving the accuracy and efficiency of tracking the 100 residents who live within the home in real time (e.g. to enable quicker localization of residents in the home by staff and to reduce reliance on in-person observation of residents' activities and the burden of documentation of activities). The LTC home also wanted to explore whether collected and summarized location data provided by the RTLS software could be used to derive clinical insights and guide data-driven care planning and quality improvement initiatives. Finally, they were also interested in using the RTLS to collect location data from residents for the development of clinical algorithms by researchers.

As per relevant legislation regarding decisions about personal care and health and safety for persons with diminished capacity in healthcare settings (Guzik-Makaruk et al. 2018), the substitute decision-makers (SDMs) of all residents were contacted by an administrator at the LTC home to notify them about the installation of the RTLS and to provide them with the opportunity to verbally consent (or refuse) to the resident wearing the bracelet and to the collection of their location data. The bracelet has a wristwatch-style top and a waterproof silicone snap-closure wristband. Initially, the standard band that was used was similar to hospital identification bands, designed to be non-removable unless cut. However, after requests from some residents and families, an alternative silicone band that could be taken on and off was introduced.

The SDMs were informed that the RTLS would primarily be used by staff to locate residents in the home, with their location viewable at any time on software on a monitor screen set up for this purpose at the central nursing station. They were also told of the home's interest in using the RTLS to collect location data over time to derive clinical insights and for quality improvement initiatives. While the bracelet included a press button that could allow residents to call for staff assistance from anywhere in the home, it was not connected to a monitored alert system and did not trigger a staff response if pressed (e.g. this feature was inactivated). Mr. Jenkins' SDM, his 60-year-old daughter was enthusiastic about the potential of this technology for enhancing his health and safety and immediately provided consent. Upon being told about her consent, a direct care staff member at the home approached Mr. Jenkins to ask him to wear the bracelet and attached it to his right arm

All care staff at the LTC home were invited to attend a one-hour training session on how to use the RTLS software to look up residents' locations and to view their summarized data. During this session, staff were also informed of the organizational rationale for installing this technology - to improve the quality of care by enhancing the safety of residents through more accurately and efficiently locating them in the home and identifying changes in patterns of their movements over time. They were not, however, explicitly told how to integrate the use of the RTLS or the collected and summarized data into their usual care practices, including how often and when they should use the system to check in on residents or how to determine the clinical significance of the summarized location data available in the software. Staff were also not given explicit guidelines about how to communicate with residents about the RTLS, including how to answer questions about its purpose or features (e.g. pressing the button, alerts). They were also notified that in the future, the home may also be interested in having the staff wear the same tracking bracelet to more accurately measure hours of care provided, inform capacity planning, and enhance workplace health and safety (e.g. personal security alarm).

Many staff left the training session feeling uncertain about how the RTLS operated or how they should effectively incorporate it into their daily routines to enhance the safety of the residents or improve operational efficiency. For instance, some staff were unsure of when and how to use the RTLS to locate a resident, including whether the system would automatically alert them if Mr. Jenkins left the floor or went on the balcony. Some staff expressed uncertainty about whether they needed to continuously monitor the residents' movements at the nursing desk. Most importantly, staff also left the session questioning what, if anything, they should say to residents if they were to ask about why they needed to wear the bracelet all the time or how to explain to them how they will use the RTLS in practice to improve their care. In particular, they were uncertain about how to engage with residents' SDMs to support informed consent if they had any questions following the initial contact or how, and whether, to involve residents in the decision-making process. For example, the staff were uncertain about the potential immediate benefits and risks of the RTLS for residents, as well as how to effectively communicate this information to residents and/or their SDMs. They were also unsure about what precise information collected by the RTLS about the resident could or would be shared with the SDM. They also lacked guidance on how to respond beyond explaining that it

was "for their safety," including when residents explicitly asked about the purpose of bracelet, had concerns about wearing it, or expressed outright dissent to wearing it. Finally, they were unclear if they should respect a resident's choice not to wear the wristband or override their choice in favor of the SDM's consent, leaving them uncertain about how to balance residents' autonomy with their duty of care.

While Mr. Jenkins' initial reaction was to admire his "new watch", over time, the care home staff observed him tugging at the bracelet and pushing it down his hand and sometimes sliding it off and placing it elsewhere. This behavior prompted staff to gently remind him about the importance of wearing it. Despite these efforts, each time the bracelet was placed back on his wrist, his facial expression showed signs of distress. He would frown and shake his head from side to side, clearly upset by the bracelet's presence. Careful observation by the staff showed no obvious signs of abrasion or skinirritation from under the wristwatch-style top or band, leaving them questioning his reluctance to wear it. One afternoon, Mr. Jenkins was in the recreation room tending to the potted plants when a staff member approached him with his bracelet, which had been left on his bedside table. As usual, the staff asked Mr. Jenkins to wear it and reminded him that it was important "for his safety." Mr. Jenkins immediately turned his back, shook his head "no," and clasped his hands together to prevent the wristband from being put on. His face became flushed red with agitation, and he started rapidly breathing. The staff member was unsure of what to do and approached a colleague with the bracelet in hand.

> Staff member: "I don't know what to do (exasperated sigh). Mr. Jenkins refuses to wear his tracking bracelet. His daughter wants him to wear it, but I am beginning to feel bad. Maybe I am pushing him too much."
>
> Colleague (a fellow staff member):
>
> I understand; I have been feeling the same way. They (the home) told us that the residents need it for safety, but I think that sometimes it upsets them more than anything. They've said it will help us keep track of everyone, but I am not sure how to explain this to him or to help him remember this. You could consider placing it somewhere where it's less noticeable to him, like on his ankle?

After this discussion with their colleague, the staff member, responding to Mr. Jenkins' distress, sat beside him and tried speaking in a calm, soothing voice, again explaining the importance of him wearing the bracelet for his safety, to find him quickly, "so we can be there when you need us." After a few minutes, Mr. Jenkins started to relax, and the staff member reached down and placed the bracelet around his ankle. He did not attempt to remove it and continued tending his potted plants.

CASE STUDY ANALYSIS

This case study demonstrates common ethical tensions involving residents, residents' families, care home staff, and the care home organization that arose in response to the implementation of the RTLS in our research. Below, we discuss these tensions in relation to the four primary biomedical ethics principles of the principlist approach: autonomy, beneficence, non-maleficence, and justice, and apply to them a feminist bioethics critique.

Autonomy and Informed Consent

Requiring informed consent for the use of RTLS technology in the context of care is grounded in respect for the autonomy of individuals to be involved in their care and to make informed and uncoerced decisions. The care home's policy regarding the informed consent process followed legislation intended to protect individuals with diminished capacity by allowing their SDMs to make decisions on their behalf in relation to their personal care and health and safety (Guzik-Makaruk et al. 2018). In the case study, staff complied with the SDM's decision and continued to place the tracking bracelet on Mr. Jenkins' wrist despite his clear signs of distress. While such prioritization of the SDM's preferences is consistent with the LTC's policy and broader regulations, this does not diminish the importance of reflecting whether such decisions are in 'the best interests' of residents, including the potential harms that may occur from prioritizing SDMs' preferences. This is particularly important, given that refusal of surveillance technologies by people with dementia is too often assumed to be irrational "resistiveness" or "non-compliance" that is attributed to their cognitive impairment or inadequate technological design rather than a valid expression of choice (Ganyo, Dunn and Hope 2011; Grigorovich and Kontos 2018; Nordgren 2018).

Empirical studies highlight additional challenges with relying on SDMs for consent to the use of surveillance technologies in care of older adults (Black, Wechsler and Fogarty, 2013; Berridge and Wettle 2020). SDMs who are family members often favor the

use of technologies to enhance the physical safety of residents with dementia and perceive their risks to privacy as less important (Niemeijer et al. 2013; White and Montgomery 2014; Hall et al. 2017, 2019; Sundgren, Stolt and Suhonen 2020). Some studies have also found that some familial SDMs express a willingness to coerce or force individuals with dementia to use such technologies (Landau and Werner 2012; Berridge and Wettle 2020). Applying guardianship and surrogate decision-making models may thus undermine residents' agency by overlooking their ability to participate in decisions and express individual preferences (White and Montgomery 2014). This suggests that the standard informed consent process may not be sufficient to address how to promote autonomy and prevent coercion of persons living with dementia in the context of decision making about the use of RTLS.

While Mr. Jenkin's dementia made him more vulnerable to making potentially harmful decisions, it did not necessarily mean that he was incapable of making any decisions, including those related to the RTLS. Even if he was judged to be incapable of making a specific decision, reliance on surrogate or substituted decision-making in both ethical reflection and legal regulations (Birchley, 2021) still requires ensuring that decisions made on his behalf are in his 'best interest,' which includes consideration of all harms and preferences and aligned with his current and past values/preferences and wishes, rather than solely those of his SDM and/or the LTC home. It is important to note that while the RTLS was implemented primarily to enhance clinical safety through more accurate localization, the home was also interested in exploring other benefits that may (or may not) accrue through the development of clinical algorithms trained on collected data that they share with commercial and noncommercial users (e.g. owner of RTLS, academic researchers). Its use in LTC thus blurs the boundaries between the collection of resident data to inform clinical care and quality improvement and research and development. The SDM's enthusiasm for both of these uses of the RTLS in our case raises concerns about whether the distinction between research and clinical care was clearly understood and appropriately reflected on by both the home and the SDMs. This echoes longstanding concerns in bioethics about therapeutic misconception, particularly in settings where access to innovative technologies is tied to study participation (Bantry-White 2018).

The Limitations of One-Time Consent

Relying on a one-time informed consent process with the SDM was also ineffective in practice. It failed to provide sufficient guidance on how to incorporate Mr. Jenkins' prior and current values into ongoing decision-making, or how to assess for assent and respond to instances of dissent. His non-verbal expressions—such as shaking his head "no", clasping his hands, appearing red in the face, and breathing rapidly—were clear indicators of distress. Furthermore, they were indicators of dissent, i.e., a desire to not wear the wristband, and potentially also reflecting an unwillingness to consent to the use of RTLS in his care. Such expressions of dissent have been documented in previous research on the use of RTLS and other surveillance technologies with people with dementia (Grigorovich et al. 2021). In the case study, despite Mr. Jenkins' dissent, care home staff followed a standard one-time consent model, prioritized the SDM's perspective, and did not implement any processes for seeking and maintaining ongoing assent from the person with dementia. As demonstrated by the conversation between the staff member and their colleague, the staff's acknowledgement of Mr. Jenkins' dissent highlights the need for continuous consent mechanisms that allowed residents to communicate their evolving preferences.

As the care home's consent policy prioritized the perspective of the SDM (for residents who were incapable of consenting), Mr. Jenkins was treated as a passive information receiver rather than a capable—or even incapable—source of knowledge that was acknowledged in the decision-making process. Adopting a continuous consent process, whereby acceptance or rejection of RTLS is more flexible and incorporates consideration of residents' current preferences based on their verbal and non-verbal expressions of assent and dissent, may be more appropriate (Pyer and Ward 2024). This is consistent with the broader feminist bioethics calls for a shift toward supported decision-making for persons with cognitive impairment, institutionalization of the right of refusal, to ensure that informed consent processes protect "already vulnerable individuals" from being unfairly pressured to defer to authority (Benjamin 2016; Peterson, Karlawish and Largent 2021).

Moral Distress and Staff Training

The implementation of RTLS can be a source of significant stress for staff. It may contribute to experiences of moral distress, particularly when staff lack adequate understanding of how the technology works and do not receive proper training to navigate its full ethical and relational implications (Riedel et al. 2022). Moral distress arises when caregivers feel unable to

act in accordance with their professional and personal values, often due to institutional constraints or uncertainty about best practices. As Hande and colleagues' review highlights (2021), a common conflict in this regard in LTC arises from the overemphasis on safety over other domains of quality of life within existing regulations and the lack of support that staff in LTC generally have to respond effectively to residents' needs and preferences. In our case study, this is evident when a staff member expresses uncertainty and emotional discomfort, stating they "don't know what to do (exasperated sigh)" and admits to feeling bad about placing the bracelet on Mr. Jenkins. Such moments illustrate how the introduction of RTLS can alter the nature of caregiving, potentially compromising the quality of relational care and staff wellbeing in the absence of appropriate support and training. Additionally, minimal staff training alongside the home's reliance on one-time informed consent for the use of RTLS may have prevented the staff from reflecting on the moral conflicts they experienced or considering how they might have navigated them in an ethically defensible way. Scholarship on workforce monitoring outside of care settings suggests that they may reinforce historic labor inequities, prompt anxiety and fear, and add emotional labor (Van Oort 2019; Grigorovich and Kontos 2020). Without proper training, consent can serve as a loophole to circumvent more critical questions about what and whose values influence decision-making about RTLS. This may prematurely foreclose a more nuanced assessment of the risks and benefits of RTLS as was in the case of Mr Jenkins. For instance, one could consider whether the potential benefit to the home's operational efficiency justified the potential harm to the resident, particularly if it compromised their autonomy and/or their relationships with staff and other residents in the home.

Although surveillance technologies such as RTLS are purported to increase operational efficiency, empirical research suggests that they do not, and in fact, they can create additional work for care home staff (Grigorovich and Kontos 2020). Introducing technology requires staff to learn how to use it, assume new data management responsibility, address any technical malfunctioning, and provide regular technological maintenance (Fisher and Monahan 2008; Coahran et al. 2018; Grigorovich and Kontos 2020). In the case study, staff were required to incorporate additional tasks related to the RTLS into their workflow including ensuring Mr. Jenkins was wearing the wristband and continuously checking his location in the software at the nursing desk. While the time that staff spent on these tasks may have been reduced through additional training, this may nonetheless have negative consequences through the disruption of usual practices. Moreover, there is limited research in this area to guide policy and practice, including studies that compare and contrast the time spent, cost, and other types of outcomes associated with in-person/usual care vs. RTLS to determine the real advantage and feasibility of these technologies in health care (Lopes et al., 2025).

Beneficence, Harm, and the Limits of RTLS

The installation of the RTLS was framed as an act of beneficence by the care home, intended to enhance the quality of care for residents by supporting broader efforts to improve care quality, ensure resident safety, and optimize the use of human resources. Mr. Jenkins' SDM provided informed consent based on her belief that the RTLS would contribute to improving the physical safety of her father. Concerns regarding the physical safety of residents, and in particular how their movements may pose a risk of injury, exploitation or fatalities, are a common justification for the use of surveillance technology with people living with dementia. However, when seeking her consent, the care home did not provide her with information on how RTLS differed from other technologies already used in the home for this purpose, such as hallway cameras, nor clarify the tradeoffs between safety and privacy for Mr. Jenkins. In particular, while cameras and electronic locks are already routinely being used to enhance safety by overseeing residents' movements, activities and interactions with others in public spaces within the many LTC homes (which already compromise residents' privacy), the RTLS enables expansion of this surveillance into residents' private lives (e.g. bathrooms, bedrooms). Notably, if Mr. Jenkins were to leave the LTC home, none of these technologies could be used to locate him, and research on these suggests that even when such technologies involve generation of automated alerts to remotely located carers, there may be insufficient human resources within LTC homes to respond to such alerts (Grigorovich et al. 2021). This is consistent with current empirical research, which suggests that older adults and their family members do not fully understand how surveillance technology functions, what data they collect and for what purpose, nor how they can impact their future care (Niemeijer et al. 2015; Hall et al. 2017).

Given that the bracelet worn by Mr. Jenkins did not include an activated call button and the RTLS could not be used to predict decline as the necessary clinical algorithms were still undeveloped and untested,

it provided little to no immediate, tangible benefit to him or other residents. As feminist bioethicists have argued, data intensive technologies such as RTLS do not always translate into meaningful improvements to quality of care or quality of life (Ho 2022). Moreover, many SDMs, residents and care home staff are likely unaware of the impact of such technologies on their privacy or how these systems collect or share data with the organization or technology developers (Gran, Booth and Butcher 2021; Behrendt and Loh 2022). This data is often reduced to quantifiable metrics, which are detached from the rich environmental and cultural context in which they are generated (Ho 2022). This can lead to a consensual loss of individual control over personal health data, making it more vulnerable to commercialization and profit-driven use (Allen et al. 2017). As a result, the balance of power and autonomy could shift even further away from the residents themselves.

The use of RTLS has the potential for beneficence if it enhances staff's ability to prevent intentional physical harm to residents and care home staff. For example, it may help to prevent resident-to-resident violence (Sifford and Bharucha 2010) and improve medication adherence (Aldeer, Javanmard and Martin 2018). However, currently there is no empirical research evidence supporting the assumption that the use of surveillance technologies is effective for deterring abuse or neglect within care homes (Hayward 2017; Berridge, Halpern and Levy 2019). Additionally, RTLS implementation may unintentionally infringe on personal freedoms. As demonstrated in this case, effective harm prevention requires not just RTLS technology but also sufficient human resources and functional features such as a call button and/or automatically generated geofencing alerts, which allow staff to respond in a timely manner through close and continual monitoring. In the RTLS implementation examined in this case, none of these factors were adequately considered in the implementation and use by the care home. As a result, even though RTLS was introduced with the intent of improving safety, its actual effectiveness was limited.

Moreover, even if the RTLS resulted in such benefits, its use could nonetheless be stressful to staff and residents and have the potential to negatively affect interactions and relationships. Although Mr. Jenkins showed "no obvious signs of abrasion or skin irritation" from the bracelet on his wrist, it nonetheless made him visibly uncomfortable as he often tugged at it, pushed it down his arm, and refused to wear it. In response, staff attempted to alleviate his discomfort by placing the wristband on his ankle. However, this solution did not fully address the distress that may have been influenced by his wearing of the bracelet or the constant surveillance it enabled, nor staff moral distress at witnessing his dissent.

Tracking Staff – Efficiency or Ethical Dilemma?

The use of RTLS can also have negative consequences for staff if it is used to track them or used as the basis for performance evaluation and sanctions. Even if staff do not wear the sensor themselves, the RTLS could be used to track response time and workflow retrospectively, including how long a resident spent in any area without moving, or how long they spent in a restricted area after entry (e.g. hallway, balcony). Thus, the extent to which staff are actively or passively monitored remains an ethical concern. This also raises concerns about how to balance the needs of staff and residents as they navigate the physical and moral space where their interests diverge, especially when institutional priorities favor efficiency over individualized and compassionate care. This is especially complex in a LTC home when residents' participation in the use of RTLS depends on their SDM's consent, and care home staff are pressured to comply with SDMs' decisions irrespective of competing resident preferences. In the literature, some staff justify the use of surveillance technologies due to fears associated with a blame culture in care homes (Hall et al. 2017). While the case study did not explicitly engage with these fears, it demonstrates that staff understood that the home believed that the RTLS would enhance the safety of residents, and that they were obligated to support its use by consistently monitoring Mr. Jenkins and reminding him to wear the device. The reliance on RTLS in LTC homes may undermine trust between staff and residents if this shifts staff focus from care to surveillance, particularly if it engenders the type of conflict captured in our case. Moreover, if the system generates data that reflects negatively on staff abilities to support the health and safety of residents, whether due to technical errors or contextual misunderstandings, staff may be unfairly held accountable, reinforcing the very blame culture the technology was intended to mitigate.

In the case study, staff were also unsure about the RTLS's operation, including its contributions to residents' safety, care quality, and operational efficiency in practice, as well as how to interpret the accessible data. They also lacked guidance on how to navigate the settings (such as frequency and type of alerts), and whether they were expected to defer to any automated alerts or identified changes in residents' usual

movements over their own professional judgment. Feminist bioethics highlights that scientific objectivity is often mistakenly equated with trustworthiness, ignoring the complexities of human care (Scheman 2011). Although RTLS ostensibly offers an "objective" means of documenting and monitoring the safety or health of residents and enabling remote care, this technology risks undermining staff professional autonomy by shifting decision-making power away from caregivers and toward predictive algorithms (Buchman, Ho and Goldberg 2017). Without clear policies on how RTLS data can be used, staff may experience increased scrutiny that prioritizes institutional efficiency over ethical, person-centred care. We thus agree with the broader literature on surveillance technologies that a more ethical approach to implementation must take a bottom-up approach to staff involvement and collaboration that involves regular communication and training (Niemeijer et al. 2011; Grigorovich and Kontos 2020).

Justice, Stigma, and Epistemic Injustice

The care home organization's use of RTLS can also be framed as an act of justice, in that all staff and residents at Sunny Meadows were given equal opportunity to participate (i.e. wear the bracelet). Moreover, the home's interest in using RTLS to allocate resources more efficiently could also be seen as an attempt to promote justice, ensuring that some residents don't receive disproportionately more time or care resources at the expense of others. However, such a perspective on justice as equality overlooks feminist interpretations of justice rooted in an ethics of care that attends to structural inequities (Gray & Witt, 2021). Adoption of a feminist perspective on justice would prompt reflection on the opportunity costs of investment in RTLS within the resource restricted environment of LTC over alternative approaches to improve quality of care (Berridge & Grigorovich, 2022) and identify ways that the use of an RTLS may contribute to inequity. As an example, the use of RTLS with a visible wearable sensor may reinforce the stigma associated with dementia for residents like Mr. Jenkins (Moody 1985; Sherratt, Soteriou and Evans 2007). Specifically, the wearable can be a visible marker of incapacity and vulnerability, which frames the individual wearing it as someone who needs to be constantly watched or controlled (Slaughter et al. 2007; Bowen et al. 2013). In the case study, the design evolved from a hospital bracelet to a silicone band, which is consistent with other efforts captured in the literature to redesign surveillance technologies to minimize identifiability (Bowen et al. 2013; Hall et al. 2017; Masciadri, Comai and Salice 2019). For example, empirical research on the implementation of RTLS suggests that residents' removal of wearables is often attributed to poor design esthetics and/or uncomfortable placement (e.g., male residents who refused pink bracelets, or perceived being tagged as stigmatizing) and suggests that this is an important barrier to user acceptance of RTLS (Bowen et al. 2013; Hall et al. 2017).

However, even with such interventions, it is critical to consider how the use of an RTLS can perpetuate epistemic injustice for residents with dementia, as asking them to wear it and not respecting their dissent diminishes their credibility as knowers—individuals capable of sharing their own experiences or preferences—and knowledge sharers (Fricker 2007). For people with dementia, epistemic injustice manifests when their cognitive unreliability is assumed, and their testimonies or preferences are disregarded or undervalued, as was the case in our study (Young et al. 2019). As a result, a wristband serves not only as a physical restraint but also as a social one, reinforcing stereotypes that further marginalize and silence people living with dementia.

Epistemic injustice has tangible consequences. Residents who wear an RTLS bracelet might face subtle forms of discrimination, such as exclusion from other types of decision-making and/or diminished access to meaningful interactions with residents who avoid them or staff who feel they do not need to engage them as often. As Jongsma, Spaeth and Schicktanz (2017) point out, this form of exclusion reflects deeper societal tendencies to marginalize those whose cognitive abilities are already questioned. In the context of LTC homes, the assumption that technology could (or should) replace or augment human interaction with persons living with dementia might further divide those deemed competent and those who are not, further exacerbating existing power imbalances between residents, their families, and care staff.

DISCUSSION

Amidst the rapidly advancing and widespread use of RTLS and other surveillance technologies in LTC homes, a technologically mediated approach to care is often promoted as being more accurate, efficient, safe, and effective than traditional human-delivered care. The ethical implications of such technologies, particularly in the context of vulnerable populations such as people living with dementia, require significant ethical scrutiny. While RTLS could offer practical benefits,

such as enhancing efforts to improve safety and operational efficiency, it raises critical concerns regarding autonomy, privacy, emotional wellbeing, and epistemic injustice. In addressing these ethical issues, it is thus essential to consider not just the operational benefits of RTLS for LTC organizations but also its impact on the dignity, autonomy, and social identity of the residents and staff. The use of technology in care settings should be carefully weighed against the potential for reinforcing existing inequalities and biases that harm populations who are already vulnerable.

The introduction of RTLS and similar data-intensive technologies should be accompanied by the development of organizational policies and practices based on comprehensive ethical frameworks that ensure continuous consent rather than one-time proxy decisions, while also providing clearer guidance on the balance between operational efficiency and resident autonomy. These frameworks should enable the meaningful involvement of residents in decision-making about RTLS use, ensuring that their voices are heard and respected. Ethical frameworks should explicitly address how decision-making power is distributed among staff, residents, and SDMs, ensuring that technology does not override resident autonomy, human dignity and personhood. Care homes should not focus solely on operational efficiency but must also safeguard compassionate, personalized care to ensure that the use of technology does not replace essential human interaction. Additionally, staff need to receive proper training to enable them to understand the impacts of these technologies and balance their use with professional autonomy, including in communication with residents and families, thus ensuring that their professional roles are not diminished.

To address these challenges, we recommend incorporating a relational ethical approach to the use of RTLS in LTC homes and the development of decision-making models that recognize the interconnectedness of relationships (Ho 2022). This would require that the perspectives of residents, families, and staff are more fully recognized in decisions regarding RTLS, fostering a collaborative environment where the needs of all stakeholders can be balanced (Gómez-Vírseda, de Maeseneer and Gastmans 2019). While the use of surveillance technologies in LTC homes is not new, the use of technologies like RTLS that enable passive and ongoing surveillance of all of residents' interactions and activities is. It introduces new types of risks that come from the collection of data that may not have direct clinical relevance and from areas of life generally exempt from a clinical gaze. Given that promotion of residents' privacy is widely recognized as relevant to efforts to improve their quality of life and wellbeing within both legal, professional, and ethical scholarship (Berridge, Halpern, Levy, 2019; Hande et al, 2021; Lima et al, 2022), the use of these technologies in LTC introduces critical ethical issues that are qualitatively different from those that have already been identified in regards to other technologies commonly used (e.g. video cameras, alarms). Our case and its analysis demonstrate the value of proactively and explicitly reflecting about the specific benefits and harms associated with use of RTLS in LTC on an ongoing basis using a relational ethical approach and developing new ways to ensure that "persons with disabilities enjoy legal capacity on an equal basis with others in all aspects of life" (UN General Assembly 2006). To enable this in practice, we suggest the following are required:

1. Establish continuous assent and consent mechanisms: Develop policies that require the use of ongoing or continuous consent processes with residents and their SDMs that clearly outline the immediate and future benefits of RTLS to them, as well as their potential harms. If a resident is determined as incapable of consenting, offer the opportunity to communicate their preferences and periodically revisit decisions to allow for their preferences to evolve and change over time (Black et al. 2010). If a resident dissents to the use of RTLS through verbal or non-verbal communication (i.e., signs of distress), explore their rationale and address their concerns. If dissent persists, care staff should not only respect the resident's dissent, as RTLS is not a care provision requirement, but also use these moments as opportunities to revisit and reassess consent (Black et al. 2010). Rather than treating consent as a static, one-time decision, staff should engage in ongoing conversations with both the resident and their SDM to ensure continued alignment with the resident's evolving preferences (Birchley 2023). Signs of distress - such as agitation, verbal objections, or repeated attempts to remove the device, should be recognized as triggers for reassessing consent, rather than seen as compliance challenges. This approach is consistent with resident-centred care and shared decision-making ensuring that autonomy is respected while balancing safety concerns. Embedding continuous consent as a routine practice not only upholds ethical standards but also fosters a care environment where residents feel heard and respected.

2. The development of transparent ethical guidelines and policies governing the implementation of RTLS in LTC, including collection and use of data, security and privacy protections, and clear roles for staff, must be established to guide organizations and staff. Given the ethical tensions identified in the case, including those that result from the reliance on proxy or surrogate consent and the potential for privacy related harms from continuous surveillance, a higher level of standard should be required along with robust data governance and transparent communication. Here we agree with Ho et al. (2014) who suggests that in the context of surrogate decision-makers in particular, "it is imperative to pursue a policy of respectful caution on behalf [of persons with dementia], guarding against practices that treat them as objects even if they are objectified only for purposes of observation intended for their own good." (Ho, Silvers and Stainton 2014). This is necessary not only to ensuring compliance with existing regulations regarding privacy and personal health information that require informed consent, but also to support individual LTC homes in developing specific policies regarding documentation of informed consent (and refusal) based on transparent communication regarding RTLS capabilities and limitations and how it will be used to enhance quality of care at the individual and organizational level. Given that SDMs often want access to data collected about their resident, and that it is an important motivating factor for their consent to RTLS use, such policies should explicitly outline the scope and limitations of data access.
3. Enhance staff training: Develop robust education and training to equip care home staff with the necessary skills and knowledge about the capabilities of RTLS and how they can use this technology effectively in the context of established workflows and activities. Ensure that they understand not only the technological features and ethical considerations of these technologies, but also that they are supported in exercising discretion and flexibility to use them in ways that enhance resident quality of life. The latter is crucial to ensure that RTLS supports, rather than undermines, compassionate care. This includes enabling staff understanding of the limits of RTLS, recognizing when human interaction is more effective, and managing potential harms that may result from its use, such as stigma and alarm fatigue. The development of comprehensive education and training for staff regarding RTLS is also necessary to enable them to appropriately support residents and families (including SDMs) in making informed decisions regarding its use that are in line with residents' values and preferences. Following culture change principles and broader efforts to ensure meaningful involvement of people living with dementia in decisions about their care, education and training is needed to ensure that staff have the skills and knowledge to obtain and revisit informed consent and assent (or refusal and dissent) to RTLS on an ongoing basis to ensuring that the use of this technology in practice appropriately balances concern for residents' welfare with respect for their remaining independence. This could include the development of more inclusive ways of communication and the use of novel decision-making tools like 'Let's Talk Tech' that has been shown to enable informed compromise on the use of surveillance technology in care through prompted and facilitated dialogue between persons living with dementia and their care partners (Berridge et al. 2023). Evaluations of this tool also support its integration into the electronic health record to document residents' preferences and to support advance care planning (Berridge et al. 2025).

By thoughtfully integrating the above recommendations, LTC homes will be better positioned to harness the benefits of RTLS while minimizing its risks, ultimately promoting an environment that values both technological innovation and the fundamental principles of human dignity and compassionate care.

CONCLUSION

The use of RTLS in LTC homes offers potential benefits for enhancing the quality of care, but also raises ethical tensions, particularly regarding how to balance the promotion of autonomy with best interests in supporting decisions of people living with dementia. Our analysis demonstrates how reliance on principlism alone may be insufficient to appropriately recognize potential harms and resolve ethical tensions and underscores the value of enriching ethical reflection with a feminist bioethics lens that centers relational autonomy and epistemic justice. We propose recommendations for a more holistic approach to RTLS use in LTC that is aligned with existing culture change

efforts in Canada and the United States to reform LTC homes to enhance resident quality of life.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the generosity of the participants who contributed to this study. The study was funded by AGE-WELL (Aging Gracefully across Environments using technology to support Wellness, Engagement and Long Life) Network (NPA: Author AI) and an AMS Healthcare Fellowship in Compassion and Artificial Intelligence (Author AG).

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the author(s).

FUNDING

This work was supported by AGE-WELL, AWCRP-2020-02; AMS Healthcare Fellowship in Compassion and Artificial Intelligence.

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