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# Evidence-based Recommendations for Assistive Technologies for Safety in Dementia Care

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# Evidence-based Assistive Technology Interventions for Safety in Residential Dementia Care

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## Abstract

A Quality Improvement (QI) project in a Midwestern Continuing Care Residential Community (CCRC) was designed to examine the evidence-base of four assistive technology platforms marketed as safety platforms as means to improve outcomes for older adults residing in memory care environments. Using the Evidence-Based Design Model Socio-Technical Systems Theory, survey data and observational data collected from the organization were considered with respect to the evidence-base supporting each technology. Eleven organizational priorities derived from collected data were used to develop an Evidence-Based Assistive Technology Fitness score for each of the AT platforms reviewed. This methodology provides a means to evaluate planning and purchasing decisions for residential care facilities in a way that aligns with the organization's unique priorities, guided by evidence-based assessment of considered assistive technology products to improve safety and care of residents with dementia.

**Keywords**

Assistive Technology, Safety, Dementia, Evidence-Based, Score Card

## Introduction

Within the context of residential care, the prevention of falls continues to be a significant priority for all healthcare organizations (Peek et al., 2019). The World Health Organization defines a fall as "an event which results in a person coming to rest inadvertently on the ground" (World Health Organization, 2018). The financial impact of both fatal and non-fatal falls has been estimated at an annual cost of US $23.3 billion (Peek et al., 2019). Persons with dementia are at a 3-4 times greater risk of falling compared to age-matched older adults without dementia and approximately 40-60% of persons with dementia have at least one fall each year (VanOoteghem et al., 2019).

In the last twenty years, the field of assistive technology has evolved as offering potential solutions to the many challenges faced by persons living with dementia and their caregivers (Daly Lynn et al, 2019; Gagnon-Roy et al., 2017; Brims & Oliver, 2019; Moyle, 2019; Kenigsberg et al., 2019). Assistive technology (AT) is an umbrella term that refers to "a product, equipment or device which is usually electronic or mechanical in nature, and designed to improve independence, safety and/or quality of life" (Brims & Oliver, 2019, p. 942). The project evaluated the literature pertaining to ATs that are marketed as safety technologies for dementia care. This includes telemonitoring or teleassistance platforms and those that are wearable sensors that monitor and track activity and other biometric data (Daly Lynn et al, 2019; Brims & Oliver, 2019; Gagnon-Roy et al., 2019 and Husebo et al., 2019).

The quality improvement project was designed to evaluate four current ATs on the market that address safety concerns related to older adults with dementia. The project was part

of a program development initiative for a planned facility rebuild and the organizational leadership expressed interest in new technologies in dementia care, for efficacy in improving safety.

## Target Audience and Relevance

The primary audience for this article is senior residential care facilities considering the implementation of new assistive technology platforms as a way to mitigate complex adverse events and to improve resident outcomes. Approaching a technology from an evidence-based framework necessitates attention to the outcomes substantiating a product's purported functions. A secondary audience is assistive technology vendors and developers, who have a stake in understanding organizational priorities and novel ways that technological fitness can be assessed. The project's aims were to continue conversations between vendors and residential care communities in terms of needs and product expectations.

## Literature Review

The four ATs evaluated in the QI project included two telecare platforms that use video monitoring to detect falls or other adverse events and two platforms that included wearable sensors that track movement and other biometric data such as temperature, steps and heart rate. The evidence-based outcomes for this subclass of ATs for safety is new and rapidly evolving. Daly Lynn et al.'s (2019) systematic review identified several outcomes including a potential for telecare devices to improve safety and reduce invasion of privacy; the provision of added security for persons with dementia; the promotion of independence; increased feelings of surveillance among persons with dementia and increased invasion of privacy; increases in alarms; challenges with technical operations and functionality; and increased costs of maintenance. Gagnon-Roy et al.'s (2017) scoping review of intelligent assistive technology

(IAT) and safety in people with dementia had mixed findings, including a potential for ATs to increase detection of at-risk behaviors (e.g. falls, wandering, forgetting medication, change in habits); decreased caregiver stress; improved participation in activities such as walking in the community; technical problems associated with the AT; and privacy and security of information (Gagnon-Roy et al., 2017). None of the studies assessed demonstrated a reduction in the number of falls or negative incidents (Gagnon-Roy et al., 2017). Brims and Oliver's (2019) systematic review and meta-analysis evaluated safety outcomes related to the use of AT with persons with dementia and compared rates of admission to care homes and fall rates. No significant differences were found between intervention and control groups in care home admission. In one study, the intervention group saw a reduction in falls by 50% (Brims & Oliver, 2019). Grigorovich et al.'s (2021) systematic review identified key facilitators of AT implementation in dementia care as usability, user-centeredness of design and understanding local workflows. Key barriers included the extent to which ATs can be tailored to individuals and myths or expectations among clinical staff surrounding technology function (Grigorovich et al., 2021). The review of outcomes related to ATs for safety in dementia care is mixed and while there is some evidence supporting improved safety outcomes with the use of teleassistance and monitoring platforms, the findings are limited by the heterogeneity of study designs and small sample sizes.

## Methods

The QI project was conducted within a Midwestern Continuing Care Residential Community (CCRC) from January to March, 2021. IRB approval was obtained for the project and it was deemed not research (See Appendix A). Three methodologies were used for data collection and evaluation based on the organizational needs:

1. Data collected from organizational Falls Rounding reviews
2. Mixed, selection-based and open-ended surveys
3. Interviews and demonstrations with four AT vendors that produce and sell ATs marketed as safety platforms for older adults living in residential care.

**Theoretical and Methodological Frameworks**

The Evidence-Based Design (EBD) Model (Ulrich, 2008; Center for Health Design, 2014) and the Socio-Technical Systems (STS) Theory (Maguire, 2014) framed the methodological and theoretical foundations of the QI project. Both the EBD Model and STS theory (See Figures 1 and 2) emphasize the value that data from end-users should hold in informing the selection of environmental and design attributes that will impact resident outcomes, clinical workflows and organizational culture (Center for Health Design, 2014; Maguire, 2014).

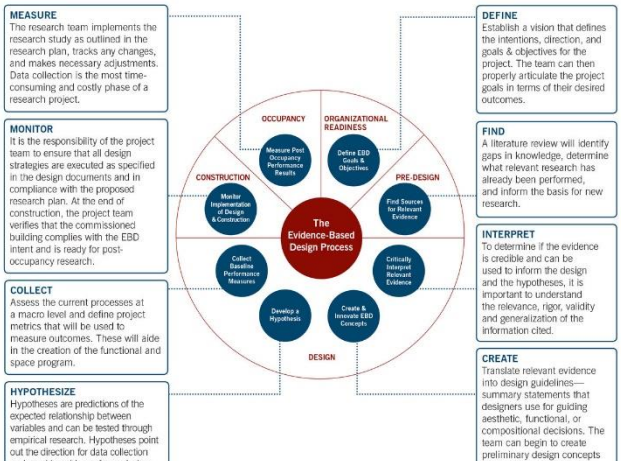


*Figure 1. From The Center for Health Design. (2014). EDAC study guide, volume 2: Building the evidence base: Understanding research in healthcare design. (3rd ed.). The Center for Health Design.*

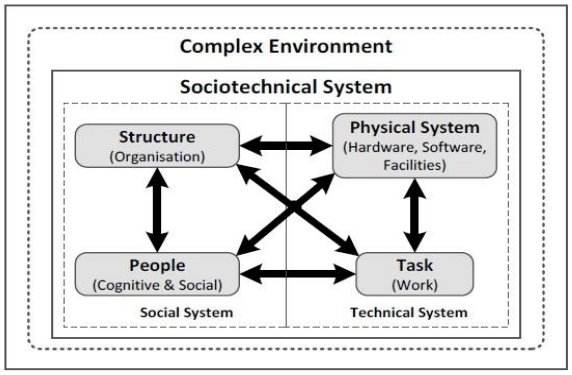


*Figure 2. From Maguire, M. (2014). Socio-technical systen interaction design – 21st century relevance. Applied Ergonomics, 45(2), 162–170. https://doi.org/10.1016/j.apergo.2013.05.011*

The key purpose of data collection from Falls Rounding and surveys with clinicians, family members and leadership participants with respect to AT platforms for improving the safety of

persons with dementia, was to assess end-user needs and expectations of assistive technology as they bare upon potential AT selection by the organization.

**Falls Rounding Reviews**

Nine Falls Rounding meetings were assessed with the organization's Health and Rehab Falls Rounding team which consisted of a Clinical Nurse Leader (MSN), the Nurse Manager (RN) and a physical therapist. Nine falls were evaluated for root cause using the Five Whys framework, which is the primary root cause analysis tool used by the Falls Rounding team to evaluate adverse events (Appendix B).

**Surveys**

Three participant groups were given an author-developed survey in two distributions: clinicians, leadership team members and family members of residents with dementia. The survey for clinician participants included seven selection-based and open-ended questions related to the current use of technology to support the care of residents with dementia, clinician challenges related to current technology use and preferred or valued features of assistive technology in caring for residents with dementia. The survey for organizational leadership participants was a mix of six selection and open-ended questions related to organizational and strategic priorities related to assistive technology for safety in caring for residents with dementia and valued features of assistive technology that align with strategic or organizational goals. The survey for family member of residents with dementia participants was a mix of three selection and open-ended questions related to current use or prior use (prior to family member transitioning to residential care) of assistive technology for safety and desired features of assistive technology within residential care. All survey selections pertaining to current use of

technology; challenges and valued features were developed from concepts in the literature (Brims & Oliver, 2019; Daly Lynn et al., 2019; and Gagnon-Roy et al., 2017).

**AT Data Collection Guide and Demonstrations**

Four ATs were reviewed using an Assistive Technology Data Collection Guide developed for the project and included technical aspects of the platform, company history and partnerships, and any evidence-based research to support claims of function or resident and staff outcomes (See Table 1). Two ATs centered specifically on falls interventions (Technologies B and D) and two platforms that monitor wearable sensors that track movement and location, among other features (Technologies A and C). Demonstrations and interviews with AT product sales representatives were conducted by Zoom.

*Table 1. AT Data Collection Guide*

| **Assistive Technology Product Analysis Data Collection Guide** |
|---|
| **Name of Product:** |
| **Company website:** |
| **Sales Contact:** |
| **Company history (duration of existence); Financial and Company Partners:** |
| **Model of Product and Iteration or Version:** |
| **Hardware Requirements:** |
| **Software Requirements:** |
| **Direct Costs:** |
| **Indirect Costs:** |
| **Functions of Product:** |
| **Strengths of Product:** |
| **Weaknesses of Product:** |

| |
|---|
| **Research and Design (evidence-based research or published efficacy or usability studies):** |

## Results

### Falls Rounding and Key Contributors to Falls

The Falls Rounding team of the organization's 61-bed health and rehab center used the "Five Whys" as a cornerstone for the root cause analysis of resident falls (See Appendix B). Understanding the facility's particular use of the The Five Whys assisted in the determination of how assistive technologies could support new directions for preventing falls in persons with dementia in senior residential care. The Five Whys for root cause analysis identifies the root cause or causes of an adverse event through the continued narrowing of causality by asking "Why?". The assumption underlying the functionality of the risk reduction tool is that in resolving identified causes for adverse events, unwanted outcomes can be reduced or eliminated through effective interventions (Card, 2016). There are eight broad domains of contributors to falls and 52 possible contributors. Of these, thirteen contributors were cited and within those, four key contributors to falls were identified (See Table 3):

1. Communication contributors between residents and staff;
2. Responding to a change in condition;
3. Detecting an underlying medical condition and
4. Equipment positioning or location.

*Table 2. Falls Rounding Demographics*

| | | | | |
|---|---|---|---|---|
| Total Number of Falls Evaluated with Five Whys | (n = 9) | | | |
| Number of Discrete Fallers | (n = 6) | | | |
| Percentage of unwitnessed falls | 100% (9/9) | | | |
| Ages of Residents | Aged 60-69 (n = 1) or 16.7% | Aged 70-79 (n=0) | Aged 80-89 (n=2) or 33.3% | Aged 90+ (n=3) or 50% |
| Percentage of sample residents with history of previous falls at the facility | (n = 5) or 83.3% | | | |
| Percentage of sample residents with history of Alzheimer's or Dementia | (n = 6) or 100% | | | |

*Table 3. Key Contributors to Falls*

| **Key Contributors to Falls Identified in Falls Rounding** |
|---|

Communication Contributors
- ***Between healthcare personnel and resident/family***

Care Management Contributors
- Developing a care plan
- Implementing a care plan
- Following a care plan
- Updating a care plan
- Availability of resources
- ***Responding to a change of condition***

Resident Factors
- Language/culture
- Mental status
- Behavioral problems
- Sensory impairment
- ***Underlying medical conditions***

Equipment, Software, Material Resources
- ***Equipment location or positioning***
- Equipment design

**Survey Results**

***Clinician Participant Group***

Fifty clinicians were surveyed within the organization and included any staff member that was licensed and had a role in caring for residents with dementia (See Appendix C). The clinician response rate was 6/50, or 12%. Of the clinician survey responses included in the results (n = 6), 83.3%, or 5, of respondents identified as "Registered Nurses or Licensed Professional Nurses" and 16.9%, or 1, identified as "other clinical role."

Clinicians reported that the current use of AT included the use of door alarms, wearable sensors, smart phone apps, and fall alarms or technologies that detect falls. Clinicians noted that the safety technologies currently used—wander bracelets, for example—prevent residents from "going in the wrong direction" and also "enable them to have the luxury of enjoying our secure

patio spaces without the fear of getting lost or hurt" (Clinician response). Another clinician noted that ATs currently used have minimal alarms.

The most frequently selected challenge by clinicians in using AT for safety was "the technology does not function as expected". Other challenges selected included knowing how to use the technology; having the time to use the technology; locating the technology; and alarms. Clinicians noted that having adequate training to use technology was important. Added documentation burdens from using technology and residents who "use the call bell improperly" were other noted challenges.

The most frequently selected valued features of AT were "improves communication between staff, residents and family," "facilitates socialization among residents," and "integrates with the EMR." Less frequently selected features were AT that detects falls and AT that locates residents. Clinicians noted that having adequate training to use technology is important. Technology that is "adaptable to each individualized person" and understanding "the next best option when technology fails" were also noted as important features of AT.

***Leadership Participant Group***

Six leadership team members were surveyed with n = 1 response, or 17% response rate. The leadership participant noted that "meaningful engagement" and "self-directed living" were important organizational and strategic priorities to consider with respect to adopting new AT. Valued features of AT included "improves communication between staff, residents and family," "detects falls," "integrates with EMR" and "includes contact tracing." The leadership participant noted that it is important for technology to "promote choice and independence" as well as "having adequate training and processes to facilitate expected outcomes."

***Family Members Participant Group***

Fifty family members were surveyed regarding their use of AT for safety at home prior to their family member with dementia transitioning into residential care and 6/50 responses were received or a 12% response rate. Technologies used included “falls alarms or technologies that detect falls,” “door alarms,” “wearable sensors” and “smart phone apps.” Family members suggested “video monitoring” and “technologies that detect falls” as recommendations for AT use in residential care.

In summary, surveys of clinician, administration and family member stakeholders revealed the following valued features of assistive technologies:

- ATs that improve communication between staff, residents and family members
- ATs that facilitate socialization among residents with dementia
- ATs that integrate with EMR
- ATs that detect falls.
- ATs that have contact tracing
- ATs that locate residents
- Having adequate training to use technology
- Technology that can be tailored to the individual
- Technology that promotes choice and independence

## Assistive Technology Platforms

Four AT platforms were evaluated through demonstrations and interviews with sales representatives. Table 4 includes a summary of the key features and functions of each of the four AT platforms reviewed (Technology A, B, C, and D):

*Table 4. Descriptions AT Platforms*

| Brief Descriptions of AT Platforms | |
|---|---|
| **Technology A** | • Wrist wearable that measures movement, activity, location, heart rate, temperature and alerts to shifts from baseline using continuous deep learning via AI algorithm; digital contact tracing; RTLS wander management; falls detection |
| **Technology B** | • AI automated video camera detects falls in resident room and/or in common spaces in real-time, alerts staff and product team conducts post-fall assessment |
| **Technology C** | • Wrist wearable uses RTLS to monitor and measure wearer movement, temperature and heart rate; RTLS wander management; falls detection |
| **Technology D** | • 3D camera uses AI algorithm to predict unassisted bed exits; send alert to staff with grayed-out video of person preparing to exit bed |

### *Aligning Assistive Technology Platforms to Organizational Priorities*

The Falls Rounding data and surveys and open-ended responses from the participant groups point to three important features for evaluation:

1. Implementation concerns and challenges to use: adequate training.
2. Valued AT features and/or functions identified through participant surveys.

3. Three key contributors to falls: communication between residents and staff; detecting underlying medical conditions; responding to a change in condition and equipment positioning or location.

A methodology was developed for establishing an Evidence-Based AT-Organizational Fitness and considered the valued features of AT by participant groups and three of the root cause key contributors to falls. Two of the implementation concerns and challenges—policies and individualizability—were excluded from evaluation with the score card. Three of the key contributors to falls that were identified through Falls Rounding, six of the features of AT that were evaluated through participant surveys and one feature mentioned by multiple respondents in open-ended questions—adequate training—were used to create an Evidence-Based AT Fitness Score Card (See Table 5).

**Evidence-Based AT Fitness Score Card**

In total, 10 organizational priorities were identified in through the data collection. These organizational priories became the basis for an Evidence-Base AT Fitness Score Card. Procedures for developing the Evidence-Base AT Fitness Score Card were as followed.

1. The 10 organizational priorities identified through data collection acted as evaluation criteria;
2. The four AT platforms were given a 0-4 score for each of these 10 organizational priorities;
3. The basis of the score was the evidence base suggesting that key features of the AT platform aligned to the organizational priority.
4. The maximum possible score is 40 and the minimum is 0. The following point designations were used for each element:

0 = AT does not have the feature or function

1 = Has the feature or function but no outcomes or evidence

2 = Has the feature or function, but low-quality outcome or evidence (field test or observational study)

3 = Has the feature or function; has peer-reviewed publication, but evidence is low quality or indeterminate relationship between feature or function, resident outcomes and tested variables

4 = Has feature or function; has peer-reviewed publication with higher power outcomes and clear significance between feature or function, resident outcomes and tested variables.

*Table 5. Evidence-Based AT Score Card*

| **Evidence-Based Assistive Technology Fitness Score Card** | | | | |
|---|---|---|---|---|
| Technology Platforms | A | B | C | D |
| Platform includes App/Chat Features for Staff and Family Communication♦* | 1 | 0 | 1 | 0 |
| Facilitates Socialization Among Residents♦*^ | 0 | 0 | 0 | 0 |
| Integrates with EMR♦^ | 1 | 0 | 1 | 0 |
| Detects Falls♦*^ | 1 | 3 | 1 | 3 |
| Monitors/Tracks/Locates Residents♦* | 1 | 3 | 1 | 3 |
| Has Contact Tracing | 3 | 0 | 1 | 0 |
| Responding to a change of condition | 3 | 3 | 1 | 3 |
| Underlying medical condition | 1 | 0 | 0 | 0 |
| Equipment location or positioning | 0 | 2 | 0 | 0 |
| Training and Implementation Support | 1 | 1 | 1 | 1 |
| Totals | 12 | 12 | 7 | 10 |
| Symbol key: ♦Clinician, *Family, ^ Leadership | | | | |

0=Does not have feature or function; 1 = Has feature or function, but no data or outcomes; 2 = Has feature or function, but low quality evidence (field test, observational data); 3 = Has feature or function; has peer-reviewed publication, but evidence is low quality or indeterminate relationship between feature or function, resident outcomes and tested variables; 4 = Has feature or function; has peer-reviewed publication with higher power outcomes or significant relationship between feature or function, resident outcomes and tested variables. Minimum = 0; Maximum = 40

The Fitness Index was obtained by dividing the points designated to each technology by the total possible points, or 40 (See Table 5s). Technology A scored a total of 12/40 or 30%; Technology B scored 12/40 or 30%; Technology C scored 7/40 or 17%; and Technology D scored 7/40 or 17% (See Table 6).

*Table 6. Evidence-Based AT Fitness Index*

| Evidence-Based Assistive Technology Fitness Index | | | |
|---|---|---|---|
| **Technology A** | **Technology B** | **Technology C** | **Technology D** |
| 12/40 | 12/40 | 7/40 | 10/40 |
| **30%** | **30%** | **17%** | **25%** |
| **Minimum score = 0; Maximum score = 40** | | | |

The score card elements to be evaluated should be tailored to each organization and are not static. The way in which the evidence is evaluated and scored should be established by team members who both know the literature pertaining to a topic and also have data from the organization that can help establish the important elements to consider when purchasing or considering a new technology for adoption.

## Discussion

The Evidence-Based AT Fitness Score Card method was intended to provide residential care facilities a tool to critically evaluate AT platforms according to site specific organizational findings and values. Technology A, the wearable sensor that tracks and monitors biometrics, performs contact tracing and includes a communication platform for all groups. Technology B, which is a falls detection video platform that does not address the communication priority though has a robust implementation and ongoing training support for developing falls intervention teams. Both Technology A and B share the same AT Fitness score of 30%. Technology C,

which is similar to Technology A in features and function, has a much lower fitness index of 7%. Technology C's low AT Fitness score is due to a relative lack of evidence to support its purported functions. Technology D, while more limited in functionality, has a higher index because of published outcomes support.

That two very similar AT platforms can have very different evidence-based AT Fitness scores can mean different things and illustrates the importance of investigating the index. It may be a newer platform that has not developed an evidence base yet. Even established companies that develop AT for safety, however, do not always generate the outcomes to support their purported functions. For these reasons, it is important for senior residential organizations to look behind the score when considering ATs in order to understand how they are validating function and feature claims and to generate questions to pose to the AT companies regarding their outcomes. This also communicates to AT developers that marketing claims should be validated with evidence, particularly with regard to safety ATs.

The score card methodology is not novel and is frequently used by organizations to make informed and value-based purchasing decisions that align with organizational strategy (Monczka, Handfield, Giunipero & Patterson, 2021). Adapted for this project, this methodology demonstrates the potential for stratifying better fitting ATs for safety in terms of organizational priorities using outcomes data and an evidence-based scoring system.

## Outcomes and Benefits

The Evidence-Based AT Fitness scoring method uses data collected from the surveys and falls rounding reviews, as well as available outcomes data supporting each platform to generate AT Fitness scores for each platform.

This method is intended to provide residential care facilities a tool by which to critically evaluate AT platforms according to site specific organizational findings and values. The score card elements to be evaluated should be tailored to each organization and are not static. The way in which the evidence is evaluated and scores are designated should be established by team members who both know the literature or available outcomes data pertaining to an AT and also have data from the organization that can help establish the important elements to consider when purchasing or considering a new technology for adoption.

The score card methodology gives residential facilities a good starting point for making informed purchasing decisions for complex AT platforms that often have robust claims regarding function and aptitude. Additionally, the Evidence-Based AT Fitness scoring method is beneficial for AT developers, as it provides them with ways to engage with their market proactively and evaluate demand-focused areas for research and outcomes development. Ideally, this methodology could be used as a collaborative effort between senior residential communities and AT developers so that specific community needs such as falls reduction or clinical workflow improvement can be addressed through coordinated and cost-free pilot studies that would also validate previously untested features of ATs.

## Limitations

One limitation of the application of the score card method was unweighted scoring. An important modification to the evidence-based score card method would be to weight organizational priorities. This becomes even more important when all evaluated ATs have equivalent or similar evidence bases. Weighting organizational priorities within the score also demands that organizations identify and rank the features and functions of ATs that are most important for their unique safety and technological contexts. Features that score high using the

evidence-based AT score card method may not be relevant for meeting key organizational needs; weighting organizational priorities would highlight ATs that have outcomes evidence to support relevant features.

An additional limitation of the QI project pertains to the strength of the organizational data used to inform the scoring method. The AT platforms were evaluated with respect to 10 organizational priorities. These priorities were informed by a limited cross-section of data and may not be representative. The Falls Rounding reviews were conducted by phone and did not include chart reviews of documentation surrounding adverse events. Additionally, in-person observational and informal interview data can make more apparent roles, relationships and clinical workflows that would inform the priorities included for consideration on the Score Card. An internal team is crucial to arrive at the scored list of priorities when making organizational changes.

## Conclusion

The QI project aimed to provide a Continuing Care Residential Community with evidence-based recommendations for new AT platforms for improving safety for residential patients with dementia. Through literature reviews on assistive technologies for safety, surveys with organizational participant groups, data collected from the organization's root cause analysis meetings and data gathered from four AT vendors, an Evidence-Based Assistive Technology Scoring method was developed and used to arrive at a Fitness Score, which is a measure of both valued requirements specific to an organization, as well as an evaluation of those requirements in relation to the proposed performance outcomes of available outcomes of assistive technologies. The score card methodology is also a valuable proactive and demand-centered method for AT

developers to use in facilitating a productive research agenda for strengthening their platform offerings and forging collaborative partnerships with senior residential communities.

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# Appendices

## Appendix A

IRB Approval

GRAND VALLEY STATE UNIVERSITY
www.gvsu.edu

DATE: January 26, 2021

TO: Dianne Conrad, DNP
FROM: Office of Research Compliance & Integrity
PROJECT TITLE: Evidence-based recommendations for assistive technology for safety and monitoring of persons with dementia in senior residential care.
REFERENCE #: 21-157-H
SUBMISSION TYPE: IRB Research Determination Submission

ACTION: Not Research
EFFECTIVE DATE: January 26, 2021
REVIEW TYPE: Administrative Review

Thank you for your submission of materials for your planned scholarly activity. It has been determined that this project does not meet the definition of research* according to current federal regulations. The project, therefore, does not require further review and approval by the IRB. Scholarly activities that are not covered under the Code of Federal Regulations should not be described or referred to as "*research*" in materials to participants, sponsors or in dissemination of findings. While performing this project, you are expected to adhere to the institution's code of conduct and any discipline-specific code of ethics.

A summary of the reviewed project and determination is as follows:

The purpose of this project is to identify evidence-based assistive technology interventions that can be used in long-term residential settings in the care of persons living with dementia. Surveys will be utilized to identify ways to improve care for residents. This project is not designed to create new generalizable knowledge. Therefore, this project does not meet the federal definition of research and IRB oversight is not needed.

This determination letter is limited to IRB review. It is your responsibility to ensure all necessary institutional permissions are obtained prior to beginning this project. This includes, but is not limited to, ensuring all contracts have been executed, any necessary Data Sharing Agreements and Material Transfer Agreements have been signed, and any other outstanding items are completed.

An archived record of this determination form can be found in IRBManager from the Dashboard by clicking the "_ xForms" link under the "My Documents & Forms" menu.

If you have any questions, please contact the Office of Research Compliance and Integrity at (616) 331-3197 or rci@gvsu.edu. Please include your study title and study number in all correspondence with our office.

*Research is a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge (45 CFR 46.102 (d)).

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# Appendix B

Five Whys Root Cause Analysis Tool

## Contributing Factors

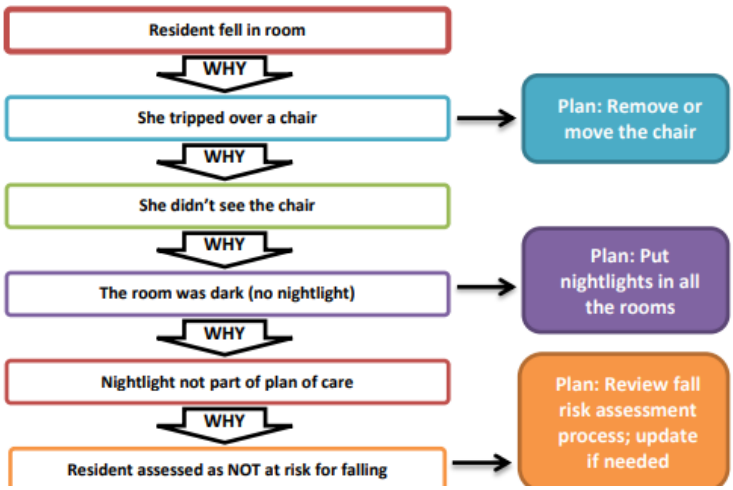
**Note: this chart is meant to provide examples of possible contributing factors and is not considered all-inclusive.**

| Communication | Organizational Factors | Care Management | Resident Factors |
|---|---|---|---|
| • With physician or RN practitioner<br>• Hand-offs or shift reports<br>• Involving resident transfers<br>• Available information<br>• Between departments<br>• Between healthcare personnel & resident/family<br>• With other organizations or outside providers<br>• Among healthcare personnel (includes temporary/agency staff)<br>• Hard to read handwriting/fax | • Overall culture of safety<br>• Unit staffing levels<br>• Shift leadership/management<br>• Adequacy of budget<br>• Systems to identify risks<br>• Internal reporting<br>• Commitment to resident safety<br>• Accountability for resident safety<br>• Staffing turnover<br>• Temporary staffing and lack of communication<br>• Staff assignment/work allocation | • Developing a care plan<br>• Implementing a care plan<br>• Following a care plan<br>• Updating a care plan<br>• Availability of resources<br>• Responding to a change of condition<br>• Resident consent process | • Language/culture<br>• Family dynamics/relationships<br>• Mental status<br>• Behavioral problems<br>• Sensory impairment<br>• Resident assumption of risk<br>• Underlying medical conditions<br>  ○ Pain<br>  ○ Neuromuscular<br>  ○ Orthopedic<br>  ○ Cardiovascular<br>  ○ Recent condition change<br>  ○ Dialysis<br>  ○ Neurological |
| **Equipment, Software, or Material Defects** | **Policies & Procedures** | **Training & Supervision** | **Work Area/Environment** |
| • Equipment meeting code, specifications, or regulations<br>• Defective/non-working equipment<br>• Software<br>• Equipment design (function, displays, or controls) | • Absent<br>• Too complicated<br>• Outdated<br>• Not followed / Not compliant | • Job orientation<br>• Continuing education<br>• Staff supervision<br>• Skills demonstration<br>• Availability of training programs<br>• In service education/competency training | • Work area design specifications<br>• Distractions<br>• Interruptions<br>• Relief/float healthcare staff |

## Using the 5-Whys

### The 5-Whys

A question-asking method used to uncover the underlying cause of an event (see example to right). Uncovering the root causes(s) leads to action plans that are more likely to prevent the event from happening again.



# Appendix C

Surveys

Project title: Evidence-based Recommendations for Assistive Technologies for Persons with Dementia in Senior Residential Care
Project leader: Lee Diener, DNP student, GVSU
Participant Group: Nursing and clinical staff
Paragraph describing the survey:

This survey examines the use of assistive technology for improving the safety of residents with dementia living in senior residential care facilities. An assistive technology is "a product, equipment or device which is usually electronic or mechanical in nature, and designed to improve independence, safety and/or quality of life" for residents (Brims & Oliver, 2019). Assistive technologies can be wearable devices, sensors or software systems that track particular data and/or communicate data to caregivers and staff. There are also assistive technologies designed to help people with their behavioral, social and mental health. The aim of these survey questions is to learn more about how assistive technology devices or platforms are currently being used in your work setting to care for and improve the safety of residents with dementia; to explore various facilitators and barriers to the use of assistive technologies in caring for residents with dementia; and to explore what future and potential uses of assistive technology may benefit the residents, future residents, staff and leadership in your organization.

1. What is your role?
   Nurse (LPN or RN)
   CNA
   Other

2. Thinking about the definition of assistive technology above, which of the following types of assistive technology do you use in your everyday work in caring for residents with dementia? (Select all that apply).

   Motion activated lighting
   Door alarms
   Wearable sensors that keep track of a person's movements
   Fall alarms or technologies that detect falls
   Memory aids
   Smart phone apps
   Other technologies that facilitate safety. Please describe what these technologies are.

3. Describe how assistive technologies in your everyday work improve the safety of residents with dementia.

4. What challenges, if any, have you experienced in using technology in caring for residents with dementia? (Select all that apply).

   Not knowing how to use the technology.
   Comfort level in caring for residents with dementia.
   Not enough time to integrate the use of technology in resident care.
   The technology does not function the way it should.
   Not able to locate the technology when needed.
   The technology alarms too much.
   The technology does not alarm appropriately.
   Another challenge not listed here.

5. Describe in as much detail as you can, the challenges you have experienced in using assistive technology in caring for residents with dementia. Specific examples are helpful.

6. Which kinds of technology functions from the list below do you think would be the most helpful to have in promoting the safety and well-being of residents with dementia? (Select all that apply).

   Technology that detects falls.
   Technology that allows staff to know where residents are.
   Technology that allows staff to know where staff are.
   Technologies that improve socialization in residents with dementia.
   Technologies that improve communication between staff, residents and family members of residents.
   Technologies that integrate with EMR
   Other technologies that do other things not mentioned here. Please describe.

7. What are important things to consider before a new assistive technology is adopted by senior care facilities?

---

Project Contact: Lee Diener, DNP student, GVSU
Survey Guide
Participant Group: Leadership team members
Project description:
The purpose of this survey is to gather your views on the use of assistive technologies in caring for persons with dementia in senior residential care. An assistive technology is "a product, equipment or device which is usually electronic or mechanical in nature, and designed to improve independence, safety and/or quality of life" for residents (Brims & Oliver, 2019). Assistive technologies can be wearable devices, sensors, monitoring technology or software systems that track particular data and/or communicate data to residents, caregivers and staff. The aim of these survey questions is to learn more about how assistive technology devices or platforms are currently being used in your organization to care for and facilitate the safety of residents with dementia; to understand how assistive technologies might align with

organizational strategy and goals; and to explore what future and potential uses of assistive technology you think could benefit overall organizational performance.

1. In which department is your primary work role?
2. Which operational or strategic priorities come to mind when you consider the use of assistive technologies in the care of residents with dementia?
3. Which of the following kinds or functions of assistive technology do you imagine most align with the organization's strategic priorities currently? (You may select more than one).

   Motion activated lighting
   Door alarms or automatic locks.
   Wearable sensors that track staff.
   Wearable sensors that track residents.
   Technologies that detect falls.
   Technology that includes contact tracing.
   Technology that facilitates socialization.
   Technologies that integrate with the EMR.
   Other technologies that facilitate safety that align with organizational priorities. Please describe what these technologies are.

   _____

Lee Diener, DNP student, GVSU
SurveyTopic: Using Technology to Improve Safety for People Living with Dementia
Participant group: Family members of persons with dementia living in a senior residential care facility or prospective family members of persons with dementia not yet living in senior residential care.
Paragraph describing the survey:
I am interested in how you currently use technology to care for, monitor and keep safe your family member or loved one with dementia. If you have a family member with dementia living in senior residential care, I am interested in your ideas and opinions about the kinds of technology you think might increase the safety of persons living with dementia. As examples, such technologies can include smart phone apps, wearable devices, sensors, or monitoring technologies, but you might use other technology and I am interested in learning more about these, too.

1. Do you currently or have you ever been a caregiver for a person living with dementia?
2. What kinds of technology did you are do you currently use to facilitate the safety of the person with dementia at home?

   Motion activated lighting
   Door alarms
   Wearable sensors that keep track of a person's movements

Fall alarms or technologies that detect falls
Memory aids
Smart phone apps
Other technologies that facilitate safety

3. Do you have other ideas about how technology could be used in long-term care to improve the safety of residents with dementia?

# Evidence-based Recommendations for Assistive Technologies for Safety in Dementia Care


Lee Diener BSN, RN, BA

DNP Project Final Defense

29 April 2021

Grand Valley State University
Kirkhof College of Nursing

# Acknowledgements


- Dianne Conrad, DNP, FNP-BC, FNAP
- Amy Manderscheid, DNP, RN, AGPCNP-BC, AGNP-C, CMSRN
- Organizational Site Mentors

# Objectives for Presentation

1. Introduce the organizational site, the clinical problem and review the literature related to assistive technology (AT) use for safety in older adult residential care for persons with dementia.
2. Review the project methodology, implementation strategies and guiding theoretical framework and implementation model.
3. Review the findings from the implementation strategies:
    - Falls rounding data
    - Surveys with participants
    - AT Data Collection Guide
4. Review the ROI for AT platforms.
5. Review evidence-based recommendations for AT for safety in senior residential care.
6. Review development of DNP Essentials
7. Obtain approval for project defense.

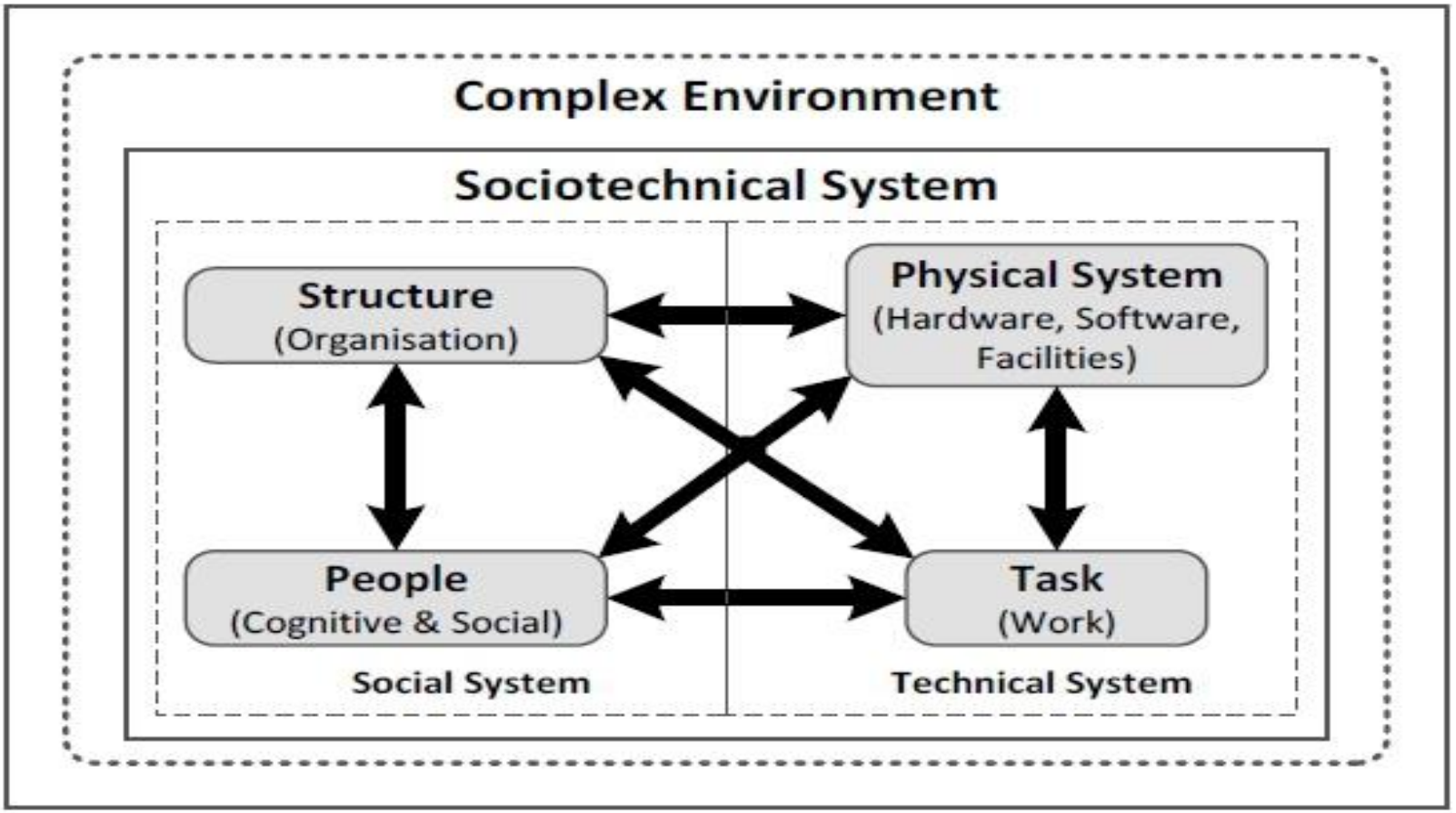
# Organizational Site

- A Continuing Care Residential Community in West Michigan, serving 500 seniors.
- The organization is in master planning stages of a rebuild of its current skilled nursing facility and home for the aged.
- An interest in identifying new technologies that could be integrated into memory care.

# Introduction to Clinical Phenomenon

- Dementia is a family of chronic, progressive neurological diseases that variably impair cognition, memory, behavior and social abilities (Moyle, 2019; Koumakis et al., 2019; Neubauer et al., 2018).
  - Increased risk of falls and other adverse events (Brims & Oliver, 2019; Daly Lynn et al., 2019)
- Assistive Technology is "a product, equipment or device which is usually electronic or mechanical in nature, and designed to improve independence, safety and/or quality of life" (Brims & Oliver, 2019, p. 943).
  - The role of Assistive Technology in caring for persons with dementia.
  - New Assistive Technology platforms focus on falls and safety interventions.

# Conceptual Model for Phenomenon: Socio-Technical Systems Model




*From Maguire, M. (2014). Socio-technical systems and interaction design – 21st century relevance. Applied Ergonomics, 45(2), 162–170.*
*https://doi.org/10.1016/j.apergo.2013.05.011*


Organizational Leadership
Community
Stakeholders Interested in AT for Safety
Staff
Residents

# Organizational Assessment Framework


Universalia/Interntaional Development Research Center Institutional and Organizational Assessment (IOA) Model. (2003). www.universalia.com

# SWOT Analysis

| Strengths | Weaknesses |
| --- | --- |
| • Capital funds earmarked for building projects.<br>• Strong leadership team.<br>• EHR and assistive technology integration.<br>• Resident participation on leadership board. | • Staff retention and engagement<br>• Programming needs for high functioning assistive technology integration. |
| **Opportunities** | **Threats** |
| • Safety and quality of life are primary foci of new assistive technologies.<br>• Competitive market for memory programming. | • COVID19 and resident safety and social engagement.<br>• Projecting future occupancy in long-term care facilities. |

# Literature Review: Purpose and Aims

**Purpose:**

To identify evidence-based assistive technology interventions for safety used in senior residential settings in the care of persons living with dementia.

**Aims:**

1. Among persons living with dementia in senior residential settings, what are evidence-based assistive technology interventions for safety?
2. Within senior residential settings, what are the barriers and facilitators to consider in adopting new assistive technology interventions or platforms for safety in caring for people living with dementia?

# Literature Review

| Theme | Key Findings | | Citation |
|---|---|---|---|
| **Evidence-Based AT Interventions** | Teleassistance and/or telemonitoring platforms (sensors—fall detectors, wander management—all using RTLS or AI based programming and automated video monitoring) and applications. | | Brims, L., & Oliver, K. (2019); Daly Lynn et al. (2019); Gagnon-Roy et al. (2017) |
| **Resident Outcomes** | May:<br>• Improve safety<br>• Reduce invasion of privacy.<br>• Provide added security.<br>• Promote independence.<br>• Increase sense of surveillance.<br>• Reduce falls | • No reduction in adverse incidents (falls, critical wandering) or avoidance of adverse events.<br>• May detect at-risk behaviors<br>• May increase participation in activities among persons with dementia | Daly Lynn et al. (2019)<br><br>Gagnon-Roy et al. (2017) |
| **Caregiver Outcomes** | • May alert the caregiver, decrease stress | | Gagnon-Roy et al. (2017) |
| **Facilitators of Uptake** | • Understanding local workflows, policies and technologies<br>• Usability and user-centered design<br>• Establishing policies, frameworks, governance and evaluation | | Grigorovich et al. (2021) |
| **Barriers of Uptake** | • Ease of use, expectations of tech function<br>• Individualizability of tech<br>• Lack of motivation for engagement<br>• Infrastructure challenges<br>• Myths, stories and shared understanding | | |

# Clinical Question

What are evidence-based recommendations for assistive technologies related to safety and monitoring for people living with dementia in senior residential settings?

# PROJECT METHODOLOGY

# Ethics

- CITI ethics training modules completed.
- IRB approval obtained 1/26/21:  Not Research
- Qualtrics surveys
- Data stored securely in password encrypted computer; no data shared; all data will be deleted at the completion of the project.

# Project Design

**Program/Toolkit Development**:

- Guided by an Evidence-Based Design Framework (Center for Health Design, 2020) and Socio-Technical Systems Theory (Maguire, 2014)
- To develop a toolkit of recommendations for assistive technologies for safety and monitoring within a memory care facility and designed specifically to address the organization's contextual needs and strategic mission.

# Setting & Participants

**The Continuing Care Residential Community and larger affiliates have an active interest in optimizing the uses of assistive technology within memory care programming:**

**Participants:**

- Clinical staff
- Organizational Leadership
- Families of residents with dementia
- Assistive Technology Vendors and Sales Representatives

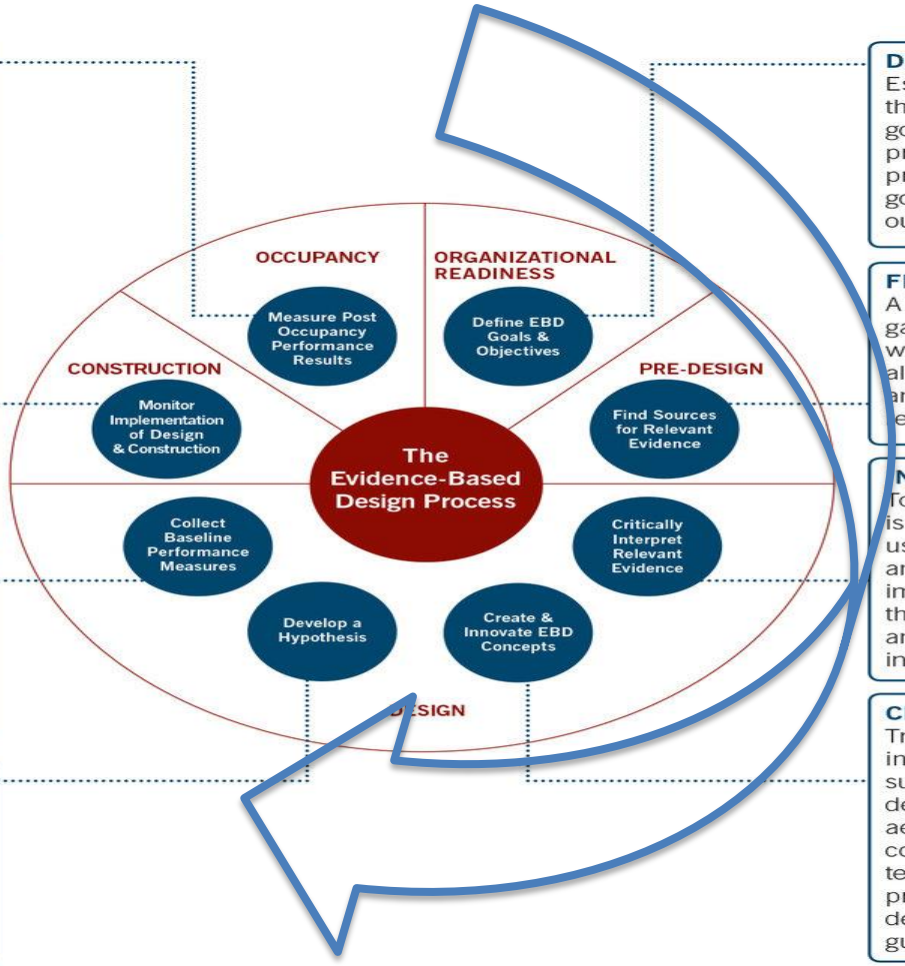
# Implementation Model: EB Design

**MEASURE**
The research team implements the research study as outlined in the research plan, tracks any changes, and makes necessary adjustments. Data collection is the most time-consuming and costly phase of a research project.

**MONITOR**
It is the responsibility of the project team to ensure that all design strategies are executed as specified in the design documents and in compliance with the proposed research plan. At the end of construction, the project team verifies that the commissioned building complies with the EBD intent and is ready for post-occupancy research.

**COLLECT**
Assess the current processes at a macro level and define project metrics that will be used to measure outcomes. These will aide in the creation of the functional and space program.

**HYPOTHESIZE**
Hypotheses are predictions of the expected relationship between variables and can be tested through empirical research. Hypotheses point out the direction for data collection and provide guidance for analyzing and interpreting the data.




**DEFINE**
Establish a vision that defines the intentions, direction, and goals & objectives for the project. The team can then properly articulate the project goals in terms of their desired outcomes.

**FIND**
A literature review will identify gaps in knowledge, determine what relevant research has already been performed, and inform the basis for new research.

**INTERPRET**
To determine if the evidence is credible and can be used to inform the design and the hypotheses, it is important to understand the relevance, rigor, validity and generalization of the information cited.

**CREATE**
Translate relevant evidence into design guidelines—summary statements that designers use for guiding aesthetic, functional, or compositional decisions. The team can begin to create preliminary design concepts derived from the design guidelines.

From *The Center for Health Design. (2014). EDAC study guide, volume 2: Building the evidence base: Understanding research in healthcare design. (3rd ed.). The Center for Health Design.*

# Implementation Strategies, Methods and Model Alignment

| Project Components | Implementation Strategies (Powell et al., 2015) | Method Used | Evidence Based Design Model Alignment |
|---|---|---|---|
| **Baseline Safety Data:**<br>Falls Rounding Meetings | Conduct local needs assessment | Collecting Data from Falls Rounding Meetings | Collect, Interpret |
| **Project Stakeholder Input**<br>• Clinicians<br>• Leadership<br>• Family Members | Assess readiness and determine barriers and facilitators<br><br>Obtain feedback from families | Surveys | Collect, Interpret |
| **Evaluate Assistive Tech Platforms** | Conduct local needs assessment | Demonstrations and AT Data Collection Guide | Collect, Interpret |
| **EB Recommendations** | Develop and distribute materials | ROI and Recommendations | Interpret, Create |

# Methods

| | | |
|---|---|---|
| **Five Whys Root Cause Contributors to Falls** | | |
| Falls Rounding Team (Unit RN, CNL, Physical Therapy) | 1. Phone calls into Falls Rounding Meetings (n=9)<br>2. Recorded data on resident age, history of falls, contributors to fall using the Five Whys.<br>3. Password encrypted data storage. | 11/20-2/21 |
| **Surveys** | | |
| Clinicians (RNs)<br>Leadership<br>Family Members of Residents with Dementia | 1. Developed selection-based and qualitative response surveys addressing use and challenges with technology based on literature review and methods literature; surveys reviewed by nursing faculty experts in qualitative research.<br>2. Distributed surveys with consent via Qualtrics in two rounds.<br>3. Surveys anonymized and stored securely. | 1/21-3/21 |
| **Assistive Technology Data Collection Guide** | | |
| Assistive Technology Vendors | 1. Developed an Assistive Technology Product Analysis Guide<br>2. Collected data from demonstrations and follow-up conversations with sales representatives. | 11/20-2/21 |

# Assistive Technology Data Collection Guide

| Name of Product | Product X |
|---|---|
| Company website | |
| Sales Contact | |
| Company history (duration of existence); Financial and Company Partners | |
| Model of Product and Iteration or Version | |
| Hardware Requirements | |
| Software Requirements | |
| Direct Costs: hardware, software, contracts (initial and annual) | |
| Indirect Costs: Maintenance, upgrading | |
| Functions of Product | |
| Strengths of Product | |
| Weaknesses of Product | |
| Research and Design (evidence-based research or published efficacy or usability studies) | |

# Analysis Plan

| | |
|---|---|
| **Falls Rounding Data** | Falls Rounding data will be assessed in terms of most commonly identified contributors to falls using the Five Whys Tool. |
| **Surveys** | Survey responses will be organized by key themes into tables with response distributions. Open-ended responses will be analyzed for content themes consistent with or divergent from those identified in the narrative literature review. |
| **Assistive Technology Data Collection Tool** | The features of the AT products will be mapped onto the valued features of AT identified through surveys and the key contributors to falls identified through Falls Rounding meetings. |

# Project Budget & Resources

| Revenue | Itemized Costs |
|---|---|
| Team Member Time: | |
| Project Manager Time: RN (in kind donation) | (45 hours x $34.72) = $1,562 |
| Facility Executive Director | (15 hours x $47.50) = $712.50 |
| Leadership Team Members | (7 hours x $65.00) = $455.00 |
| Clinical Staff: RN | (4 hours x $ 30.00) = $120.00 |
| Clinical Staff: LPN | (4 hours x $22.00) = $88.00 |
| Clinical Staff: CNA | (8 hours x $15.00) = $120.00 |
| Assistive Tech Product/Company Interviews | (20 hours x $0) = $0 |
| Subtotal: | $3,057.50 |

| Expenses | |
|---|---|
| Team Member Time: | |
| Project Manager Time: RN (in kind donation) | (45 hours x $34.72) = $1,562 |
| Facility Executive Director | (15 hours x $47.50) = $712.50 |
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| Clinical Staff: CNA | (8 hours x $15.00) = $120.00 |
| Assistive Tech Product/Company Interviews | (20 hours x $0) = $0 |
| Subtotal | $3,057.50 |
| Project Costs: | |
| Qualtrics service: | $0 |
| Final printed deliverable | $50 |
| Total project costs: | $50 |

# RESULTS

1. Results from Falls Rounding Data

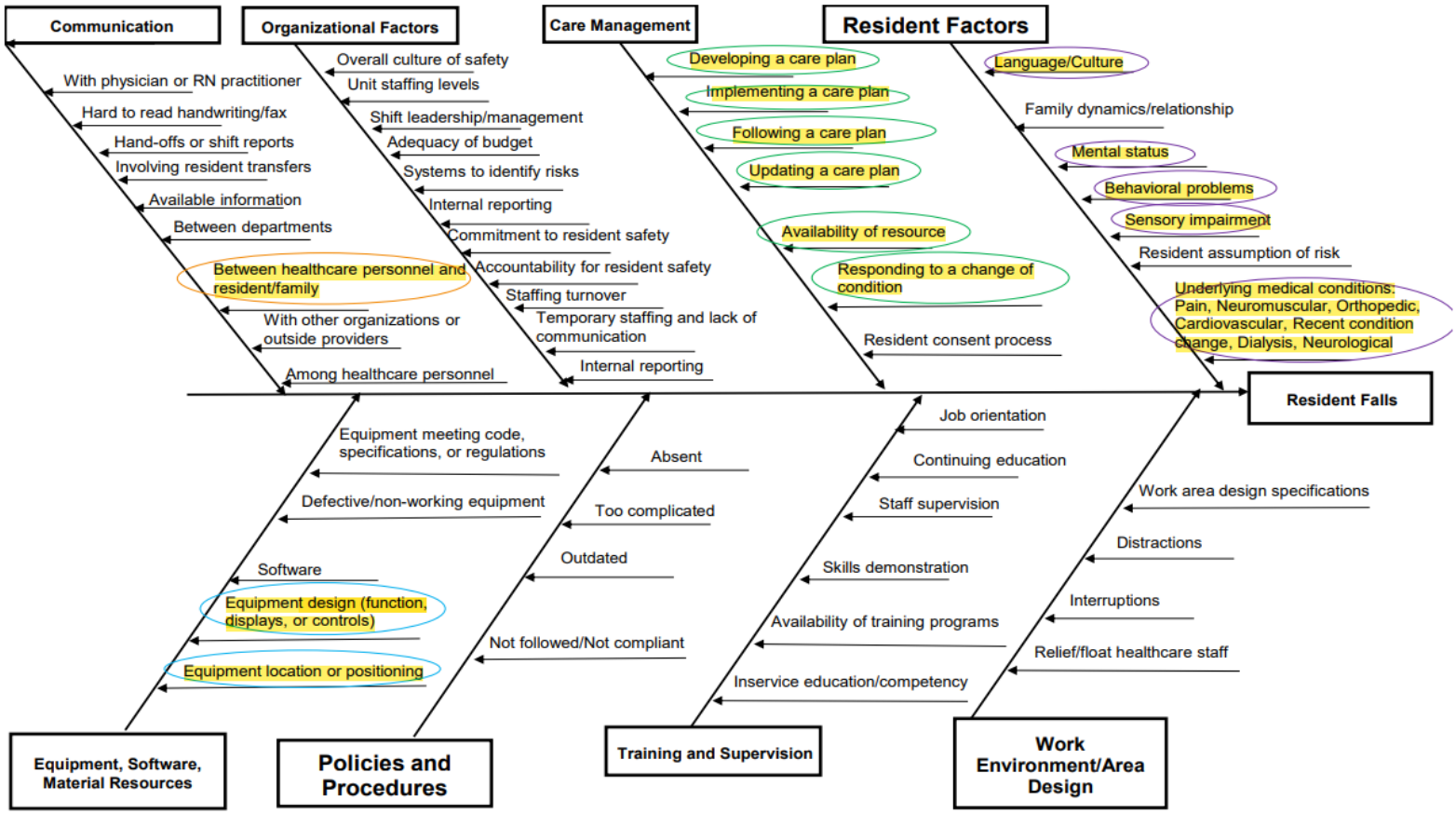
2. Results from Survey Data

3. Assistive Technology Summaries and Evidence-Based AT Fitness Score Card

# Demographic Data from Falls Rounding Meetings

| | | | | |
|---|---|---|---|---|
| Total Number of Falls Evaluated with Five Whys | (n = 9) | | | |
| Number of Discrete Fallers | (n = 6) | | | |
| Percentage of unwitnessed falls | 100% (9/9) | | | |
| Ages of Residents | Aged 60-69 (n = 1) or 16.7% | Aged 70-79 (n=0) | Aged 80-89 (n=2) or 33.3% | Aged 90+ (n=3) or 50% |
| Percentage of sample residents with history of previous falls at the facility | (n = 5) or 83.3% | | | |
| Percentage of sample residents with history of Alzheimer's or Dementia | (n = 6) or 100% | | | |

# Five Whys Root Cause Contributors to Falls



# Summary Findings from Falls Rounding

| Key Contributors to Falls Identified in Falls Rounding |
| --- |
| Communication Contributors |
| Between healthcare personnel and resident/family |
| Care Management Contributors |
| Developing a care plan |
| Implementing a care plan |
| Following a care plan |
| Updating a care plan |
| Availability of resources |
| Responding to a change of condition |
| Resident Factors |
| Language/culture |
| Mental status |
| Behavioral problems |
| Sensory impairment |
| Underlying medical conditions |
| Equipment, Software, Material Resources |
| Equipment location or positioning |
| Equipment design |

# Survey Results

| Survey Participant Group | Role | Response Rate (n/N) |
|---|---|---|
| Clinical team members * | RN | n=6/50 or 12% |
| Family members of residents with dementia * | N/A | n=6/50 or 12% |
| Leadership team members* | ** | n=1/6 or 17% |

*Variable survey completion rates for all participant groups

**Disclosure of role withheld due to small sample size.

# Summary of Survey Data

| | Clinicians | Leadership |
|---|---|---|
| **Challenges** | Adequate Training | Adequate Training |
| **Valued Features of AT** | Improves Communication between staff, residents and family | Improves Communication between staff, residents and family |
| | Facilitates Socialization among Residents | Facilitates Socialization among Residents |
| | Integrates with EMR | Integrates with EMR |
| | Detects Falls | Contact Tracing |
| | Monitors/locates residents | |

| | Family |
|---|---|
| **AT Used at Home** | Door alarms, falls detection, smart phone apps |
| **Recommendations for Use of AT in Residential Care** | Video monitoring<br>Falls detection<br>All technology seems good |

# AT Data Analysis: The Evidence-Based AT Fitness Score Card

- Brief Descriptions of AT Platforms
- Evidence-Based AT Fitness Score Card

# Assistive Technology Platforms

| Brief Descriptions of AT Platforms | |
|---|---|
| **Technology A** | • Wrist wearable that measures movement, activity, location, heart rate, temperature and alerts to shifts from baseline using continuous deep learning via AI algorithm; digital contact tracing; RTLS wander management; falls detection |
| **Technology B** | • AI automated video camera detects falls in resident room and/or in common spaces in real-time, alerts staff and product team conducts post-fall assessment |
| **Technology C** | • Wrist wearable uses RTLS to monitor and measure wearer movement, temperature and heart rate; RTLS wander management; falls detection |
| **Technology D** | • 3D camera uses AI algorithm to predict unassisted bed exits; send alert to staff with grayed-out video of person preparing to exit bed |

# Evidence-Based Assistive Technology Fitness Score Card

| Technology Platforms | A | B | C | D |
|---|---|---|---|---|
| **Platform includes App/Chat Features for Staff and Family Communication♦*** | 1 | 0 | 1 | 0 |
| **Facilitates Socialization Among Residents♦*^** | 0 | 0 | 0 | 0 |
| **Integrates with EMR♦^** | 1 | 0 | 1 | 0 |
| **Detects Falls♦*^** | 1 | 3 | 1 | 3 |
| **Monitors/Tracks/Locates Residents♦*** | 1 | 3 | 1 | 3 |
| **Has Contact Tracing** | 3 | 0 | 1 | 0 |
| **Responding to a change of condition** | 3 | 3 | 1 | 3 |
| **Underlying medical condition** | 1 | 0 | 0 | 0 |
| **Equipment location or positioning** | 0 | 2 | 0 | 0 |
| **Training and Implementation Support** | 1 | 1 | 1 | 1 |
| Totals | 12 | 12 | 7 | 10 |

Symbol key: ♦Clinician, *Family, ^ Leadership

# Evidence-Based Assistive Technology Fitness Index

| Technology A | Technology B | Technology C | Technology D |
|---|---|---|---|
| 12/40 | 12/40 | 7/40 | 10/40 |
| **30%** | **30%** | **17%** | **25%** |

**Minimum score = 0; Maximum score = 40; unweighted**

# AT COSTS and ROI

# AT for Safety: Costs and ROI Projections

| | Projected Annual Technology Costs* | | |
|---|---|---|---|
| | **Intial Set-Up Costs** | **Monthly Service Costs** | **Total Annual Y1** |
| | | | |
| Tech A | | | |
| Minimum Coverage (100 beds) | $60,000 | $6,700 | $140,400 |
| Full Coverage | ----- | ----- | ----- |
| Tech B | | | |
| Minimum Coverage (10 beds) | $7,500 | $1,250 | $22,500 |
| Full Coverage (50 beds) | $37,500 | $6,250 | $112,500 |
| Tech C | | | |
| Minimum Coverage (50 beds) | $50,000 | $1,300 | $65,600 |
| Full Coverage (100 beds) | $100,000 | $2,600 | $131,200 |
| Tech D | | | |
| Minimum Coverage (5 cameras in | ----- | $7,200 | $86,400 |
| Full Coverage | ----- | ----- | ----- |

# AT for Safety: Costs and ROI Projections

| Projected Annual Adverse Events & Associated Costs** | | | | | | |
|---|---|---|---|---|---|---|
| Fall w/out Injury | | Fall w/ Injury | | Hospitalization | | Total |
| Cost | No. | Cost | No. | Cost | No. | Cost |
| | | | | | | |
| $1,900 | 86 | $15,000 | 6 | $33,000 | 6 | $451,400 |

| Projected Annual Cost Avoidance*** | | |
|---|---|---|
| Low Estimate | Base Estimate | High Estimate |
| 10% | 20% | 30% |
| | | |
| $45,140.0 | $90,280.0 | $135,420.0 |

# AT for Safety: Costs and ROI Projections

| | Return on Investment in Payback Months**** | | |
|---|---|---|---|
| | Low Estimate | Base Estimate | High Estimate |
| | Payback Periods | Payback Periods | Payback Period |
| Tech A | | | |
| Minimum Coverage (100 beds) | 37.32 | 18.66 | 12.44 |
| Full Coverage | ----- | ----- | ----- |
| Tech B | | | |
| Minimum Coverage (10 beds) | 5.98 | 2.99 | 1.99 |
| Full Coverage (50 beds) | 29.91 | 14.95 | 9.97 |
| Tech C | | | |
| Minimum Coverage (50 beds) | 17.44 | 8.72 | 5.81 |
| Full Coverage (100 beds) | 34.88 | 17.44 | 11.63 |
| Tech D | | | |
| Minimum Coverage (5 cameras) | 22.97 | 11.48 | 7.66 |
| Full Coverage | ----- | ----- | ----- |

# AT for Safety: Costs and ROI Projections

| | Return on Investment in Adverse Events Needed to Avoid**** | | | | | |
|---|---|---|---|---|---|---|
| | Fall w/out Injury | | Fall w/ Injury | | Hospitalization | |
| | Cost | No. | Cost | No. | Cost | No. |
| Tech A | | | | | | |
| Minimum Coverage (100 beds) | $1,900 | 74.00 | $15,000 | 10.00 | $33,000 | 5.00 |
| Full Coverage | | ----- | | ----- | | ----- |
| Tech B | | | | | | |
| Minimum Coverage (10 beds) | $1,900 | 12.00 | $15,000 | 2.00 | $33,000 | 1.00 |
| Full Coverage (50 beds) | | 60.00 | | 8.00 | | 4.00 |
| Tech C | | | | | | |
| Minimum Coverage (50 beds) | $1,900 | 35.00 | $15,000 | 5.00 | $33,000 | 2.00 |
| Full Coverage (100 beds) | | 70.00 | | 9.00 | | 4.00 |
| Tech D | | | | | | |
| Minimum Coverage (5 cameras) | $1,900 | 46.00 | $15,000 | 6.00 | $33,000 | 3.00 |
| Full Coverage | | ----- | | ----- | | ----- |

# Recommendations

Organization Recommendations

1. Collect relevant data to inform score card criteria.
2. Evaluate current technology infrastructure.

Analysis Recommendations

1. This project uses a score card approach to evaluating the ATs in terms of organizational findings and the evidence-base for ATs.
2. Identify evaluation criteria that are important for your organization to measure (using #1 from organizational recommendations). The 10--criteria score card can be adapted and criteria weighted.
3. Use the AT Data Collection Guide, the ROI Calculator and the attached score card template to (re) evaluate vendors.

Pilot testing an AT

1. Based on a weighted analysis of organizational needs, determine which ATs may be a good fit.
2. Negotiate a pilot test.

# Conclusions: Clinical Question

What are the evidence-based recommendations for assistive technologies related to safety and monitoring for people living with dementia in senior residential settings?

1. Literature Review
2. Falls Rounding Data
3. Surveys
4. AT Product Data
5. Evidence-Based AT Fitness Score Card

# Limitations

- COVID-19
  - Physical presence
  - Data collection
    - CDC and public health guidance informed data collection options.
    - Surveys are self-reports and should be supplemented by observation (watching what people do with technology), focus groups or informal interviews.
- AT research base is new and limited
- Identifying AT platforms for safety

# Sustainability Plan

- Falls Rounding Team
  - Present the findings and score card tools.
  - Review the AT platforms
  - Facilitate next steps.
- Leadership Team
  - Present the ROI and Cost Projections for ATs reviewed
- AT Companies
  - Share the score card methodology.

# Dissemination

- Presentation to the Falls Rounding Team
- White paper and toolkit to the Leadership Team
- Manuscript prepared for Assistive Technology Outcomes and Benefits which highlights the methods for matching AT platforms to community needs and challenges.

# DNP Essentials Reflection

I. Scientific Underpinnings for Practice

II. Organizational and Systems Leadership for Quality Improvement and Systems Thinking.

III. Clinical Scholarship and Analytical Methods for Evidence-Based Practice

IV. Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care

V. Health Care Policy for Advocacy in Health Care

VI. Interprofessional Collaboration for Improving Patient and Population Health Outcomes

VII. Clinical Prevention and Population Health for Improving the Nation's Health

VIII. Advanced Nursing Practice

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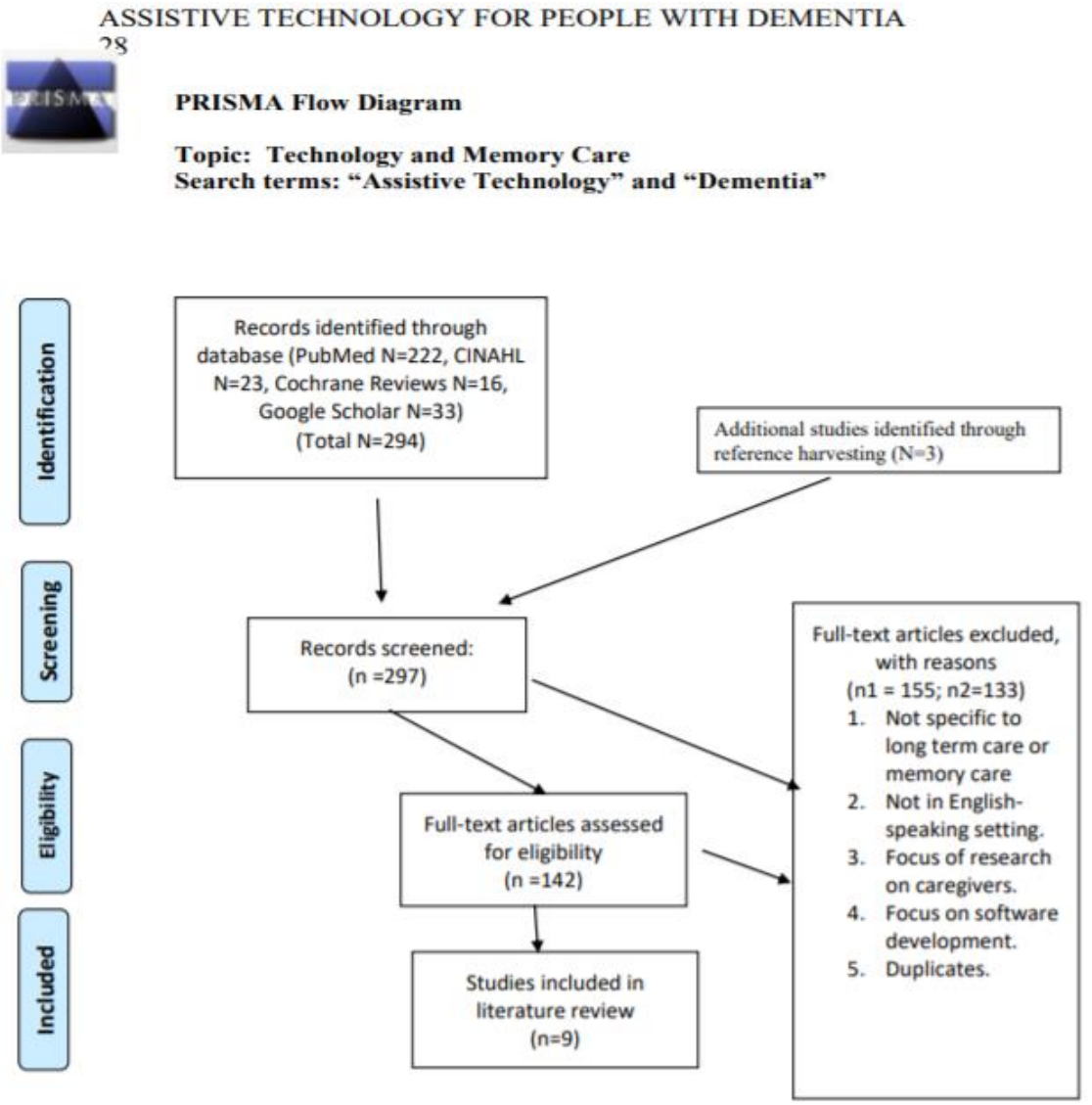
# PRISMA Flow Diagram

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