Standards for Supportive Systems for Cognitive Health and Dementia

PI: Rafik Goubran, Carleton University

Philipe Masson, Kelly Milne

In collaboration with Dr. Bruce Wallace, Dr. Rafik Goubran, Dr. Frank Knoefel

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1 Executive Summary

This report explores current solutions to support Aging-In-Place (AiP) for Persons Living with Dementia (PLWD) and specifically focuses on current products that have been announced or released onto the market by companies. The report provides a summary of two product analysis reviews. The first is a survey of 29 products chosen to provide a representative sample of products positioned to address needs across the life domains for PLWD. These were analyzed based on publicly available information across the life domains they are positioned to address, the end user targeted by the solution such as a solution to support the care giver and across a number of technical assessments of the solution. In parallel, a student team as part of a capstone project explored products specifically targeting wandering and this is provided as a second review.

One key assessment for the solutions was their stated compliance with standards (which was minimal) and also to identify areas where standards compliance is lacking and perhaps the standards themselves are lacking.

Key areas for standards need/compliance include:

Security/Privacy: Minimal information is provided related to security and privacy of the data being collected by the systems. Relevant standards exist for health data within the healthcare system such as HIPAA in the USA and PIPEDA (or the provincial equivalents) for Canada and these are not referenced.

Data Ownership: There is a lack of discussion and clarity within the product descriptions related to how data is stored and who (other than the actual patient) has access to the data.

Interoperability: Products are basically all positioned as standalone platforms and again there is little information about interoperability with other products.

Geographic Domains: With most products coming from USA based companies and the literature focused on USA consumers, there is a lack of clarity for users that are not located in the USA.

Ethical Considerations: Going well beyond Data ownership, the report shows some glaring examples of Ethical Considerations that are not considered within products. As but one example, there are products that have been created for the purpose of supporting independence for the Aging Adult but do not actually include the Aging Adult themselves within the provided knowledge or even administrative aspects of the application.

2 Main Report

2.1 Introduction

There is a wide range of technology-based products announced by companies or already in the market that are being marketed and positioned as "AgeTech" with specific focus on the needs of persons living with Dementia (PLWD) or their care team of supporting family or friends [1]–[3]. In this report, we have reviewed a sample of these products with a goal of understanding where and if standards are required [4], [5]. The standards areas considered relate to the actual function provided by the solution in relation to the needs of PLWD and care givers, technical aspects of the solutions such as interoperability, security, or privacy. Given the importance that technology may have to support Aging-In-Place (AiP), standards could play a significant role in the need for consumers to be able to understand and trust solutions.

2.2 Methodology

A methodology was developed to assess the different technologies that have been proposed. This new methodology was created to allow comparison and analysis of the various technologies against the needs of aging adults and challenges associated with cognitive health and dementia. Common variables were chosen to allow comparison of different types of technologies. The primary variables chosen focus on the PLWD needs through consideration of the Life Domain, Product Design Focus, Patient-Tech Interaction, Product Maturity, Data Privacy & Security, and Interoperability [6], [7].

- **Life Domain** [6]
    - Life domains refer to the key areas of daily living activity and personal needs. In this case we split it into 7 groups

- **Health and Self-Esteem:** Relates to increasing or maintaining personal health and self-esteem. Things such as self care, self assessment, physical training, personal appearance, medication reminders, etc.
- **Housing (Physical Space):** Relates to modifications and maintenance of the physical space of a home. Things such as lights, managing temperature, ventilation, automated cleaning, etc.
- **Activities of Daily Living (ADL):** Relates to regular activities of daily life which have to do with one's own body. Things such as bathing, hygiene, bathroom, eating, etc.
- **Instrumental Activities of Daily Living (IADL):** Relates to regular activities of daily life which involve the use of tools and technology. Things such as driving, banking, interacting with the outside world, shopping, cooking, etc.
- **Mobility and Transportation:** Relates to the ability to displace oneself to desired locations through various means. Things such as handrails, wheelchairs, elevators, driving, private and public transportation services, motor skills, etc.
- **Communication and Governance:** Relates to the ability to attain information and communicate with other people, communities, organizations, and government. Things such as mobile phones, e-mail, accessing information, noise abatement, automated messaging, hearing aids, alarms, etc.

    - **Work and Leisure:** Relates to continuing or extending personal work, career, and leisure activities. Things such as management, calendars, tools, focused lighting, games, etc.

- **Product Design Focus**
    - The product design focus is a way to determine who the technology is designed for. We split this into 6 groups.
        - **Personal / Patient:** Intended to be used personally by the patient (PLWD) as a general consumer.
        - **Family Member or Informal Caregiver:** Intended for an informal caregiver such as a friend or family member as a general consumer.
        - **Personal Caregiver and Support Services:** Intended for caregivers and support services that are not directly related to healthcare.
        - **Formal Healthcare Provider:** Intended for a formal healthcare provider which could be accessed either through private or public healthcare. This could be something like a nurse, occupational therapist, personal support worker, rehab assistant, pharmacist, etc.)
        - **Clinical Use:** Intended to be used in a clinical setting by physicians, nurses, etc.
        - **Engineers, Scientists, Researchers:** Intended to be used for research purposes.
- **Patient-Tech Interaction**
    - This section relates to how the patient interacts with the technology and if they have decisional autonomy and functional independence.

  - **Decisional Autonomy:** This is a patient's control over decisions and the ability to direct those decisions.
  - **Functional Independence:** This is a patient's ability to potentially do things themselves.

- **Product Maturity**
  - This section is a way to try and determine at which stage of development the technology is in currently. A numbering system was used from 0 to 4, the higher the number the closer it is to being commercially available.
    - **0 = Design / Prototype stage:** The product is still in the conceptual and prototype stage of development.
    - **1 = Tested in a Lab or Self-Tested:** The product has been designed and tested internally.
    - **2 = Tested in a "Test" Apartment, Home, Community or Facility:** The product has been tested in a specified test environment.
    - **3 = Tested in an Actual Apartment, Home, Community or Facility:** The product has been used and tested in an actual practical environment such as someone's home.
    - **4 = Deployed Commercially:** The product is deployed commercially and available for purchase.
- **Data Privacy & Security**
  - This section relates to everything around data, what's being collected, how it is stored, its privacy and security. This data was collected and based on what was

available through the website of a given product. We split this into four parts, each asking different questions about data.

- What data is collected and its level of anonymity?
- What data leaves the local network or devices and its level of anonymity?
- What does the technology or company mention about the data, how its used, stored, collected, shared, etc.?
- What does the technology or company mention about the security of the data, encryption, access, anonymization, etc.?

- **Interoperability**
  - In this section we added anything that relates to interoperability of the technology with other devices. This could be how easy it is to integrate with other technologies or what kind of external controls or access is provided for 3rd party tools.

Some other information was recorded such as links to research papers and studies, background of the leadership and founders, listed countries of operation, technical specifications links, and other informational notes found throughout the research process.

The assessing of a device consisted of reading through their website and taking the information available to determine the details for each of the variables of interest. For example, in the case of Chirp, the device uses ambient sensing to detect activities of daily living and has 2-way communication which means it is associated with the two life domains of Activities of Daily Living and Communication and Governance. The product appears to be designed for informal caregivers, personal caregivers, and formal healthcare providers. The patient would retain both

decisional and functional independence with this device. The product maturity isn't obviously stated but it appears to have been tested in lab and mentions availability sometime in 2023. Details around their data privacy and security were then noted for each of the relevant sections based on the information available on their website and FAQ. Other information was then gathered if available, such as any links to research papers or articles, details on the background of leadership, countries of operation and specifications. This process was repeated thoroughly for each individual technology.

2.3 Analysis

A total of 28 technologies were assessed with the methodology previously stated for which there were 21 distinct companies. An analysis was performed with the data and information collected which is detailed in the relevant sections below. It should be noted that this data set is a sample of what technologies are currently available. This means that it is not an exhaustive list of every technology related to AiP and PLWD, rather, it is a subset which can be used to give insights into potential areas that could be of interest for future investigations and the state of products compliance and/or use of any existing technology or product standards.

2.3.1 Life Domain

Our life domain analysis consisted of 7 groups:

- Health and Self-Esteem
- Housing (Physical Space)
- Activities of Daily Living
- Instrumental Activities of Daily Living
- Mobility and Transportation
- Communication and Governance
- Work and Leisure

Out of the 28 technologies assessed, the most common life domain observed was Communication and Governance with a total of 26 (~92.9%) and the second most common was Health and Self-Esteem with a total of 19 (~67.9%). The least common domain observed was the Work and Leisure with a total of 1 (~3.6%) and second least common was Housing with a total of 10 (~35.7%). See Figure 1 below for details.

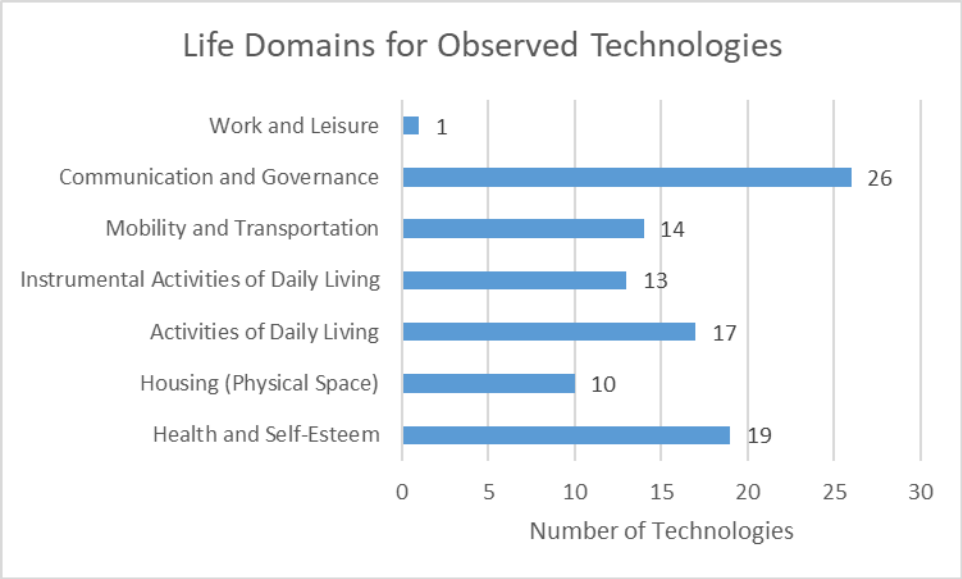

Figure 1: Total number of technologies associated with each life domain for the 28 observed technologies.

Domain pairings for assessed to determine common and uncommon life domains pairings for each of the technologies. The most common pairs are associated with Communication and Governance which is expected due to it being the most common life domain. Table 2 below shows the total number of occurrences for each pair.

Common Pairs of Life Domains							
	Health and Self-Esteem	Housing (Physical Space)	Activities of Daily Living	Instrumental Activities of Daily Living	Mobility and Transportation	Communication and Governance	Work and Leisure
Health and Self-Esteem	N/A	8	10	8	10	17	1
Housing (Physical Space)	8	N/A	9	4	10	10	0
Activities of Daily Living	10	9	N/A	7	12	16	0
Instrumental Activities of Daily Living	8	4	7	N/A	6	13	0
Mobility and Transportation	10	10	12	6	N/A	12	0
Communication and Governance	17	10	16	13	12	N/A	1
Work and Leisure	1	0	0	0	0	1	N/A

Table 1: Total number of technologies with a given pair of life domains.

The probability that a technology will have a specific second domain given an existing one was then calculated and shown in Table 2. For example, if Health and Self-Esteem is a life domain that is present on a given technology the probability that Housing is also present for that same technology is 42.1%. In contrast, if Housing is an associated life-domain on a technology there's an 80% chance that Health and Self-Esteem is also present on that technology. An interesting observation was that if Housing is present on a technology, it also always had Mobility and Transportation.

Matching Probability of Life Domains								
	Total	Health and Self-Esteem	Housing (Physical Space)	Activities of Daily Living	Instrumental Activities of Daily Living	Mobility and Transportation	Communication and Governance	Work and Leisure
Health and Self-Esteem	**19**	N/A	42.1%	52.6%	42.1%	52.6%	89.5%	5.3%
Housing (Physical Space)	**10**	80.0%	N/A	90.0%	40.0%	100.0%	100.0%	0.0%
Activities of Daily Living	**17**	58.8%	52.9%	N/A	41.2%	70.6%	94.1%	0.0%
Instrumental Activities of Daily Living	**13**	61.5%	30.8%	53.8%	N/A	46.2%	100.0%	0.0%
Mobility and Transportation	**14**	71.4%	71.4%	85.7%	42.9%	N/A	85.7%	0.0%
Communication and Governance	**26**	65.4%	38.5%	61.5%	50.0%	46.2%	N/A	3.8%
Work and Leisure	**1**	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	N/A

Table 2: Probability that a technology will have a specific second domain (top row) given an existing domain (left column).

The span of domains was then observed to determine how many technologies cover a given number of domains. In this case the most frequent span was 3 domains with a total of 10 technologies and there were none for 0 or 7 domains. The average number of domains for a technology was calculated to be approximately 3.57 ± 1.34. If we were to assume that a small span of life domains could suggest that the technology is more specialized and that a large span could suggest that it is more broad, there appears to be a slight bias toward more specialized technologies. However, this is a small bias if we assume an unbiased average would yield 4.0, thus the calculated average 3.57 only has a ~10.7% difference. See Figure 2 below for details.

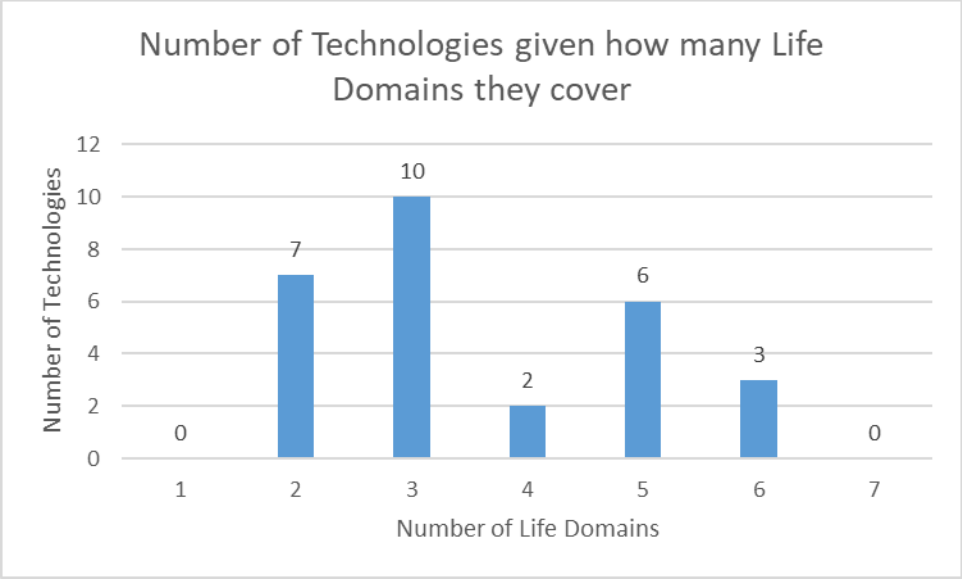

Figure 2: Total number of technologies given how many life domains they cover.

2.3.2 Product Design Focus

Our product design focus consisted of 6 groups.

- Personal / Patient
- Family Member or Informal Caregiver
- Personal Caregiver and Support Services
- Formal Healthcare Provider
- Clinical Use
- Engineers, Scientists, Researchers

Out of the 28 technologies observed, the most common design focus was for personal caregiver and support services with a total of 27 (~96.4%) and the least common was for clinical use with a total of 3 (~10.7%). The low number of products intended for clinical use was expected since we were targeting technologies which are intended to provide solutions for AiP. There were no

products which were focused on Engineers, Scientists and Researchers which was also expected since these technologies are not intended for these purposes. See Figure 3 below for more details.

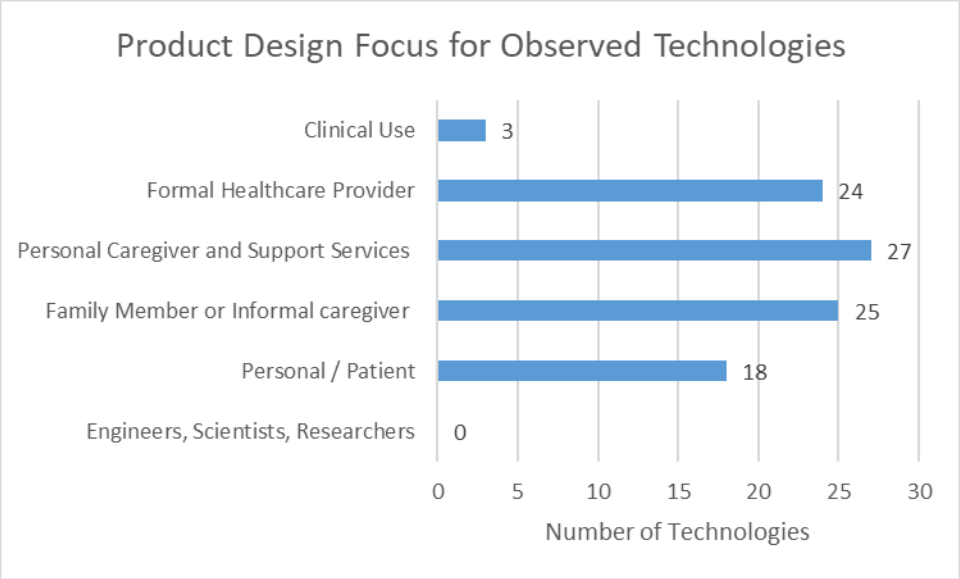

Figure 3: Number of technologies associated with a given product design focus.

The span of how many different groups a technology is targeted toward was also observed. The average number of groups was calculated to be approximately 3.46 ± 0.79. The most common was 4 groups with a total of 15 technologies (~53.6%) and least common was 5 groups with only 1 technology (~3.6%). There were no technologies that targeted 1 or 6 groups. See Figure 4 below for details.

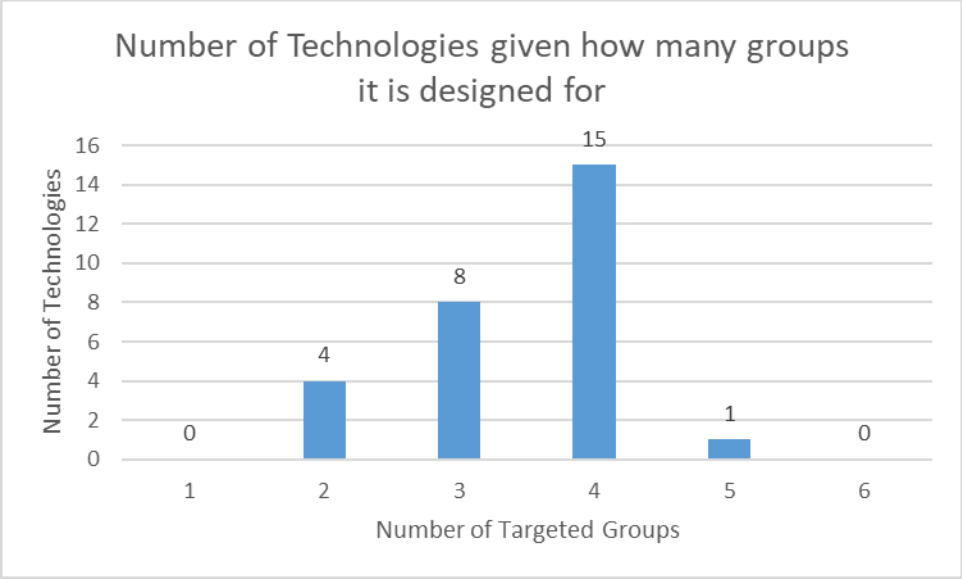

Figure 4: Total number of technologies given how many groups it is designed for.

Group pairs were also assessed to determine common and uncommon pairs of groups a technology is designed for. The most common pairing was between Family Members / Informal Caregivers and Personal Caregiver / Support Services with 25 technologies (~89.3%) focused on both groups. The least common pairings were related to clinical use which is expected due to the low number of technologies that had this focus in our observed data set. See table 3 below for details.

Product Focus Pairs					
	Personal / Patient	Family Member or Informal Caregiver	Personal Caregiver and Support Services	Formal healthcare provider	Clinical Use
Personal / Patient	N/A	18	18	16	1
Family Member or Informal Caregiver	18	N/A	25	21	1
Personal Caregiver and Support Services	18	25	N/A	23	2
Formal healthcare provider	16	21	23	N/A	3
Clinical Use	1	1	2	3	N/A

Table 3: Total number of technologies given a pair of focus groups.

The probability that a technology will have a specific second focus group given an existing one was then calculated. For example, if a technology was focused on Personal / Patient, the probability that it was also focused on Family Member or Informal Caregiver was 100%. In contrast if a technology was focused toward Family Member or Informal Caregiver, there's only a 72% chance that it also focused on Personal / Patient. See table 4 below for details.

The lines below the top line of this table highlight a significant concern with a number of solutions proposed in this space. These products are created to support the independence of the aging adult who by definition is an adult and hence owns the decisions around what data is collected about them and who has access to the data. The fact that solutions exist that serve the needs of other around the older adult and NOT the older adult themselves is very concerning as it brings into question the ethics associated with the use of these solutions [2]. There are cases where a PLWD may not be their own decision maker but to have that assumed by the solution is inappropriate.

Matching Probability of Product Focus						
	Total	Personal / Patient	Family Member or Informal Caregiver	Personal Caregiver and Support Services	Formal healthcare provider	Clinical Use
Personal / Patient	**18**	N/A	100.0%	100.0%	88.9%	5.6%
Family Member or Informal Caregiver	**25**	72.0%	N/A	100.0%	84.0%	4.0%
Personal Caregiver and Support Services	**27**	66.7%	92.6%	N/A	85.2%	7.4%
Formal healthcare provider	**24**	66.7%	87.5%	95.8%	N/A	12.5%
Clinical Use	**3**	33.3%	33.3%	66.7%	100.0%	N/A

Table 4: Probability that a technology will have a specific second focus group (top row) given an existing one (left column).

2.3.3 Patient-Tech Interaction

Observations were made around the patient and its interactions with the technology to determine if it would support a patient's decisional autonomy and functional independence. There are 23 (~82.1%) technologies which provide both decisional autonomy and functional independence. In most cases, it would likely be preferable to preserve a patient's autonomy and independence if possible, which most technologies provided. There was no preference noticed between decisional autonomy and functional independence in our data. For more details see table 5 below.

Observations for Patient Interactions with Technology	
Patient-Tech Interaction	Number of Technologies
Total Decisional Autonomy	24
Total Functional Independence	24
Only Decisional Autonomy	1
Only Functional Independence	1
Both Decisional Autonomy & Functional Independence	23
Neither Decisional Autonomy or Functional Independence	3

Table 5: Overview of the observations made for patient interactions with technology with respect to decisional autonomy and functional independence.

2.3.4 Product Maturity

Product maturity was assessed to approximate the current stage of testing, development and access for a given technology from initial design to commercial availability. The stages were defined as follows:

0. The product is currently in design or prototype stage.
1. The technology has been tested in a laboratory or self-tested environment.
2. The technology has been tested in a testing apartment, home, community, facility, etc.
3. The technology has been tested in a real-world environment such as an actual apartment, home, community, facility, etc.
4. The technology is deployed and available commercially.

During our assessment we found that no devices were still at a prototype stage (Score of 0) and that only one was either internally tested or used in a test scenario (Score of 1 or 2). The remaining 27 devices were all either tested in a real-world environment or available commercially. See table 6 below for details.

Product Maturity	
Score	Number of Technologies
0	0
1 or 2	1
3 or 4	27

Table 6: Number of technologies given their current stage of development.

2.3.5 Privacy, Data & Security

Information related to privacy, data and security of the technologies was obtained by asking four different questions and collecting any information available on their website. These questions were as follows:

1. What data is collected and its level of anonymity?
2. What data leaves the local network or devices and its level of anonymity?
3. What does the technology or company mention about the data, how its used, stored, collected, shared, etc.?
4. What does the technology or company mention about the security of the data, encryption, access, anonymization, etc.?

With the data collected from these questions, we were able to determine the number of technologies which had any mention of some of the key components around data, privacy, and security. Table 7 below shows the details of our findings.

Any mention of specified information	Number of technologies with mentions	Percentage
Mentions what data is collected directly on the device	26	92.9%
Any mention of anonymization performed on the data	4	14.3%
Any direct mention of privacy	10	35.7%
Mentions what data leaves the device or local network to an external network or source	16	57.1%
Any mention on how data from the technology or company is used, stored, collected, shared, etc.	12	42.9%
Any mention about the security of the data, encryption, access, etc.	9	32.1%

Table 7: Number of technologies that mention a specified aspect related to data, security, and privacy.

There seems to be a near complete lack of detailed information when it comes to data and privacy. Most companies have little to no mention about privacy other than a very brief generic mention that their technologies "respect privacy" or that it is "secure". Very few mention the anonymization process for the data. Most have little to no mention to what extent the data is being used, stored, shared and even worse, mention next to nothing about the technical security of the data, its encryption, who has access, etc. So the 32% number provided in Table 7 is a best case scenario as many products that mentions they have security could have highly inadequate actual security implementations.

2.3.6 Interoperability

Most of the technologies observed did not have outright interoperability with other smart devices. The technologies that used a suite of different sensors had the ability to connect within their own devices and applications, which is to be expected, but they did not have support for sensors or devices outside of their own products.

Two had the ability to connect to an API (Application Programming Interface) which could be very useful when developing third party tools and software. Two either support or are in the process of implementing support for IoT (Internet of Things) devices. One is in the process of implementing Zigbee integration to be used on existing Zigbee networks. Two mention integration with existing nurse call systems. One mentions data integration with third party systems. One has Amazon Alexa integration.

Given this information, the total number that have mentioned some level of interoperability as a consideration is 9 of 28, which is only around 32% of the technologies we observed.

2.4 Additional Findings

Throughout the assessment process, some other things were noticed outside of the primary variables of interest.

There were 17 out of the 28 technologies (~61%) that had links to some sort of studies, research papers, news articles, etc. The studies themselves were not assessed, only that they linked to some sort of external research or information related to their technology.

We noticed a general lack of datasheets and technical information around the products. Only 7 of the 28 technologies (25%) had some technical specifications that were available. It is understandable that these devices are not intended for a technical audience, however even things as trivial as a lamp or remote control have easily accessible data sheets. Having technical details such as data sheets makes understanding the technologies and their function much easier.

It did seem like the products that were coming from USA (United States of America) had slightly different styles in the language that was used to describe their technology. It appeared to be more oriented toward marketing or sales verbiage instead of being more focused on providing detailed information. It was also noticed that USA based products often appeared to make assumptions that everyone resides in the USA. This could be due to them only wanting to target the USA as their consumer base.

Also noticed frequent claims around their products being “the best”, “the first”, “the only” solution of its kind. We suspect that most of these claims are unfounded and likely to be outright incorrect. This kind of language seems like a marketing tactic more than an accurate representation of their technology.

There appears to be seemingly low technical standards for most of these devices. This could be just a personal perception but there seems to generally be very little details on technical information related to the devices. Most other consumer-ready technology has a lot of technical detail that is readily available such as data sheets, technical manuals, full device specifications, etc. It doesn’t seem like most of these devices have much of any of this information even for those available to be purchased by the public. This is somewhat disturbing since finding technical details on devices previously used is usually an easy process. In the case of assessing these technologies related to cognitive impairment and dementia with aging adults, it was on average much more difficult. Even simple things such as children’s toys have easily accessible technical information which are not nearly as important as devices intended to help with someone’s cognitive health. It

is concerning that technologies which are supposed to potentially have a huge impact on someone's well-being might have little to no technical information available.

2.5 Challenges

One of the challenges faced was due to many of the technologies having a lack of technical information which made understanding the technologies sometimes very challenging. This lack of technical information makes it difficult to get accurate information about what a particular device is doing for things such as what data its recording, how its processing the information, the specifications around the sensors, etc. It also seemed like many of the information on the websites focused primarily on the solutions to problems their technology proposes to solve without giving much or any detail on how they solve the issues. This can make it difficult to get an understanding of how these devices work and what you might be able to reasonability expect from the system.

Another challenge was the quality and presentation of the information on the websites. For some of them it was difficult to obtain certain types of information since it was scattered in small descriptions on different pages. Some had information that was only available through their videos and did not detail that information in text anywhere on their website. Sometimes very useful information such as data privacy was buried in the FAQ sections.

3 Comparison of Tracking Devices

In the context of a 4th year Capstone project, students gathered information on tracking devices on the market for various applications that could be used to support a PLWD that is at risk of wandering or getting lost. In many cases, the technologies were created for other applications and use cases, and these have been adapted or are being used for Dementia applications even if that is not the intended application.

These technologies had a wide range of design characteristics that are summarised in the tables below. This intended application for the product was evenly distributed across the various intended market applications.

One area where there was great variation was in the chosen battery technology as the item trackers typically did not include cellular radios and hence were able to claim much longer battery life. This is at the expense of range to find a lost person as many of the devices are paired with a smart phone app and allow the device to be found when the smartphone can communicate with the device through Bluetooth or other short reach radio. One exception is the Apple AirTag that uses all Apple phones as part of its search network.

The products intended to track living subjects (PLWD, Children, Pets) all tend to include cellular radios providing much greater reach although many of these also have very short battery life that is typically a few days at most.

These products also have many of the issues identified in the other products where there is limited information provided on the methods that they use for security and privacy of the information collected.

Product Intended Use Case	# Products Identified
Item Trackers	8
Pet Trackers	7
Dementia GPS Trackers	6
Child Trackers	7

Table 8: List of intended market for tracking devices compared

Battery Characteristics	# Products Identified
Rechargeable	21
Replaceable	7
Battery Life	**# Products Identified**
<= 0.5day	3
>0.5 day, <=day	3
2-3 days	6
1 week	1
2-4 weeks	3
1-3 months	2
Up to 1 year	10

Table 9: List of batteries used in the products

Radio Technology	# Products Identified
Bluetooth	16
Cellular (LTE etc)	16
WiFi	9
GPS	14
Other	2

Table 10: List of radio technologies used within the platforms.

3.1 Summary

These products show the wide range of options available for dementia tracking devices. The myriad of technology options and basic performance measures such a battery life are extremely complex. The use of devices such as the Apple AirTag created for item tracking for PLWD (Pets or Children) tracking is actually contrary to the user agreement even though consumers may be choosing to do exactly that especially when child watch AirTag bracelets are easily found on the Internet.

One aspect of interoperability and standardization is the diversity of technology and in many cases the only device that can locate the device is a paired smartphone. Apple AirTag demonstrates the

potential for all smartphones to be part of the search network. This has also shown the risks of these technologies as they have been used for stalking and car theft. Apple has addressed this with OS features for iOS devices and an App for Android that notifies the user if an AirTag is with them that is not theirs, but it only works on Android if the Apple app is installed. With Google announcing at AirTag equivalent device, there is hope that all smartphones will have the native OS features for tags and standardization of this has the potential to address a common solution to the stalking/theft inappropriate use while also allowing for these devices to be used for PLWD safety.

4 Proposed Areas for Technical Standards

The analysis indicates a number of areas where standards could be of great value to assist the consumer of these products and solutions to better understand their functionality and also to assess aspects of their operation. The Wikipedia definition of Technical Standard is "A **technical standard** is an established norm or requirement for a repeatable technical task which is applied to a common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods, and related management systems practices."

A number of areas were observed where standards are required and in some cases, existing standards may be used for this new domain avoiding the need for new standard development.

Security/Privacy: The minimal information provided around security and privacy of the data being collected by the systems, some of which should be considered health data is a significant gap in the products and protection of the end users. Given the relevant standards exist for health data within the healthcare system such as HIPAA in the USA and PIPEDA (or the provincial equivalents) for Canada, there are existing standards on which product can build or directly use. A secondary aspect of this is that the products and companies need to actually provide information on this subject within their product literature.

Data Ownership: The lack of discussion and clarity within the product descriptions related to how data is stored and who (other than the actual patient) has access to the data is very concerning. There is a need for clarity on data ownership and access [2].

Interoperability: Products are basically all positioned as standalone platforms and again there is little information about interoperability with other products. This identifies an area where standards are required with Matter [8] being one example that is emerging but none of the products

reviewed mention this. Matter only addresses system to system interoperability and there are other areas (collected data) where standards are also required.

Geographic Domains: With most products coming from USA based companies and the literature focused on USA consumers, there is a lack of clarity for users that are not located in the USA. The issues related to if the product will function in Canada. This also relates to where and how the data collected is stored as again, users may require their data to remain in Canada and not be subject to laws of other countries.

Ethical Considerations: Going well beyond Data ownership, the report shows some glaring examples of Ethical Considerations that are not considered within products. As but one example, there are products that have been created for the purpose of supporting independence for the Aging Adult but do not actually include the Aging Adult themselves within the provided knowledge or even administrative aspects of the application. Standards (perhaps linking back to privacy standards) are required to ensure that ethical considerations are addressed by products and solutions [2].

5 References

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6 Appendix A – Acronyms

PLWD	People Living With Dementia
AiP	Aging in Place
ADL	Activities of Daily Living
IADL	Instrumental Activities of Daily Living

7 Appendix B – Technologies Assessment Data

Product analysis spreadsheets – see “Standards Appendix B Spreadsheet.xlsx”

8 Appendix C – GPS Assessment Data

Product analysis spreadsheets – see “Standards Appendix C Spreadsheet.xlsx”