AgeTech **D**iscussions:
Exploring **P**erspectives on **T**echnology

Tochtech Technologies Toch Sleepsense | Report
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Executive Summary

Canada's population is aging faster than ever before and this has many implications in terms of healthcare, social services, and the economy. In response, AgeTech, or Age Technology, a subset of the health technology industry, has emerged in recent years and uses technology to support healthy aging by enhancing and adapting alternative care approaches. Yet, for many older adults, especially those living in northern and rural communities, there exists a disconnect preventing emerging AgeTech from getting to those that need it the most.

The Centre for Technology Adoption for Aging in the North (CTAAN) focuses on bridging that technology adoption gap by testing, piloting, adapting, and implementing new and existing technology solutions tailored to address the challenges experienced by older adults and care partners in northern and rural communities in British Columbia. One of CTAANs' key service is AgeTech Discussions: Exploring Perspectives on Technology, heretofore referred to as ADEPT. The ADEPT workshops focus on emerging AgeTech to describe the applicability, usability, and feasibility of a featured AgeTech from end users' perspectives in northern and rural BC.

This report shares the results from ADEPT Workshops featuring Tochtech Technologies Toch Sleepsense. Data collection occurred over two ADEPT Workshops with a total of 13 participants. Each workshop included pre- and post- online surveys, a demonstration of Toch Sleepsense, and a facilitated discussion period where participants discussed the usability, feasibility, and accessibility of Toch Sleepsense in long-term care facility settings across BC.

Participant findings from the workshops were analysed and five themes emerged which are described in this report. These themes include: 1) Enhancing overall quality of care in long-term care facilities with Toch Sleepsense, 2) Improving sleep quality and health with Toch Sleepsense virtual monitoring, 3) Supporting staff and guiding staffing strategies with sleep tracking, 4) Addressing Toch Sleepsense implementation challenges, and 5) Toch Sleepsense system and design insights.

Theme 1 details how Toch Sleepsense could enhance the quality of life and sleep for residents by supporting personalized care-planning and providing health care transparency to family in long-term care facilities. Theme 2 discusses how virtual monitoring could improve the sleep quality and health of long-term care residents through virtual checks of vitals, sleep movement, and in/out of bed status. Theme 3 illustrates how Toch Sleepsense could provide objective data to guide staffing strategies. Theme 4 explores implementation barriers and solutions in northern, rural, and interior BC long-term care facilities. Theme 5 describes perceptions of the Toch Sleepsense system and design.

Primary recommendations include ensuring collaboration between health systems decision makers and long-term care facility management to understand site-specific barriers to implementation. As well, the co-development of training/support for care staff and educational demonstration videos specific to the northern, rural, and interior long-term care facility contexts should be considered. Further, the development of resources detailing data privacy/storage and management would be highly valuable to prospective long-term care facilities.

This report reveals insights from healthcare professionals with expertise in the long-term care ecosystem of BC. Tochtech Technologies Toch Sleepsense was found to be a novel and potentially invaluable bed alarm system that could enhance the quality of life and care for residents of long-term care facilities, as well as augment long-term care staffing support, across northern, rural, and interior British Columbia.

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Background

By 2036, 23%-25% of Canadians will be over the age of 65.[1] This is a fundamental and unprecedented shift; Canada's population is aging faster than ever before. Having an aging population has many implications in terms of healthcare, social services, and the economy. According to the Government of Canada, older adults currently represent 17% of the Canadian population but account for 47% of the total healthcare costs.[2]

Although Canadians are living longer, they are also more likely to develop a chronic or life-limiting illness and have complex care needs as they age.[1-2] Consequently, increasing numbers of individuals are entering into long-term care facilities when personal and community supports are no longer able to provide a sufficient level of care.[3] Often, those that transition to live in long-term care experience a decrease in daytime activities, social interaction, and access to nature and daylight.[4] These factors, along with other aspects of institutionalized environments, such as noise, nighttime light exposure, and other nocturnal care practices, have been shown to impact long-term care residents' sleep quality and duration.[5] For instance, light exposure at night suppresses melatonin secretion which inhibits circadian rhythm synchronization and increases the number of times a resident wakes up during the night.[6] As well, nighttime noise, specifically resident and staff vocalization, can cause stress to residents and interfere with sleep.[5] The effect of poor sleep for residents of long-term care facilities is two-fold - residents may experience cognitive dysfunction, daytime sleepiness, increased falls, and decreased wellbeing and quality of life, while facility operations and staffing are negatively impacted which affects day to day care quality and efficiency.[7] Persons living in long-term care facilities face increased barriers to sleep as compared with community-dwelling older adults.[7] With over 30,000 persons residing in long-term care facilities in BC alone,[8] the need to improve resident sleep is paramount. By modifying nighttime care practices, long-term care resident sleep can be improved leading to a decrease in falls, improved quality of life, and well-being.

In recent years, innovative solutions and technologies have begun to emerge from the AgeTech sector. AgeTech, or Age Technology, a subset of the health technology industry, uses technology to support healthy aging, and to support care partners and health professionals to improve quality of life for aging adults. By enhancing and adapting alternative care approaches through emerging technologies, it may be possible to enable and extend the ability for older adults to safely age in place within their own homes, improve long term care facility experiences, and/or decrease long-term care costs/needs.

The Centre for Technology Adoption for Aging in the North (CTAAN) supports aging in northern and rural communities by making Age Technologies more available to older adults, care partners, and the health care systems that support them. CTAAN's programs focus on testing, piloting, adapting, and implementing new and existing technology solutions tailored to address the challenges experienced by older adults and care partners in northern and rural communities.

CTAAN is built on a partnership with UNBC, the Northern Health Authority, and AGE-WELL. CTAAN has an extensive network of partners and "Living Lab" sites that allow for evaluation, testing, and validation in real-world settings. CTAAN leads testing, research projects, and

evaluation to validate technology and works collaboratively with our partners to support implementation for at home settings and in care settings across the continuum of care. This information provides companies with important third-party validation that will not only provide key product insights but will allow the company to achieve a first sale or further reinforce a value proposition that will help the company scale in the region and far beyond. These services are provided by CTAAN staff and include researchers, students, older adults, community partners, and healthcare providers.

The first step to introducing AgeTech to the region is one of CTAANs' key services, AgeTech Discussions: Exploring Perspectives on Technology, heretofore referred to as ADEPT, which focuses on emerging AgeTech in northern and rural BC to describe the applicability, usability, and feasibility of a featured AgeTech from end users' perspectives. Through workshops, end users participate in facilitated discussions and provide important insights and recommendations to inform design and adjustments of featured AgeTech. This process provides technology developers and companies with evidence that helps form the next steps to scale their products and services to northern and rural areas.

Feature Technology: Toch Sleepsense by Tochtech Technologies

Toch Sleepsense is a non-wearable sleep sensor and tracker that provides long-term care staff the ability to remotely monitor residents' safety and quality of sleep in real-time. The palm sized device is placed under the leg or wheel of the bed and can detect body movement and vital signs, and alerts when a resident is out of bed, has not returned to bed, or is experiencing a health emergency event. Through central monitoring and virtual bed checks, Toch Sleepsense provides enhanced resident safety by reducing fall risk and wandering and improving pressure injury care management.

Toch Sleepsense can be integrated into a variety of care systems, including nurse call, and patient care or smart care systems, eliminating system redundancies and improving workflow. This sleep sensor addresses numerous staffing challenges, by decreasing need of in-person checks, reducing resident sleep interruptions, and enabling staff to focus on residents who need the most assistance. This system generates evidence-based sleep quality reports and analysis that can be used in health care planning and decision making to improve sleep quality and overall wellbeing and quality of life for long-term care residents.

Figure 1. Toch Sleepsense device and placement

Methods

This report features Tochtech Technologies Toch Sleepsense – the next generation bed alarm. Together, CTAAN and Tochtech Technologies connected to explore potential collaborative projects with the primary goal of implementing Toch Sleepsense in long-term care facilities across BC. To assess the feasibility and usability, CTAAN offered one it's key services: ADEPT (facilitated workshops supported by NRC-IRAP funding through CTAAN, and contributions from Tochtech Technologies).

ADEPT workshop preparation began with an introductory presentation of Toch Sleepsense by Tochtech Technologies to the UNBC research team. Through discussions, Tochtech Technologies identified a gap in understanding the diverse and unique contexts of long-term care facilities across northern, rural, and interior BC, including the decision-making processes across health regions, variability in staffing levels and nighttime care policies, nurse call systems, Wi-Fi capabilities, purchasing, and the implementation feasibility and usability of the Toch Sleepsense across these settings. With a key objective of exploring the "Feasibility and Usability of Tochtech Technologies Toch Sleepsense in Healthcare Facilities in Northern, Rural, and Interior British Columbia", long-term care facilities were selected as prospective settings for implementation. Accordingly, management and staff from healthcare facilities fitting this description were recruited for these ADEPT Workshops. Additionally, we applied maximum variation sampling techniques to ensure diversity, equity, and inclusion in our recruitment. Data collection occurred in March and April 2023 over two workshops and the target number of participants was reached. Consent was obtained from all participants prior to the workshops.

Each workshop followed the same format: 1) a pre-workshop survey for participants to complete in the first 20 minutes; 2) the Toch Sleepsense presentation with product demonstration; 3) a question-and-answer session with a Tochtech Technologies company representative; 4) a facilitated group discussion; and finally, 5) a post-workshop survey to be completed at the end of the discussion. In the pre-survey, participants provided demographic information and answered questions about their experience with bed alarm/sensors systems, and attitudes towards sleep monitoring and management in their respective health care facilities/authorities. In the post-survey, participants shared further insights relating to the Toch Sleepsense bed alarm system and their satisfaction with the presentation/demonstration, general workshop facilitation, and organization.

Tochtech Technologies presented their Toch Sleepsense bed alarm system – current research, outcomes, trials, and the physical design were detailed as well as the platform for remote monitoring and trend analysis. The facilitated group discussions were led by trained CTAAN staff. A discussion guide was used to direct the conversations and focused on soliciting information around bed alarms/sensors, Toch Sleepsense, northern, rural, and interior BC healthcare facility contexts, decision planning, nurse call systems, staffing efficiency/human resources, implementation considerations, and required supports. Prompts used to elicit participant views and experiences were open-ended opinion and experienced-based questions.

Workshops lasted 2.5 hours each and were digitally recorded. Audio was transcribed verbatim and checked for accuracy. All identifying information was removed to ensure confidentiality. Qualitative data was analyzed using a thematic approach guided by Braun and Clarke (2006). This involved following the six-phase process outlined using an inductive approach to code and generate themes:

1) Familiarisation with the data: Each transcript was read several times and initial thoughts noted to establish familiarity.
2) Coding: Concise initial descriptive codes were generated in a systematic manner and data relevant to each code was collated.
3) Searching for themes: A coding framework was developed by adding, removing, and organizing the initial codes into potential themes and sub-themes.
4) Reviewing themes: To maximize internal homogeneity and external heterogeneity, each theme was examined and refined in relation to the codes and in relation to the entire data set. A thematic map was used to help ensure the themes fits together meaningfully and the distinctions between them were clear.
5) Defining themes: The ‘‘essence’’ of each theme was identified and described clearly to determine the aspect of the data which each theme captured.
6) Producing the report: Extracts were knit together an analytical narrative with interview quotes integrated to contextualize the analysis in relation to the objectives of the research and to existing literature.

Quantitative survey data was summarized using descriptive statistics in Excel, while qualitative data was analyzed using NVivo 12. A consensus approach was applied to ensure the findings and illustrative quotes used in this report best represented the prevailing patterns across participants to provide thorough recommendations for the implementation of Toch Sleepsense across northern, rural, and interior BC healthcare facilities.

Ethics approval for the ADEPT workshops was provided by the University of Northern British Columbia ethics board (H22-00499), the Northern Health Operations Board (RRC-2022-004) and the National Research Council (2022-56).

Workshop Findings

PARTICIPANTS & PRE-SURVEY

Thirteen participants took part in two ADEPT workshops held in March and April of 2023, respectively. Participants were employed as executive directors/directors, practice leads, managers, coordinators, and supervisors with expertise providing care to older adults and those residing in long-term care facility settings. Participants roles related to operations, policy, planning, research, seniors care, and recreation, within long-term care (11; 84.6%), community-based care (n=1; 7.7%), or both (n=1;7.7%).

Participants were motivated to attend the ADEPT workshop featuring Toch Sleepsense for many reasons, including a desire to improve long-term care patient care and quality of life through technology like Toch Sleepsense, to improve staffing support and efficiencies through bed alarm technology, and to learn about how Toch Sleepsense technology can contribute to quality and safety improvements in long-term care facilities. Additionally, participants were interested in learning and discussing the suitability, and implementation feasibility of Toch Sleepsense in their facilities, the types of data that Toch Sleepsense can collect, and how this technology can reduce staffing needs and improve efficiencies, benefits to long-term care residents and staff, care experience improvement, long-term care fit, and potential future benefits.

A majority of participants had never used bed sensors/sleep monitoring and management systems prior to the workshop (see Figure 2.), and most agreed there was a need for this type of technology in long-term and home-based seniors' care. Participants foresaw that bed sensor and sleep tracking technology would be most beneficial to decrease/prevent falls and injury and improve staffing efficiencies. Additionally, participants highlighted virtual monitoring and the potential for falls prevention, user friendliness, resident safety and well-being, system integration, and the impact on staffing workload as high priority needs for a bed sensor/sleep monitoring and management system.

With regards to regular technology use, over 90% of participants reported using Lifestyle & Communication Technologies [e.g., smartphone, tablet, computer], half reported using Health Technology [e.g., Fitbit, Apple Watch], and less than half reported using Healthcare Provider Technology [e.g., Telehealth], Smart Home Technology [e.g., smart fridge, alarm systems], and Assistive Technology [e.g., Mobility aids, Hearing aids] in their daily life. Almost all participants indicated an increased use of technology during the COVID-19 pandemic individually and most agreed that the need for support technology has increased for older adults since the beginning of the pandemic, stating decreased healthcare access and social isolation as the cause.

Figure 2. Pre-survey results of prior use of bed sensor/sleep monitoring technology

FACILITATED DISCUSSION: KEY THEMES

During the facilitated discussion, participants shared their perceptions of Toch Sleepsense in relation to long-term care facility settings in northern, rural, and interior communities in BC. Five key themes were developed through analysis of the workshop discussions: 1) Enhancing overall quality of care in long-term care facilities with Toch Sleepsense, 2) Improving sleep quality and health with Toch Sleepsense virtual monitoring, 3) Supporting staff and guiding staffing strategies with sleep tracking, 4) Addressing Toch Sleepsense implementation challenges, and 5) Toch Sleepsense system and design insights (see **Figure 3.**).

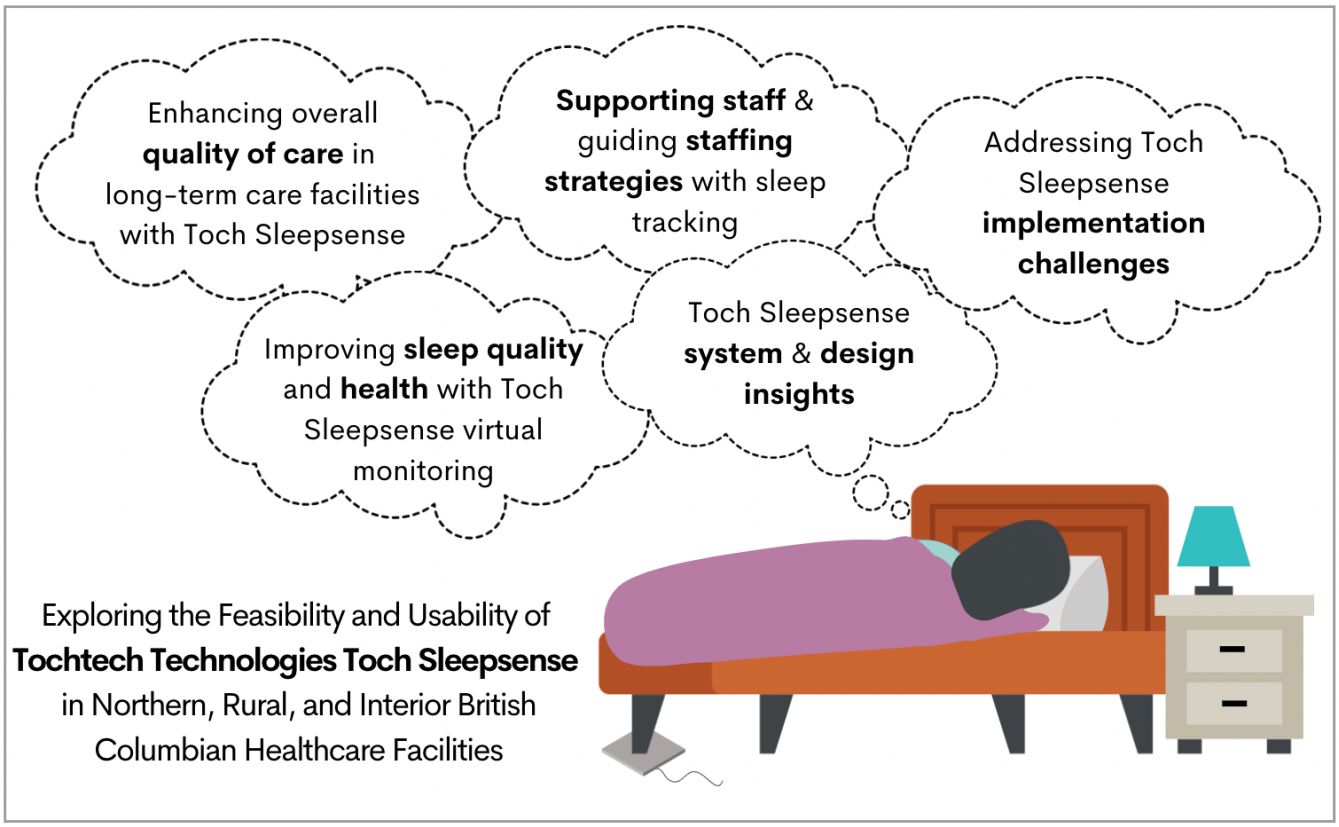

Figure 3. Key themes identified by ADEPT Workshop participants

THEME 1: Enhancing overall quality of care in long-term care facilities with Toch Sleepsense

In reflecting on the suite of capabilities offered by Toch Sleepsense, participants highlighted a complex set of challenges to supporting long-term care residents comprising diverse direct care issues, including environmental barriers, staffing shortages, and resource limitations. With the addition of Toch Sleepsense, participants saw great potential for some of the resulting burden to be alleviated, which, in turn, could create opportunity to improve the quality of care for each resident. Specifically, participants noted value of the Toch Sleepsense to augment person-centred care in a way that had not been previously possible, by utilizing the individualized sleep data Toch Sleepsense provides.

> *To have a system that takes away some of the work from the staff, and then something that can actually run that personalised sleep report. Yeah, it creates a lot of efficiencies. Wonderful.*

> *With the longitudinal resident information [from Toch Sleepsense], we can inform care planning, help to inform what is an optimal plan for the different residents, and going to bed and using [Toch Sleepsense] to generate better care. I don't think we have any method, right now, quantitatively, to be able to do that, whereas this we can go back to [Toch Sleepsense data] and say, 'Okay, we're going to put this resident to bed an hour later, and see if she's still getting up at 3 in the morning,' or 'Is something else changed with her eating, naptimes, etc.?' and now being able to test and adjust that care plan.*

By integrating the data from Toch Sleepsense into care planning, participants discussed how personalised care plans could be enhanced and how the care plans could better inform families that their loved one was receiving the best possible care.

> *It would really be a good way to customize a care plan to fit the residents needs and transparency to family is huge. Sometimes family would complain about something that isn't happening and we would have the evidence to say look this is happening; this is an objective sensor collecting data and we can share that with them.*

> *The benefit of [Toch Sleepsense] is definitely transparency to families…this would be a huge thing being able to disclose everything to families and so this would be something where they can actually see the trends.*

Participants also discussed how the virtual sleep monitoring data provided by Toch Sleepsense could assist in critically examining long-standing bedtime routines for gaps or adjustments needed to optimize care for residents.

Table 1. Long-term care resident nighttime routines

Illustrative Quotes
"Residents are put to bed quite early - sometimes after dinner at 7:30PM or 8:00PM, but if we start to see, for example, a resident is having issues with his/her sleep, we should be personalizing that care and saying maybe there are things this person can enjoy doing at 8:00PM."
"I feel this is the routine that staff have had for years and even when they give orientation to new staff they say, 'Okay this is what we do, this is what we've done for years, 8:00PM is their curfew, everyone goes to bed and after 9:00PM we have downtime'…. Everyone is in bed by 8:30PM and I'm wondering if we're personalizing our care according to residents' needs."
"If they go to bed at 6 and are laying there for 3 hours, we can look at that and say this isn't an appropriate time to put the resident to bed, they should be out and engaged. Not lying in bed restless putting them at risk of trying to climb out and fall so it would give us a good baseline of resident's natural sleep cycle."

Participants described how residents go through many medication changes, and subsequent side effects, namely sleep quality issues, when living in long-term care.

> *We have done quite a few medication reviews and you know that every time you take something away or introduce something new there are going to be side effects to sleep.*

Use of the data collected by Toch Sleepsense was recognized as a way to support medication reviews and help in guiding care planning activities with residents and their families. With Toch Sleepsense, clinicians would be able to leverage the data to better understand the impacts of medication on sleep.

> *So, then the [Toch Sleepsense] data definitely would be helpful for medication review and medication effectiveness…definitely being able to disclose everything to families. This would be something where they can actually see the trends.*

Overall, participants viewed Toch Sleepsense as an innovative tool to enhance the quality of life and sleep for residents through personalized care-planning, while also providing transparency to family in long-term care facilities across northern, rural and interior BC.

> *I think this would greatly benefit our residents' different realms of health: person-centered care, social, emotional, mental health, if they're sleeping better, if they're having less responsive behaviors, there's so many realms of health that it covers, and I am super excited.*

THEME 2: Improving sleep quality and health with Toch Sleepsense virtual monitoring

Participants underscored the importance of quality sleep for residents in long-term care facilities, and how a lack of sleep and/or interrupted sleep due to in-person bed checks can result in poor resident outcomes.

> *Sleep is important. We, at times, see a lot of responsive behaviours in common areas because they are tired from being woken up from checks and then anything - noise, traffic, anything can really be a stress for the residents.*

With the virtual bed check capabilities offered by Toch Sleepsense, participants anticipated fewer sleep interruptions for residents, creating a more relaxed, home-like environment.

> *We check residents every hour or two – it is done for safety, but it can also wake residents up. So, if [Toch Sleepsense] allows for ensuring the resident is safe without opening the door and waking them up while they are sleeping that I think is a huge benefit because then they will get a better sleep.*

> *I think if we can have better sleep for our residents, that's such a huge piece for their quality of life and if we're not having this task where we go in and have to check and wake them up, I think that would be great. Make it, you know, more home-like.*

Toch Sleepsense virtual sleep monitoring was viewed as especially worthwhile in smaller sized facilities and facilities with staffing shortages.

> *I think this will be great for facilities challenged with staffing and will improve ability to monitor residents sleep quality more closely and so, from a northern perspective, this will definitely help us care for our residents.*

Additionally, participants explained the various negative impacts a fall could have on a resident, as well as the staff caring for the resident. Employing a system like Toch Sleepsense that can detect and prevent falls through virtual checks would be instrumental in decreasing falls risk and improving safety.

> *My first thoughts are that if it makes a difference in falls prevention, that alone, actually being able to respond to a fall in real time and prevent it is selling it for me.*

> *I think all our staff come to work to do a job, so preventing one fall that has a poor outcome where there's hospitalization, [needing to] contact families, and physicians, and get through the assessment - the angst that causes staff. So, in terms of benefits to the staff I think they will be very happy to have a tool that prevents falls or has the potential to prevent falls.*

Likewise, the ability to monitor movement was of great value to improving health and safety, not only for residents, but staff as well.

> *Now you have [Toch Sleepsense], you can see that they're in bed and they're fine. I do like that you can cater to repositioning, you can [identify] the residents that need to be repositioned that already have existing pressure ulcers. I think that's great.*

> *The other thing that would be quite interesting with [Toch Sleepsense], we also see a high number of staff injury when they are repositioning residents. So, to actually have data coming up saying that they are either moving on their own or there isn't a need to reposition...wonderful.*

Altogether, participants affirmed the virtual monitoring capabilities of Toch Sleepsense to be a novel way to improve the sleep quality and health of long-term care residents by facilitating virtual checks of vitals, sleep movement, and in/out of bed status.

THEME 3: Supporting staff and guiding staffing strategies with sleep tracking

When contemplating the numerous staffing challenges experienced in long-term care facilities in northern, rural, and interior BC, participants agreed that Toch Sleepsense offers an opportunity to support staff, and positively impact staffing strategies, either through refining care allocation, or restructuring lines and shifts.

Participants described how the low staff to resident ratios experienced by long-term care staff during overnight shifts contributed to heavier workloads, oftentimes without breaks. With Toch Sleepsense facilitating virtual monitoring of residents, participants contended that staff would be afforded more time balance during shifts.

> *"I'm picturing some of our facilities with multiple neighborhoods and thinking of the skeleton crews that are on overnight, and how often staff miss a break. I'm visualizing staff being able to go, literally, leave that neighborhood and go to their proper break rooms and get that true time away. Knowing that someone from a completely another area of the facility can actually be monitoring their resident."*

Utilizing the sleep monitoring data collected by Toch Sleepsense as a guide to refine care allocation and create more efficient staffing approaches was suggested as central to ultimately providing a more positive environment for residents and staff, alike.

Table 2. Toch Sleepsense as a support resource for staff

Illustrative Quotes
"I think the way we manage our resources at night - here we only have a couple of people - a nurse and a care aid. So, for a large number of residents it would be more manageable, or we would be able to better strategize where we are at any point with, [Toch] Sleepsense."
"And if we can focus on that 20% of residents that are causing the majority of work at night, that's going to allow us during the day to help our physicians to target those behaviours and actually reduce that workload and improve the resident's quality of life, so that to me was the biggest positive."
"For me, the takeaway from this [Toch Sleepsense] presentation is work smart, not hard. If we have a tool that is going to better distribute workload and allow focussing on the 5-6 residents that need more attention than the rest, I think that's a step in the right direction."

Moreover, participants saw great utility in monitoring sleep trends to inform staffing schedules and act as an additional support in situations where staffing challenges were exacerbated by leaves or absences.

> *I think it'll be interesting to see if it is implemented…looking at restructuring a line. If we notice a lot is happening at night and there isn't a lot of staff on at night, it might mean redistributing hours based on resident need…I think it could be interesting to see the impact on staffing and when we need to have more staff in different areas based on what's happening with residents.*

> *It's all the possibility! So, when I was looking at the live data [in the Toch Technologies demo], there was so much movement between 3:00 and 5:00 AM - you could start to see the trend and maybe we need shifts that start...if it's really quiet between 10:00 PM and 3:00 AM, maybe it's a shift to early night shift starting.*

> *I think it might be an opportunity as an extra safety line. We talked about traditionally having less staff at night. Maybe you only have a couple nurses, and one calls in sick. Now you have a tool that you can monitor more, or maybe a manager can even pick it up, let's do a check in and make sure everyone is alright.*

In sum, participants saw plenty of opportunity to improve staff support and guide staffing approaches through the use of sleep tracking data collected by Toch Sleepsense.

THEME 4: Addressing Toch Sleepsense implementation challenges

Participants were enthusiastic about the potential for Toch Sleepsense to be implemented in northern, rural, and interior BC long-term care facilities and agreed that an effective implementation would be dependent on facility technology infrastructure, department approvals, and garnering support from key leadership.

> *My first thoughts were: I'd love to have that here for us.*

> *There is definitely potential here and I think my personal point from this presentation is there's definitely opportunity for us to bring that into our facilities.*

Participants from across BC described long-term care facility nurse call system technology as aging and had concerns that the technology infrastructure would not support integration with the Toch Sleepsense system.

> *So, if a sites nurse call system is, you know, pretty ancient, then I'm not sure if this is going to tie in? I know a lot of our facilities are using [name of nurse call system].*

> *…it might be too soon for some of our places for the integration of [Toch] Sleepsense with our existing systems – it might be a challenge…but that definitely doesn't mean we cannot do it.*

For participants in northern communities, a combination of geography, rurality, and service provisions impacted Wi-Fi accessibility and coverage. Paired with the aging technology infrastructure, this was of particular concern.

> *My only thought is the technology is definitely very advanced, and the remaining systems that we already have in place, I think, unfortunately, up in the north we are a little behind in technology and Wi-Fi that we use in our facilities.*

> *We know from personal experience when Wi-Fi goes down it effects everything so those types of things can definitely have an impact and the further north you get from [name of northern city] the trickier it gets. When I think of [small northern rural town] where there's only a few beds, yeah, the cost of implementation probably isn't significant, but the infrastructure might impact its usability.*

Existing Wi-Fi coverage issues impacting implementation feasibility caused much apprehension, evident in the challenges discussed by participants from rural and interior BC.

> *So, I think that the single biggest barrier for me is Wi-Fi. If we either have no Wi-Fi or crappy Wi-Fi - it's either going to work well or people are going to lose their mind because it's not working and they can't get it to, or there's a dead spot in the patient wing, and everyone's cranky because it's not working there. So, I think it would really need to make sure [the Wi-Fi is] there for [Toch Sleepsense].*

> *One of the concerns that I have is that of how the system works that they use Wi-Fi. I don't know how the other homes Wi-Fi is, but here for example in our community the bandwidth of the Wi-Fi was reduced.*

Though variable Wi-Fi coverage across long-term care facilities posed a barrier to implementation, participants from northern BC saw the potential integration of Toch Sleepsense technology as an opportunity to bring further awareness to these Wi-Fi issues.

> *If we were to implement tomorrow, who has the Wi-Fi capacity? Because, I mean, we've been battling for Wi-Fi at [name of long-term care facility] for years. So, you know, maybe this would be the catalyst?*

Participants from interior BC echoed this sentiment, explaining how Toch Sleepsense could be the incentive needed to improve Wi-Fi access in long-term care facilities.

> *There is absolutely work happening behind the scenes, because we recognize that we cannot continue to do business without Wi-Fi, so it's a given that we're promoting getting Wi-Fi into all our facilities. And this is one of the starting points - there's opportunity here.*

In considering other technology-based aspects of implementation, participants highlighted the need to ensure confidentiality of electronic transmissions and storage of the sleep data, including vitals, movement, and other personal information collected by Toch Sleepsense.

Participants explained that a privacy risk assessment would need to be conducted and would include a number of departments approval prior to implementation.

> *A security assessment of form, an application, we need to do first, and then there's also our privacy impact assessment. Yeah, need approval for that as well. And there's also, if it's a contract business, we put through this review of the contract as well and then the leadership part comes so that other people can add to that, but yeah, some kind of a combination of departments.*

> *In most places it would be fine if it was something that doesn't require a transmission of health data – [implementation] would be pretty straight forward, it could be done internally, but with Toch Sleepsense, it would likely be more complicated because now we have to involve the privacy office, probably [health authority research department]. There's going to be more involvement because there will be health data collected and transmitted and stored at an offsite. Even if it is inside the country, it is a private organization collecting it so it would require more approvals.*

While a privacy risk assessment could delay implementation, participants asserted that integrating Toch Sleepsense was worth the potentially complex process to improve quality of life for residents.

> *I think it would meet the need from our site from what I've seen. I understand process and approvals and what not, but all of the features of [Toch Sleepsense] I think would greatly benefit our residents.*

In reflecting on ways to overcome these barriers, many participants suggested a pilot to evaluate Toch Sleepsense for fit, cost impact, and quality of care. Determining the feasibility and usability in a real-world setting could be used to help inform leadership and decision-makers on scaling and implementing Toch Sleepsense in additional long-term care facilities.

Table 3. Piloting Toch Sleepsense at long-term care facilities

Illustrative Quotes
"For me, the technology is interesting, might be worthwhile to do a small pilot, you know I'm looking at our facility, and it has different neighborhoods that may benefit, maybe this is a good fit for our special care unit or something like that were we see more falls and restlessness."
"And I think it would be a really interesting project to track and look at the reduction in operational costs, medication, and quality of care after implementation."
"Some of the components related to implementation is integration with research – this can be very helpful. So, then we can track the data as we're doing it and then demonstrating whether it's working or not."

Along with providing evidence-based data, participants discussed how trialling Toch Sleepsense could garner support from staff and create interest in leadership and decision-makers.

> *I think a lot of implementation is speaking to that leadership, is how to create the excitement for what the change is going to look like. Maintaining that momentum to make it into a habit, that it becomes part of the work that this site does create and maintain that change, so that once it's implemented a year from now is still being used on a daily basis. But if you can't build this habit upfront, yeah, no.*

> *I also find successes with building awareness, and that's allyship or support building. First get people involved and excited about it to help create the shift and willing to try it.*

Rounding out the discussion, participants believed that by adopting innovative new technology into long-term care facilities, like Toch Sleepsense, management would be able to demonstrate a commitment to providing quality care in resource limited times.

> *I think the more technology that we have available… I think that a lot of families will see that as continuing to move with the times and looking for best practice initiatives, so I could see them being thankful that we have that technology and feeling a bit more reassured.*

> *And it can't replace actual staff, but it's at least showing that we are taking this initiative to look for other options to support what we're able to do at our sites. I think it'd be fairly positive.*

In sum, participants reported aging technology infrastructure, variable Wi-Fi coverage, and privacy concerns as barriers to implementing Toch Sleepsense in long-term care facilities across northern, rural, and interior BC, but suggested that an evaluation pilot could provide opportunity to develop interest and support from long-term care staff and leadership/decision-makers.

THEME 5: Toch Sleepsense system and design insights

The Toch Sleepsense system itself was met with enthusiasm by participants, as was the platform interface and physical design, though participants had some concerns around longevity and durability of the device in long-term care settings.

Participants were impressed with Toch Sleepsense system, with many expressing wonder at the full suite of capabilities and functions.

Table 4. Impressive Toch Sleepsense system

Illustrative Quotes
"At first, I thought, 'Is this make believe?', it just sounded too good to be true!"
"To me, it is a little bit like magic that you can monitor all this stuff by just having it under the bed. I'd want to see it to believe it."
"I was impressed with this technology, you know if the technology does what it says it does, if its reliable, I think it has a lot of potential and in my point of view I think preventing falls is of course very important, but there is a lot of other things we would like to know about our residents with [Toch Sleepsense]."

The interface was also applauded by participants, who praised the simple layout and straightforward design.

> *The interface was super intuitive.*

> *And what I think of the design of user interface?*
> *Yes, how easy it is to use and intuitive to use.*

When discussing the physical device, participants liked the plain, sleek look, however, some had concerns around durability and potential loss.

> *I think they're great cause they're not intrusive, but what if we lose them – housekeeping – or they don't see them, because it's gray and it matches the bed, and then they knock into them with their, mops, you know, things like that, but having said that, I don't know if I'd want neon pink devices either.*

Others questioned the robustness of the discreet Toch Sleepsense device, particularly in long-term care settings around residents with cognitive impairment, such as those with dementia.

> *I know with dementia residents – they like to take things apart. Has there been trials in dementia neighborhoods? I like it's a neutral colour and might blend with the bed so it won't draw their attention to mess with it, but I'm just curious if any of that has been put into the design or camouflaging it so dementia patients aren't removing or doing strange things with it.*

> *One thing about the device being inconspicuous… so, we have some residents that might want to get that device out from underneath that bed. Lots of busy residents, taking all kinds of things apart. So, sort of camouflaged into the floor might be good idea for some residents. Then have the option to not have it [camouflaged], either.*

Participants detailed how cumbersome the existing bed alert/monitoring systems were with many cords/wires hanging at resident's bedsides – at times, causing fall injuries to staff/family. Some participants saw the minimalistic design with a thin cord as an upgrade/beneficial while others had apprehension around the potential damage that could happen with the cord and the amount of movement around the bed.

> *"The maintenance is always tasked trying to get those cords off the floor. Our beds go up and down, so the fall prevention piece, and how simplistic [Toch Sleepsense] is, and easy to clean and whatnot – that, I would say, is the biggest seller for me."*

> *"One thing I noticed with the sensors and bed alarms, when it involves a cord, there's a risk the cord may get snapped or damaged, the remote controls get replaced, so there is a lot of damage that usually happens around the bed and they are expensive. I'm thinking do they have anything in place to prevent that from happening?"*

Participants enjoyed the presentation but wanted a better visual understanding of the device. For instance, a ramp to facilitate easy placement under a wheeled bed leg was mentioned and participants were uncertain how it might work in their facility setting. Participants suggested a video demonstration would be helpful.

Table 5. Toch Sleepsense placement demonstration

Illustrative Quotes
"I would say it would be beneficial if we could see a video of how – in real action – how it is being used and because, as we know, once a week we have rooms cleaned – beds are moved and we clean under there, put it back – if it's there on the floor, how we get it back in position? Are we lifting the bed? Or I know there is the ramp that [Tochtech Technologies presenter] mentioned, but now will this cause a new issue if it isn't put in place properly? So, there could be some downside to it."
"I would also like to see a bit of a demo on how [Toch Sleepsense] gets into that position. Like, what does staff have to do? Do they roll up the, you know, all our beds are on wheels, and the wheels are pretty big, I imagine it easily just rolls on top of that device, but it'd be nice to be able to see how that works - like in a video, yeah."
"I think it's just more the beds have to be moved at least once every week. It may be more than that, if staff are doing care, they may pull [the bed] out, and there is limited space in the room so [the bed] isn't staying stationary with one leg on top of [the Toch Sleepsense device] all the time. There might be times it is moved, so that is my biggest concern, so the number of times the wheel goes on or off – is it going to damage it? Again, we have to really see it to believe it. It is a good idea, it's good to hear about that tech but without seeing it in person, I don't know how much it is something we can go with?"

In summary, participants were enthused with the Toch Sleepsense system and device. In addressing logistical concerns around the Toch Sleepsense device in long-term care settings, participants highlighted concerns around durability and maintenance, and suggested a video demonstration to clarify placement be included in the presentation.

POST-SURVEY

Altogether, participants described the workshop as interactive, informative, collaborative, and well-paced, with open and rich discussions. Participants enjoyed the demonstration of Toch Sleepsense in real-time and a majority would recommend the workshop to a friend or colleague. All the participants could see themselves using Toch Sleepsense in their professional role and indicated that they would recommend Toch Sleepsense to others, specifically colleagues, clients/patients, and families.

Participants reported that both residents/clients and management/staff would benefit from the implementation of Toch Sleepsense in long-term care facilities. For residents/clients, participants suggested that those at high risk for falls, wanderers, those with dementia, or those that have trouble sleeping would benefit the most. For management/staff, participants pinpointed that the ability to collect evidence-based sleep data would improve care plans and subsequently care and sleep quality, decrease staff workload, improve accountability, and provide more data opportunities to improve quality of life at long-term care facilities.

Participants listed the top features of Toch Sleepsense as 1) improving falls prevention, 2) monitoring and tracking sleep through virtual bed checks, 3) augmenting care planning with evidence-based data, and 4) supporting staff and increasing accountability (see Figure 4.).

Additional barriers to implementation were reported as lack of funding, staff resistance to adoption/training, human resources limitations, integration logistics, and maintenance.

Participants suggested that Tochtech Technologies should consider adapting the Toch Sleepsense device to be cordless/wireless, adding weight tracking, body positioning, and air quality sensing (for incontinence issues) capabilities, integrating with other software not listed in the presentation (such as Goldcare, Momentum, and Meditech), and expanding sensor system range in resident room.

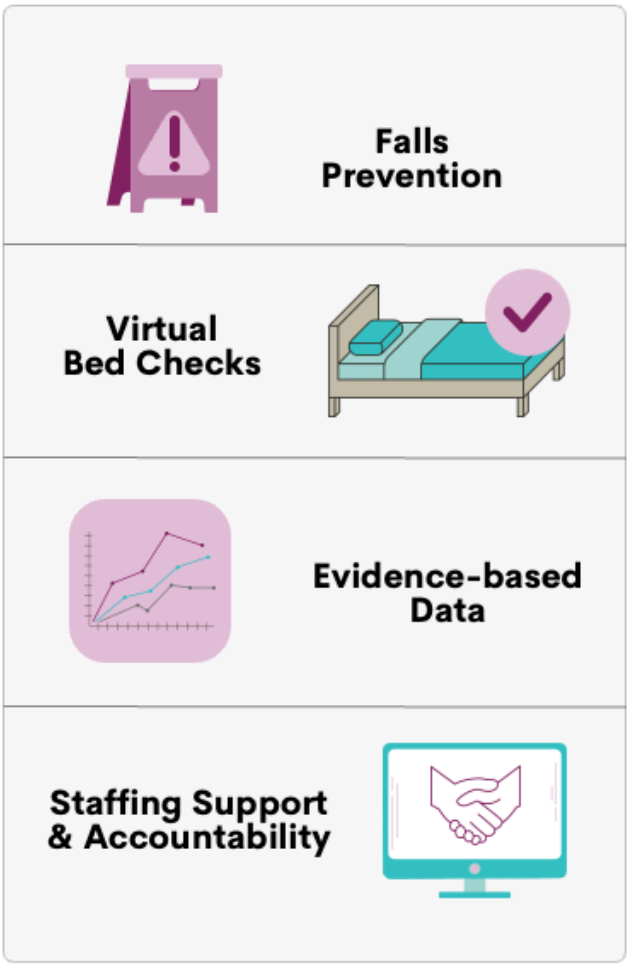

Figure 4. Toch Sleepsense top features as reported by ADEPT workshop participants

Summary & Recommendations

This report presented the perspectives of northern, rural, and interior long-term facility staff who participated in ADEPT Workshops featuring Tochtech Technologies Toch Sleepsense in March and April 2023. Through qualitative analysis of the facilitated workshop discussions, five themes were developed and included: 1) Enhancing overall quality of care in long-term care facilities with Toch Sleepsense, 2) Improving sleep quality and health with Toch Sleepsense virtual monitoring, 3) Supporting staff and guiding staffing strategies with sleep tracking, 4) Addressing Toch Sleepsense implementation challenges, and 5) Toch Sleepsense system and design insights.

This report reveals Tochtech Technologies Toch Sleepsense as a novel and potentially invaluable bed alarm system that could enhance the quality of life and care for residents of long-term care facilities, as well as augment long-term care staffing support across northern rural, and interior British Columbia.

The following are a list of recommendations based on the findings of this report for supporting implementation of Toch Sleepsense in northern, rural, and interior long-term care facilities:

- Collaborate with health authorities and each long-term care facility to understand the unique barriers associated with each setting, including nurse call system infrastructure and Wi-Fi coverage and accessibility
- Explore co-development of training/support for care staff in northern, rural, and interior long-term care facilities
- Consider creating a video demonstrating how to place the Toch Sleepsense device under beds in different contexts (i.e., with/without ramp, no wheel, with wheel, etc.)
- Create easy to use quick step guides for staff to reference
- Consider expanding device to integrate with more nurse call systems
- Complete a data privacy assessment to increase opportunities to conduct real-world trials in select BC long-term care facilities and create a resource on data privacy/storage and management
- While many participants identified the potential value in sharing the sleep monitoring data with family, others were apprehensive and suggested careful planning and management of data to ensure an appropriate level of disclosure according to location and context

NEXT STEPS

- Report findings will inform potential development of real-world trialling in northern, rural, and interior long-term care facilities
- Report findings will also be used to facilitate the exploration of expanded Toch Sleepsense features trialling in interior long-term care facilities
- In-person technology demonstration to interested participants at the CTAAN lab
- CTAAN to identify long-term care facilities interested in trialing Toch Sleepsense and facilitate connection, support, and evaluation as needed

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