STACK CARE

DELIVERING HOME CARE EFFICIENCIES AND REDUCING HOSPITALIZATIONS THROUGH THE USE OF

PASSIVE MONITORING TECHNOLOGIES

Executive Summary

Passive monitoring technology has been shown to deliver home care efficiencies and reduce hospitalizations. These technologies enable remote monitoring and observation, which in turn improve the efficiency and timing of care delivery to clients. Remote monitoring systems issue caregivers and families a warning when an older adult's behavior and activity patterns are outside expected typical ranges, allowing for early intervention and avoidance of hospitalizations. Overall, the use of passive monitoring technology in home care has the potential to improve client well-being, reduce out-of-pocket healthcare costs, and increase the efficiency of care delivery.[1]

Introduction

The workforce shortage in home-based care has reached crisis proportions. While industry leaders and managers are making every effort to bridge the gap between the number of patients and families seeking assistance and the availability of workers to provide that care, this gap is increasing at an unsustainable rate.

The population of adults 65 years and older is projected to double by the year 2050. This demographic shift across the U.S. population exacerbates the current shortage of caregivers that over 12 million people of all ages rely on today.[2]

Home care agencies across all sectors report that workforce supply is limiting the ability of agencies to accept new cases and to start care quickly, even for families with immediate needs due to a changed condition or following a hospital stay.
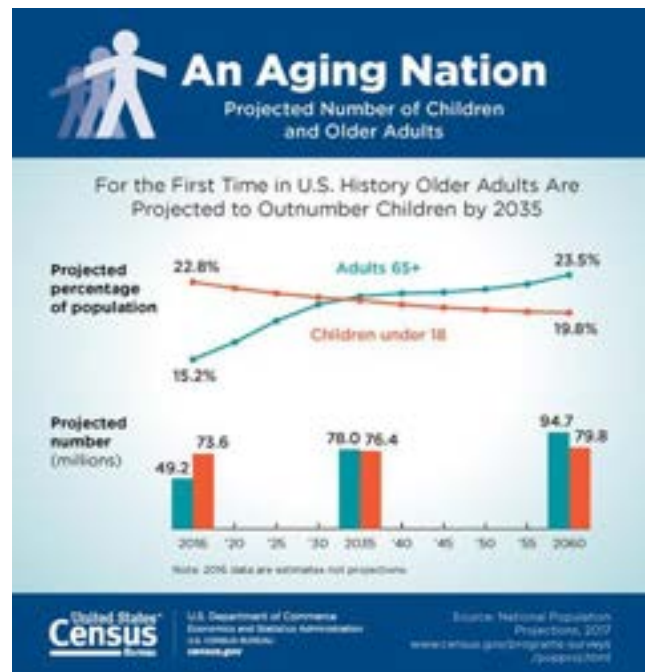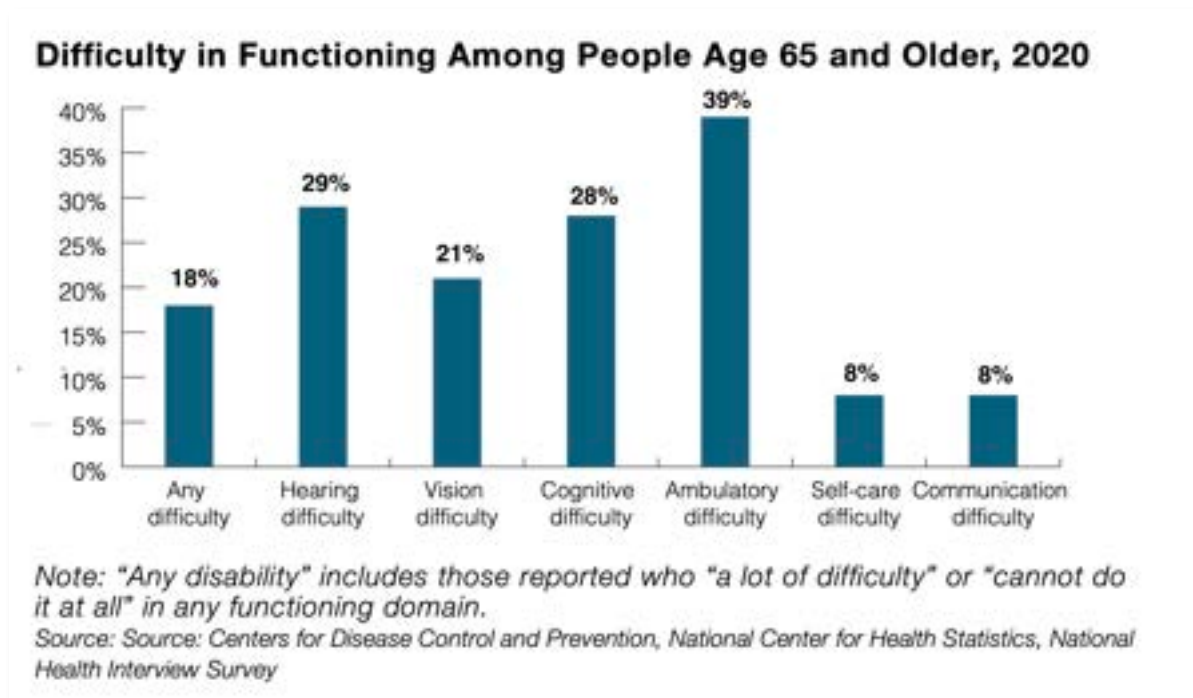
# Home care is becoming an increasingly important part of the healthcare system

The healthcare landscape is changing rapidly. As the population ages, more people live with chronic conditions requiring ongoing management and care. However, traditional healthcare models, such as hospitalization and frequent in-person doctor visits, are often costly and disruptive to patients' lives.

Advances in health technology, such as communication and monitoring systems, have enabled older adults to lead independent lifestyles.[3] Technology-integrated homes and passive monitoring technology (PMT) enable broad supervision of chronically ill and elderly patients using information and communication technology tools in a comfortable environment. These technologies support improved monitoring and observation, which in turn improve the efficiency and timing of patient access to the healthcare delivery, and allow seniors to live more independently with a sense of security and even reduce the feelings of loneliness and isolation.[4]

Passive Monitoring Technology (PMT) provides holistic supervision of chronically ill and elderly patients, enabling and supporting improved monitoring and observation, thus empowering the growing population of older adults to live more independently while lowering healthcare expenses.[5]

Difficulty in Functioning Among People Age 65 and Older, 2020

Category	Percentage
Any difficulty	18%
Hearing difficulty	29%
Vision difficulty	21%
Cognitive difficulty	28%
Ambulatory difficulty	39%
Self-care difficulty	8%
Communication difficulty	8%

Note: "Any disability" includes those reported who "a lot of difficulty" or "cannot do it at all" in any functioning domain.
Source: Source: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey

Approximately 75% of preventable health costs are attributable to chronic disease, a large percentage of which can be avoided through earlier diagnosis followed by monitoring and surveillance.[6] Early intervention intended to support independent living (such as Passive Monitoring - PMT) has the potential to reduce the likely use of other kinds of care resources, such as ER visits and hospitalizations.[7]
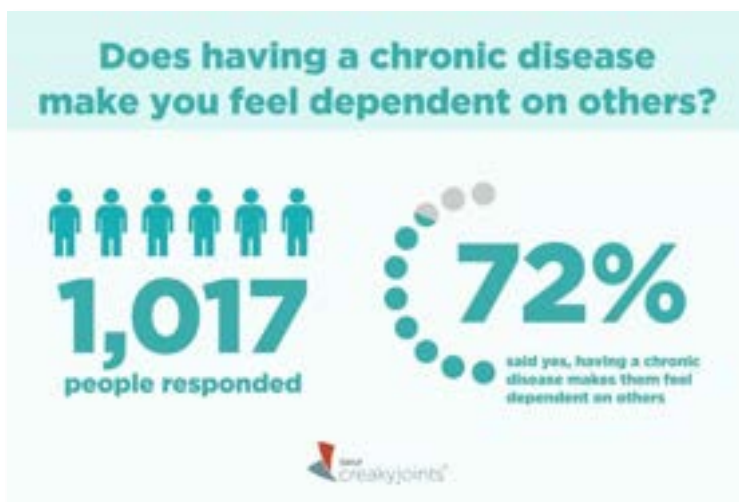
Passive Monitoring Technologies generate value by potentially reducing the probability of incurring other kinds of healthcare costs. Monitoring and signaling have the potential to initiate health-related interventions (e.g., from an informal caregiver, a case manager, or a clinician) at less costly stages, thereby helping to reduce unnecessary use of more resource-intensive settings, such as emergency rooms (ERs) and inpatient hospitalizations.[8]

Table 1

LHM tracking sensor activity capabilities and list of identifiable conditions

Tracking sensor activities for ADLs	Relevant and related diseases, conditions, and symptoms
Sleep	Acute bronchitis and bronchiolitis, COPD, CHF, Arthritis, Pain, Medications, UTI, Depression/Anxiety, Vomiting, Diarrhea, Edema
Location	COPD, Diabetes mellitus, Heart Disease, Depression/Anxiety
Bathroom use	Diabetes mellites, UTI, Edema, CHF, IBS, Diarrhea, Constipation, Crohn's, Dehydration
Gait	Arthritis, Asthma, Chronic bronchitis, CHF, COPD, Pain, Edema
Movement	Acute bronchitis and bronchiolitis, Arthritis, Asthma, Chronic bronchitis, COPD, Heart disease, Depression/Anxiety, Pneumonia, Pain, Edema, Fatigue
Social	Asthma, Chronic bronchitis, Heart Disease, Depression/Anxiety, Pain, SOB, Fatigue
Eating	Acute bronchitis and bronchiolitis, COPD, Diabetes mellitus, Major depressive disorder, Pneumonia, Nausea, Constipation, Heart Disease
Vitals	Acute bronchitis and bronchiolitis, Asthma, Chronic bronchitis, CHF, COPD, Chronic renal failure, Diabetes mellitus, Heart Disease, Pneumonia, Infection

Source GreatCall data on LHM product

The use of passive health status monitoring can result in statistically significant reductions in aggregate billable interventions including physician visits, laboratory tests, urgent care visits, hospital visits, and emergency room visits, as well as statistically significant reductions in hospital days.[9]

A study by Avalon Health Economics LLC to estimate the potential savings associated with PMT showed savings of approximately $425 per-member per-month (PMPM) for those using PMT compared to those on the standard of care pathway.[10]

The monthly costs of passive activity-monitoring systems vary, but in the long run, they frequently pay for themselves by preventing out-of-pocket costs for unplanned doctor visits, laboratory tests, and hospital stays. A 2009 study* of three assisted living facilities reviewed the costs and benefits of passive monitoring over three months. Patients who were monitored had fewer emergency room visits and fewer hospital days than those who were not monitored, and their healthcare costs for billable services were much lower: monitored participants spent $17,407, including monitoring costs, and unmonitored ones accrued $67,753.[11]

Another benefit of prolonging independent living is the avoidance or delay of more intensive long-term care, as this yields a significant saving because the costs of assisted living are so much higher than independent living.[11] Identifying and assessing problems early, while they are still small, provides a window of opportunity for interventions to alleviate problems before they become catastrophic. Older adults and others with chronic health conditions benefit from early detection of health changes and can get help when treatment is the most effective and when prevention of hospital or nursing home care is still possible.[12]

Early intervention can also help avoid consequential illnesses or infections which frequently result from an undetected issue.

* Adjusted 2023 values using U.S. Bureau of Labor Statistics calculator would be $22,817.61 including monitoring costs, versus $88,851 unmonitored

Economic Impact of Passive Monitoring on Home Care Agencies

The economic impact of passive monitoring on home care agencies can be significant. Here are a few ways in which it can affect the bottom line:

1. Improved efficiency: By providing real-time data about a patient's health status, passive monitoring can help prioritize caregivers' time and focus on the most urgent cases, improving overall efficiency.

2. Reduced hospitalizations: Passive monitoring can help detect changes in a patient's health early on, allowing for timely interventions that can help avoid hospitalizations and other costly medical interventions.

3. Reduced labor costs: Passive monitoring can reduce the need for in-person visits by caregivers, allowing home care agencies to reduce labor costs while still providing high-quality care.

4. Improved client health and wellbeing: By providing continuous monitoring and early intervention, passive monitoring can help improve client well-being and quality of life, leading to higher patient satisfaction and a better reputation for the home care agency.

5. Evidential input to determine care level: Discussion of required care level with family members is often difficult. Analytics and evidence provide data-driven decision-making and ease difficult discussions with client families.

Monitoring technologies have long represented a field of interest for healthcare professionals in that they promise a wealth of information and better-focused and personalized care. In the new technology-enabled world, we are transitioning from incident management to health and wellness management and disease prevention.

Examples of data collection and outcomes

A systems approach towards remote health-monitoring in older adults: Introducing a zero-interaction digital exhaust[13]
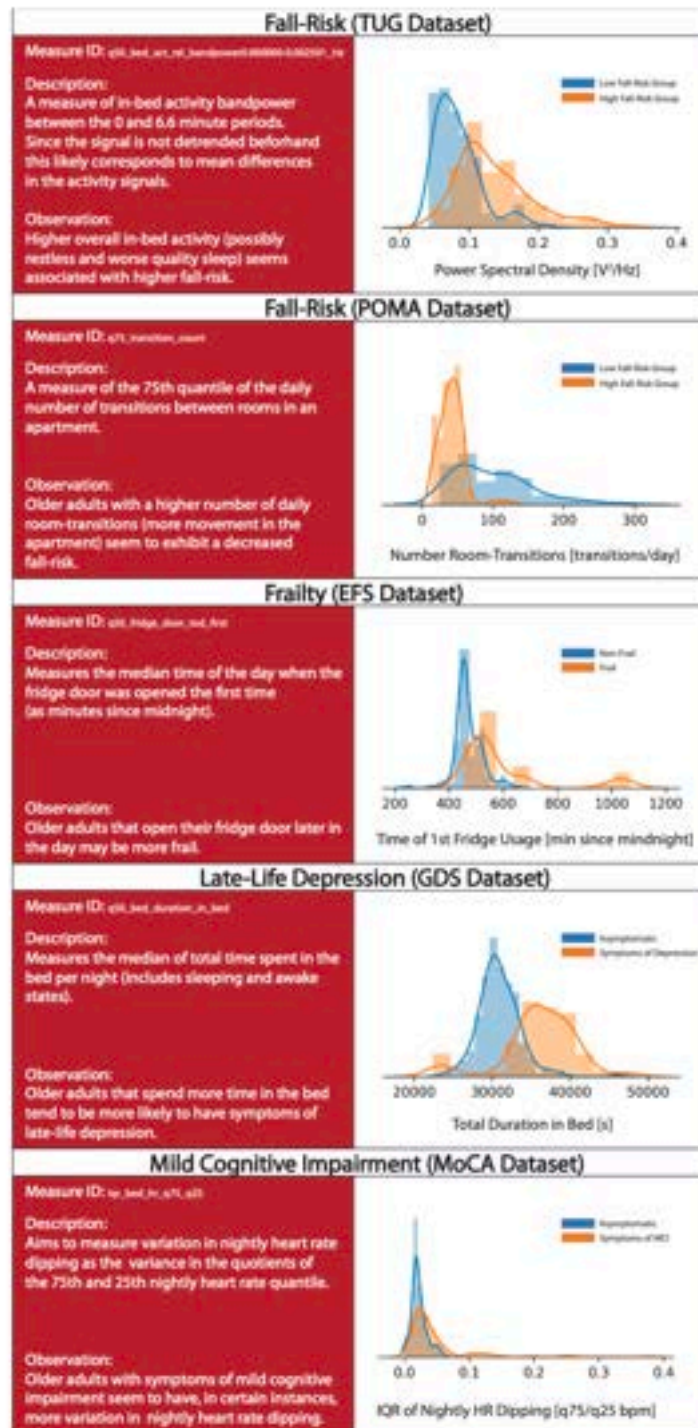

Fig. 2 Most important digital measure for each outcome. Displays descriptions and density plots of the most important digital measure for each outcome. Across all density plots, blue indicates a positive/neutral outcome, while orange indicates a negative outcome. It should be noted that the proposed associations reflect correlation and not causation and should be interpreted accordingly.

Passive Monitoring Technologies

Passive monitoring technologies for seniors refer to the use of internet-connected sensors, predictive analytics, health data, and artificial intelligence to monitor the health and safety of seniors in their homes. These technologies are designed to operate in the background, without requiring active input or participation from the user. As sensors and devices collect data throughout the day, they send the information to a central processing hub through the Internet. That data is then compared to baseline data. Anything that falls too far outside the "typical" zone is flagged as a potential cause for concern and escalated in the care management system. Some systems may send automated alerts to a designated caregiver via email or mobile phone when activity in the monitored zone falls outside of the baseline.

Some examples of passive monitoring technology include:

1. Motion sensors: these sensors can be placed throughout a home to track movement patterns and detect changes in activity levels. They can be used to monitor for falls, track sleep patterns, detect signs of agitation or restlessness, and more.

2. Audio recordings: systems capture and record sounds in the senior's environment to provide insight into the senior's daily activities, such as whether they are getting up and moving around, whether they are eating, and whether they are interacting with others (note: in some States recording conversations without consent may be illegal). The audio recordings can also be useful in detecting signs of distress or potential health issues.

3. Cameras: capture video footage of the senior's environment to monitor their activities and ensure their safety. This can provide insight into the senior's daily routines, such as whether they are taking their medication on time, whether they are engaging in physical activity, and whether they are experiencing any

undeclared falls or other accidents. Access to, and storage of, recordings should be carefully monitored for privacy reasons.

4. Environmental sensors: These sensors can track factors such as temperature, humidity, and air quality to monitor for conditions that could affect the health and well-being of the individual.

5. Wearable devices: These devices can be worn on the body to track vital signs such as heart rate, blood pressure, and oxygen saturation. They can also be used to monitor activity levels and detect falls.

6. Smart home devices: These devices, such as smart thermostats and lighting systems, can be used to monitor activity levels and detect changes in routine.

7. Medication dispensers: These devices can track medication adherence and alert caregivers or family members if doses are missed.

The data collected by these devices can be analyzed and used to identify patterns and trends, allowing caregivers and healthcare providers to intervene earlier if there are signs of deterioration. The goal of passive monitoring technology is to provide more efficient and effective care while allowing individuals to maintain their independence and autonomy.

Limitations of Passive Monitoring

Motion sensors provide information that is meant to indicate a resident in motion, but limitations in the technology exist. For example, the lack of identification capability may not indicate if the activity is performed by the actual client or by the caregiver or family that is caring for him or her. However, in the event that another person is present in the home, the StackCare system will aggregate the information and highlight that one of the home occupants needs help. Due to the fact that another person is in the home, the person in need can get prompt assistance.

Furthermore, passive monitoring systems may not be able to detect all potential issues or emergencies. However, no system is able to detect all issues remotely 24/7; passive monitoring represents an effective and affordable way to detect a large number of potential issues.

While infrared motion sensors only detect motion, passive monitoring systems can raise privacy concerns, including the ethics of data collection and sharing. It is important to address privacy concerns and ensure that seniors' autonomy and privacy are respected.

How Does StackCare Differentiate From Other Monitoring Technologies

StackCare's Unique Features

StackCare is a passive monitoring system designed specifically for seniors that uses a combination of infrared motion sensors, artificial intelligence (machine learning), and data science to monitor and analyze the senior's activities and wellness status. Compared to other passive monitoring systems, StackCare has several unique features that set it apart.

1. Comprehensive monitoring: StackCare uses a variety of sensors to monitor a senior's activities, including motion sensors, door sensors, and temperature sensors. This allows for a comprehensive view of the senior's daily routine, including their movements, sleep patterns, and the temperature and humidity levels in their home.

2. Machine learning algorithms: StackCare uses machine learning algorithms to analyze the data collected from the sensors and detect patterns that may indicate changes in the senior's health or wellness. This can help caregivers and family members identify potential issues early on and intervene before they become more serious.

3. Non-intrusive: StackCare is designed to be non-intrusive, meaning that it does not require any active participation from the senior. The sensors are placed throughout the home and do not require any input from the senior, allowing them to maintain their privacy and independence.

4. Private: Since StackCare does not involve any recording or transmitting of audio or video data, it is a more private and less intrusive way to monitor seniors compared to cameras or audio monitoring systems. This can help seniors maintain their privacy and independence, while still allowing caregivers and family members to keep an eye on their health and well-being.

5. Customizable alerts: StackCare allows caregivers and family members to customize alerts that notify them when certain events occur, such as a door being left open for an extended period of time or a sudden change in the senior's activity level.

6. Flexibility: StackCare can be customized to meet the specific needs of each senior. Caregivers can choose which sensors and devices to use and set up customized alerts and notifications.

7. User-friendly interface: The StackCare platform is designed to be easy to use for both caregivers and families and even seniors themselves. The interface is intuitive and user-friendly, making it easy to access information and insights.

8. Integration with healthcare providers: StackCare can integrate with healthcare providers and electronic health records, allowing caregivers to share data with healthcare professionals and coordinate care more effectively.

Overall, StackCare provides a comprehensive and user-friendly passive monitoring system that can help caregivers and family members better understand the needs and well-being of seniors. Its use of AI and data science algorithms and integration with other healthcare systems make it a powerful tool for detecting potential health issues and improving care coordination.

What does StackCare Detect

1. Fall Detection: StackCare can detect potential falls by looking for unexpected changes in activity patterns or lack of motion. If a fall is suspected, StackCare notifies caregivers and family members so that they can intervene and provide appropriate medical attention.

2. Bathroom Activity: Monitoring bathroom activity with seniors helps with the detection of accidents (Seniors are at an increased risk of falls and other accidents in the bathroom due to mobility issues and other health conditions) and the detection of health conditions that affect bathroom habits such as incontinence or UTIs.

3. Sleep Monitoring: StackCare monitors sleep patterns by using motion sensors to detect when the senior is asleep or awake. This information can be used to identify potential sleep disorders or other health issues that may be affecting the senior's sleep quality.

4. Kitchen Activity: StackCare's sensors detect when the senior is using the kitchen and when the refrigerator door is opened. If StackCare's sensors detect a lack of activity in the kitchen during typical meal times, this may indicate that the senior has missed a meal. alerts are sent when two consecutive meal times have been skipped.

5. Wander detection: The exit door contact sensor detects and alerts if the senior opens the door at unusual times of day or night, as this may indicate potential wandering behavior.

6. Environmental Monitoring: StackCare monitors the temperature and humidity levels in the senior's home, which can be useful in identifying potential health hazards or environmental factors that may be affecting the senior's well-being.

7. Activity Monitoring: StackCare monitors the senior's daily activities and provides insights into their mobility and physical activity levels. This information can be used to identify potential health issues or changes in the senior's health status.

Real-Use Clinical Examples

Fall Detection

With this real user example, 2 StackCare notifications alerted the caregiver that the client needed help. Annie D. fell during the night and triggered a Bathroom Overstay notification after 15 minutes. She was also able to reach the Help Button which is typically installed in the bathroom and bedroom, since most falls occur during the night and the early morning hours.

Janet, the client, had an accident in the hallway while heading to the bathroom at 3:55 am. Knowing that the system would send an alert after 3 hours, she remained still and waited for assistance. The daughter received the alert and immediately went to her mother's house to provide help. Fortunately, the client is doing well. It's possible to adjust all notifications, and the daughter and the home care agency decided to reduce the period of the Night Activity Monitor to 1 hour, potentially lowering it to 15 minutes.

Untypical Activity Patterns
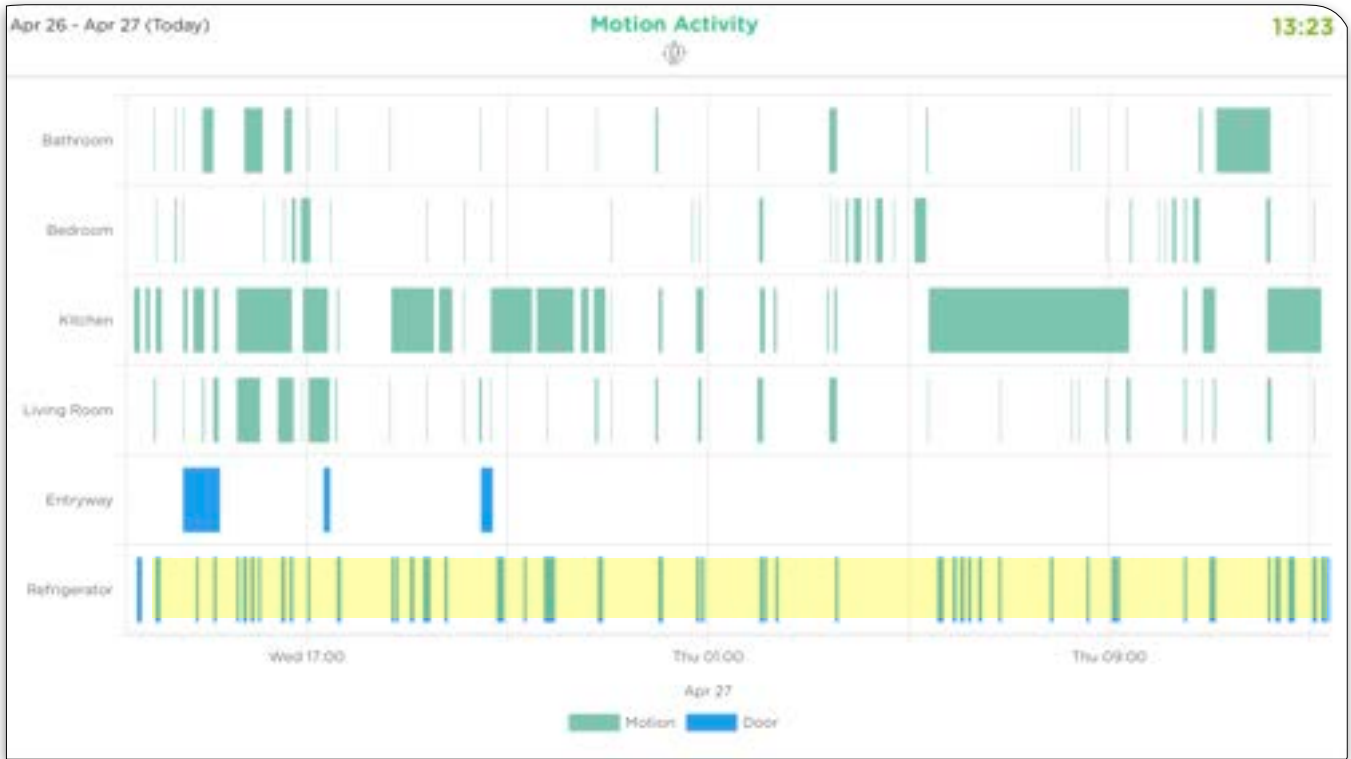
StackCare is designed to also identify behavioral patterns commonly associated with cognitive decline, such as agitation and repetition. One of our clients, Heather, exhibits repetitive behavior by frequently opening and closing the refrigerator door throughout the night while spending most of her time in the kitchen.

The Night Activity Monitor is triggered by Heather, who doesn't sleep. Upon a quick glance at the graph, it's evident that despite no movement in the bedroom, Heather is present in the kitchen during the alert.

Untypical Activity Patterns (cont)

Client Wesley always gets up around 7:30 am. On Sunday, April 23, client wasn't able to get out of bed due to a muscular weakness. Client has Inclusion Body Myositis (IBM), an inflammatory muscle disease characterized by progressive muscle weakness. By 9 am, his family received the alert that client had an untypical pattern of not being up by 7:30 am and knew that Wesley needed help. Caregiver only comes in on Monday morning, so client would potentially have been stuck in bed for 24 hours without the StackCare alert to family members.

Sleep Activity

John had a difficult time sleeping. The thick green bars in his bedroom indicate that he was restless throughout the night, with more sustained motion indicated. Additionally, he made six trips to the bathroom, which confirms he had a restless night. As a result, the home care agency flagged him to indicate an increased risk of falling.

Hana, the client, experiences cognitive decline and tends to wander between the kitchen and living room at night. Not sleeping in the bedroom triggers the Night Activity Monitor. as tiredness can lead to a dramatic increase in fall risk. The home care agency utilized StackCare data to demonstrate to the families that Hana requires in-home nighttime care.

Urinary Tract Infections

The client usually goes to the bathroom around 3 to 6 times a day. However, on January 10, the number of bathroom visits suddenly increased to 17. As a result, a notification was sent, and the home care agency promptly arranged for an immediate doctor's visit. The doctor diagnosed the client with a UTI and prescribed antibiotics. Within two days, the bathroom visit count returned to the normal range.

The client experienced a significant increase in bathroom visits over a span of four days. The daughter promptly scheduled a doctor's appointment, and after taking antibiotics for a day, the bathroom visits decreased to only 8.
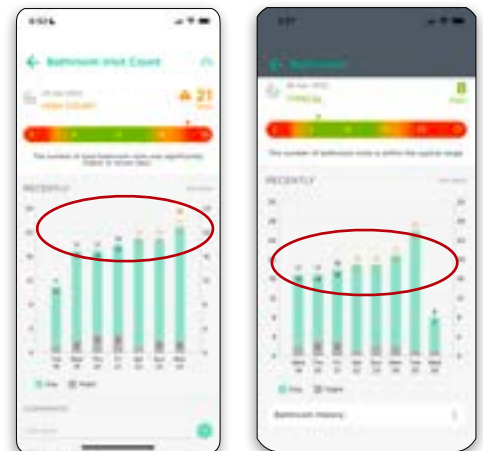
Constipation

As a result of constipation, the client frequently triggers Bathroom Overstay notifications. Quality of life and well-being of clients can be greatly improved by addressing and resolving this issue.

Temperature Alert

On March 26, temperature alert was issued at 7 am. Temperatures throughout the home were dangerously low due to unusually cold outside temperatures. The home care agency called client and adult daughter to adjust house temperatures to safe levels. The client turned on heating and the temperature graph shows that temperatures went back up to safe levels.

StackCare also detects excessively high temperatures. This client for example regularly turns on her gas fireplace even in the middle of the summer. Thankfully, the home care agency received the notification and called her to check that she was ok. Client had fallen asleep in her armchair and we believe that the call from the agency potentially saved her from a serious heat stroke.
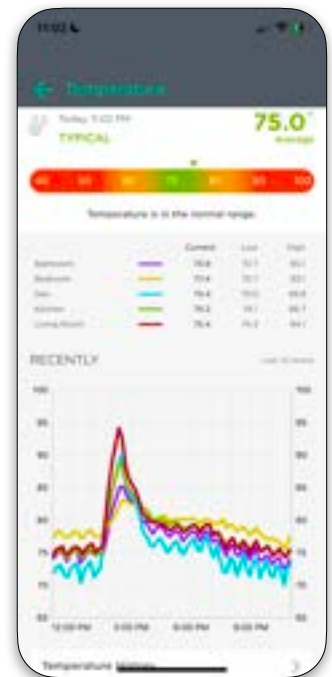
Nighttime Elopement
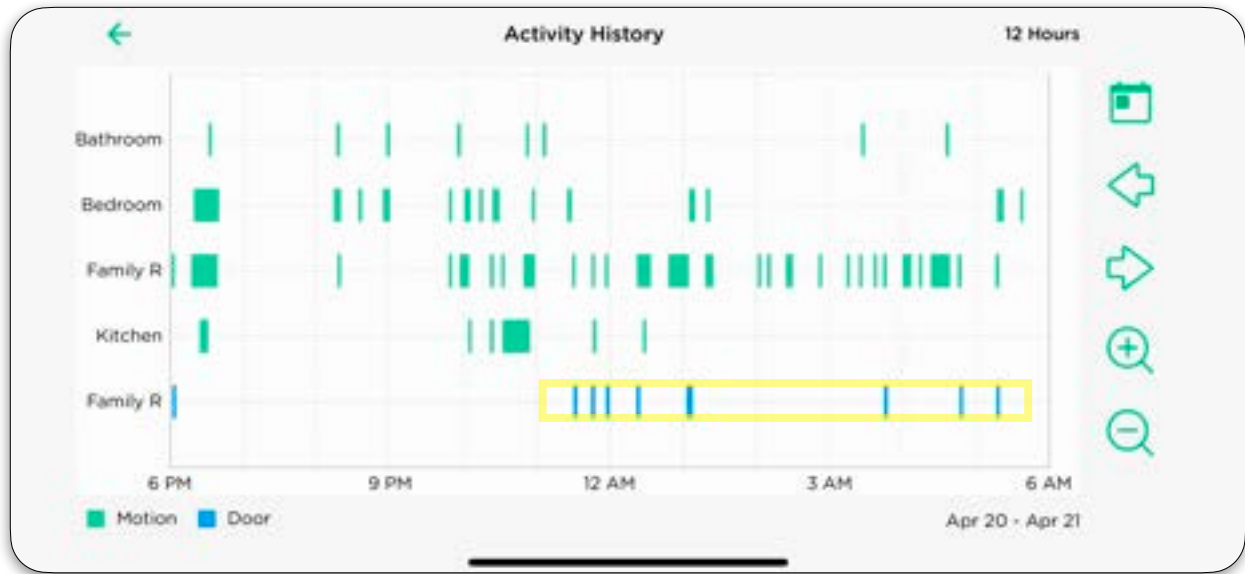
Client Lisa regularly and frequently opens the door throughout the night, every night. On the night of April 20 - April 21 for instance, she opened her Exterior Door 8 times between the hours of 11:30 am and 4:46 am.

Nighttime elopement and wandering put older adults at great risk, understanding that 1 in 6 adults with Alzheimer's go missing every year and 30% of individuals die before being found.

Based on this information, the home care agency was able to convince the family that Lisa needed care during night hours. As the Activity History graph shows, Lisa spends most of the night in the Living Room and wandering between the other rooms.
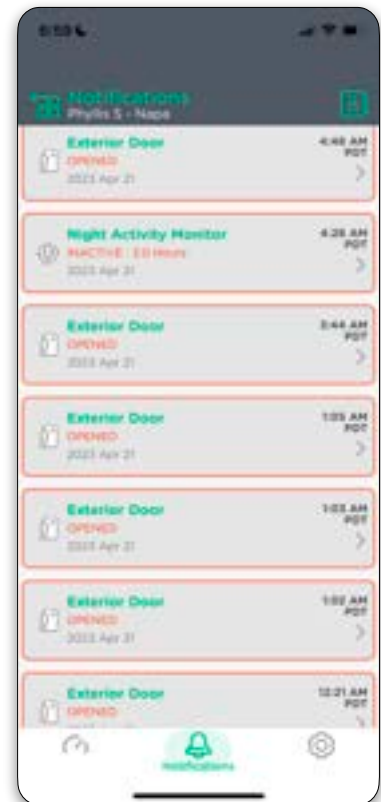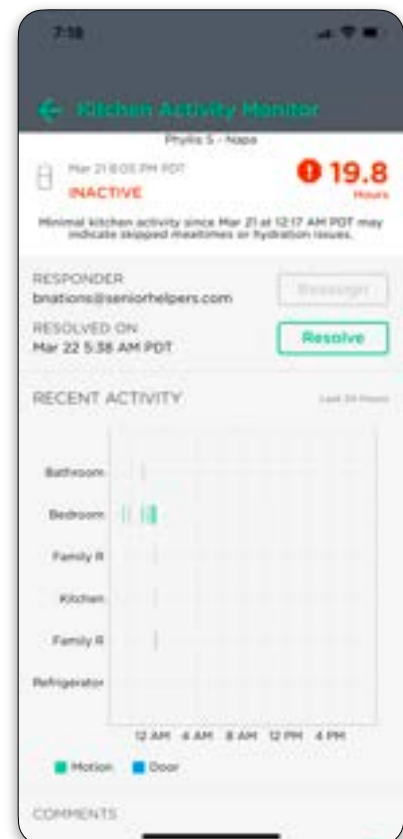
## Inactivity

Kitchen Activity
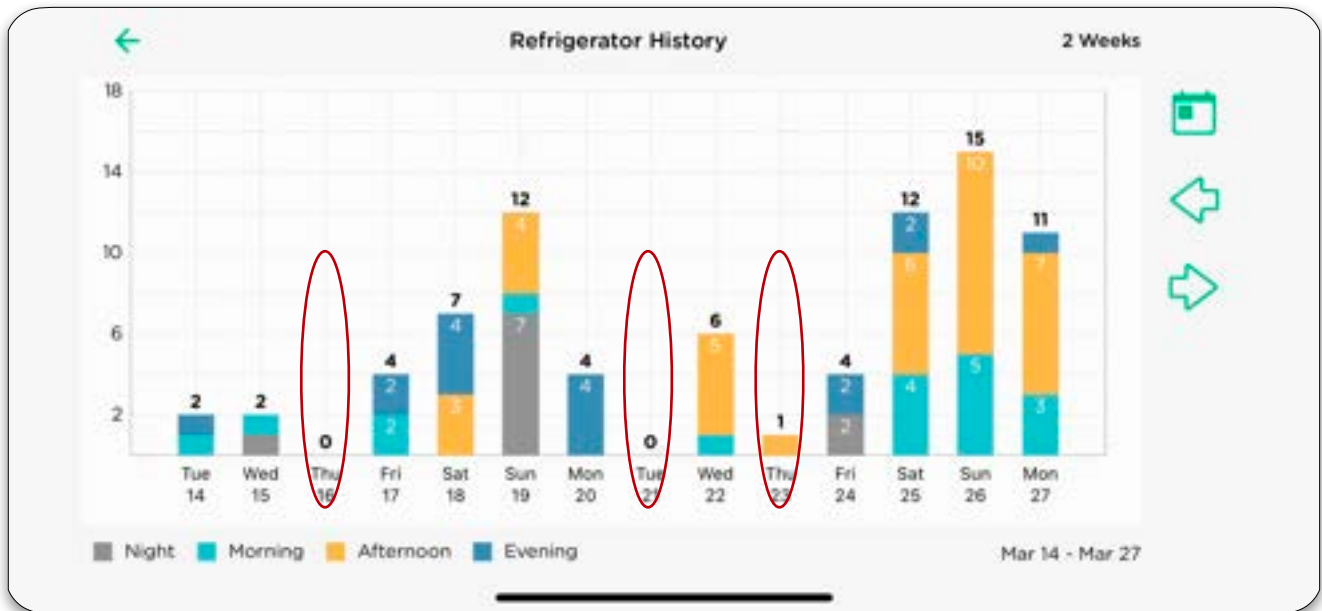
Client Sarah frequently misses meals, particularly dinner. Important to note that almost 93% of people who are malnourished live at home, which means nutritional health is often not monitored and approximately 30% of older people admitted to the hospital arrive malnourished. Some of the causes of malnutrition in the elderly are chronic illnesses, loneliness, depression, and dementia.

Based on the StackCare data, the home care agency changed the care hours from morning to afternoon; the caregiver prepares dinner for Sarah ensuring that she eats a proper meal.

Bedroom Activity
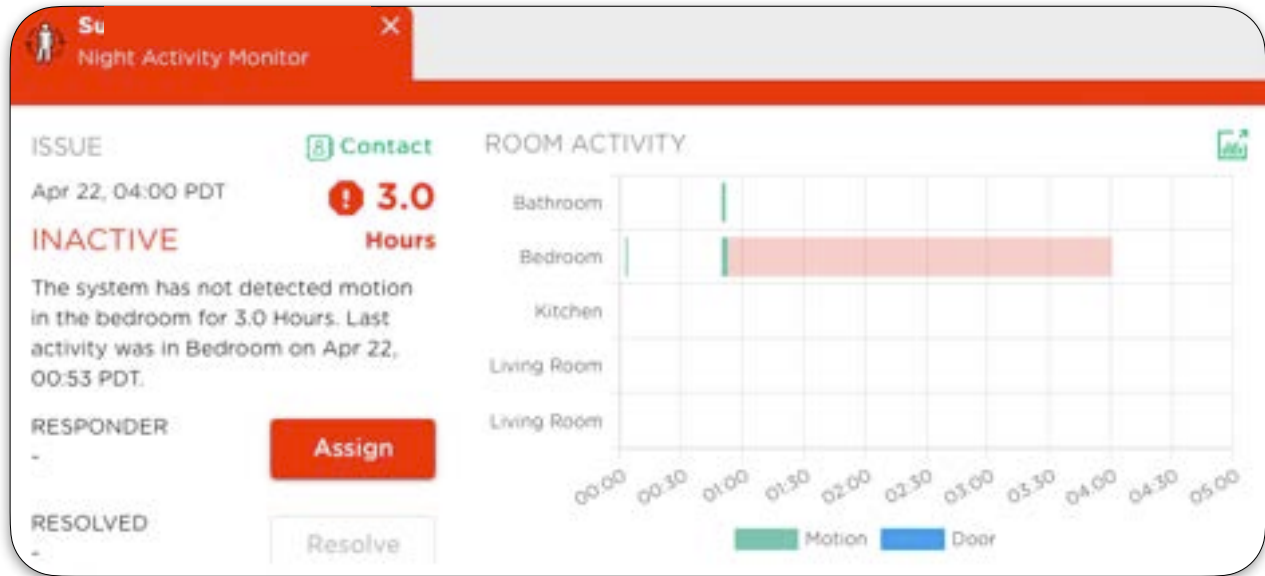
Family received alert that no nighttime motion had been detected. As the graph shows, client Susan did not go into another room. A brief visit to the bathroom followed by the lack of motion was cause for alert. Indeed, Susan had fallen in the hallway between her bedroom and her bathroom. Her son checked in on her and helped her get back up. Of the falls that occur at night, most occur between 9 pm and 7 am when elderly people wake to use the bathroom. Response time is critical for a speedy, easy recovery and the ability to return to independent living. In this case, the family adjusted for a much shorter activity monitor and installed a help button in that hallway.

Daytime Activity

On April 25, client Richard experienced a fall while entering the basement, and an alert was generated after he failed to register any motion in his typical activity zones for 4 hours. It's worth noting that Daytime Activity notifications can be customized, with a minimum period of 1 hour. Home care agency took immediate action by responding to the alert and safely transferring Richard to the Emergency Room for medical attention.

After 2 hours of inactivity in the home, a Day Activity Monitor notification was sent out. The home care agency reviewed the notification and observed on the graph that the client exited the home at 7 pm via the Front Door. Upon checking the Activity History, it was discovered that the client returned and entered the home through the Car Port door at 9:35 pm. There was no reason to be concerned and no need to check in on the client.
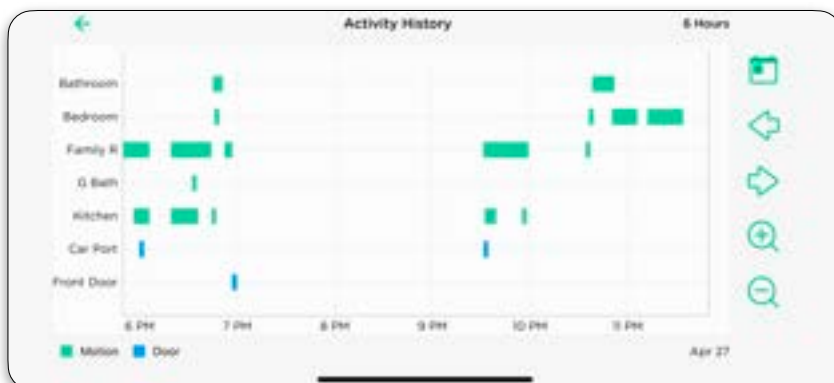
Summary

StackCare's detection capabilities can significantly improve the care of older adults and their quality of life, while also positively affecting their financial situation. Early identification of disability precursors makes intervention easier, and prompt detection of events associated with functional decline, such as falling, can enable healthcare professionals and family caregivers to respond effectively.

In summary, passive monitoring technologies provide effective care coordination tools that have a positive impact on the professional caregivers' efficiency, and reductions in their workloads. This approach may be one of the key solutions to the problem of care delivery to the world's growing elder population and offers senior care providers a unique opportunity to efficiently provide high-quality care despite labor shortages and increasing costs.

To find out more about how StackCare works and about our B2B conditions for home care agencies, book a demo meeting!

Call us: 941-400-0794
Email us: info@stack.care

STACK CARE

What StackCare Users Have To Say:

"We have been using StackCare for several months. First of all, it's very easy to use. It has helped us a great deal in managing one of our clients who lives in independent living. Lastly, the customer service with StackCare is amazing!"
Robert Nations, CEO of SH Napa

"StackCare is a great addition to our home care services, providing valuable insights into the health and well-being of senior citizens. Families find it reassuring and helpful, and it's easy to use even for non-tech-savvy individuals. The push notifications feature makes it easy to know when assistance is needed, and using StackCare has resulted in an increase in care hours for some clients. The customer service is exceptional, making me wholeheartedly recommend StackCare."
Michele Dorn, Client Service Coordinator - SH Baltimore

"I found the App and install for StackCare to be extremely easy to follow and set up the system. The app is very user friendly and guides you step by step and leaves no questions on how to install everything."
Connie Hamilton, Director of Care for SH Napa

"I use StackCare to engage new clients without hiring more staff, giving me time to recruit more caregivers. It provides added value to customers and alerts us to any changes in behavior that need attention. Notifications are automatic, eliminating the need for constant monitoring."
Molly Johnson - Owner, FirstLight Home Care of Silicon Valley

"When my mother was diagnosed with Parkinson's Disease, she wanted to be able to stay in her home, independently, as long as possible. With StackCare, I receive daily updates sent directly to my phone. These updates let me know when she gets up in the morning and automatically looks at her activity throughout the day, which helps alert me to any daily differences or trends that may indicate a problem. This comprehensive analysis, combined with the ease of use of the system, has provided me with tremendous reassurance and has made StackCare an invaluable tool in maintaining my mother's independence at home."
Dr. Kyle Garner, M.D. - Adjunct Chief of Staff Sarasota Memorial Hospital

"StackCare has been a huge help for my sister and me to monitor our mother's activities at home without interfering with her independence. It's easy to set up, unobtrusive and gives us peace of mind knowing that she's okay. We can check in from anywhere in the world and see that she's moving around normally and sleeping well. It's a solution that benefits everyone involved."
Kevin Corcoran, Customer

External Sources

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