Establishing the impact of Vitalerter in six County Durham Care Homes – Real World Evaluation

Executive report

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Summary

The evaluation project was funded by the Department of Health & Social Care's Digitising Social Care Fund through NHS North East and North Cumbria Integrated Care Board. The project was led by the Academic Heath Science Network North East and North Cumbria (AHSN NENC) in collaboration with a North East care home provider, Porters Care, Durham County Council and the University of Sunderland. The AHSN NENC commissioned the University of Sunderland to produce this independent real world evaluation report.

This project aimed to evaluate the effectiveness of the machine learning and sensors based non-wearable Vitalerter device in reducing falls within care homes and manual turns. To summarise, this mixed methods evaluation highlights the benefits, limitations, and future directions for the Vitalerter.

Aims & associated Findings of the evaluation:

1) **Aim:** How effective is the Vitalerter solution in preventing falls?
   Finding: Vitalerter contributed to a statistically highly significant reduction in falls.

2) **Aim**: How effective is the Vitalerter solution in reducing turn checks for residents?
   Finding: Vitalerter evidenced a statistically significant reduction in the estimated number of turns according to resident turn protocols and the number of turns needed. Vitalerter is an effective tool in preventing unnecessary turns by measuring residents' ability to move independently.

3) **Aim:** What are the key (known/unknown) qualitative and quantitative benefits (cashable/non-cashable) that will apply to care homes, care home staff, supporting clinical services/staff and the care home residents themselves?

   Finding:
   - Vitalerter contributed to the reduction in falls, which reduced time consuming falls-related paperwork.
   - A reduction in falls led to a reduction in one-to-one support when a resident falls and requires support and medical attention.
   - Vitalerter provided a more even distribution of care worker time among residents who were/were not categorised as fall risks. Thus, there were improvements in the provision of person-centred practice.

- Staff reported improvements in wellbeing and decreased work-related stress, indicating the potential for reduced staff sickness.
- The Vitalerter's ability to reduce manual turns means a greater distribution of staff time, less physical strain of staff members and greater comfort and quality of sleep for residents in the future.
- All of this could be economically modelled to demonstrate potential cost savings, including associated costs of falls impact on secondary care such as ambulance and hospital attendance and impacts within the care home upon the residents return.

4) **Aim**: Is the solution viable to rollout out on a larger scale across area and the wider NENC region?
   Finding: The solution is viable to roll out on a larger scale, however this is conditional on some necessary changes to improve user experience. There is the potential to roll out the Vitalerter across different care pathways and environments such as intermediate and secondary care.

What is Vitalerter?

Vitalerter is a care monitoring solution, which enables residents to be monitored by a single device. These detect bed exits, and continuous measures of heart rate, respiratory rate, and precise movements of the body, without being placed on the person, and is thus non-obtrusive. Vitalerter is designed to reduce falls, pressure sores, and prevent critical and costly events leading to hospital admission and treatment. Vitalerter is attached to the bed frame of a resident using a magnet and the device run continuously and automatically when the resident is in their bed. Following this, the Vitalerter can alert staff using mobile handsets up to 3-4 minutes before a resident attempting to exit their bed. Thus, this technology predicts and prevents falls, the alert enables staff, where possible, to assist a specific resident before they fall out of bed.

Vitalerter also monitors how frequently a resident move and repositions themselves. Long-term care facilities employ a 2 hourly manual turn protocol to reduce pressure sores. Such manual turns can disrupt the residents sleeping pattern and take up a significant amount of care worker time. Residents who reposition themselves will not require the manual turn, whereas those who have not are at risk of pressure sores and require a manual turn. Vitalerter resets the 2 hourly timer if the resident moves themselves or send an alert at the 2 hour time point if no movement has been made. Vitalerter also measures sleep quality, recovery, and sleep phases, whilst tracking movement, respiratory and heart rates during sleep.

The data from each Vitalerter is fed into the central dashboard enabling both individual and global reports to be produced an analysed daily, weekly, and monthly reports can be generated.

Evaluation project process

Ethical approval was applied for and awarded from the University of Sunderland under application 017665 in April 2023. Project governance approval was applied for and awarded by Durham County Council in May 2023.

The devices were installed by the product provider and staff training was provided to each care home. Support was offered through regular stakeholder meetings. Weekly project meetings were hosted by the AHSN for key senior stakeholders to cover project progress as an opportunity to discuss and address any related points or issues where required. Summary updates were circulated via email to keep those who couldn't attend informed. Flyer and information leaflets were distributed to care homes to encourage active participation and create awareness of any issues that occurred with the devices and details on how to avoid them.

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The evaluation employed a mixed methods methodology, integrating both qualitative and quantitative approaches.

Part 1 Data was collected by from the Vitalerter devices. Via a sharing agreement the data was shared with the evaluation team at the University of Sunderland. Residents who were assessed as high-falls risk by the care homes were placed under the falls category and had a Vitalerter attached to their bedframe, n = 15 devices in total (n = number of participants in each group, 15 residents allocated a Vitalerter in the falls group). Residents who were on a turn protocol also had a Vitalerter attached to their bedframe, n = 15 devices in total. Data collection spanned 12 weeks, during this period Vitalerter was designed to continuously monitor and collect data regarding each resident. However, difficulties emerged in the data collection period such as resident deaths and hospital admissions, and a significant change in the resident's condition. This prevented some devices collecting continuous data for 3 months.

The data was analysed, to measure whether there was a statistically significant reduction in falls during the Vitalerter evaluation compared to the 3 months baseline data prior to the intervention.

The data examining residents' ability to move independently was utilised to highlight Vitalerter's potential ability to accurately depict the correct turns protocol needed per resident, compared to the turns protocol residents had been assigned using traditional methods. There were no operational changes made as this was a data collection exercise only. If these devices were intended to activate staff, there would need to be changes made to operational guidance and procedures.

Part 2 Involved a series of interviews completed by the evaluation team at University of Sunderland to understand key stakeholders' experiences of using Vitalerter. A total of eight participants were interviewed, six semi-structured interviews were conducted and one small focus group, comprising two participants. All interviews were conducted and recorded online using Microsoft Teams and were transcribed verbatim.

Part 1 - Quantitative Findings

Falls

Data collection for the 3 months prior and during the evaluation was analysed to examine whether there had been a significant reduction in falls. Descriptive data was collected and examined via frequencies for the 25 residents with a Vitalerter. The data examined the feedback staff provided when responding to the alert from the Vitalerter. It was important to obtain staff feedback on the reason for each alert, so patterns could be established, reviewed and any necessary actions carried out if needed. In total 10 different reasons for alerts were identified in the data (refer to Table 1).

Table 1: Frequencies of reasons for Vitalerter alerts

Type of Alert	Frequency of Alert
There are people near the resident's bed	355
The staff took care of the resident	2951
The resident was about to leave the bed	261
Staff clicked no feedback	19
Staff didn't click done	1220
The resident has already left the bed	286
The resident was not leaving the bed	693
The resident was not in the room	64
Turned to back	3
Turned to side	2
	Total: 5854

*From second data analysis

The evaluation team carried out two episodes of data analysis. The first was based on the initial data received and the second was due to additional information related to the data received. During the first analysis baseline data was compared to the data collected during the 12 weeks of the Vitalerter period regarding the frequency of each resident's falls. This was to examine whether there was a reduction in falls during this time. The descriptive statistics suggest there was a statistically significant reduction in falls during the Vitalerter trial. Statistical significance means the reduction in falls has not occurred by chance; it has happened due changes made and the intervention. Given the limitations of the data collected the analysis cannot state this decrease was due to Vitalerter alone, however it suggests it was a large contributory factor.

The second analysis was completed due to additional information received (28/07/23) at a project meeting which enabled greater understanding of the data and evidenced the need for a second analysis for example one resident died during the study, one resident had been moved to the end-of-life pathway and others were removed prior to the data collection going live. To control for any impact these factors may have had on the results, any of the 25 residents where there was not a 12-week data collection period, where data was missing or where cases were not reported in terms of baseline data were removed. This totalled n = 10. After removing incomplete datasets there were a total of n = 15 active devices with data for a continuous 12-week period (see Table 2).

The descriptive and inferential analysis was conducted again to increase rigour and reliability of the data. The inferential analysis showed a highly significant reduction in falls during the intervention period, ***p = .008***. The ***p*** value represents statistical significance, and is considered significant if the value is less than < .05. In pure numbers there was a reduction of falls incidence from 58 falls across the sample to 27 during the evaluation period. The summary of this is detailed in table 2.

Table 2. Baseline and Intervention Falls Number

Resident	**Baseline falls (3 month)**	**Intervention (3 month)**
F1	9	6
F2	8	1
F3	4	0
F4	10	4
F5	0	0
F6	6	3
F7	1	1
F8	3	1
F9	10	6
F10	0	0
F11	1	0
F12	0	0
F13	4	3
F14	0	0
F14	2	2
TOTAL	58	27

Turns

Vitalerter was used to examine resident's ability to move independently without being manually turned by staff. Residents who required a turn protocol had the Vitalerter attached to their bedframe to monitor the resident's movement. There were 15 residents with a Vitalerter for turns. The frequency of turns per 12-hour period for each turn protocol was calculated and multiplied by the number of days Vitalerter was on each resident's bed to obtain an estimate of the expected turns. This was compared to the number of actual turns needed, calculated by the resident's independent movement, the difference was calculated to measure whether a reduction had occurred and to what degree of significance. The descriptive statistics suggest a considerable decrease in the number of turns needed during Vitalerter evaluation period than the number originally estimated (See Table 3). The inferential analysis evidenced a statistically significant reduction in turns performed and turns required after factoring in residents' independent movement, ***p = .001.*** As the ***p*** value is less than .05, we can state this difference is statistically significant. It is important to note that the staff were not receiving the turns alerts via the Vitalerter system and were only using the turns protocol in place. For the purposes of this evaluation data was gathered to illustrate the potential impact Vitalerter could have. If staff were to utilise the alert function there would need to be changes to operational procedures and governance.

Table 3. Reductions per resident in turns required

Resident	Turns estimated over Vitalerter period	Number of turns required (identified by Vitalerter due to lack of independent movement)	Theoretical reduction of turns needed
T1	184	116	68
T2	300	50	250
T3*	102	87	15
T4*	552	2	550
T5*	177	155	22
T6*	368	149	219
T7	1104	914	190
T8	304	268	36
T9*	368	248	120
T10	552	390	162
T11	552	482	70
T12	552	515	37

T13	424	254	170
T14	736	567	169
T15	736	503	233

*Resident is bed managed

Additionally, the number of days the Vitalerter was assigned to each bed compared to the number of dates an alert was set off highlighted an interesting finding (See Table 4 Number of days with alerts received). For some residents the number of days alerts were sent in comparison to the number of days Vitalerter was live, was quite considerable, meaning that some resident's went days and even weeks without requiring a manual turn, which may indicate the need for turn protocols to be reassessed, a limitation of the technology, or admission to hospital. Additionally, four out of the five bed managed residents have considerable differences between how many days Vitalerter was on the resident's bed frames and how many days there was alerts to turn the resident. This finding is interesting as in theory bed managed participants should have less gaps, due to these residents being permanently placed in their bed and typically being less mobile and thus less able to move independently. However, the data is not sufficient to make conclusions on why there was at times considerable gaps in the data indicating the resident was moving continuously without any assistance from staff.

Table 4: Number of days with alerts received

Resident	**Turn Protocol**	**Number of days Vitalerter on bed**	**Number of days with alerts**
T1	3	23	18
T2	4	50	49
T3*	4	34	10
T4*	2	92	83
T5*	4	59	15
T6*	3	92	66
T7	2	92	55
T8	3	38	11
T9*	3	92	47
T10	4	92	49
T11	4	92	44
T12	4	92	19
T13	3	53	46
T14	3	92	55
T15	3	92	67

*Resident is bed managed

Part 2 - Qualitative Findings

The interviews were analysed for themes that emerged from the interviews. Three themes were identified in this thematic analysis: (1) Benefits of using the Vitalerter; (2) Challenges of using the Vitalerter; and (3) Future directions for using the Vitalerter.

Theme 1) Benefits of using Vitalerter

This theme highlights the benefits staff experienced when using the Vitalerter in their roles. This theme identified the negative impact falls can have on staff members, and the positive impact of the Vitalerter reducing falls on staff wellbeing. The Vitalerter demonstrated a saving of staff members time due to the perceived reduction in falls as there was less paperwork to complete, alongside other costly factors such as staff waiting with the resident for medical assistance and potential admittance to hospital, which has been associated with an increase in care required post-hospital admission. The release of staff time seemed to benefit other residents who were not a high falls risk, and led to greater person-centred provisions of care for residents.

Theme 2) Challenges of using the Vitalerter

This theme explores the challenges staff members experienced when using the Vitalerter in their role. There were some technological challenges identified such as low battery power, over-sensitivity, lack of flexibility regarding placement of the device, and alert notifications either taking too long to come through to the handset or not coming through. At times the devices froze and stopped working, thus staff had to restart the handset, which decreased the effectiveness of the predict-prevent purpose of the device. There were also practical challenges experienced, which related to supply and demand per care home size and number of residents allocated devices. In addition, challenges in the assessment of need for the device were identified, with some staff reporting a lack of benefits due to the resident not requiring the device.

Theme 3) Future directions for using the Vitalerter

This theme illustrates participants views on the future directions of the Vitalerter. Some participants felt there was no changes required, however most participants felt some changes would be beneficial to the future use and implementation of the technology. Two participants felt greater flexibility of the device would provide greater reduction of falls. Participants also highlighted the value of linking the Vitalerter system with nursing system already in place and thus remove the need for a separate handset. It was felt by some participants that the Vitalerter could be more flexible with its continuous monitoring, for example the ability to pause or stop monitoring when the resident was no longer in the bed to reduce overburdening care workers with false alerts. Care workers also identified the need to be involved in the allocation of Vitalerter's, whereby their knowledge and insight could be used to better inform the decision-making process.

Limitations and Recommendations

There were limitations during the data collection period which reduced the beneficial impact of Vitalerter and impeded meaningful conclusions obtained from data analysis.

- The Vitalerter device requires stable and sufficient network connectivity to send alerts notifications to the handsets. Lost of network connection affected staff experiences and led to potential missing data. It is recommended that signal enhancing options to boost and maintain network connection are implemented prior to use.
- Baseline data was difficult to obtain despite an initial agreed data plan being in place, it was learnt that difficulties emerged due to the degree of data required for a robust and rigorous data analysis. It is recommended that pre-trial data collection be conducted at the earliest stages of the project to enable sufficient and accurate data including changes in device locations and resident circumstances.
- Vitalerter is sensitive to noise, thus when attached to a bed using an airflow mattress a specific algorithm is required, this information was not shared by relevant stakeholder's leading to false alerts which occurred whilst one participant was in hospital.
- Vitalerter devices were damaged or unplugged, which typically occurred when rooms were being cleaned.
- The device itself could be more robust given the environment it is designed for, combined with all staff within the care homes being provided with more information on how to avoid damage to devices where possible and the implications of devices being unplugged and damaged.
- There were difficulties with the battery-life of the handsets, spare batteries and charging sets were provided, however these needed to be prioritised to ensure staff were receiving notification.
- For future use Vitalerter alerts and notifications could be incorporated into the existing care home systems would use less staff time and remove the requirement for additional handsets.

- Some devices were assigned to residents who were high falls risk, however the generic falls risk assessment was found not to fit in with the specific specifications of Vitalerter's ability. A bespoke falls risk assessment is required in the future to assess residents who are high falls risk from their bed.
- In the initial stages of the project staff engagement was high, engagement gradually decreased over time in some areas, this was despite there being project engagement weekly meetings with the core team offering a forum to raise and address any issues raised. Many of the alerts were not actioned by staff which decreased the evaluation teams capability.
- The supplier employed a customer training operative to ensure staff are supported when implementing and using the Vitalerter to ensure open communication, awareness, and engagement. For future use it is recommended the supplier provides each care home with a clear and comprehensive overview of the installation, responsibilities, resident's needs, clearly defined project goals, deliverables, timelines, and potential risks.
- One considerable restricting factor of staff engagement was workload, it is recommended that ensuring a manageable workload for all staff would improve engagement in the future.
- Key stakeholders including care staff could be engaged from the early stages of the project to enhance engagement, uptake, understanding and awareness. It was deemed more appropriate for the senior team to attend project meetings; creating a reliance on dissemination of information. This may be vital to improve engagement, as post-analysis reflection highlighted some of the staff members felt anxious and out of their depth using the technology.
- It is recommended that 'super-users' or device champions may increase uptake and engagement by providing more support, particularly in the initial stages. This was initiated but the staff member changed roles within the organisation and the 'super user' was not reestablished.

Future Directions and Next Steps

1) The evaluation suggests that Vitalerter contributed to a reduction in falls experienced during the trial period.
2) The frequencies conducted on staff's responses to alerts indicates a need for greater engagement and understanding of using the technology, suggesting the need for additional training prior to use and refresher updates.
3) To enable an accurate measurement of Vitalerter's predictive and preventative ability greater assessment of need is required to ensure that only residents who are deemed at high risk of falls, particularly from the bed setting are allocated a device.
4) To overcome technological and practical challenges experienced for future use, key stakeholders should be involved in the early stages, which may increase engagement and uptake.

Whilst challenges were experienced, this evaluation does suggest the Vitalerter may increase staff wellbeing and reduce work-related stress, reduce falls and fall-related risk, and have the potential to ensure residents are on the most appropriate turn protocol, however changes are required prior to future implementation.

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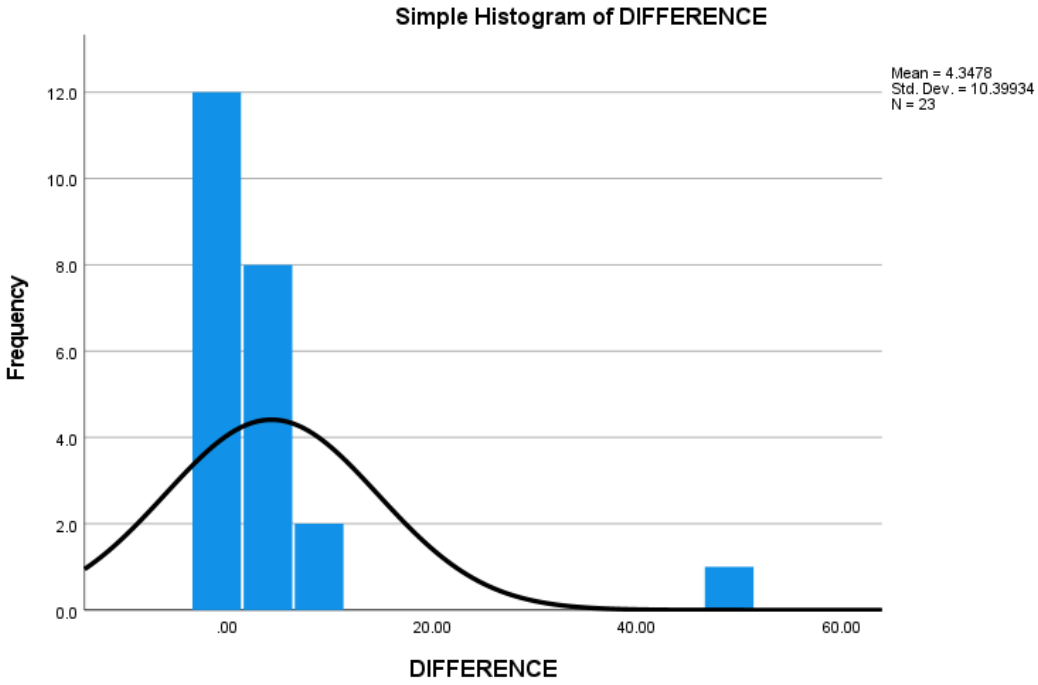
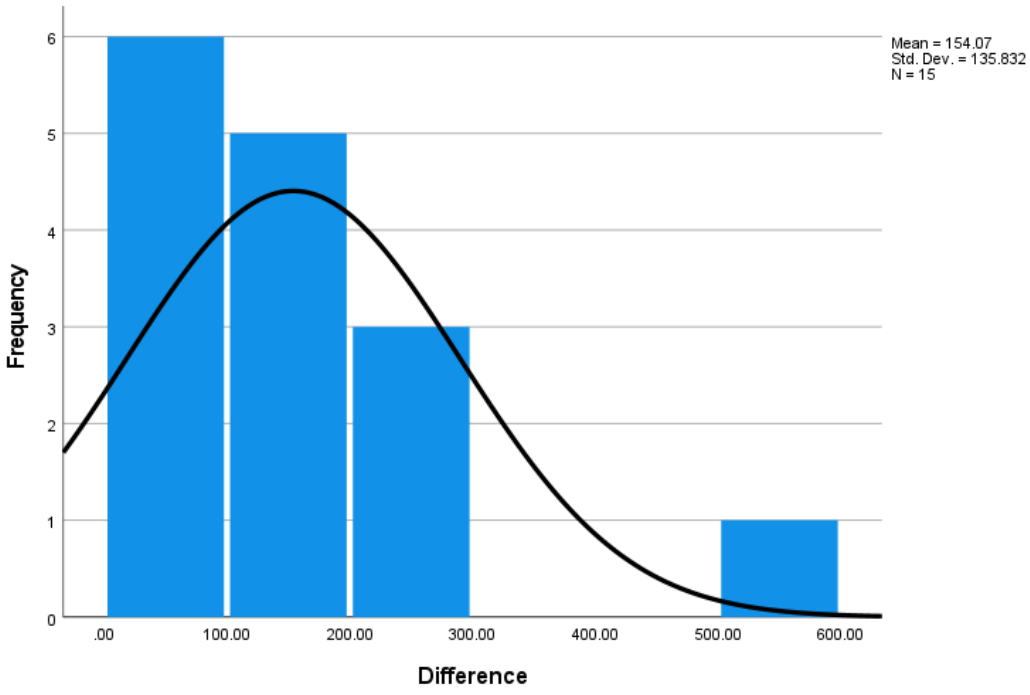
Appendix A: Falls Histogram



Appendix B: Turns Histogram



Appendix C: Histograms for recalculated falls