

The impact of the Oxehealth system

March 2022



Tees, Esk and Wear Valleys
NHS Foundation Trust

Executive Summary (1/3)

Tees, Esk and Wear Valleys NHS Foundation Trust partnered with Oxehealth to improve the safety, quality, and efficiency of care on their inpatient wards.

This report consolidates feedback from staff and patients and quantitative analysis. The study involved 3 active wards:

Cedar
Mixed PICU

Elm
Female Acute

Rowan Lea
Mixed Older Adult

Staff and patient feedback was collected after 6 months of use of Oxevision on Elm and Cedar and 4 months of use on Rowan Lea. The feedback was collected through surveys, interviews, and long-answer feedback forms with ward staff and patients.

The quantitative analysis evaluated Rowan Lea and Elm in an observational “before and after” cohort study and Cedar ward in an observational “before and after” study. The studies analysed changes to patient safety in terms of incidents and incident severity as well as observation hours and bank and agency spend.

Executive Summary (2/3)

1. Improved safety on the wards

- Over 90% of staff reported Oxevision improves safety on the ward and helps them identify falls they may otherwise not have known about. 90% of staff reported the system enabled them to prevent potential incidents and 86% reported the system made it easier to monitor the physical health of patients.
- 83% of patients felt the system kept them safer and 88% felt that it allowed staff to respond to them more quickly

Older Adults (Rowan Lea)

- 16% relative reduction in falls in bedrooms when compared to the control ward
- 25-40% relative reduction in assaults across the bedroom and ward respectively when compared to the control ward

Acute (Elm)

- 7% relative reduction in self-harm in bedrooms when compared to the control ward
 - Harmful¹ self-harm in the bedroom reduced relative to the control ward from 7 to 4 compared to an increase of 2 to 6 on the control ward
 - Ligatures also had a relative decrease when compared to the control ward

PICU (Cedar)

- 25% reduction in self-harm in bedrooms compared to its baseline
- 17% and 10% increase in assaults bedrooms and across the ward, respectively, compared to its baseline

¹ Harmful incidents are incidents classified as moderate degree of harm or higher. A moderate degree of harm incident is an incident that resulted in significant but not permanent harm, e.g. a fracture.

Executive Summary (3/3)

2. Improved patient experience

- 100% of patients felt the system reduced disturbance at night-time
- 89% of patients felt that the system improved their wellbeing and 92% felt it enabled staff to care for them better
- Patients felt the system helps them get better sleep (80%), gives them a greater sense of privacy (83%) and dignity (90%) and improved their relationship with staff (88%)

3. Positive impact on risk management and restrictive practice levels

- 90% staff reported that the system enables them to better manage patient risk

4. Improved care quality

- 79% staff reported that the system enables them to provide better care for patients
- 72% staff reported that the system provides them with more information to help make better care or clinical decisions

2. 31% entries of enhanced observation hours in Rowan Lea's raw data had no end date and therefore an analysis was not conducted due to data limitations.

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Methodology

Quantitative Evaluation Methodology

- A “before and after” cohort study for Rowan Lea and Elm, and a “before and after” study for Cedar. Analysis was completed for self-harm, assault, falls, enhanced observation hours and bank and agency spend related to increased observations. The table below provides additional detail on the evaluation
- Cedar was found to have a higher proportion of female patients compared to its potential control ward, Bedale. Due to the difference in patient demographics, Bedale was not a suitable control ward for Cedar

Staff & Patient Feedback Methodology

- Feedback collection comprised of; 29 18-question staff surveys (7 from Elm, 7 from Rowan Lea, 16 from Cedar), 14 10-question patient surveys (9 from Elm, 5 from Cedar), 13 one-to-one staff interviews across all active wards, 6 long-answer staff feedback forms from Rowan Lea and 2 pieces of written feedback from ward managers Becky Duffy at Cedar and Sue Cowans at Elm
- Topics covered in staff questionnaires, interviews, and feedback forms were on patient safety, patient care and experience, staff experience and day-to-day staff ways of working with the Oxhealth system

Active ward	Pathway	Staff & Patient Feedback Collection Period	Quantitative evaluation				
			Baseline period	Post go-live period	Evaluation period	Control wards	Evaluation Method
Elm	Female acute (20 bedrooms)	6 Months Post Go-Live	20 Mar 20 to 17 Nov 20	17 Nov 20 to 30 Sep 21	8-month baseline 11-month post go-live	Tunstall	Before and after cohort study
Cedar	Mixed PICU (10 bedrooms)	6 Months Post Go-Live	20 Mar 20 to 16 Nov 20	16 Nov 20 to 30 Sep 21	8-month baseline 11-month post go-live	No control	Before and after study
Rowan Lea	Mixed older adult (20 bedrooms)	4 Months Post Go-Live	20 Mar 20 to 06 Jan 21	06 Jan 21 to 30 Sep 21	10-month baseline 9-month post go-live	Westerdale South ¹ Westerdale North ¹	Before and after cohort study

1. A control ward average was used to evaluate Rowan Lea. This was worked out by taking the mean average of two control wards (Westerdale North and Westerdale South). Results were annualised to determine the impact per year and normalised to account for different ward sizes.

Quantitative Evaluation Limitations

COVID-19 pandemic: The COVID-19 pandemic is highly likely to have impacted wards in different ways, for example, staffing. The impact of COVID-19 cannot be adjusted for in the analysis, but efforts have been made to try to minimise its effect by defining the evaluation periods and using control wards.

Low sample sizes: The low number of assaults in Tunstall may have limited the analysis for comparison with Elm. In addition, the low number of moderate or higher self-harms, assaults, and falls may have limited the severity analysis across the evaluation.

Suitability of control wards: The control wards used were not exactly the same as the active wards but were sufficiently similar to be compared. The control wards had the same pathways, similar ward designs and patient demographics.

However, confounder interviews with Ward Managers showed differences between the wards that may have influenced the results of the analysis. Details of these influencing factors are shared alongside the analysis.

Cedar was found to have a higher proportion of female patients compared to its potential control ward, Bedale. This was a result of aiming to improve sexual safety on the wards and made self-harm risk higher on Cedar than on Bedale. This difference between the wards meant that **Bedale was not a suitable control ward for Cedar**.

Bank and agency spend related to increased observations: Request reasons for bank and agency staff have been significantly skewed towards COVID-19 during the pandemic. Conclusions from these results may have been impacted by this change.

Enhanced observations data: Rowan Lea enhanced observation data was incomplete and therefore was not analysed. Rowan Lea's bank and agency spend related to increased observations was still analysed.

Confounders: Analysis conducted on data from real world environments may be influenced by changes and initiatives ongoing to varying extents on the wards and may affect these results. Through interviews with ward managers and matrons some of these confounders are outlined throughout the analysis

Safety Impact:

Impact on safety, incidents and severity of incidents

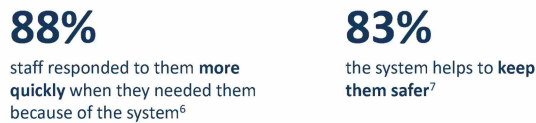
Improved safety on the wards

Staff and Patient Feedback

Key highlights from staff surveys:
Staff reported the system...



Key highlights from patient surveys on safety:
Patients felt...



¹N=28, ²N=25, ³N=25, ⁴N=24, ⁵N=25, ⁶N=8, ⁷N=12

Improved safety on the wards

Staff and Patient Feedback

*"There was an incident on Cedar ward where a patient made a significant suicide attempt. A staff member used the Oxehealth system **to check in to a patient between observation rounds** and saw that there was concern.*

*The staff member then attended the patient's bedroom and **began emergency medical procedures.***

*Although it was the nursing interventions that saved the life, it was felt by the whole nursing team that **it was the Oxehealth system that gave the nurses a head start** in saving this patient's life by alerting us to the concern."*

[U/S] Ward Manager

*"Before, it was common for me to hear of an incident from the hallway, without seeing anything, and I would enter the room, potentially **putting myself at risk.***

*Now, if I check with Oxehealth and see that a patient has odd vital signs or is smashing the room up and self-harming, I can **make sure I've got a team of people supporting me.** If a patient is expressing aggressive behaviour or trying to make a weapon, we can go in with a team **to make sure that the patient and the staff are safe.**"*

[U/S] Healthcare Assistant and Activity Coordinator

*We've had a few falls where Oxehealth has been instrumental in **providing us insights into how and why patients have fallen.** On these occasions, we've contacted Oxehealth, and they have provided us with a detailed report describing the event.*

*These reports have been very helpful in helping us investigate **how and why the patient has fallen.** We have even used these reports in our **frailty meetings to help identify triggers** for when patient's may be having a difficult time and have been **able to change our practice or identify measures** to put in place to **prevent future falls.***

[U/S] Ward manager

Improved safety on the wards

Incident Data Analysis
Falls, Assaults, Self-Harm

Rowan Lea
Older Adult

16% ↓
Relative change in
bedroom falls

25-40% ↓
Relative change in
assaults

Elm
Female acute

7% ↓
Relative change in bedroom self-harms

7 to 4 ↓
(Control 2 to 6)
Relative decrease in
harmful¹ bedroom self-harms

Cedar
Mixed PICU

25% ↓
change vs. baseline in bedroom self-harms

37% ↓
change vs. baseline in harmful¹
bedroom self-harms

10-17% ↑
change vs. baseline in assaults

1. Harmful incidents are incidents classified as moderate degree of harm or higher. A moderate degree of harm incident is an incident that resulted in significant but not permanent harm, e.g. a fracture.

Rowan Lea reduced bedroom falls by 16% relative to the control

Rowan Lea, mixed older adults
Falls

- Falls on Rowan Lea had a relative **reduction of 16%** in the bedrooms when compared to the control ward.
- Harmful falls¹ in the bedroom increased relative to the control ward (2 to 7 on Rowan Lea compared to 1 to 5) but reduced across the ward relative to the control ward. The **small sample size** of harmful incidents means that a percentage change provides limited insight. Therefore, a percentage change has not been calculated for harmful falls.
- As a COVID-19 admission ward, patients in Rowan lea were required to isolate in bedrooms upon entry. This is likely to have impacted the bedroom fall results in Rowan Lea, especially as patients tend to fall more in the first 24-72 hours of admission.

Bedroom falls, annualised

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Bedroom falls	Rowan Lea	61	65	7%	-16%
	Westerdale (Avg)	115	147	28%	
Harmful falls	Rowan Lea	2	7		
	Westerdale(Avg)	1	5		

Ward falls, annualised

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Ward falls	Rowan Lea	110	116	5%	-27%
	Westerdale (Avg)	182	262	44%	
Harmful falls	Rowan Lea	5	7		
	Westerdale(Avg)	4	8		

1.Harmful incidents are incidents classified as moderate degree of harm or higher. A moderate degree of harm incident is an incident that resulted in significant but not permanent harm, a e.g. a fracture. 11 | Confidential - not for public use

Left hand side bedroom results, right hand side the ward. □Messaging focus on bedrooms

Rowan Lea reduced assaults by 25-40% relative to the control

Rowan Lea, mixed older adults
Assaults

- Assaults on Rowan Lea had a relative reduction of 25% and 40% in the bedrooms and on the ward respectively, when compared to the control ward.
- Throughout the evaluation time period Rowan Lea reported no harmful assaults.

Bedroom assaults, annualised

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Bedroom assaults	Rowan Lea	39	25	-34%	-25%
	Westerdale (Avg)	52	46	-12%	
Harmful assaults	Rowan Lea	0	0		
	Westerdale(Avg)	1	0		

Ward assaults, annualised

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Ward assaults	Rowan Lea	173	116	-33%	-40%
	Westerdale (Avg)	207	233	12%	
Harmful assaults	Rowan Lea	0	0		
	Westerdale(Avg)	1	0		

Elm reduced bedroom self-harms by 7%

Elm, female acute
Self-harms

- **Self-harm** in bedrooms on Elm had a **relative reduction of 7%** when compared to the control ward.
- **Ligatures** in bedrooms had a **relative reduction of 7%** when compared to the control ward.
- Harmful self-harms in bedrooms had a relative reduction (7 to 4) when compared the control ward (2 to 6). The **small sample size** of harmful incidents means that a percentage change provides limited insight. Therefore, a percentage change has not been calculated for harmful falls.
- Tunstall has a newer anti-ligature environment (compared to Elm) and different approaches to patient risk management for self-harm. For example, Tunstall has a higher proportion of patients on 1 to 1 observations to manage self-harm. Both these factors are highly likely to have impacted the results below.

Bedroom self-harms, annualised						Ward self-harms, annualised							
	Ward	Baseline	Post go-live	Change (%)	Relative change (%)		Ward	Baseline	Post go-live	Change (%)	Relative change (%)		
Bedroom self-harms	Elm	223	353	58%	-7%	Ward self-harms	Elm	286	401	40%	-4%		
	Tunstall	65	111	70%			Tunstall	86	127	47%			
Harmful self-harms	Elm	7	4			Harmful self-harms	Elm	7	5				
	Tunstall	2	6				Tunstall	2	6				

*Confounder interviews highlighted differences in building infrastructure between Elm and Tunstall, with Tunstall having a more "ligature-safe" hospital building this could be a potential factor that contributed to the higher number of ligature incidents on Elm than Tunstall in the baseline and post-go live periods.

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Cedar reduced self-harms and harmful self-harm but assaults slightly increased

Cedar, mixed picu
Self-harms & Assaults

- Self-harm incidents on Cedar **decreased vs. the baseline by 25%** in the bedrooms.
- Harmful self-harms in bedrooms decreased (2 to 1).
- **Assaults increased 17% and 10%** vs. the baseline in the bedroom and on the ward, respectively. There were no assaults of moderate, severe, or major severity.
- There was an **increasing proportion of female patients** on Cedar **making self-harm and assault risks higher** post go-live. This is highly likely to have **underestimated the results** laid out below. On Cedar, the proportion of female patients increased (from 4:6 to 1:9 male to female ratio).

Bedroom and ward self-harms, annualised

	Baseline	Post go-live	Change (%)
In the bedroom			
Bedroom self-harms	264	198	-25%
Harmful self-harms	2	1	
On the ward			
Ward self-harms	298	236	-21%
Harmful self-harms	2	4	

9% increase in ligatures

Bedroom and ward assaults, annualised

	Baseline	Post go-live	Change (%)
In the bedroom			
Bedroom assaults	73	85	17%
Harmful assaults	0	0	
On the ward			
Ward assaults	270	297	10%
Harmful assaults	0	0	

Improved physical health monitoring

Staff and Patient Feedback

- **86%** staff reported that the system has made it **easier to monitor the physical health of patients**¹

*"In seclusion, we can **safely monitor our patients' vital signs now that we have the Oxehealth system installed**. Previously we have been **unable to do this as it has been too risky** to enter seclusion which unfortunately meant that we were only able to monitor patients' respiration rates.*

*Now when the patient is in seclusion, **we can monitor their vital signs frequently without putting staff at risk** by entering the seclusion. This **does not replace any engagements** we have with the patients, however it has been useful for us as we can monitor their **physical health more effectively** when they are nursed in there.*

*The same applies for **patients who have had rapid tranquilisation medication**...often **patients refuse to have their observations taken**, and the Oxehealth system **allows us to take their vital signs such as respiration and pulse rates even when they refuse**."*

[I/S] Ward Manager

Impact on Clinical Practice:

Impact on patient experience, risk management
& restrictive practices and care quality

Improved patient experience

- 92% patients felt staff **care for them better**¹
- 89% patients felt that the system **improved their wellbeing**²
- 100% patients felt **reduced disturbance at night time**³
- 80% patients felt the system **helps them get better sleep**⁴
- 83% and 90% patients felt that the system gave them a **greater sense of privacy and dignity**^{5,6}
- 88% patients reported feeling like the system has **improved their relationship with staff**⁷

*"We had one patient who had suicidal tendencies. He had a self-harm incident which resulted in us needing to check on him every 15 minutes. The Oxehealth system helped a lot here, where **instead of going to check on him myself and risk agitating him more, we ended up stepping down his observations and checking on him through the Oxehealth system to make sure he was safe. It definitely helped him calm down faster and even improved my relationship with the patient.**"*

[U/S] Student Nurse

*"With the Oxehealth system, **noise levels at night on the ward have generally improved** and there's less of a need for bedroom sensors. At night, the **system helps staff to be able to check patients are safe without disturbing them** if they are sleeping. It's very useful to monitor sleep and activity during the night while patients rest."*

[U/S] Staff Nurse

¹N=12, ²N=9, ³N=12, ⁴N=10, ⁵N=12, ⁶N=10, ⁷N=8.

Positive impact on risk management and restrictive practice levels

- 90% staff reported that the system enables them to better manage patient risk¹

Staff can better manage patient risk by having full ward awareness:

Patients have a greater sense of agency through less restrictive care:

"When we have had a particularly aggressive or violent patient, the system has been able to tell us where they are. We have been using this to avoid situations of assault or aggressive behaviour.

So if I see that a patient I'm concerned about has left their room to go to the communal area, and they have previously been violent or aggressive, then I can make sure that either I or another staff member can go into the communal area to make sure that all other patients and the patient in question are safe."

[I/S]

Healthcare Assistant and Activity Coordinator

"The system has given patients a certain level of autonomy. Since we're not necessarily checking the rooms all of the time patients don't feel as disturbed, so if they are resting, they're getting a better rest than they would if we were checking on the room every half hour and it gives them more autonomy to come and ask for help when they need it.

We're always present in the communal areas and we're always checking on patients in their bedroom regularly using the system. But because we're not necessarily having to go to the door all the time, they don't feel as restricted or almost babysat and start to feel a bit more independent."

[I/S]

Clinical Lead

¹N=29

Improved care quality

Staff and Patient Feedback

- 79% staff reported that the system enables them to **provide better care** for patients¹
- 72% staff reported that the system provides them with **more information to help make better care or clinical decisions**²

Staff make more informed clinical and care decisions:

"One feature we have found useful is **viewing the activity reports to gain insight into patients' sleeping patterns**. The system can be used to **monitor our patients' sleep/wake cycle** when they are in bed. This is particularly helpful for patients who may be presenting as manic with a poor sleep pattern – we can see whether our **medication regime is working to a therapeutic level**."

[I/S] Ward Manager

Staff feel a greater peace of mind when caring for patients:

*"I had one patient that was on 15-minute observation rounds. I was concerned, and a **bit suspicious and paranoid** myself **about keeping her safe** since I didn't have eyes on the room. For my peace of mind, I checked on her more frequently. **She ended up irritated with me and it damaged the staff-patient relationship**.*

*We now use the Oxehealth system to **check on them more frequently** between observations. Using this system allows the **patient to feel a little bit more independent** but **we've got the confidence and peace of mind** of knowing that they're safe."*

[I/S] Clinical Lead

¹N=29, ²N=29

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Appendix

How do clinicians utilise Oxevision to prevent incidents and incident related harm? (1/2)

Self-Harm

- Intervening when patients are spending extended periods of time in the bathroom or at the bedroom door, where the risk of self-harm is higher - signalled by In Bathroom and At Door alerts, respectively
- Performing a visual safety check (whilst taking vital sign observations) and acting in response to any self-harm risks or warning signs
- Having additional insights on patient location to improve awareness of which patients are in their bedrooms and might therefore be in need of additional therapeutic support
- Responding to Room Entry alerts when multiple people might be in a patient's bedroom, which can indicate several risks related to self-harm
- Taking a positive risk by stepping down observations, using the system as an assistive tool - supporting patients to learn new coping skills and to break maladaptive cycles of behaviour that can lead to self-harm

Assaults

- Proactively intervening (in response to a Room Entry warning) when multiple people may be in a patient's bedroom, which can indicate several risks related to assaults
- Attending to patients who have left their room - signalled by an Out of Room alert - and might be in need of support, thereby better managing risks in communal areas
- Enabling patients to de-escalate in their bedrooms by monitoring them in a less intrusive way than with traditional observation techniques (i.e., taking contact-free vital signs measurements and doing visual safety checks instead of arm's length one-to-ones). This gives patients time to calm and reduces the risk of re-escalation
- Gaining patient location insights to help staff plan a safe de-escalation intervention before entering a patient's room

How do clinicians utilise Oxevision to prevent incidents and incident related harm? (2/2)

Falls

- Proactively intervening if a frail patient is getting out of bed or has got out of bed unaccompanied - signalled by an Edge of Bed, Out of Bed or Out of Room alert
- Responding to patients who are at risk of falling and have remained in their en-suite bathroom for a prolonged period of time - indicated by an In Bathroom alert
- Taking remote observations at night with the Vital Signs module - reducing patient disturbance and the likelihood that they will wake up and become disoriented
- Accessing contextual video information (anonymised, blurred footage) via the Replay Alert functionality following an Edge of Bed or Out Of Bed alert, or by requesting a report from Oxehealth to understand how a patient fell. This provides insights into how to prevent future falls and helps identify environmental risks that should be removed
- Reviewing historical information on patient activity in Activity Reports (e.g. time in bed and frequency of bathroom visits) to individualise care plans and adapt decisions to reduce the risk of falls

Operational Value:

Impact on observation hours and Bank & Agency
spend

Early signs the system is delivering operational value

Staff and Patient Feedback

- 76% staff reported that **observation levels for some patients can be lowered** because patient risk can be better managed¹
- 63% staff reported that their **observation rounds are faster** when they use the system to confirm patient safety at night²

*"At times, the Oxehealth system **stops us from increasing observation levels.***

*For example, there was a lady who had a lot of **aggression** and instead of going into her room and **agitating her** we opted for **stepping down her observation levels** and checked on her with Oxehealth until she would calm down."*

[I/S] Staff Nurse

*"The Oxehealth system has helped **save time in the sense that it is easier to check patients that need that a bit more attention** in between checks. We are able to focus on the room and see what they are doing and to **make sure that they are safe.** We are still taking observations from the care round every hour but I can use Oxehealth in between checks to know that the patients are safe."*

[I/S] Healthcare Assistant

This project was not expected to deliver a reduction in enhanced observations and the data quality is poor

- The system can help staff to better manage patient risk while enabling less restrictive practices, which can lead to stepping down 1 to 1 observations earlier or completely.
- However, Standard Operating Procedures (SOPs) related to enhanced observations were **explicitly not modified** and staff were **trained to not consider the system as a tool in relation to support stepping down** 1 to 1 observations.
- Data was received for enhanced observation hours (translated into spend) and for bank/agency spend.
- It is unlikely that this data can be used to assess value for money due to several reasons:
 - Data for Rowan Lea was unusable as a result of poor data quality
 - Cedar's patient demographic became significantly more skewed to female patients (from 4:6 to 1:9 male to female ratio) from January 2021 (post go-live), which is likely to have increased enhanced observations due to a higher risk of incidents
 - The approach to inputting request reasons in bank and agency spend changed during the COVID-19 pandemic; the data shows a significant reduction in spend for enhanced observations but may be the result of a shift in "request reason" to COVID-19
- The results show that enhanced observations have **reduced for Elm, increased for Cedar, and could not be analysed for Rowan Lea¹**, while bank and agency spend related to enhanced observation has **significantly reduced in all wards**.

1. 33% entries of enhanced observation hours in Rowan Lea's raw data had no end date.

For Discussion: observational hours vs. B&A spend

Enhanced observation hours, annualised

Ward	Baseline	Post go-live	Change (%)	Change (£)	Relative change (%)	Relative change (£)
Elm	11,527	10,108	-12%	-£15,917	-1%	-£848
Tunstall	15,329	13,542	-12%	-£20,039		
Rowan Lea	Unusable due to data limitations				N/A	
Cedar	21,031	27,233	29%	£69,556	N/A	

Bank and agency spend related to increased observations, annualised

Ward	Baseline (£)	Post go-live(£)	Change(£)	Change (%)	Relative change (£)	Relative change (%)
Elm	154,120	41,874	-112,246	-73%	-66,439	-61%
Tunstall	206,495	145,122	-61,373	-30%		
Rowan Lea	38,096	9,484	-28,612	-75%	-1,331	-12%
Westerdale Avg	264,229	75,009	-189,220	-72%		
Cedar	317,118	36,405	-280,713	-89%	N/A	N/A

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Staff coding issue and how things change over the COVID period
Add other B&A requests to triangulate data
Add table in appendix

Older adult confounders

Rowan Lea, mixed older adults
Confounders

Rowan Lea

- **Staffing challenges due to COVID-19:** Use of temporary staff increased to support COVID-19 isolations requirements on the ward.
- **Patient isolation requirements due to COVID-19 and impact on bedroom falls:** Became a COVID-19 admissions ward during pandemic where patients had to isolate for 24hr on entry. This is highly likely to impact the bedroom fall results in Rowan Lea, especially as patients tend to fall more in the first 24-72 hours of admission.

Westerdale

- **Staffing challenges due to COVID-19:** Use of temporary staff increased to cover staffing shortfalls caused by the pandemic.
- **Increased staffing establishment:** Staffing establishment review on Westerdale North completed in October 21 increased number of staff on each shift by 1. This was implemented after the evaluation period and therefore will not affect the results.
- **Patient demographics:** Patient with Parkinson's diagnosis was considered to be a frequent faller. This patient was considered not to be outlier and the analysis showed that the person fell 9 times which did not skew results.

patients tend to fall in the first 72 hours of admission and they were isolating the first 24 hours so confounder for bedroom falls.

Female acute confounders

Elm, female acute
Confounders

Elm

- **Staffing challenges due to COVID-19:** Use of temporary staff increased to cover staffing shortfalls caused by the pandemic.
- **Enhanced observations:** Patients on this ward therapeutically benefit from positive-risk taking which has led staff to care for patients in the least restrictive way possible, using observations only when necessary and instead opting for engagement levels.

Tunstall

- **Staffing impact due to COVID-19:** Throughout the pandemic, Tunstall supported two COVID admission wards where they would move patients to if they needed isolation. Tunstall supported these wards by providing staff from their staffing establishment and therefore increased staffing requests.
- **Enhanced observations:** Higher proportion of patients on 1 to 1 observations (3 patients on 1 to 1 for the last 12 months) compared to Elm which may have impacted incident levels.
- **Environmental differences:** There were differences in building infrastructure (e.g. shower curtains, plants, shower vents, windows) between Elm and Tunstall, with Tunstall having a more “ligature-safe” hospital building. This could potentially contribute to the difference in number of self-harms, particularly ligatures, between wards.

PICU confounders

Cedar, mixed PICU
Confounders

Cedar

- **Staffing challenges due to COVID-19:** Use of temporary staff increased to cover staffing shortfalls caused by the pandemic.
- **Increased self-harm risk:** Higher proportion of young female patients (from 4:6 to 1:9 male to female ratio) from January 2021. This increased the self-harm risk, and therefore the use of enhanced observations to better manage risk. This **potentially impacted the number of 1 to 1 observation hours and the number of incidents** in Cedar across the evaluation period.

Cedar and Bedale self-harm incidents

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Bedroom self-harms	Cedar	264	198	-25%	191%
	Bedale	152	39	-74%	
Harmful self-harms	Cedar	2	1	-37%	N/A
	Bedale	14	0	-100%	

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Ward self-harms	Cedar	298	236	-21%	138%
	Bedale	248	82	-67%	
Harmful self-harms	Cedar	2	4	89%	N/A
	Bedale	24	0	-100%	

Cedar and Bedale assault incidents

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Bedroom assaults	Cedar	73	85	17%	187%
	Bedale	83	34	-59%	
Harmful assaults	Cedar	0	0	0%	N/A
	Bedale	2	0	-100%	

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Ward assaults	Cedar	270	297	10%	35%
	Bedale	277	226	-18%	
Harmful assaults	Cedar	0	0	0%	N/A
	Bedale	4	1	-63%	

Elm increased assaults relative to the control but decreased assaults when compared to its baseline

Elm, female acute
Assaults

- Assaults on Elm had a relative increase of 143% when compared to the control ward but decreased by 19% vs. the baseline on the ward.
- There were no harmful assaults during the evaluation period.
- Elm and Tunstall have differences in their approach to patient risk management, for example Tunstall has a higher proportion of patients on 1 to 1 observations, which could impact the number of assaults between wards.

Bedroom assault incidents, annualised

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Bedroom assaults	Elm	22	23	3%	73%
	Tunstall	8	5	-40%	
Harmful assaults	Elm	0	0	N/A	N/A
	Tunstall	0	0	N/A	

Ward assault incidents, annualised

	Ward	Baseline	Post go-live	Change (%)	Relative change (%)
Ward assaults	Elm	143	115	-19%	143%
	Tunstall	41	14	-67%	
Harmful assaults	Elm	0	0	N/A	N/A
	Tunstall	0	0	N/A	

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Confounder analysis with ward managers on both wards has found that there may be a difference in reporting that could have led to the difference in sample size in incidents of self-harm and assaults.

Bank and agency spend related to 1 to 1 observations

Bank & Agency 1 to 1 spend (Annualised)						
Ward	Baseline (£)	Post go-live(£)	Change(£)	Change (%)	Relative change (£)	Relative change (%)
Elm	154,120	41,874	-112,246	-73%	-£66,439	-61%
Tunstall	206,495	145,122	-61,373	-30%		
Cedar	317,118	36,405	-280,713	-89%	-£89,503	-71%
Bedale	345,205	137,060	-208,145	-60%		
Rowan Lea	38,096	9,484	-28,612	-75%	-£1,331	-12%
Westerdale Avg	264,229	75,009	-189,220	-72%		

Bank and agency total spend

Bank & Agency total spend (Annualised)						
Ward	Baseline (£)	Post go-live (£)	Change (£)	Change (%)	Relative change (£)	Relative change (%)
Elm	607,624	521,256	-86,369	-14%	-£316,290	-38%
Tunstall	453,311	624,842	171,530	38%		
Cedar	842,885	937,095	94,211	11%	£71,649	8%
Bedale	869,115	892,378	232,64	3%		
Rowan Lea	514,632	571,657	570,25	11%	£41,694	8%
Westerdale Avg	600,302	618,185	17,883	3%		

Methodology details

Completed analysis: A before and after study was completed for Elm, Cedar, and Rowan Lea. Tunstall and Bedale were used as control wards for Elm and Cedar, respectively. A mean average of data from Westerdale South and Westerdale North was used as a control ward, Westerdale (Avg.) for Rowan Lea.

The number and severity of self-harm, assaults and falls, bank and agency spend related to 1:1 observations data, and enhanced observation hours was compared before (baseline period) and after go-live (post go-live period) to calculate the impact of the Oxehealth system and compared to a control ward.

- **Incidents:** Records of incidents were collected from the Trust's Datix system for analysis. Many different fields and factors were used to analyse all the incident category types, specifically focusing around assaults, self harms, and falls.
- **Bank and agency:** Spend on bank and agency staff was collected by requesting hours and cost for each instance of bank and agency use. Request reason for additional staff was analysed with 1:1 observation spend being used to measure the impact of the system.
- **Enhanced observation hours:** Records of patient observation levels were analysed to total the amount of staffing hours used to monitor patients in a 1 to 1, or more than 1 to 1, setting.

Data normalisation and extrapolation: A weighting is applied to normalize the data using Occupied Bed Days (OBDs) to account for variation in occupancy and ward size (i.e. number of bedrooms), and then annualized to determine the impact per year.

Outliers treatment: Outliers are data points that differ significantly from other data points and unexpected (i.e. it would not be expected to occur). Therefore, outliers can skew the results of an analysis and make the results less representative of the realistic impact of the system.

Outliers were considered for self-harm, assault, and fall incidents separately. Patients were considered as outliers if they had:

- More than 30 self-harms and an incident rate of 0.5 per day or higher
- More than 20 assaults and an incident rate of 0.5 per day or higher
- More than 15 falls and an incident rate of 0.25 per day or higher

9 outliers were identified in total and removed from the analysis. This was 0.82% of total patients throughout the evaluation time period. The breakdown of outliers was:

- 6 outliers for the analysis of self-harms.
- 3 assaults for the analysis of assault incidents.
- 0 falls for the analysis of assault incidents.

Control ward suitability

Control wards were assessed on their suitability to evaluate active wards on the following criteria:

- Ward pathway
- Ward size
- Patient gender
- Ward and room design
- Patient length of stay
- The number of baseline incidents
- The baseline Bank and agency spend related to 1 to 1 observations
- Confounders

Tunstall was used as a control ward for Elm.

Cedar did not have a suitable control ward to compare results against due to differences in patient demographics between Cedar and its proposed control ward, Bedale.

Rowan Lea did not have a single suitable control ward to compare results against due to the ward receiving a mix of patients with functional or organic mental health conditions. A mean average of Westerdale North, a functional unit, and Westerdale South, an organic unit, was taken instead and merged into a single ward, Westerdale (Avg).

Control ward suitability

Ward factors												
Ward	Cedar	Bedale	Elm	Tunstall	Rowan Lea	Westerdale Avg.	Westerdale North	Westerdale South	Bransdale	Moor Croft	Overdale	Wold View
Pathway	PICU	PICU	Acute	Acute	Older Adult		Older Adult	Older Adult	Acute	Older Adult	Acute	Older Adult
Gender	Mixed	Mixed	Female	Female	Mixed	Mixed	Mixed	Mixed				
Ward Size	10	10	18	20	20	17	20	14	16	18	14	18
Ensuite	True	True	True	True	True	True	True	True	True	True	True	True
Baseline figures												
Ward self-harms	298.2	247.9	285.6	86.3	9.3	10	16.8	2.8	80	3.3	73.5	13
Ward assaults	270.3	276.8	142.8	40.9	172.5	207	32.2	382.6	24.2	34.1	43.1	599.1
Ward falls	N/A				110.3	182	136.3	227.9	6	35.2	9.3	199.2
Bedroom falls					60.6	115	101.1	129.4	1.5	26.4	3.4	113.3
Baseline bank & agency spend for increased obs	£317,118	£345,205	£154,120	£206,495	£38,096	£264,229	£118,778	£409,681	£87,626	£26,261	£24,218	£298,704
Confounders impact	Significant differences in patient cohort and therefore risks on the ward		None		None				Did not evaluate			
Overall control ward suitability												

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