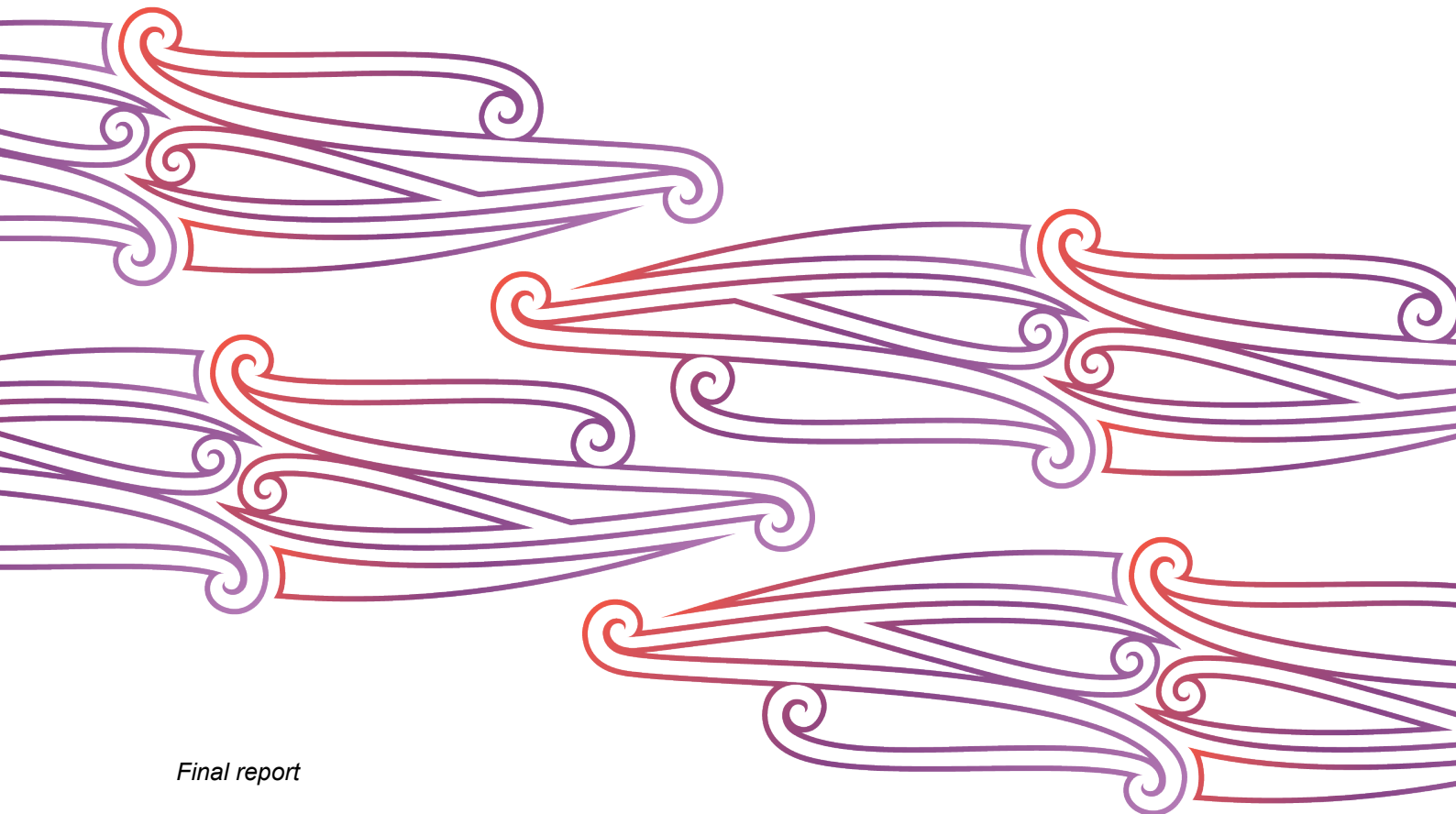


HEALTH QUALITY & SAFETY
COMMISSION NEW ZEALAND
Kupu Taurangi Hauora o Aotearoa

Evaluation report
**Test of the national paediatric early warning system
implementation**

August 2022



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Acknowledgements

The Commission gratefully acknowledges the significant work of and valuable feedback from the project teams and other staff at the hospitals involved in the testing.

List of abbreviations

ADHB	Auckland District Health Board
BOP	Bay of Plenty
CDHB	Canterbury District Health Board
CUSUM	Cumulative sum
DHB	District health board
HQSC	Health Quality & Safety Commission
ISBAR	Introduction, Situation, Background, Assessment, Recommendation (a clinical handover framework)
IT	Information technology
NICU	Neonatal intensive care unit
NMH	Nelson Marlborough Health
PAR	Patient at risk
PEWS	Paediatric early warning system
PEW score	Paediatric early warning score
PVS	Paediatric vital signs
PVSC	Paediatric vital signs chart
QR	Quick response (scannable bar code that stores data)
RN	Registered nurse
SCBU	Special care baby unit
SPC	Statistical process control

Report summary

This report presents key findings from the evaluation of the national paediatric early warning system (PEWS) implementation test in five hospitals across three district health boards¹ (DHBs).

Background

The Health Quality & Safety Commission (the Commission) and the Paediatric Society of New Zealand | Te Kāhui Mātai Arotamariki o Aotearoa developed four nationally consistent, paediatric vital signs charts (PVSCs) during 2020/21 as part of a PEWS. This system is made up of clinical, measurement, education and governance components.

The evaluation

Between August 2021 and June 2022, the Commission worked with Starship Children's Health at Auckland DHB, Bay of Plenty DHB and Nelson Marlborough Health to test the components of the system. The formative evaluation aimed to understand whether a national system meets the needs of deteriorating tamariki, is fit for purpose and operates effectively in a selection of settings.

The evaluation drew on qualitative data collected throughout the testing period, a survey of the test site project teams, PVSC audit data and an analysis of the impact of shifting to a national paediatric early warning score (PEW score) using historical observations from Canterbury DHB.

Findings and conclusion

Overall, the test sites found the national system fit for purpose in that it supported recognising deterioration and guiding appropriate escalation. All sites supported having a national system that used four age-banded PVSCs, with minor changes made to several parameters on the PVSCs to improve clarity.

Overall, sites considered that a national PEWS offers opportunities for reducing inequity. It was suggested that when fully implemented, the system should promote more equitable outcomes for tamariki in hospital because their care is tailored in response to their individual clinical need. PEWS would also contribute to reducing inequities because it acknowledged whānau concern as a priority. However, given the short period of time, we cannot yet draw conclusions about the contribution of PEWS to more equitable outcomes for tamariki. The PEWS worked effectively in the range of hospital settings: rural, secondary and tertiary.

The evaluation data suggest that staff may need support with taking a full set of observations, particularly blood pressure. Analysis of the current state of local PEWS helped build the case for change. Using the whānau/staff concern was challenging for teams and requires an agreed process for using it. This will be changed to be solely about whānau concern. Feedback about the local mandatory escalation pathway and the response to escalation indicates that using the modifications section and having a plan to follow are important aspects of education about the system. Overall, though, the data suggests that the system is becoming established in the test sites, and there are some signs of process improvement.

¹ We have retained the term DHB throughout this report as this applied to these organisations during the testing. From July 2022 these organisations were changed to Districts Te Whatu Ora.

Integrating all the sections of the PVSC into a pre-existing electronic system was time consuming. A business analyst and digital lead need to be involved from the beginning of the project, with input from the vendor.

The analysis of Canterbury DHB data suggests that, while there will be a tendency for patients to score more highly on the national PEW score, it is unlikely to trigger more 8+ or emergency (blue zone) responses. The audit data supports this finding.

Support from the Commission met the expectations of the test sites. However, the package of tools and guidance could be improved by adding detail to the user guide, developing a quick reference guide and having instructions accessible through a quick response (QR) code on the back of the PVSCs. Having earlier support with using the auditing tool would also be useful.

COVID-19 had a significant impact on staffing and consequently the ability of staff to participate in education and complete preparation and implementation activities and audits. Beyond the impact of the pandemic, staff shortages, particularly in nursing, also affected education and the testing timeframes.

Additionally, a realistic assessment of the resource required to implement the PEWS needs to be made explicit to sites before preparation and implementation begins.

It is recommended that the system be implemented nationally after some changes have been made to the PVSCs and with further development of education and guidance materials.

1 Introduction

1.1 Purpose of this report

This report presents key findings from the evaluation of the national paediatric early warning system (PEWS) implementation test in five hospitals across three district health boards (DHBs).

1.2 Background to the project

The need for the project and aim of PEWS

Published evidence about the degree or extent of failures to recognise or respond to acute deterioration in tamariki² in hospitals in Aotearoa New Zealand or internationally is limited. However, use of paediatric early warning tools and a systematic approach to escalation and response to tamariki at risk of deterioration is widely recommended.^{3,4,5}

The aim of the system is to reduce adverse outcomes from failures to recognise and respond to acute physical deterioration of tamariki inpatients.

What the PEWS involves

The Health Quality & Safety Commission (the Commission) and the Paediatric Society of New Zealand | Te Kāhui Mātai Arotamariki o Aotearoa agreed to develop four nationally consistent paediatric vital signs charts (PVSCs) during 2020/21 as part of a paediatric early warning system programme.⁶ These four charts are a key component of a PEWS and contain the paediatric early warning score (PEW score) with localised mandatory escalation pathways (examples are provided in Appendix A). The system is made up of clinical, local measurement and governance components.

Support for development of PEWS from the sector

Key stakeholders showed their support for a national PEWS at a workshop in December 2020. The draft PVSCs were developed with the PEWS working group and incorporated feedback from the sector prior to being tested. These were based on the Starship PVSCs, which were based on international evidence. The components of the charts are core vital signs, additional non-scoring vital signs, PEW scoring (1,2,4, E), mandatory escalation pathway, modifications, national tools to aid observation of pain, respiratory distress, oxygen mode and local tools.

² Tamariki is used as an umbrella term to include pēpē, tamariki and rangatahi.

³ Australian Commission on Safety and Quality in Health Care. 2012. *National Safety and Quality Health Service Standards* (September 2012). Sydney: Australian Commission on Safety and Quality in Health Care.

⁴ National Confidential Enquiry into Patient Outcome and Death. 2011. *Are we there yet? A review of organisational and clinical aspects of children's surgery*. London: National Confidential Enquiry into Patient Outcome and Death.

⁵ Royal College of Paediatrics and Child Health. 2016. *A safe system for recognising and responding to children at risk of deterioration*. London: NHS Improvement.

⁶ Note that neonates who have not yet been discharged from hospital after being born, or who are admitted to a neonatal bed or special care baby unit, should, if the newborn observation chart is available, have their observations plotted on the newborn observation chart as part of the newborn early warning system.

Testing of the system

Between August 2021 and June 2022, the Commission worked with three DHBs to test the components of the system. Testing involved looking at the sites' current state and identifying a consistent approach to the clinical, local measurement, education and governance components of the system. The testing also assessed whether the package of tools and guidance is fit for purpose in identifying deterioration in tamariki admitted to hospital and providing appropriate levels of escalation and response. Each test site went through a preparation period prior to implementation.

2 The national PEWS test sites

This section of the report sets out how the five test sites were selected, which services were involved in the testing and how the testing was rolled out at each site.

2.1 Selecting the sites

The opportunity to test the national PEWS was offered to all DHBs as part of sector feedback on the draft PVSCs. Test sites were identified through an expression of interest and chosen to represent different populations; a rural, tertiary and secondary perspective; and the use of electronic (not paper) PVSCs. Five hospitals across three DHBs were test sites (see Table 1).

Table 1 The PEWS test sites

Test sites	Wards	DHB	Hospital type	Region	Implementation date
Starship	General paediatric ward (25) Haematology and oncology wards (27AB).	Auckland (ADHB)	Tertiary	Northern	22 Nov 2021
Tauranga Hospital	Emergency department Ward 4A	Bay of Plenty (BOP) DHB	Secondary	Midlands	14 Feb 2022
Whakatāne Hospital	Day stay Children's assessment unit		Rural		
Nelson Hospital	All paediatric settings, including the emergency department	Nelson Marlborough Health (NMH)	Secondary	South Island	14 Mar 2022
Wairau Hospital			Rural		

2.2 The paediatric services and testing at each site

Starship Children's Health, ADHB

Starship Children's Health is a major paediatric teaching and research centre in Auckland. It provides a range of complex medical, surgical, cardiac and mental health services for tamariki and young people throughout Aotearoa New Zealand and the South Pacific. Services are provided in inpatient, outpatient, day stay and community settings.

Starship implemented the national PEWS with any child requiring observations in its general paediatric ward (25) and haematology and oncology wards (27A oncology day stay and 27B

inpatient). In the emergency department and the paediatric intensive care unit, the national PVSCs were used for tamariki transferred out to wards 25 and 27AB. Prior to the test, Starship used four age-related PVSCs. Their existing escalation pathway was not mandatory but recommended. Their PEW score was added up using 1,2,4, E. Starship's local PVSCs were used as the basis for the draft national PVSCs. Note that Starship was the only test site that had two different chart systems operating in their hospital (the test chart and the existing chart).

Staffing at the Starship test site is listed below:

- registered nurses (RNs)
- charge nurse/clinical charge nurse
- clinical nurse manager
- patient at risk (PAR) nurse specialists
- nurse educators
- nurse unit managers
- house officers and registrars
- senior medical officers.

Starship implemented the national PEWS for approximately four months, starting in November 2021. They continue to use the PVSCs in the test wards until the national implementation. The aim is to spread the system throughout the rest of Starship later in 2022.

Tauranga and Whakatāne hospitals, BOP DHB

The BOP DHB serves approximately 255,000 residents and includes the population centres of Tauranga, Katikati, Te Puke, Whakatāne, Kawerau and Ōpōtiki. Around one-third of this population is under 25 years of age. About one-quarter of the BOP DHB population identify as having Māori ethnicity, and 18 iwi are located within the district.

In the BOP DHB, the PEWS was tested at Tauranga and Whakatāne hospitals (these hospitals are 92 kms apart by road). Tauranga has a paediatric inpatient ward and paediatric assessment unit and children's day stay, and Whakatāne has a paediatric inpatient unit.

Before the testing, Tauranga and Whakatāne hospitals used four age-related PVSCs based on those used by Starship. Their escalation pathway was not mandatory. These were used in the emergency department, the paediatric ward, the acute care unit and the post anaesthetic care unit.

In Tauranga, the system was tested in the emergency department, ward 4A (paediatric ward), the day stay ward and the children's assessment unit. In Whakatāne, it was tested in the emergency department and the children's ward.

The emergency departments in both hospitals are mixed units, providing care for adult and paediatric patients.

Testing of the system at both hospitals was due to begin in November 2021 but began instead in February 2022 because of staffing and resource constraints. They continue to use the system and will switch to the finalised PVSCs once released.

The staffing of the Bay of Plenty test sites is set out in Table 2:

Table 2 Bay of Plenty test site staffing

Tauranga	Whakatāne
RNs, charge nurse Resident medical officers Senior house officers Senior medical officers	RNs, charge nurse Flow nurses Resident medical officers Senior house officers – in hours Senior medical officers
A nurse educator position shared between Tauranga and Whakatāne was vacant during the test period	

Nelson Marlborough Health

Nelson Marlborough Health (NMH) provides health services in the Nelson, Tasman and Marlborough regions, serving approximately 160,000 people.

In NMH, testing occurred at both Nelson and Wairau hospitals these two hospitals are 118 kms apart by road). Nelson paediatric unit has 14 beds. Patient age ranges from 0 to 15 years. Patient types include acute and elective admissions, surgical (day stay and short and long stay) and medical (assessment and short and long stay).

Wairau paediatric department in Blenheim has eight beds (three neonatal and five paediatric). Age ranges from 0 to 15 years. Patient types include acute and elective admissions, surgical (day stay and short and long stay) and medical.

Nelson and Wairau Hospital paediatric departments are secondary-level paediatric units: patients of high complexity are transported to tertiary services. In both hospitals, the PEWS was tested in all locations providing care for tamariki, including the emergency departments, which are mixed units providing care for adult and paediatric patients.

The electronic observations system

Both Nelson and Wairau paediatric wards use the electronic observations system, Patientrack. Therefore, the decision was made to develop and test with Patientrack. However, clinical notes are still written on paper and scanned into the electronic record. Additionally, the emergency department, intensive care unit and post anaesthetic care unit do not use Patientrack so do not routinely record observations in this system. A paper PVSC was required for these areas, with the final set of observations recorded in the ward Patientrack PVSC before the patient is transferred to the paediatric ward.

Their existing escalation pathway was not mandatory in NMH. Their system used 1, 2, 3 for scoring vital signs, and level of consciousness contributed to the PEW score.

Testing of the system at both Nelson and Wairau hospitals was due to begin in November 2021 but began in March 2022 because of difficulties with incorporating the PVSCs into Patientrack.

Staffing

Staffing at the test sites in NMH is set out in Table 3.

Table 3 Nelson Marlborough Health test site staffing

Nelson	Wairau
RNs, charge nurse, clinical speciality nurse Nurse educator Resident medical officers	RNs, charge nurse Nurse educator Resident medical officer
Senior medical officers Quality improvement team	

2.3 Test site support and commitments

Table 4 lists the resources provided to support the testing and the commitments made by test sites.

Table 4 Test site support and commitments

National PEWS programme team support for sites	Guidance package provided to sites	Site commitments
<ul style="list-style-type: none"> • a one-day planning workshop. This was modified to a six-hour online Zoom session because of COVID-19 restrictions. • an initial site visit from programme team members, along with the offer of more visits as required. These were planned as in-person visits but were modified to Zoom meetings because of COVID-19. • a guidance package to support project teams • education on how to use the tools and guidance (if needed) • recorded session on engaging stakeholders for teams to work through • fortnightly Zoom meetings • support by telephone, email and text messaging as required. 	<ul style="list-style-type: none"> • preparation and implementation guide • project charter template • current state assessment tool • PVSCs with PEW score • PVSC user guide • escalation mapping tool to develop a local escalation pathway • PowerPoint presentation for staff education on the PVSC and PEW score • clinical governance recommendations • audit form for monitoring the use of the PVSCs, and an electronic spreadsheet for data entry, analysis and reporting • post-event case review tool to guide exploration of issues related to the PEW score for individual patients • frequently asked questions • fact sheets about specific clinical aspects related to PEWS, eg, sepsis, ISBAR. 	<ul style="list-style-type: none"> • designate an executive sponsor • establish a project team with a clinical lead and a project lead • test the tools and guidance documents provided • train clinicians to use the national PVSCs, including vital signs input and modifications • establish an auditing team and train them in audit methodology • collect and report data, including from a pre-test audit • make project staff available for training and attendance at initial planning workshop and Zoom meetings throughout the test period • participate in evaluation activities.

ISBAR = Introduction, Situation, Background, Assessment, Recommendation.

3 Evaluation approach

The goals of testing the PEWS were to ensure that the national approach met the needs of deteriorating tamariki, was fit for purpose and operated effectively in a range of settings. The evaluation took a formative⁷ approach to understand whether the testing met these goals.

The evaluation aimed to understand any:

- clinical utility issues with the PVSC and PEW score
- preparation and implementation issues encountered by test site project teams
- improvements required to the tools, guidance and support provided by the Commission.

It centred on the practical assessment of the PEWS implementation and impact on early recognition and response to deteriorating tamariki. This report contains recommended actions based on this assessment by those testing the PEWS.

The national team planned the evaluation and collected and analysed the data. An independent contractor conducted some of the analysis and wrote the report. Earlier drafts of this report were reviewed by the test sites and the PEWS working group. Feedback from these groups was incorporated into this final report.

3.1 Evaluation questions

The evaluation questions set out below reflect the focus on learning and improvement.

1. Is the system fit for purpose?
 - a. What changes, if any, are needed before the system is scalable?
 - b. What changes occurred at the test sites with the introduction of the system?
 - c. What improvements in recognising and responding to deterioration occurred during the testing timeframe?
2. How can we improve the national support to hospitals implementing improvements to their systems?
 - a. Did the support provided meet the needs and expectations of the test sites?
 - b. Did we deliver the implementation package in the best way that we could and was it usable?
 - c. How can we improve the package of tools and guidance?

The criteria for assessing that the national system is fit for purpose is that it supports recognising deterioration and guiding appropriate escalation and response.

⁷ The purpose of a formative evaluation is to help form or shape an intervention. When used as the intervention evolves, it can provide information about revision and modification of the work. It includes both qualitative and quantitative data. (The Health Foundation. 2015. *Evaluation: what to consider. Commonly asked questions about how to approach evaluation of quality improvement in health care*. URL: <https://www.health.org.uk/publications/evaluation-what-to-consider>.)

4 Data collection and analysis

This section of the report sets out the types of data and analysis used in the evaluation.

4.1 Qualitative data

The evaluation drew on document review, including notes collected throughout the testing period from meetings, phone calls, interviews, focus groups and an online survey. Table 5 summarises the qualitative data used in the evaluation. All of the qualitative data was entered into a spreadsheet to enable key word searching and analysis of the data across topics.

Table 5 Qualitative data collection

Qualitative data types	Sites
Project charters	BOP DHB Starship
Current state assessments	BOP DHB NMH
Focus groups and interviews	Starship hospital Tauranga hospital Whakatāne hospital Nelson hospital Wairau hospital
Online survey of staff who could not attend focus groups or interviews (free-text fields)	Nelson hospital
Collated feedback during testing	Starship wards 25 and 27AB
Notes from meetings during the testing	Starship hospital Tauranga hospital Whakatāne hospital Nelson hospital Wairau hospital
Project report	NMH
Small-scale tests of the updated PVSC for tamariki aged 0–11 months	Starship hospital Whakatāne hospital

4.2 Survey of test site project teams

The evaluation also draws on the responses from an online survey sent to the test site project teams. This contained five free-text response questions and two Likert scale⁸ response questions.

4.3 Quantitative data

Quantitative data used in the evaluation came from:

⁸ A common approach to scaling responses in survey research, where respondents grade their answer on a scale.

- an analysis of the impact of shifting to national PEW scores using historical observations from Canterbury DHB (CDHB) (this analysis is primarily relevant to DHBs that use PVSCs that are the same as or similar to those used by CDHB)
- audits of the national PVSCs (see Table 6) and a summary of the NMH weekly Patienttrack reports.

Table 6 Audit data available from the implementation period

Site	Audit period	Records excluded	Weeks of data used in the evaluation
Starship	22 November 2021 to 14 February 2022	0	12
Tauranga Hospital	14 February to 23 May 2022	0	14
Whakatāne Hospital	14 February to 6 June 2022	1	16
Nelson and Wairau Hospitals	14 March to 31 May 2022	0	11

5 Equity considerations

The sites were encouraged to have consumer, Māori and Pacific peoples advisors as members of their project teams. Starship had their Māori and Pacific peoples care navigators as team members. All sites struggled with having consumers as team members because of the COVID-19 lockdowns and restrictions. Several project team respondents to the survey suggested that the Commission provide further education on facilitating the involvement of Māori and Pacific people within the project team.

Overall sites considered – in general terms – that a national PEWS offers opportunities for reducing inequity. It was suggested that, when fully implemented, the system should promote more equitable outcomes for tamariki in hospital because their care is tailored in response to their individual clinical need. Additionally, a consistent system would facilitate identifying inequities.

[PEWS] will help because you are responding to a PEW number, not dismissing certain cultures because you think that parents in that particular culture panic. [Focus group, BOP DHB]

A national system should provide some consistency. Research in the future using this could maybe help identify inequities. [Focus group, Starship]

PEWS would also contribute to reducing inequities because it acknowledges whānau concern as a priority.

This evaluation could not consider outcome measures because of the short period of time since implementation and the limited amount of data available. Therefore, we cannot yet draw conclusions about the contribution of PEWS to more equitable outcomes for tamariki.

Testing of the PEWS considered whether there were any geographical challenges related to the size and staffing of the hospitals. The selection of the sites meant that two rural, two secondary and one tertiary hospital were represented. The project teams developed localised escalation pathways to ensure that these worked for the hospitals and incorporated how escalation to higher levels of care would be done if needed. For the BOP DHB, the same escalation pathway was used for their rural and secondary hospitals; however,

different escalation pathways were used for the NMH rural and secondary hospitals. The PEWS worked effectively in the range of hospital settings.

Recommended actions

- Explore further how PEWS can incorporate equity considerations.
- Work through the Te Ao Māori Framework as the national implementation approach is developed.
- Strengthen the guidance for project teams on involving consumers, Māori, and Pacific peoples advisors within the project teams.

6 Qualitative findings

This section provides an overview of key themes and feedback relating to the overall PEWS, PVSCs, escalation and response. It draws on the qualitative data sources listed in Table 5.

6.1 Overview of the feedback on the system

The feedback on the PVSCs and the system overall included positive and negative comments and suggestions for changes.

Key themes were as follows.

- COVID-19 had a significant impact on staffing and consequently the ability of staff to participate in education and complete preparation and implementation activities and audits. Beyond the impact of the pandemic, staff shortages, particularly in nursing, also affected education and the testing timeframes.
- Analysis of the current state of local PEWS helped build the case for change.
- Staff in the test sites supported having a nationally consistent approach to the system and using the four age-banded PVSCs.
- The PVSCs are valuable in supporting clinical judgement and decision-making, particularly for less experienced clinicians.
- Feedback suggested that reviews of tamariki were being done earlier. Views about the impact of this on workload were mixed, but any increase was considered small.
- Respondents generally considered that each of the age group PVSCs recognised deterioration accurately for that age group.
- Minor changes to the parameters and design of the PVSCs were suggested.
- There was little feedback about the ease of calculating the PEW score; however, education around applying critical thinking to the score was needed.
- Views on the mandatory escalation pathway were mixed. Comments highlighted the need for modifications to be used appropriately and reminders that the pathway is mandatory.
- There are opportunities to better support use of the PEWS through easily accessible information, eg, quick reference guides.

- Integrating all the sections of the PVSC into a pre-existing electronic system was time consuming. A business analyst and digital lead need to be involved from the beginning of the project, with input from the vendor. Further development work is required to include the escalation pathway onto digital platforms.
- Teams found that using the whānau/staff concern box was challenging and required an agreed process for using it. Changes were suggested.

6.2 Impact of COVID-19 and staffing shortages generally

All sites commented on the significant impact of the COVID-19 pandemic on ward staffing and resourcing of clinical staff to complete testing and audits. These impacts included:

- planned surgical admissions were half of normal rates
- staff turnover and redeployment of senior staff to meet acute needs was significant
- project support from non-clinical staff was provided virtually instead of onsite
- PVSCs not going into rooms with patients isolating with COVID-19
- reluctance to put personal protective equipment back on to complete a missing observation
- consumers could not be invited to be project team members.

Beyond the impact of COVID-19, sites commented on staffing shortages generally, particularly in nursing. Non-clinical staff, including nurse educator support, was lacking in some sites, and clinicians had to do the work to implement the system. There were notable benefits in having dedicated hours allocated to senior staff to complete quality improvement assessments and planning and education on the PVCS before and during testing. For example, in the two NMH sites, around 95 percent of staff in paediatric wards received direct-contact education and support around the use of the PVSCs and escalation process changes in the preparation period.

The sites were encouraged to have consumer, Māori and Pacific peoples advisors as members of their project teams. Starship had their Māori and Pacific peoples care navigators as team members. All sites struggled with having consumers as team members because of the COVID-19 lockdowns and restrictions.

6.3 Feedback on the pre-test local PEWS

Before implementing the national PEWS, comments from the project teams suggested their local PEWS were working well. However, the data provided in the sites' current state analysis identified room for improvement. For example, in NMH's audit of inpatients in the paediatric wards of Nelson and Wairau Hospitals in October 2021, 68 percent of the 180 observations were incomplete sets – blood pressure was the missing parameter in all these cases. The current state analysis carried out by the test sites helped build the case for change. During the testing of the national system, project staff reflected on this situation:

Audits of charts show that we are not as good as we thought we were, especially not good at blood pressures.

6.4 The PVSCs

Overall, sites considered that the PVSCs positively changed nursing practice. Feedback suggested that review of tamariki and interventions were taking place earlier, and reporting in clinical progress notes relating to the system improved. The audit of PVSCs, with results

emailed to nurses, also contributed to improved practice. Sites supported using the new PVSCs nationally, with minor alterations and increased education and guidance.

No concerns were expressed regarding having one chart for tamariki aged 0–11 months, unlike the previous two PVSCs (0–3 and 4–11 months) that had been used in NMH. One site suggested the ‘12+ years’ age on the PVSC may need to be clearly defined as 12–16 years. Some uncertainty was also reported around when to use the newborn observation chart and newborn early warning score as against the PVSC for tamariki aged 0–11 months:

This could be unclear for areas with special care baby units rather than neonatal intensive care units.

In relation to the design of the PVSCs generally, people liked having the numbers in the middle of the chart, found the colours were easier to see than on previous PVSCs and liked having the terminology and symbols match the adult vital signs charts. However, space was limited, and some concern was expressed about not documenting the actual value of the vital signs parameter on the PVSCs. Also, the triple folding necessary to fit the PVSCs into folders made it bulky and obscured some information. Feedback on specific signs and parameters on the chart, including design aspects, is discussed below, with recommended actions.

Recommended action

- Add clarification to the user guide and frequently asked questions about when to use the newborn observation chart and newborn early warning score.

The partial observation symbol

On the PVSCs, an asterisk (*) indicates a partial observation. This is intended to be used either when there is intent to take a partial observation (e.g., blood pressure needs to be checked every hour, but not all vital signs) or when the observations are incomplete because they cannot be taken (eg, a child is extremely upset).

Feedback on the use of the asterisk as the partial observation symbol was mixed. Some said they used it regularly and that marking partial PEW scores improved over time. Others said they were unaware of it or wanted guidance on how to use it.

On previous local PVSCs, sites had used a plus symbol (+) to denote a score based on a partial set of observations. Some sites continued to do this during the testing of the national PVSCs, whereas others used the asterisk. In discussion about retaining the asterisk, concern was expressed that it had an intrinsic meaning, usually to indicate additional information in a footnote, which did not apply to the PVSCs. However, a plus sign was appropriate because ‘it’s a score with a plus’, that is, the measured score, and a plus letting you know that it’s a partial and could be higher’.

In the electronic system, integrating an asterisk to indicate partial observation caused some difficulty as there is a distinct difference between how the system displayed ‘partial’ sets and sets where a ‘full set’ had been instigated but one or more parameters were omitted. It was suggested that a partial observation could instead be a different colour in electronic systems. In NMH, the quality lead designed a guide to explain the difference between a partial PEW score and a full set with omissions in Patientrack.

In addition, auditing the frequency of partial completion was noted as an opportunity for quality improvement.

Recommended actions

- Change the partial observation symbol from an asterisk (*) to a plus symbol (+).
- Explain how to use partial observation symbol through a QR code on the back of the chart and in a printed quick reference guide.
- Establish the partial observation process on the paper PVSC and then address the electronic version.

Respiratory rate

Comments on the respiratory rate parameter centred on two concerns. First, in the PVSC for tamariki aged 0–11 months, the upper range (≥ 70) was not high enough to allow a visual trend to be seen. Second, it was noted that respiratory patients can have a high PEW score, which ‘might worry junior nurses more than an experienced nurse’. There were no comments about the respiratory distress parameter.

Changes to the upper range of the respiratory rate and moving to increments of 10 breaths on the PVSC for tamariki aged 0–11 months were undertaken in June. Subsequent tests of these changes found that they were fit for purpose. Staff involved did not feel it would affect their use of the other PVSCs (which have increments of five breaths for respiratory rate). Please note that these were desk reviews and were not tested on the wards.

Recommended action

- Make the upper range of the respiratory rate parameter ≥ 90 for the PVSC for tamariki aged 0–11 months. This requires a change in increment from 5 to 10 breaths per minute for each horizontal line on the chart.

Oxygen

Feedback suggested that more education was needed on how to record varying forms of oxygen therapy.

For example, one site noted there was no variable positive airway pressure respiratory support mode table on the PVSCs, and no ‘pressure’ area next to ‘high flow’. Another commented that ‘blow by oxygen can automatically score the patient a 4’.

Also, the boxes below ‘Room air’ do not add to the PEW score but are for documenting mode and high flow. This could be clarified on the chart (see Figure 1).

Figure 1 The oxygen parameter in the PVSCs

Oxygen (L/min or FiO ₂ %) write value	$\geq 4\text{L or } \geq 35\%$																4
	$< 4\text{L or } < 35\%$																2
	Room air X																0
	Mode High flow																

Recommended actions

- Apply the score of ‘0’ to the ‘Room air’ line only.
- Change ‘high flow’ to ‘high flow rate’.
- Explain the ‘Room air’, ‘Mode’ and ‘High flow’ lines through a QR code on the back of the chart and in a printed quick reference guide. Provide detailed examples in the user guide.

Oxygen saturation

There were a few comments on the changes to oxygen saturation scoring. In previous local PVSCs, scoring started at 92 percent; on national PVSCs, scoring starts at 91 percent. One ward nurse considered it was 'not good' to have a PEW score (of 1) with 91–94 percent oxygen saturation, as 'it exaggerates the PEW score, which sometimes forces a review, which is often unnecessary'. However, the national team note that the oxygen saturation curve is steeper over 91–94 percent than over 95–100 percent. PEWS is a recognition and response system to prompt the nurse to make an escalation for response. If oxygen saturation only triggered at 92 percent, the start of that deterioration could be missed.

Recommended action

- No changes to oxygen saturation scoring.

Heart rate

Comments on the heart rate parameter centred on patients with an eating disorder having low heart rates that did not represent a medical emergency. This situation was commonly given as an example of the need for modifications of the parameter.

Recommended action

- Provide guidance about the use of the modifications section in the user guide, through a QR code on the back of the chart and in a printed quick reference guide.

Capillary refill

Most of the feedback on the capillary refill parameter focused on it being in a new place compared with previous PVSCs. Because of this, it was sometimes missed. However, completion of this parameter improved over the duration of testing.

Another point made was that 'checking central capillary refill means we may miss peripheral shut down when [a patient is] febrile'. Information about the rationale for using central rather than peripheral capillary refill is included in the current user guide.

Recommended actions

- No changes to capillary refill scoring.
- Emphasise the importance of staff having access to the user guide.

Blood pressure

Blood pressure was commented on as the parameter most often not being completed (and this was supported by the audit data). However, this was identified early in current state analysis and in the testing as 'an opportunity for quality improvement', and it improved over the course of the testing ('way more [blood pressures] and if not, giving reasons why not taken').

There were concerns from one site around not being able to plot low diastolic blood pressure for tamariki aged 0–11 months. It was felt that being able to get a visual representation of the trend in blood pressure was important.

Changes to the lower range of the plottable blood pressure were made to the PVSC for tamariki aged 0–11 months in June. Subsequent tests of this change found that they were fit for purpose. Please note that these were desk reviews and not tested on the wards.

Recommended actions

- Expand the lower range of plottable blood pressure to ≤ 19 on the PVSC for tamariki aged 0–11 months.
- Reinforce the importance of blood pressure completion in the education package with references to evidence.

Whānau/staff concern

On the PVSCs, marking the whānau/staff concern box with an X indicates that whānau or staff have concerns about tamariki becoming more unwell. This box is intended to give agency to whānau, who know their tamariki best. Any concerns are then detailed in the clinical record.

Sites gave mixed feedback on the whānau/staff concern box. Several people found it a good addition as it 'identifies to others more concerns... than just the vitals' and improves conversations around whānau concern. One person noted that, while the box was 'excellent', it required the nurse 'to verbalise the concern to the team and also relies on the ability of the RN to advocate for the patient/family/whānau'.

Generally, the feedback showed that people were unclear about how to use the whānau/staff concern box. The box did not differentiate between whānau and staff concern. It was suggested that this issue could be addressed by using a W or an S on the PVSC instead of an X. However, staff can record their concerns and response in the patient notes directly, so this box could be used solely for whānau concern. Audits at one site suggested that this is how the box was being used (ie, staff concern had been mentioned in the progress notes, and escalation indicated concern, but staff concern was not marked in the box).

Some respondents were unsure about whether the box was a prompt to ask whānau or a space to record that whānau raised concerns. Also, the relationship between the whānau concern box and Kōrero mai⁹ was unclear.

Further, it was not clear whether marking the box with an X meant whānau weren't present, were present but hadn't been asked, or whether they had been asked but no concern was expressed. It was widely suggested that a tick instead of an X could be used to indicate whānau had expressed concerns about their tamariki becoming more unwell.

Recommended actions

- Remove 'staff', ie, make this a place for whānau concerns.
- Use Y for concern, N for no concern and A if whānau were not present or not asked.
- Explain how to use the whānau concern box (and how it relates to Kōrero mai) in the user guide, through a QR code on the back of the chart and in a printed quick reference guide.

Level of consciousness

On the PVSCs, an 'unresponsive' level of consciousness is a blue alert (shown in Figure 2). However, one site wanted varying levels to trigger actions or escalation.

⁹ Kōrero mai (Talk to Me) is a process co-designed to enable patients and their whānau get the help they need if they feel concerned about a change in a patient's condition. This has been co-designed and implemented in a few hospitals. For more information, go to this [website](#).

Need to respond to decreased level of consciousness at not responding to pain or decreasing, not just unconscious. [Focus groups, Tauranga]

Figure 2 The level of consciousness parameter in the PVSC

Level Of Consciousness <i>mark LOC with X</i>	Alert																			
	Voice																			
	Pain																			
	Unresponsive																			777

Recommended action

- Add a level of consciousness case example to the education package, related to the ‘always escalate if concerned’ message.

Temperature

On the PVSCs, the temperature is marked with an X, with the actual value (to one decimal point) written in for values outside the plottable range (see Figure 3).

Figure 3 The temperature parameter in the PVSC 0–11 months

Temperature (°C) <i>mark Temp with X</i> <i>write value if off scale</i>	≥ 40																			
	39s																			
	38s																			
	37s																			
	36s																			

Feedback from the sites on the temperature parameter centred on the legibility of the temperature box and whether the temperature range provided was fit for purpose.

Several doctors reported it was difficult to review the temperature as the area was small and hard to read. Having the PVSC marked with an X with the actual value written above or below the X ‘could give a skewed appearance of temperature spikes’. Some respondents thought it was important to have the exact temperature recorded at all times and not just when outside the plottable area of the chart, but it would be more legible ‘if there was consistent practice of writing above the mark’.

The dotted blue line at the midpoint of the 37°s was considered too faint and should be made more obvious. Although one person was ‘not sure that indication of normal temperature [is appropriate for] the tiny wee babies’. It was also noted that a previous PVSC had a solid red line at 38°C, ‘which makes it easier to see if the child is febrile’.

The appropriateness of the temperature parameters was also commented on. Having the range start at 36°C was felt to be ‘not low enough’. This was noted for adolescents with eating disorders. Several respondents considered the range should start at 35°C. Overall, though, it was considered 35.5°C compared with 36°C had little clinical benefit as ≤36°C is low.

Feedback from paediatric oncologists during initial chart development suggested that being able to plot temperature up to ≥41° was helpful in their patient group, which is why the chart extends to that temperature. This was not initially possible on the PVSC for tamariki aged 0–11 months because of space limitations, which was addressed when changes were made to respiratory rate charting.

On the electronic chart, the temperature was not a mandatory parameter. This led to temperature observations being missed.

Recommended actions

- Ensure all PVSCs have a green temperature line at 37°C and have a row for recording temperatures in the 35s.
- Provide clarification in the user guide about marking temperature as accurately as possible, with particular attention to temperatures under 36°C.

Pain score and other ideas for non-scoring vital signs

Views on the location of the pain score were mixed, with most considering it good ('pain score location good to prompt the pain assessment'). One person suggested it should be coupled with the Face, Legs, Activity, Cry, Consolability behavioural pain assessment scale. It was also noted that it 'would be good to have a space elsewhere to document pain score when not doing observations'.

Lack of a blood sugar and a weight parameter was noted by several respondents. Although these are not established vital signs, they could be local tools. Similarly, the suggested pictorial Baxter Retching Faces (BARF) scale could be a local tool.

Recommended action

- No changes to the recording of pain score.

6.5 PEW score

Across sites, respondents generally considered that each of the age group PVSCs recognised deterioration accurately. There was little feedback about the ease of calculating the PEW score: one site noted that audits showed that staff were not always clear about where the change in score occurred for any given parameter.

Overall, the feedback emphasised the need for education and critical thinking about the score. For example, it was possible that a patient with a high score may not require repeated reviews once a response from a clinician included a plan for triggers for further escalation. It was also possible that a patient required escalation despite a low PEW score; for example, someone with sepsis could have a low score. Education should also address critical thinking when there was a sudden or marked change in the PEW score. This is discussed further in section 6.7 on page 23.

Recommended action

- Any implementation should include initial and ongoing education about the utility and limitations of a PEW score, critical thinking and the role of the score as part of a system.

6.6 The modifications section

The modifications section on the front of the chart allows for the PEW score to be changed to prevent inappropriate escalation. This is designed for specific parameters, not the total score. That is, it allows adaptation for the 'normally abnormal'. Each hospital had to decide which clinical roles were able to make modifications and ensure that these staff were aware of what was required. Modifications should be used sparingly.

On the electronic PVSCs, the hospitals' local policy requires a registrar or senior medical officer to physically make a modification rather than approving one over the phone.

Across the test sites, there was feedback that more guidance for doctors and nurses was needed to use the modifications box (eg, when it is appropriate and who is authorised to do

it). One person suggested a flow chart relating to making modifications might be useful. Another noted that it was difficult to identify the amended observations after the modification had been made.

The low heart rate for patients with eating disorders was given as an example of when a modification should be made.

The heart rate for our patients with an eating disorder has been a problem as it triggers an emergency call. Nurses not wanting to do this as they know the patient is fine and low heart rate is normal for them. We did use the modification box sometimes. [Resident medical officers] needed prompting to chart the modification. [Focus group, Starship]

In other feedback, sites reported that the PAR team was also notified of patients with modifications to their PVSC and that, irrespective of any modification, staff still need to escalate any concerns.

Recommended actions

- Provide guidance about the use of the modifications box in the user guide, through a QR code on the back of the chart and in a printed quick reference guide.
- Local education for both nursing and medical staff should include how to use modifications.

6.7 The mandatory escalation pathway section

The PVSCs show a mandatory tiered escalation pathway setting out the actions for increasing PEW scores. The actions are developed locally using the escalation mapping tool to reflect the staff and resources available. Note that this represented a change in clinical practice for sites without an existing mandatory escalation pathway.

During the testing, the escalation pathways for Starship and NMH hospitals were adapted to reflect these sites' learning on how the pathways were being used. For example, one site had changed the response for PEW score 1 to 3. Initially, the mandatory escalation pathway instructed staff to 'Discuss patient status with nurse in charge'. This resulted in too many 'unnecessary calls' and was amended to 'Consider discussing with senior RN on shift'.

The escalation pathway was not visible on the Patienttrack digital platform.¹⁰ Instead, laminated PVSCs and the escalation pathway were displayed around the ward and on the back of all laptops so staff could easily see the actions according to the score. The aim is to have the escalation pathway visible on the electronic PVSCs.

Sites expressed mixed views on the mandatory escalation pathway. Some respondents were in favour because of the contribution to safety: the mandatory pathway 'removes the barrier of deciding whether or not to report to a doctor'.

Mandatory escalation keeps our 'stably unstable' patients safe – often kids with consistently high [PEW score] are taken off PAR as they "have nothing to add/change" – unsafe! [Feedback from Ward 27AB, Starship]

However, there were also concerns that the mandatory escalation pathway would:

¹⁰ Connection with Smartpage (not available at the time of testing PEWS) would provide automatic escalation to the correct team.

- diminish critical thinking and nursing judgement
- create an unfeasible workload ('overnight there aren't enough doctors – they'll basically stop listening')
- result in discussions not being documented.

We are called and told by staff – 'We have to tell you the [PEW score] is >4 but we aren't worried.' The staff explain why, eg, fever and tachy, and they have given pain relief and they don't need a review right now, so then nothing gets documented. [Feedback from Ward 25, Starship]

It was noted that a patient could still score four or above from 'simple things', for example, '2 for being on oxygen and a little bit brady when sleeping'. However, the pathway did not account for nursing assessment and intervention.

A [PEW score] of 4 requires medical review, but within a few minutes of nurse's intervention, ie, position change, [PEW score] = 2 and can be monitored without the need for medical review. [Feedback from Ward 27AB, Starship]

One person suggested that this meant staff would wait to take observations.

You are more likely to wait until you get an observation number in normal range or to ensure your PEW score is less than 3 if your clinical judgment explains the increase, eg, temperature 39.6°C with increased heart rate, respiratory rate and increased blood pressure and you don't believe they need a medical review as they are due Panadol – But this makes an inaccurate [PVSC]. [Feedback from Ward 27AB, Starship]

Additionally, several people considered the mandatory code blue for any vital sign in the blue zone was 'not always necessary', particularly for a low heart rate.

Having eating disorder patients on their first few nights, their heart rate is 30–50 s, normally while asleep, and a code blue isn't necessary. [Feedback from Ward 25, Starship]

Audits also identified a reluctance to place mandatory code blue calls in relation to bradycardia in a patient with an eating disorder. This highlighted the need for modifications to be used appropriately and reminders that the pathway is mandatory.

Recommended action

- No changes to the mandatory escalation pathway section on the PVSC.
- Strengthen guidance about ensuring a wide range of staff are involved in escalation mapping and do small tests of the escalation pathway before using it.

Response to escalation

Feedback from the sites suggested that the mandatory escalation pathway, although generally similar to the previous local PVSCs, was resulting in slightly more calls for review. This tended to mean 'a few patients requiring rapid responses that didn't really need them'. Although there was some concern from ward nurses that escalation may happen unnecessarily ('I'm not ringing a house surgeon every hour'), this was not reflected in feedback from medical officers or paediatricians.

Feedback about the impact of the escalation pathway on workload from 'no change' to 'increased' was mixed. It was also mixed about changes to how people worked. Although it 'made it slightly more complicated with the light increase in escalations', it also 'makes it clearer in terms of the observations needed'. It was noted that, although patients might have a score requiring one-to-one nursing care, that didn't mean this would happen because of staffing shortages.

There was some concern about how well the escalation pathway was being tested given the low numbers of escalated patients during the (non-winter) test period. The extent to which the national PEWS would result in more calls for review is explored in the analysis of CDHB PVSCs on page 33 of this report.

PVSC audits and clinical notes reviews showed there were occasions when it was unclear whether the appropriate escalation had occurred and been responded to. These instances were followed up directly with the teams involved to ensure the mandatory escalation pathway was being followed.

Overall, discussion of the response to escalation emphasised that using the modifications box and having a plan to follow are important aspects of the PEWS.

Recommended actions

- Add clarification to the user guide about the importance of developing and documenting a management plan, which may include expectations about ongoing monitoring, in response to an escalation pathway being triggered.
- Emphasise the importance of locally suitable escalation pathway actions to project teams.

6.8 The back of the PVSCs

The back of the PVSCs is used for national and local tools. In the preparation for testing, all sites were asked to identify the local tools that were important for them. These were then included in the test of the system. On the electronic PVSCs, laminated copies of the assessment tools were placed in notes folders to promote continuity of tool use. During the testing, some sites made changes to tools that were not used.

Feedback from sites about the back of the chart was minimal. In general, having the tools in one place was considered useful ('a consistent reference point') but also 'a lot of information... somewhat overwhelming when information needs to be accessed quickly'. One site suggested swapping the position of the local and national tools on the back of the PVSCs to make local tools more visible (because of the 'Z' fold of the charts).

Intervention documentation

The interventions box appears on the back of the paper PVSCs as part of local tools for three of the sites. These sites had used an intervention box on the front of the PVSCs they used before testing. This meant a change in practice for the nurses at these sites. Feedback from these sites was focused on the lack of space to link the intervention recorded in the box on the back of the chart with the appropriate sign on the front of the chart.

It was suggested that the front of the PVSCs could include an intervention row at the bottom (as in the previously used local PVSCs) or a column for interventions 'to document which intervention the [PEW score relates] to'.

Recommended actions

- Swap sides for national and local tools on the back of the PVSCs and increase the size of the headings.
- No changes to the front of the chart required for interventions, noting that a hospital can develop an alternative method for documenting interventions that meets their needs, for example, clinical record.

6.9 Lessons from implementation

Overview

Strong feedback from all sites noted that preparation and implementation required a significant time commitment. Much of the work was done by team members, particularly nurses, in their own time. Sites were positive about the support from the Commission; however, all sites discussed underestimating what was involved. The impact of COVID-19 made the project considerably more difficult. Having quality improvement staff and a nurse educator greatly supported education and training.

Leadership and governance

Each of the sites had a clinical lead (medical) and clinical lead (nursing) as part of the project team. Feedback from the sites about the impact of leadership and governance during the testing was minimal. Two sites described how the PEWS has been included in wider clinical governance arrangements. At Starship, the system has been made a standing item on the agenda of the child health patient deterioration committee and is discussed in a wider patient deterioration committee. Similarly, the Starship PAR team has a weekly adverse event report, and these events can be escalated to the safety committee.

At NMH, the PEWS is part of a patient deterioration feedback loop. Immediately after a deterioration event, the duty nurse manager (or appropriate clinician) provides online post-event audit information to the clinical nurse managers and heads of departments for review and follow-up. Issues are monitored for themes across the system. Themes, patterns and items of concern are escalated to the Patient Deterioration & Resuscitation Committee or to the Clinical Governance Patient Safety Group according to the level of input required. NMH has a clinical governance strategy in place. As part of this strategy, clinicians are supported to make incremental improvements in their immediate clinical area without 'breaking' other parts of the system. The paediatric clinicians have a solid understanding of quality improvement principles and the need for data and measures to support change.

Recommended actions

- Strengthen guidance about the role clinical leads have with the project, especially on engaging with medical and nursing colleagues and role modelling.
- Strengthen guidance about the role of clinical governance for supporting the project and then having oversight for ongoing sustainability and continuous improvement of the system.

Education

Before testing, sites developed tailored communication and education packages to support the project, such as promotional intranet announcements and information sessions. One-to-one education was provided for paediatric ward nurses, and nurses and medical officers were guided through the PVSCs.

The impact of COVID-19 (on staff sickness, isolation requirements and the physical relocation of clinical services) made it challenging to educate wider teams, such as those in emergency departments and post anaesthetic care units. Having a local PEWS champion was important, but staff resources were needed to meet clinical need, which reduced the amount of education delivered. Having quality improvement staff and a nurse educator greatly supported education programmes.

Received a PowerPoint, but formal education of PEWS didn't really happen; some confusion on who was to deliver it. Would think a 2- to 3-week focus with all 120 nurses/medical staff receiving education would work. [Focus group, Tauranga Hospital]

It was noted that different groups need different education packages, for example, 'doctors needing more emphasis on how to complete modifications and the escalation pathway'. A certain amount of one-on-one teaching was essential, for example, with new staff or to address particular points of misunderstanding. Education needs to be 'short and sweet' and practical.

Feedback from sites stated that it was important to explicitly include doctors, as there were not 'robust lines of education for doctors around PEWS'. One site suggested that this education could be attached to meetings that doctors have to attend anyway, that is, within an organised existing structure. Discussion should be encouraged, particularly if people feel they will be or were called inappropriately.

The next step from our perspective is [that] education should go beyond just [the PEWS]. Reminding people how they communicate, ISBAR format, especially in the middle of the night. [Interview, Wairau Hospital]

As the testing proceeded, sites customised materials to suit staff needs and focused on gaps identified from feedback and audit, for example, making a poster about capillary refill, reiterating why taking blood pressure was important and giving reminders about whānau concern.

Specific aspects of the system that could be better supported with more guidance have been noted earlier in the report. Suggestions for improving the education and training generally included:

- having a quick reference guide for the parameters, eg, covering making modifications, how to chart high flow, how to use staff/whānau concern and explaining which chart to use for older adolescents
- online education with videos
- having a QR code on the PVSCs that links to guidance and examples
- education (across resources) about critical thinking when there is a sudden or marked change in the PEW score total.

Recommended actions

- Update the user guide.
- Develop a quick reference guide and access to supporting material at the point of care.
- Put a QR code on the back of the PVSCs linked to guidance materials.
- Provide case studies about use of the PVSCs, especially for aspects that aren't totally understood (such as partial observations).

- Develop a package for MOH LearnOnline and local learning management systems.

Preparation and change management

Overall, sites emphasised the need for 'a lot of human resource' to make the system change work. Project leads commented on the inadequate resource committed to the testing project and consequent pressure on them, a situation exacerbated by COVID-19 and general staff shortages.

One nurse consultant remarked that the project was not just 'changing out a few charts' but changing the whole system. Extensive one-on-one teaching was required to drive the change and embed it.

There is never much resource committed to these projects. I was allocated 12 hours a week, but I really did 30 hours per week. [Focus group, Starship]

At Starship, staff wanted to maintain audits and keep up the momentum of the project as they felt change was not embedded after the three-month trial; however, the hours allocated for the project lead had ended.

NMH reported that no-one anticipated the time commitment required (for all involved) to implement the PEWS electronically on Patientrack. Having a new clinical digital lead involved in the project and no previous business analyst or information technology (IT) input added to the challenge. NMH recommend involving IT or a business analyst from the start of such a project.

Recommended actions

- From the beginning of the project, be explicit about the expectations of resourcing from sites, including funded resource for a project lead and quality lead within working hours.
- Build in more time for the suggested preparation period and consider how the national team can further support project teams during this period.

Feedback and opportunities to learn

During the testing, sites successfully collected feedback from staff in a number of ways, including feedback boards or boxes, the whiteboard function on Teams and questionnaires. One site noted that getting feedback from nurses from a feedback board did not work but that giving nurses individual questions on a sheet of paper did. There was some sharing of feedback and relationship building between sites. For example, the Whakatāne project lead shared their medical staff feedback around the escalation pathway with the Tauranga project lead, and people from both sites reflected on how 'valuable it was to meet in person'.

The audit tools and process

Audits were considered a useful tool for feedback and learning. Sites found the audit tool and instructions to be largely straightforward and suggested some improvements, such as making sure the logic in the templates matches the audit form and that the functionality of the dashboard is understood from the project outset.

All sites found auditing time consuming. In NMH, the electronic system allowed staff to submit an audit on their phone 'when they could snatch a few minutes between jobs'. There were mixed views on having multiple auditors involved at a site. Having a sole auditor

provided consistency in analysis and feedback, but having several people involved improved the ability to audit at different times and spread the workload.

Feedback from results was shared by auditors in various ways: doing a poster for the wards, giving verbal feedback to individuals or to groups at handover times and sending emails if there was a consistent issue. In the BOP, both Tauranga and Whakatāne were auditing PVSCs from their emergency departments and using the data to support discussions with the emergency departments about the importance of the PEWS. One project lead noted the importance of giving feedback after auditing the PVSCs, but that 'there was no time to do this'.

Need about 2 hours a week for auditing and not when on shift. Need [to be] quiet and uninterrupted. [Focus group, Whakatāne Hospital]

It would be useful for the Commission to further support project teams with ways to use and share the learning from the audits, particularly with doctors.

The audit form, while long, did capture everything needed, and none of the sites suggested removing any part of it. There was some discussion about whether 'patient marked as unresponsive in level of consciousness' could instead be picked up in escalation and response. One site suggested that ethnicity categories could be more detailed (ie, not just at level 1). The comment section on the form was helpful in developing feedback for ward staff.

Project support from the Commission

The project support from the Commission included tools, information and guidance (the support is listed in Table 4 on page 11). Across the sites, people were positive about the support from the Commission. The level of communication was good, fortnightly Zoom catch-ups were appreciated and support was available if needed (and responses were very prompt). The current state analysis and audit tools were considered useful.

That current state analysis tool was really good. Found it helpful. You look and see some good stuff that you are doing but that there are opportunities too. It forces you to analyse. [Focus group, Starship]

As so much of the communication and support is delivered online, Commission staff could have a process to check that sites have received information as DHB IT systems can quarantine emails and attachments.

Additional support suggested by the test sites related to education and training resources (as discussed in the education section above).

Other

Having the five sites launch their testing at different times meant the Commission worked with sites separately more than was envisaged. For example, they did not have all-site Zoom meetings because the work was at different stages. Also, Starship completed the test period but then faced an interim period during which wards used different chart systems until the national implementation.

7 Findings from the survey of test site project teams

An online survey was sent to the test site project teams. The survey questions (five free-text responses and two Likert scale responses) focused on what worked well and opportunities for improvement. The overall response rate was 49% (see Table 7).

Table 7 Number of responses to survey of project teams

Sites	Project team members (n)	Responses received (n)
Starship	11	3
Tauranga and Whakatāne hospitals	16	9
Nelson and Wairau hospitals	14	8
Total	41	20

The roles of the 20 respondents are shown in Table 8.

Table 8 Roles of the survey respondents

Role	Number
Team member	9
Project lead/manager	5
Clinical lead	2
Clinical nurse manager	1
Sponsor	1
Auditing/testing team member	1
Business analyst	1
Total	20

Quality improvement knowledge

As shown in Table 9, almost all respondents (16/20) considered that being involved in the project had increased their knowledge of at least one element of quality improvement science.

Table 9 Knowledge of quality improvement science that increased during the PEWS test

Elements of quality improvement science	Number
Importance of clinical leadership and governance to support testing and implementing improvements	16
Defining roles and responsibilities of the project team	15
Using measurement to support testing and implementation, eg, audits	14
Importance of educating staff as part of testing and implementing interventions	14
Having different data sources to understand the current state/system, eg, audits, experiences, complaints and compliments, adverse events, process mapping, etc	13
Considering how the improvements will be sustained beyond the project	13
Understanding consumer and staff experiences of the current state/system	12
Testing change ideas/interventions, eg, desk reviews of escalation pathways	12
Identifying process, outcome and balance measures to know whether a change is an improvement	12

Elements of quality improvement science	Number
Engaging with key stakeholders throughout the project	12
Forming a project team	11
Identifying change ideas to test and implement	11
Developing change ideas into interventions	11
Developing an aim statement to guide the project	10
Implementing interventions	10
Getting a shared theory of change to guide the project; this can be described in a driver diagram	9
Using a project charter/plan to guide the project	9
Involving consumers in the project team	6
Involving Māori and Pacific peoples within the project team	5
Using small tests of change (plan-do-study-act cycles) to test interventions	5
None of the above	3
Other	3

Several respondents suggested elements of quality improvement that they felt the Commission could provide more education on:

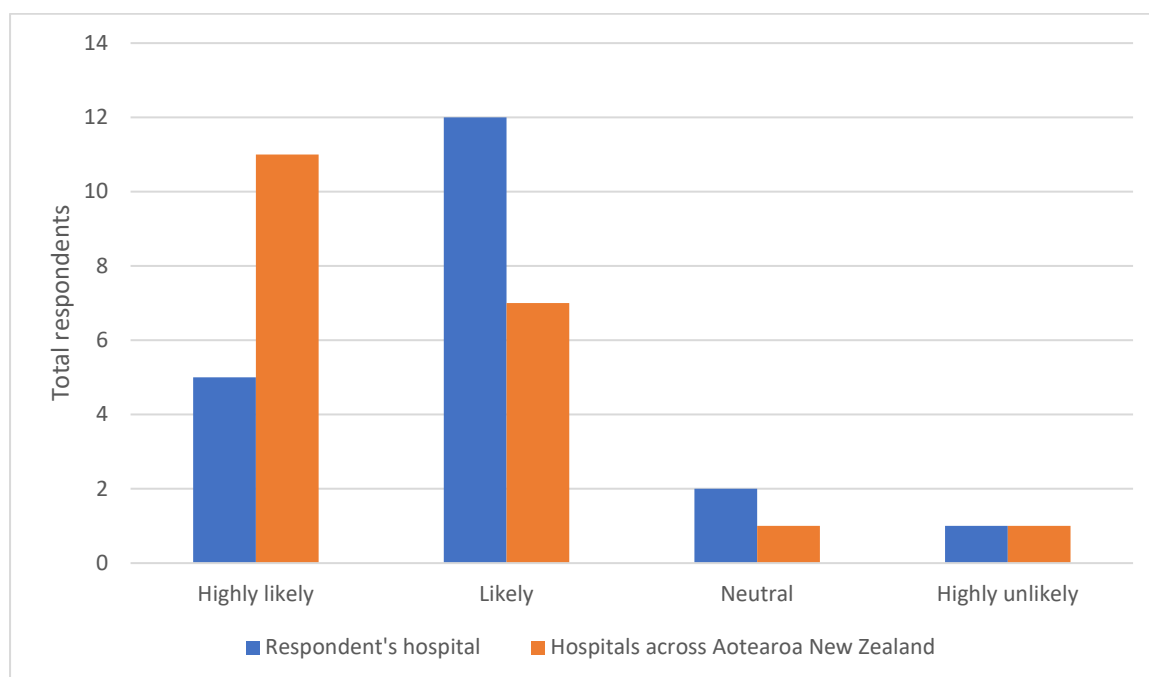
- the auditing process ('none of us were very familiar with spreadsheets')
- facilitating the involvement of Māori and Pacific peoples within the project team
- knowing who to expect to be key stakeholders and how to access clinical governance groups.

One respondent commented that the project was 'much more work than anticipated'.

Likelihood that the national PEWS will lead to improvement in the care of deteriorating tamariki

Twelve respondents in their hospital considered that the national PEWS is likely to lead to an improvement in the care of deteriorating tamariki (see Figure 4). Notably, more thought it 'highly likely' that the system would lead to an improvement in hospitals across Aotearoa New Zealand (11 respondents) rather than in their own hospital (5 respondents).

Figure 4 Likelihood that the national PEWS will lead to an improvement in the care of deteriorating tamariki



Highlights and challenges

Most respondents (18/20) commented on a highlight of being involved in the testing of the national PEWS. These highlights were:

- being part of a project team (including the national team) where all were working to improve care ('working with [the Commission] to develop the PVSC, working as a team to effect change in practice') (ten respondents)
- being involved in improving practice ('seeing immediate positive effects and utility') (four respondents)
- learning and teaching ('watching the staff on our PEWS team grow and develop other skills...') (three respondents)
- the pre-test current state analysis ('a really comprehensive review and helpful to stop, understand and reflect on where we were at') (one respondent).

Most respondents (18/20) also commented on challenges, which centred on:

- resourcing, including the impact of COVID-19 ('lack of time to go to meetings, read new information and keep up to date with changing plans ') (11 respondents)
- needing project management, business analysis and IT support ('IT team didn't appear to be apprised of the project or the resource needed for it') (three respondents)
- changing established practice ('changing the mindset of the staff who were used to the old PEWS charts and escalation pathways to adapt to and use the new pathway') (six respondents)
- engaging stakeholders ('complete disengagement from medical staff') (three respondents).

One respondent commented on the need for a more flexible process:

The new PEWS is barely different from our previous version, and the process could have flexed a bit more to recognise this – scheduling 8-hour meeting days for clinicians suggests a lack of awareness of how our jobs are structured!

Nine respondents made other comments about the experience of working on the project. These reflected:

- enjoyment of the project and appreciation for Commission support (five respondents)
- the difficulty of involving other stakeholders within the hospital (one respondent)
- the occasional difficulty of reaching consensus (one respondent)
- the added complexity to the project of using electronic charts (one respondent)
- the challenges and rewards of auditing (one respondent)
- suggestions for project improvement (two respondents):

I think that, had I realized how difficult it was going to be to get ED and acute care on board, I would have started the education earlier.

At the beginning of next project or implementation, ensure a RACI¹¹ is done to determine who should be involved and to what extent – would have saved a lot of frustration and stress in this implementation if the proper resources had been on the project from the start.

8 Quantitative findings

8.1 Comparison with CDHB PEW score

To analyse the extent to which the national PEW score would trigger a review compared with a local PEW score, we looked at CDHB's historical PEW score data (from approximately 80,000 unique patients) and evaluated the scoring of the CDHB data compared with the national scoring. This analysis is primarily relevant to locations that currently use the same or similar PVSCs to those at the CDHB. It provided some information about the expected effect of integrating the 0- to 3-month chart for tamariki aged 0–3 months into that for those aged 0–11 months.

The Table 14 in Appendix B shows, for each age-banded PVSC, the change in escalation band between the current CDHB and the national PVSCs. Highlighted values show the proportion of patients who stay in the same escalation band, and most patients stay in the same escalation band. Of those who moved, this was usually up one escalation band. Only small numbers of patients moved up more than one band or down a band in national PVSCs. The effect of amalgamating the 0- to 3-month and the 4- to 11-month PVSCs seems limited.

Almost all of the patients in the PEW score 8+ band on the CDHB PVSCs scored the same in the national PVSCs. However, overall, only 56 percent of the patients in the blue zone in

¹¹ RACI stands for Responsible, Accountable, Consulted, and Informed. A RACI is a responsibility assignment chart.

the CDHB PVSCs were also in the blue zone in national PVSCs, with the remaining 44 percent in a lower escalation band.

Overall, this comparison suggests that, although patients will score more highly on the national PVSCs, this is unlikely to trigger more PEWS score 8+ or emergency (blue zone) responses, and the absolute number of affected patients will be low.

8.2 Audit and measurement

This section of the report presents an overview of results from sites; more detailed findings are presented in the appendices. Overall, the audit data suggests that the PEWS is becoming established and there are some signs of process improvement. The audit results also demonstrate the test sites' commitment to using data to implement, monitor and improve the PEWS.

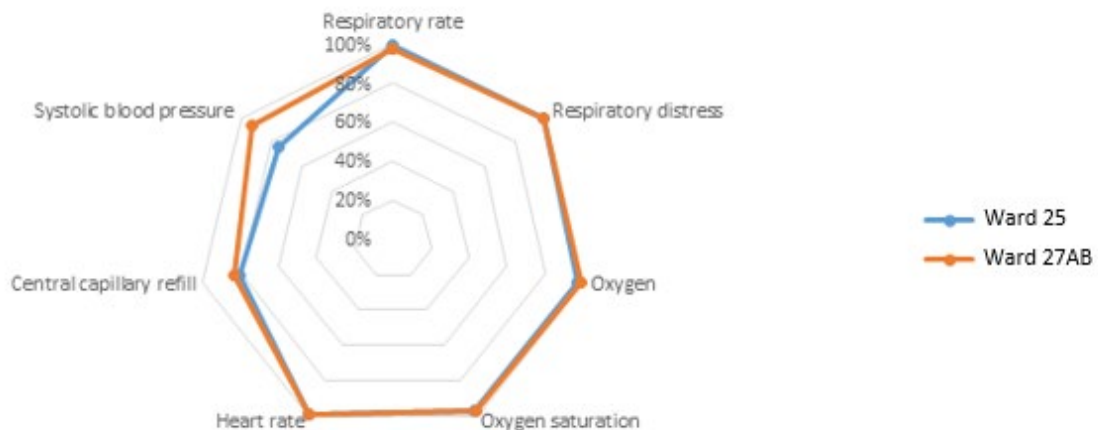
Starship

Overview of audit results

The Starship team collected 12 weeks of audit data (260 cases) for wards 25 and 27AB, from the week beginning 22 November 2021 through to 14 February 2022. The data was cleaned, and no records were removed. In six records (from early in the audit), the clinician used the wrong PVSC. This points to the importance of educating wider hospital teams to ensure the correct chart is used. See Appendix C for the full review of Starship's audit data.

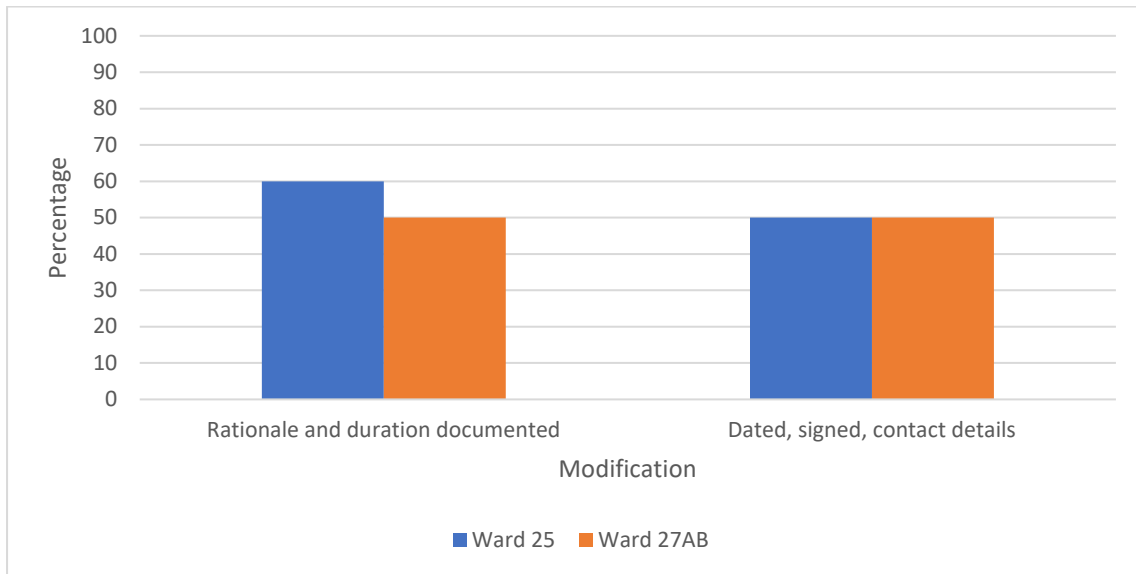
Figure 5 shows the percentage of PVSCs with completed core vital signs (aggregated data for both wards). The signs that were not completed consistently on the PVSCs were systolic blood pressure (measured in 75 percent for Ward 25 and 93 percent for Ward 27AB) and central capillary refill (measured in 81 percent for Ward 25 and 84 percent for Ward 27AB).

Figure 5 Completed core vital signs over the implementation period, Starship



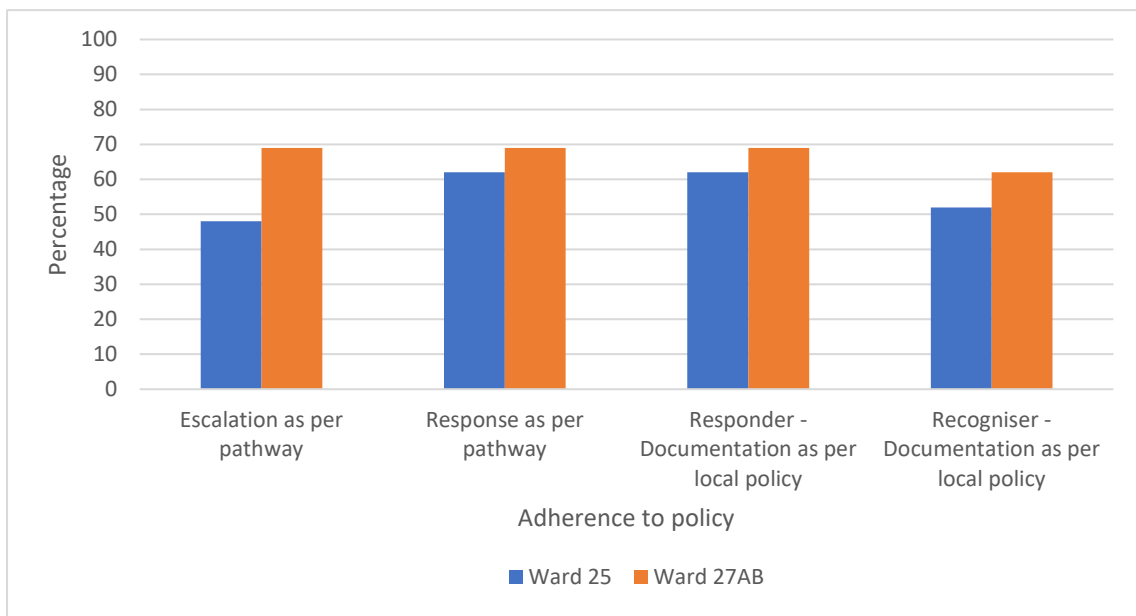
Overall, 12 of the 260 audited cases had modifications to vital signs parameters recorded. As shown in Figure 6, of the 10 cases from Ward 25, 60 percent had the rationale and duration documented and 50 percent had date, signature and contact details. For Ward 27AB, 50 percent of these had the rationale and duration, date, signature and contact details. These are all required for appropriate modifications and indicate that medical staff are not consistently documenting modifications.

Figure 6 Summary of modifications made to the PEW score trigger and over the implementation period, Starship



Across both wards, 44 of the 260 audited cases had an escalation because of a PEW score of four or more. As shown in Figure 7, escalation and response was appropriate to the pathway for almost 70 percent of cases in Ward 27AB but for a smaller proportion of cases in Ward 25. Additionally, documentation was not completed for all of these escalations.

Figure 7 Summary of escalations over the implementation period, Starship



Process measures

More data points are needed to enable comprehensive comment on the audit findings relating to Starship's process measures of the PEWS test. However, some points can be made:

- the use of partial sets of observations appears to have declined over time in Ward 25
- where partial sets of vital signs are taken (and marked with an asterisk), they are being correctly calculated
- complete sets of vital signs are not always being correctly calculated
- opportunities exist for further improvement.

The audit findings for the process measures used by Starship during the test of national PEWS are in the full review of Starship's audit data in [Appendix C](#).

Outcome measures

The national team developed outcome measures for testing based on the literature, the data hospitals may already be collecting and discussion with the Scottish paediatric programme leads. The evaluation team was interested in what measures were useful to the test sites. As shown in Table 10, of the national measures, the Starship project team used measure one, adapted measures two and three and added two additional measures. They did not use measures four and five as there is no higher acuity hospital in Aotearoa New Zealand beyond Starship. The audit findings for all five outcome measures used by Starship during the test of the national system are shown in the full review of Starship's audit data in Appendix C. Note that, during the test period (November 2021 to March 2022), there was no marked increase in cases across these measures.

Table 10 National and Starship outcome measures for testing PEWS

National outcome measures		Starship outcome measures
1	Number of escalations to rapid response team (or equivalent)	Number of escalations to rapid response team (code pink)
2	Number of unplanned admissions to higher level of care (intensive care)	Number of escalations to rapid response team (code blue)
3	Number of unplanned admissions to higher level of care (high dependency unit)	Number of PAR encounters
4	Number of unplanned admissions to higher level of care (transfer to higher acuity hospital)	Number of unplanned admissions to higher level of care (intensive care/high dependency unit)
5	Number of unplanned admissions to higher level of care (increased 1:1 care)	Number of unplanned readmissions to higher level of care (intensive care/high dependency unit)

PAR = patient at risk.

Tauranga Hospital

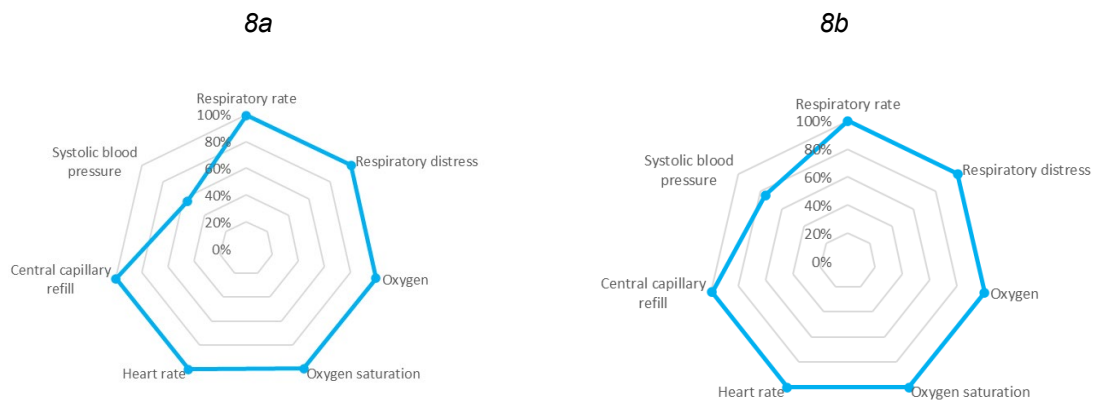
The Tauranga team collected 14 weeks of baseline audit data for their paediatric ward and 15 weeks of implementation audit data (week beginning 14 February to 23 May 2022). They also undertook smaller audits for their day stay unit and emergency department over this

period. This report uses the data from their paediatric ward only. See [Appendix D](#) for the full review of Tauranga's audit data.

Overview of audit results

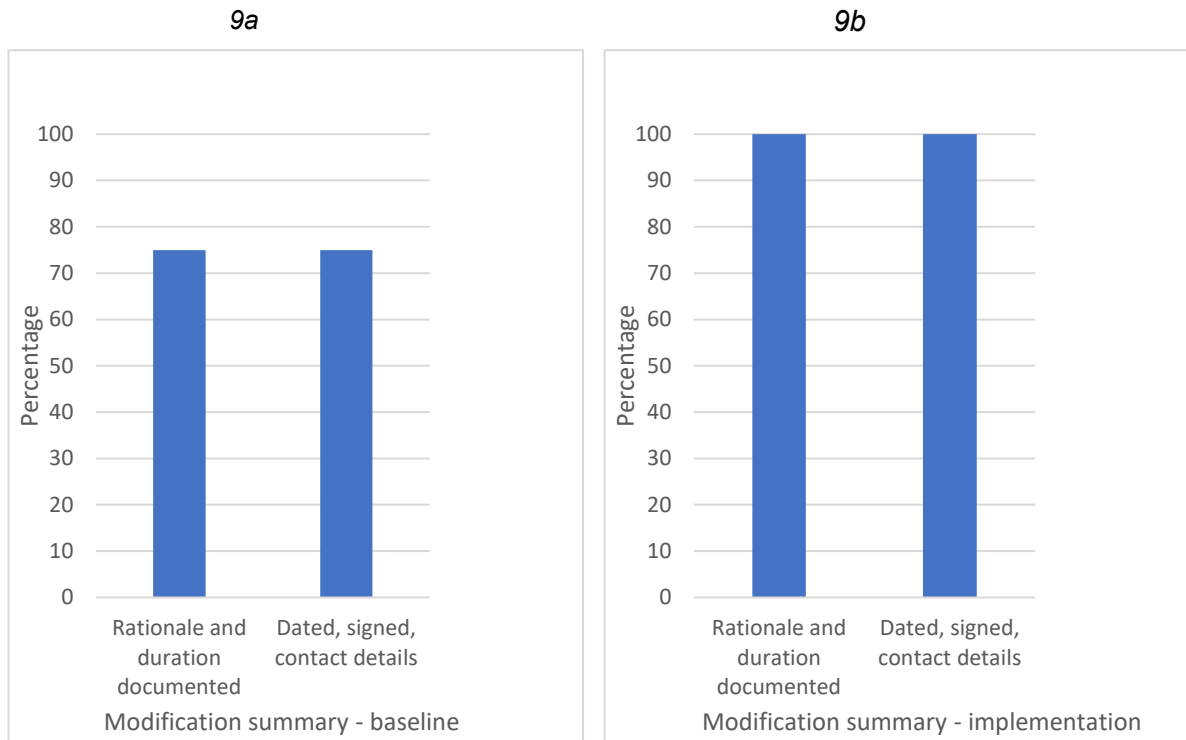
Figure 8 shows the aggregated data for the Tauranga paediatric ward comparing baseline with implementation. The core vital sign that was not completed consistently on the PVSCs was systolic blood pressure (56 percent completed over the baseline period, which increased to 75 percent over the implementation period).

Figure 8 Completed core vital signs at (a) baseline and (b) over the implementation period, Tauranga Hospital



At the baseline, four of the 140 audited cases had modifications made to the PEW score trigger. Of these, 75 percent had the rationale and duration, date, signature and contact details documented. Over the implementation period, three of the 150 audited cases had modifications made to the PEW score trigger. All of these had the rationale and duration, date, signature and contact details documented (see Figure 9).

Figure 9 Summary of modifications made to the PEW score trigger at (a) baseline (n=4) and (b) over the implementation period (n=3), Tauranga Hospital



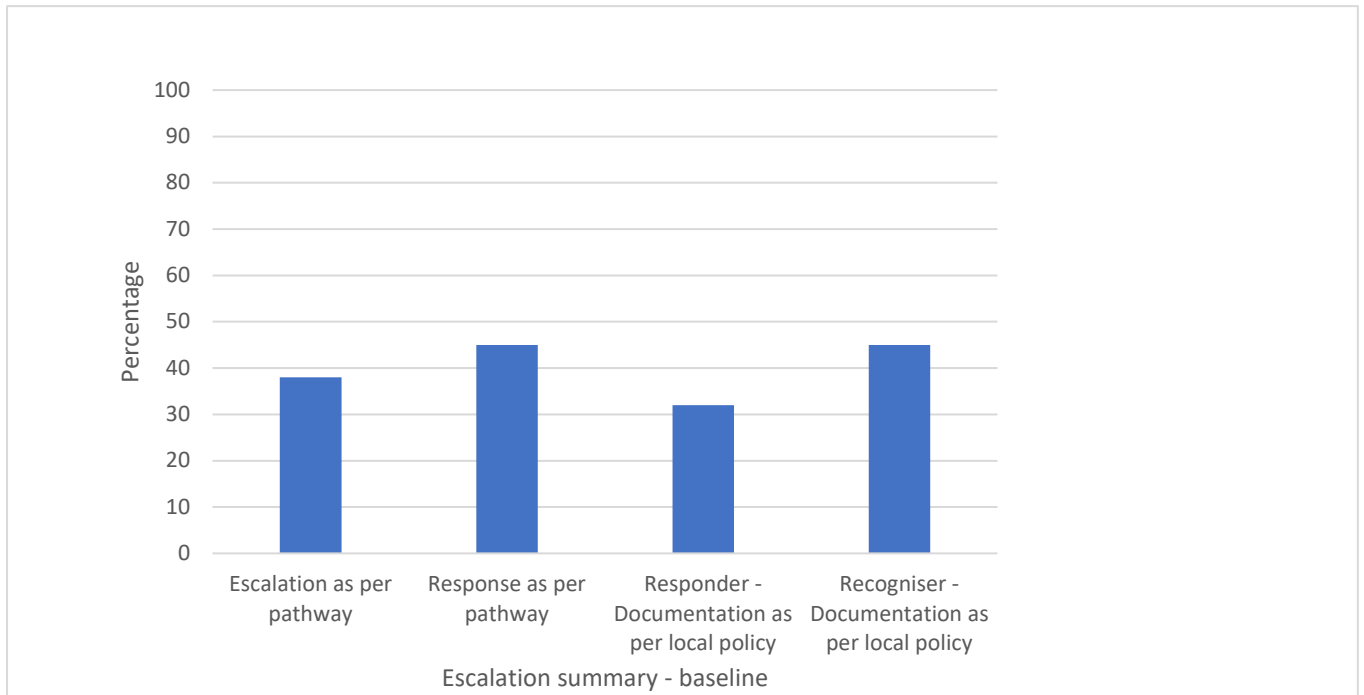
For the baseline, 13 of the 140 audited cases had an escalation of PEW score of four or more. Of these, 38 percent were escalated and 46 percent had the response as per the escalation pathway. Documentation by recognisers occurred as per local policy for 46 percent of these escalations, and documentation by responders occurred as per local policy for 31 percent of these escalations.

Over the implementation period, two of the 150 audited cases had an escalation of PEW score of four or more. Only one of these had the escalation and response as per the escalation pathway as well as the documentation by recogniser and responder as per local policy (see Figure 10).

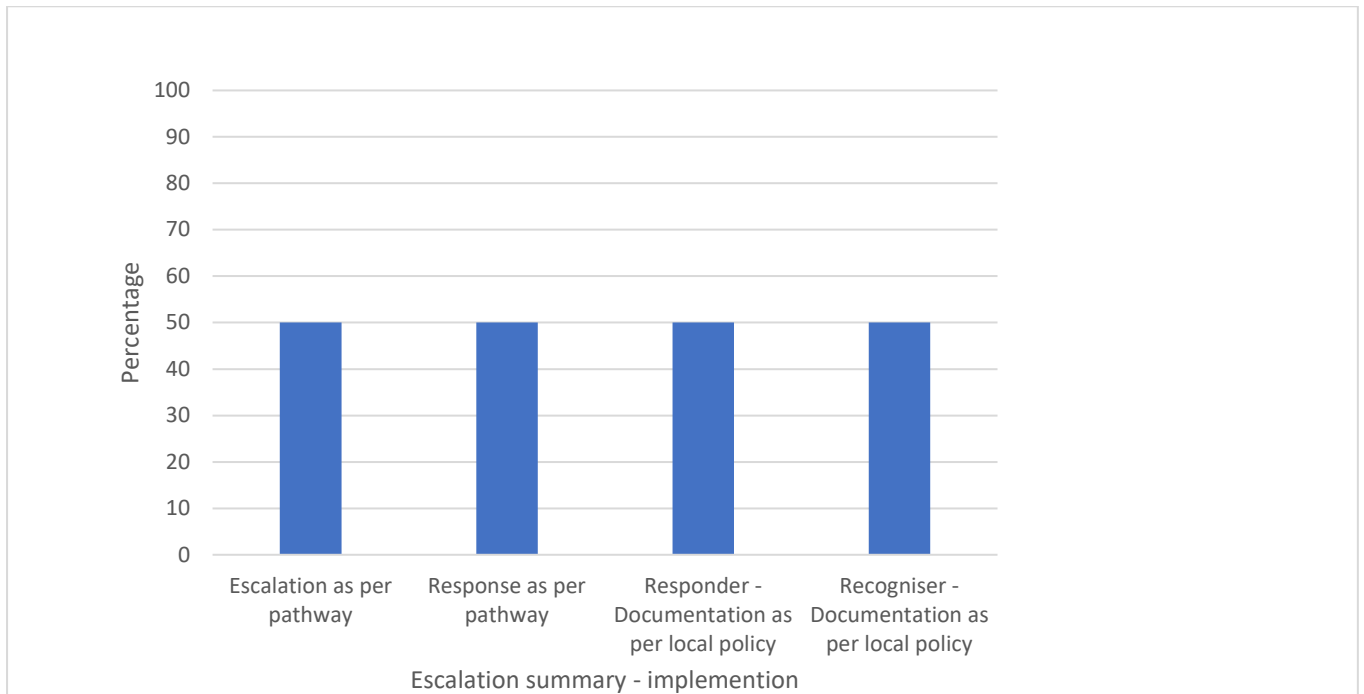
The reduction in number of escalations could be due to lower acuity of the patients and/or earlier recognition and response.

Figure 10 Summary of escalations at (a) baseline (n=13) and (b) over the implementation period (n=2), Tauranga Hospital

10a



10b



Process measures

The audit findings for the process measures used by Tauranga Hospital during the test of national PEWS are summarised below and are shown in more detail in the full review of their audit data in [Appendix D](#).

- The percentage of patients receiving appropriate frequency of vital sign monitoring was consistently 100 percent during the implementation period.
- The percentage of patients where the use of partial sets of vital signs was appropriate improved towards the end of the audit period.
- The percentage of patients with a completed core vital sign set for the most recent set of vital signs improved during the education period before starting to use the new PVSCs, and this continued during most of the audit period. However, the data suggests that some work is needed to maintain the gains.
- The percentage of patients with a partial PEW score total marked with an asterisk improved during the implementation period. Most of these partial PEW scores had the reason documented in the clinical record.
- Where whānau and/or staff concern was recorded on the PVSCs, whether the concern had been acted on and documented was not always noted (in the clinical record).
- The data shows an improvement in the correct calculation of the total PEW score. This occurred during the education period before starting to use the new PVSCs. However, the data also shows that some work is needed to maintain the gains.
- Opportunities exist for further improvement

Outcome measures

The Tauranga project team focused on the process measures during the testing. They are now looking at how they can collect and report on outcome measures.

Whakatāne Hospital

The Whakatāne team collected 11 weeks of baseline audit data for their paediatric ward (29 November 2021 to 7 February 2022) and 16 weeks of implementation audit data (14 February to 6 June 2022). They also undertook smaller audits for their acute care unit and emergency department over this period. This report uses the data from their paediatric ward only. The workload and number of admissions meant they were unable to audit 10 cases every week. In total, 91 cases were audited for the baseline and 144 cases were audited for their implementation period. The data was cleaned, and one record was removed. See [Appendix E](#) for the full review of Whakatāne's audit data.

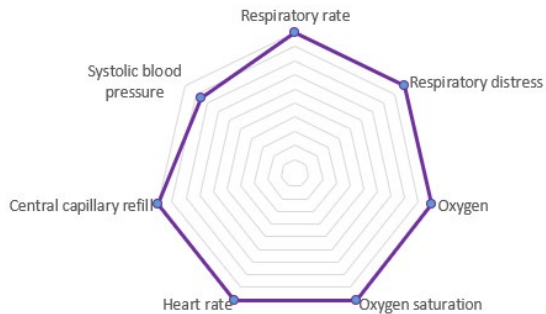
Overview of audit results

The following graphs show the aggregated data for the paediatric ward comparing baseline with implementation.

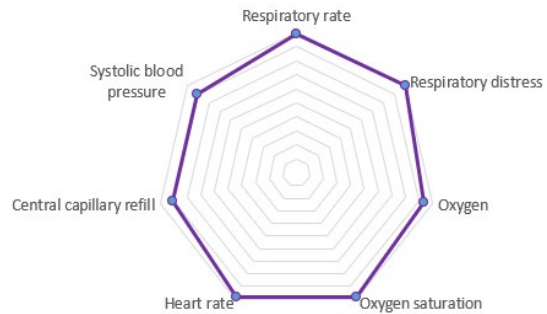
The core vital signs that were not completed consistently on the paediatric vital signs charts were systolic blood pressure (measured in 87 percent over the baseline period, which increased to 90 percent over the implementation period), heart rate (97 to 99 percent), oxygen (96 to 94 percent) and central capillary refill (96 to 91 percent). See Figure 11.

Figure 11 Completed core vital signs at (a) baseline and (b) over the implementation period, Whakatāne Hospital

11a



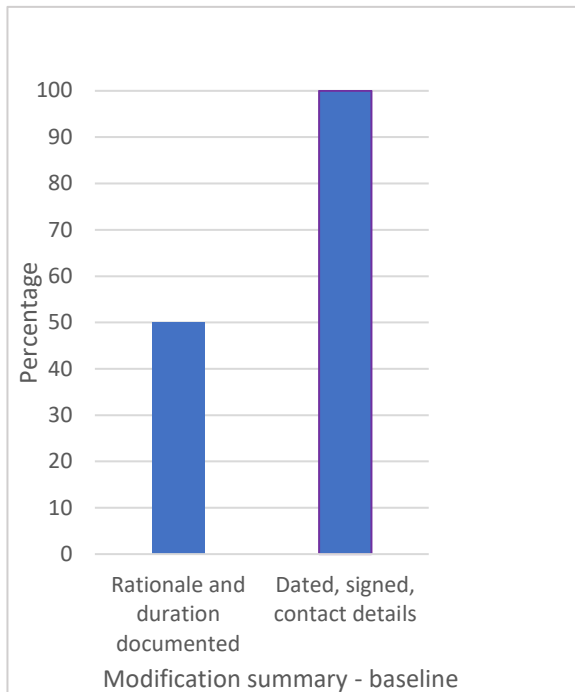
11b



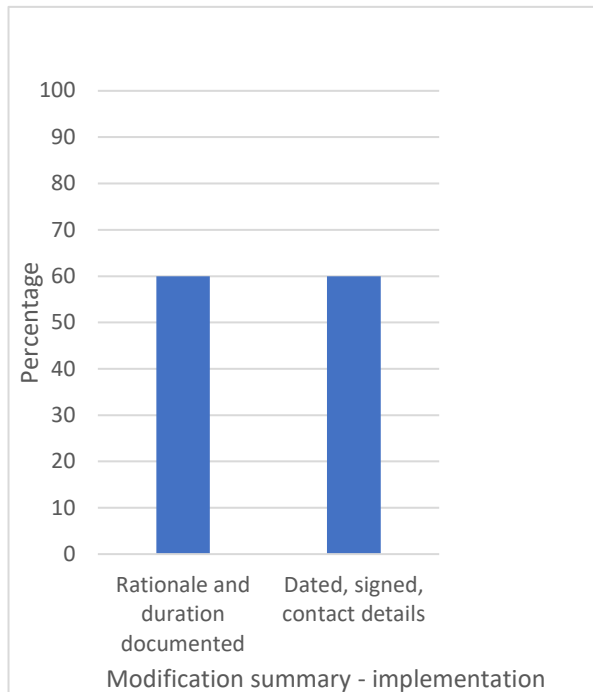
For the baseline, two of the 91 audited cases had modifications made to the PEW score trigger. One of these had the rationale and duration documented, and both had the date, signature and contact details documented. Over the implementation period, five of the 144 audited cases had modifications made to the PEW score trigger, and 60 percent of these had the rationale and duration, date, signature and contact details documented (see Figure 12).

Figure 12 Summary of modifications made to the PEW score trigger at (a) baseline (n=2) and (b) over the implementation period (n=5), Whakatāne Hospital

12a



13b

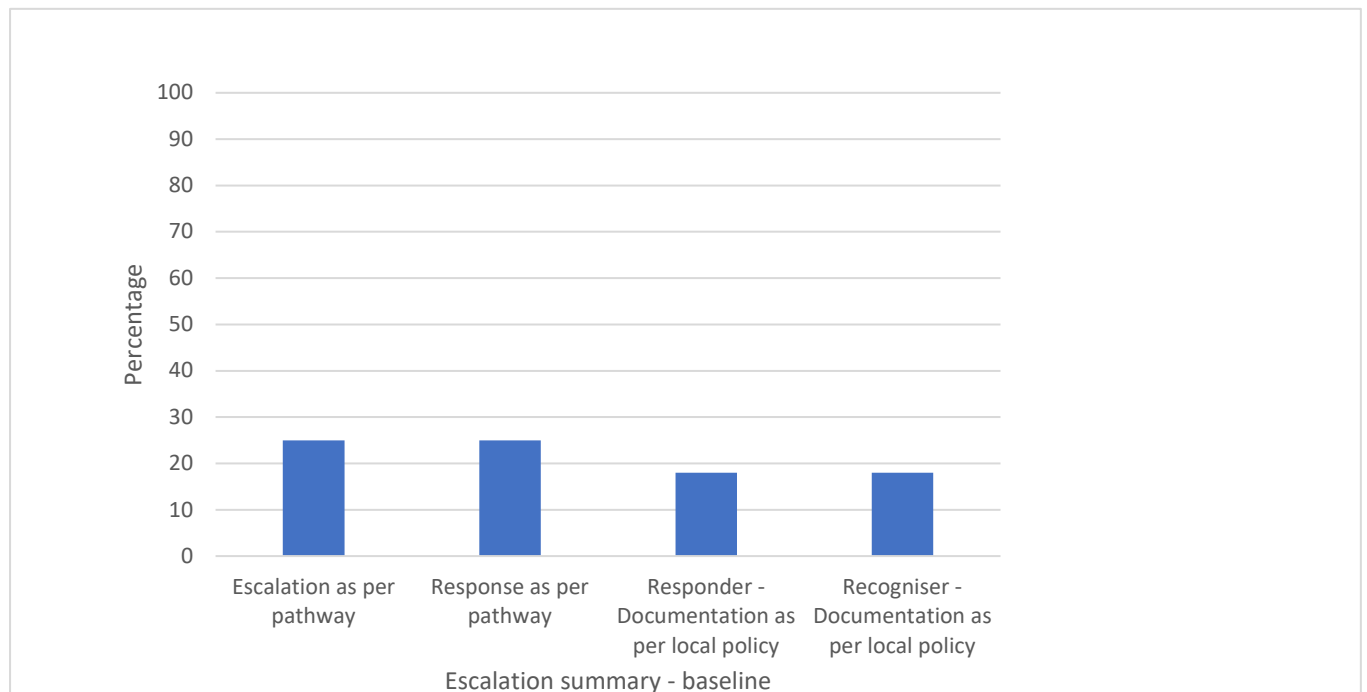


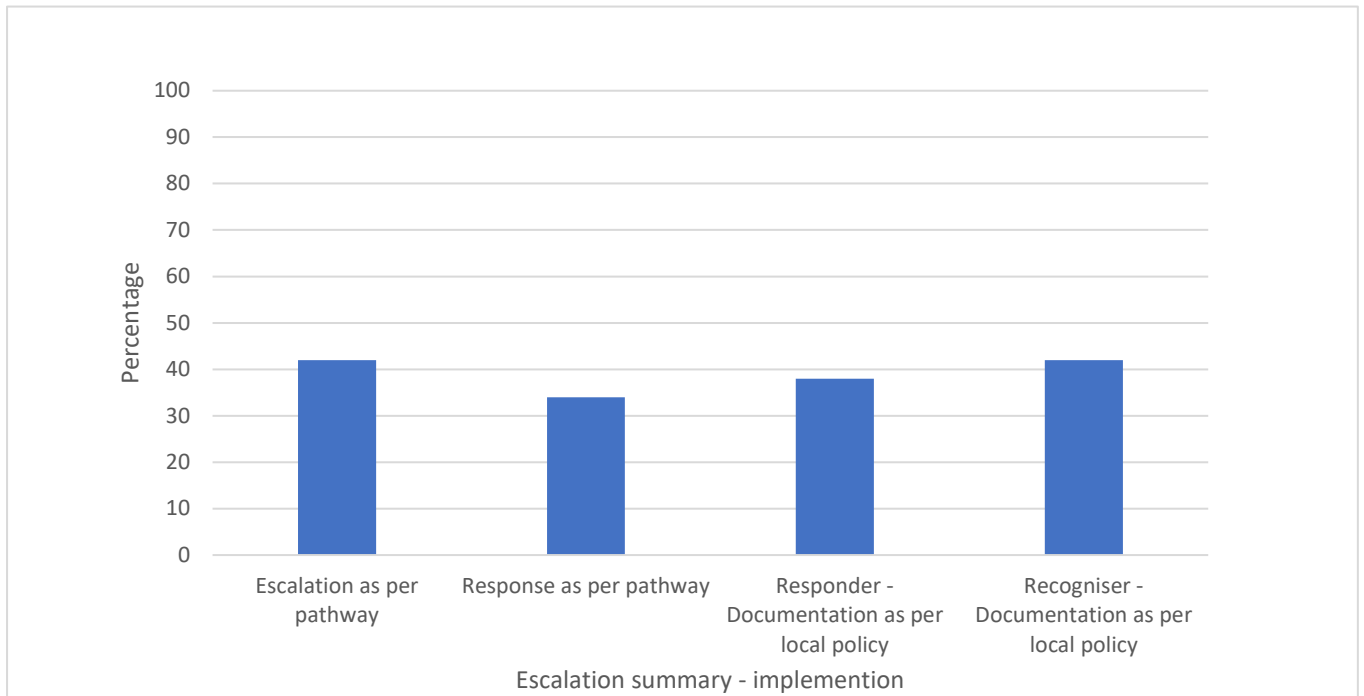
For the baseline, 16 of the 91 audited cases had an escalation of PEW score of four or more. Of these, less than 30 percent were escalated and had a response as per the escalation pathway. Documentation by recognisers and responders occurred as per local policy for less than 20 percent of these escalations.

Over the implementation period, 24 of the 144 audited cases had an escalation of PEW score of four or more. There was a small increase in the percentage of those that had an escalation and response as per the pathway as well as the required documentation (see Figure 13).

Figure 13 Summary of escalations at (a) baseline (n=16) and (b) over the implementation period (n=24), Whakatāne Hospital

13a





Process measures

The audit findings for the process measures used by Whakatāne Hospital during the test of the national PEWS are summarised below and are shown in more detail in the full review of their audit data in [Appendix E](#).

- The variation in the percentage of patients receiving appropriate frequency of vital sign monitoring appears to have reduced during the implementation period.
- The data over time does not indicate a change in the percentage of patients where the use of partial sets of vital signs was appropriate or in the percentage of patients with a completed core vital sign set for the most recent set of vital signs.
- The use of an asterisk to mark the partial PEW score increased over the implementation period.
- During the implementation period, the percentage of patients with whānau and/or staff concern recorded decreased. When whānau and/or staff concern was recorded, whether the concern had been acted on and documented was not always noted in the clinical record.
- The PEW score in both partial and complete sets of vital signs sets are being calculated correctly on a regular basis.
- Opportunities exist for further improvement.

Outcome measures

The Whakatāne project team focused on the process measures during the testing. They have started looking at how they can collect and report on the outcome measures identified by the national project team (these measures are listed in Table 10 on page 366).

Nelson and Wairau Hospitals

The NMH team collected 11 weeks of implementation audit data (from week beginning 15 March to 31 May 2022). They combined the weekly retrospective auditing across the paediatric wards at their two hospitals. This meant they were able to audit 10 cases every week. In total, 120 cases were audited for their implementation period. They used an electronic tool to complete the audits.

The team used their Patientrack data to focus their auditing using the following selection criteria:

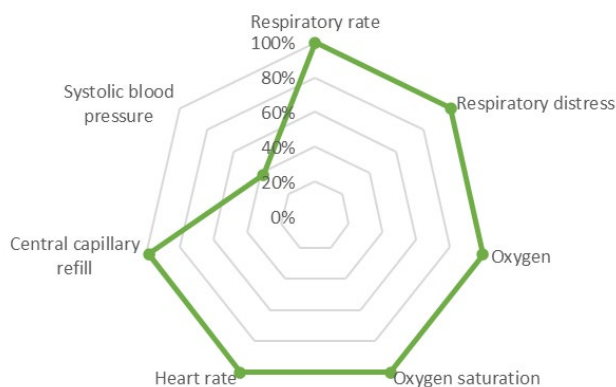
- modifications to PEWS trigger
- PEWS greater than or equal to four
- whānau/staff concern marked yes
- unresponsive marked yes
- if there weren't enough records to make 10, then add a random selection of admissions.

This approach meant they were able to test their escalation pathway and the clinicians doing the auditing could focus on the questions related to the escalation pathway. See [Appendix F](#) for the full review of Nelson and Wairau Hospitals' aggregated audit results.

Overview of audit results

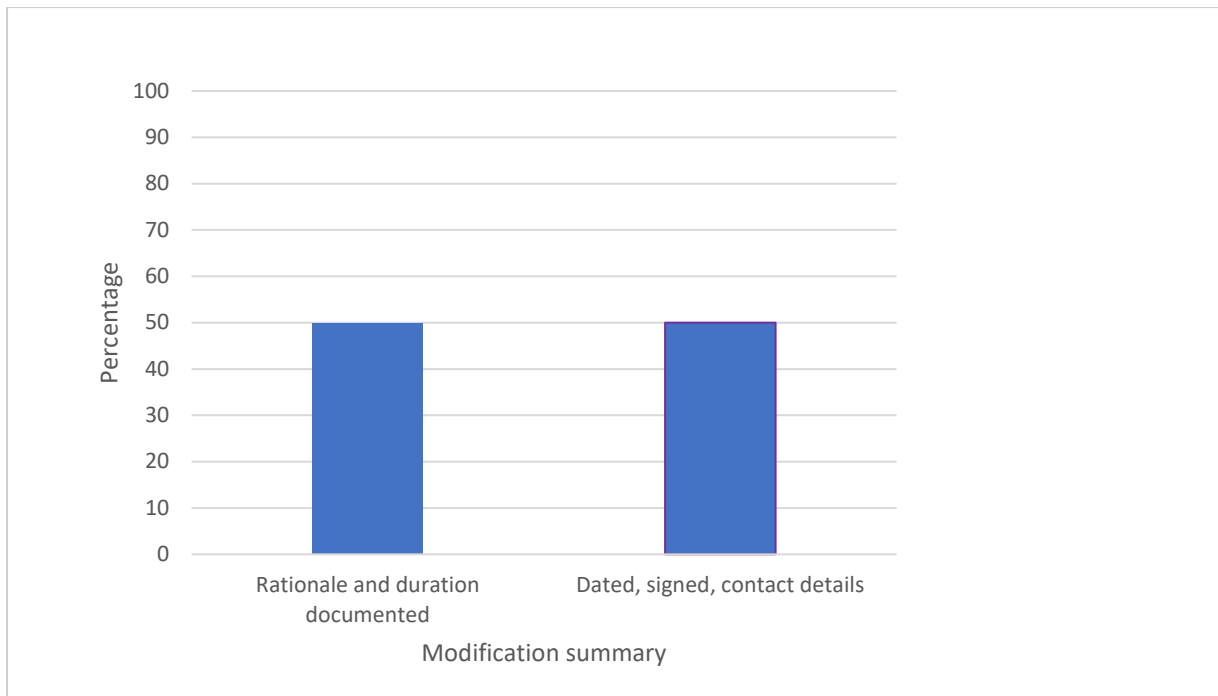
The following graphs show the aggregated implementation data for the paediatric wards. As shown in Figure 14, the core vital sign that was not completed consistently on the paediatric vital signs charts was systolic blood pressure (measured in 38 percent).

Figure 14 Completed core vital signs over the implementation period, Nelson and Wairau Hospitals



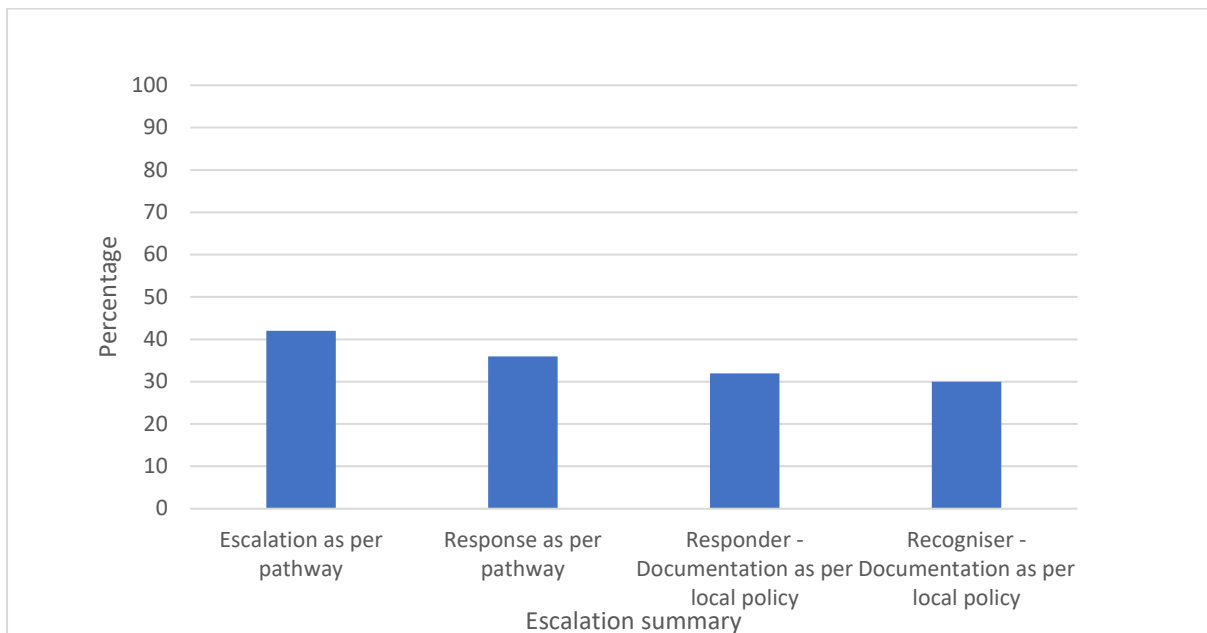
Over the implementation period, four of the 120 audited cases had modifications made to the PEWS trigger, and 50 percent of these had the rationale and duration, date, signature and contact details documented (see Figure 15).

Figure 15 Summary of modifications (n=4) made to the PEW score trigger over the implementation period, Nelson and Wairau Hospitals



Over the implementation period, 46 of the 120 audited cases had an escalation of PEW score of four or more. The escalation pathway was followed for 41 percent of these, 35 percent had the response as per the pathway, 33 percent had the responder completing documentation and 30 percent had the recogniser completing documentation (see Figure 16).

Figure 16 Summary of escalations (n=46) over the implementation period, Nelson and Wairau Hospitals



Process measures

The audit findings for the process measures used by Nelson and Wairau Hospitals during the test of the national PEWS are summarised below and reported in more detail in the full review of their audit results in [Appendix F](#).

- A high percentage of patients had their vital signs monitored at an appropriate frequency.
- Over the implementation period, the appropriate use of partial vital signs sets reduced. Opportunity exists for improvement activity in the appropriate use of partial sets.
- An opportunity also exists for improvement activity in completing core vital signs sets, particularly around observing blood pressure, which was the most frequently missed vital sign.
- Over the implementation period, the use of the asterisk marking partial signs ('toggle off' in Patienttrack) increased.
- Low numbers of whānau/staff concern were marked (eight in total). However, nearly all (seven) had the concern acted on and documented.
- A high percentage of patients had correctly calculated PEW scores (partial and complete vital signs sets) – as would be expected with an electronic system that automatically calculates the PEW score.¹²

Outcome measures

At the time of preparing this report, outcome data from Nelson and Wairau Hospitals was not available. Their approach to reporting on the national outcome measures is described in the full review of their audit data in [Appendix F](#).

Summary of the weekly Patienttrack reports from NMH

In addition to the audit data described above, NMH provided a summary of the weekly Patienttrack reports for 12 weeks of the PEWS testing. The reports are extracted by visit numbers, not national health index numbers, to capture tamariki admitted more than once in a week. The inclusion criteria are admission to a paediatric ward at Wairau or Nelson Hospital (for four hours or more) of patients aged 0–15 years. From the 12 weeks of weekly Patienttrack reports, 362 admissions met the criteria and 341 had a PVSC chart on Patienttrack.

Process measures

Table 11 lists selected process measures from the 341 admissions with a PVSC chart on Patienttrack during the 12 weeks of the testing. This summary shows the very small number of modifications during the test period and, again, points to the need to support staff to address incomplete observations, particularly when taking blood pressure.¹³

¹² The team report that any incorrect calculation was due to the clinician entering the vital signs set using the existing partial pathway rather than the 'toggle off'. In Patienttrack, selecting partial is not calculated.

¹³ In an audit of inpatients in paediatric wards of Nelson and Wairau Hospitals in October 2021 (before the national PEWS trial), 24 of 180 admitted patients met the threshold to trigger a response. A sample review of these patients' notes showed that 62 percent of the most recent set of observations were incomplete; blood pressure was the missing parameter in all these cases.

Table 11 Summary of the PVSCs on Patientrack, Nelson and Wairau hospitals

Response triggers	N (%) (n=341)
Modifications	4 (1)
Unresponsive	0 (0)
Whānau/staff concern	18 (5)
PEW score ≥4	57 (17)
Incomplete observations (from the first set of observations recorded ≥4 hours after admission) ^a	60 (18)

^a 59 without blood pressure (one without blood pressure and capillary refill); one without capillary refill.

Ethnicity

Table 12 shows the ethnicity breakdown of the 341 admissions. Note that Māori tamariki were around one-quarter of admissions and 37 percent of the admissions with a PEW score of four or more. NMH noted that Patientrack and audit data analysis provides an opportunity to work alongside Māori primary care teams to support Māori tamariki and their whānau and will use clinical coded (International Classification of Diseases, Tenth Revision) data reports to further look at themes of diagnoses.

Table 12 Ethnicity breakdown of the PVSCs on Patientrack; Nelson and Wairau hospitals

Ethnicity	Admissions (N=341), N (%)	PEW score ≥4 (N=57)	Whānau/staff concern (N=18)
Māori	80 (23)	21	4
Pacific peoples	14 (4)	4	1
Asian	22 (6)	2	1
European	217 (64)	29	12
Other	8 (2)	1	0

9 Conclusion

Overall, clinical staff at the test sites found the national PEWS fit for purpose in that it supported recognising deterioration and guiding appropriate escalation. In the feedback, all sites supported having a national system that used four age-banded PVSCs, with minor changes to some chart parameters to improve clarity. Most survey respondents thought it likely or highly likely that the national PEWS would lead to improvements in the care of deteriorating tamariki in hospitals across Aotearoa New Zealand.

Overall, sites considered that a national PEWS offers opportunities for reducing inequity. It was suggested that, when fully implemented, the system should promote more equitable outcomes for tamariki in hospital because their care is tailored in response to their individual clinical need. PEWS will also contribute to reducing inequities because it acknowledges whānau concern as a priority. However, given the short period of testing, we cannot yet draw conclusions about the contribution of PEWS to more equitable outcomes for tamariki. The

PEWS worked effectively in the range of hospital settings: rural, secondary and tertiary. Reducing inequities and enhancing Māori health outcomes is an important factor for the Commission and the PEWS. Further exploration and work in this area is recommended as the team plan the national implementation of the PEWS.

The qualitative feedback highlighted the need for quickly accessible explanations and guidance for aspects of the system. The data overall suggests that staff may need support with taking a full set of observations, particularly blood pressure. Feedback about the mandatory escalation pathway and the response to escalation indicates that using the modifications section and having a plan to follow are important aspects of education about the PEWS. Overall, though, the data suggests that the system is becoming established and there are some signs of process improvement.

Generally, sites considered that they were reviewing and intervening earlier with the national system. The analysis of CDHB data suggests that, while there will be a tendency for patients to score more highly on the national PVSCs, this is unlikely to trigger more 8+ or emergency (blue zone) responses. The audit data available from the test sites supports this finding.

All sites considered the human resource available for the testing project to be inadequate, with consequent pressure on project teams and challenges to educating staff about the PEWS (particularly wider hospital teams) and auditing the PVSCs. Having quality improvement staff and nurse educators made a significant positive difference to sites that were able to utilise these staff. The COVID-19 pandemic exacerbated existing staff shortages and heavy workloads. The resource required needs to be realistically assessed and made explicit to sites from the beginning of the project. Project management and business analysis support also have a critical role.

Integrating all the sections of a PVSC into a pre-existing electronic system was also time consuming. Further development work is needed to include the escalation pathway into digital platforms. A business analyst and digital lead should be involved from the beginning of such a project, with input from the vendor.

Given the lack of information on the impact of clinical governance and leadership structures used to support the implementation and use of the PEWS, the evaluation offers no conclusion on models that worked well. However, most survey respondents noted that working on the project had increased their knowledge of the importance of clinical leadership and governance to support testing and implementing improvements. As strong clinical governance and leadership is an important factor in encouraging clinical staff to engage in an early warning system, this area will need particular attention in a national implementation of the PEWS.

Support from the Commission met the expectations of those at the test sites, who noted an appropriate level of communication, support available if needed and very prompt responses. Most survey respondents considered that involvement in the project had improved their knowledge of quality improvement science. Analysis supported by the Commission of the current state of local PEWS was useful and helped build the case for change. The package of tools and guidance could be improved by adding detail to the user guide relating to specific parameters on the PVSCs, developing a quick reference guide and having information accessible through a QR code on the back of the PVSCs. The Commission could also further support project teams with ways to use and share the learning from PVSC audits.

9.1 Recommendations

The PEWS should be implemented nationally, noting the actions recommended in Table 13.

Table 13 Summary of recommended actions

Area	Recommended actions
Equity considerations	<p>Explore further how PEWS can incorporate equity considerations.</p> <p>Work through the Te Ao Māori Framework as the national implementation approach is developed.</p> <p>Strengthen the guidance for project teams around involving consumers, Māori and Pacific peoples advisors within the project teams.</p>
PVSCs	
	<p>Add clarification to the user guide and frequently asked questions about when to use the newborn observation chart and newborn early warning score.</p>
The partial observation symbol	<p>Change the partial observation symbol from an asterisk (*) to a plus symbol (+).</p> <p>Explain how to use the partial observation symbol through a QR code on the back of the chart and in a printed quick reference guide.</p> <p>Establish the partial observation process on the paper version and then address the electronic version.</p>
Respiratory rate	<p>Make the upper range of the respiratory rate parameter ≥ 90 for the PVSC for tamariki aged 0–11 months. This requires a change in increment from 5 to 10 breaths per minute for each horizontal line on the chart.</p>
Oxygen	<p>Apply the score of '0' to only the 'Room air' line.</p> <p>Change 'high flow' to 'high flow rate'.</p> <p>Explain the 'Room air', 'Mode' and 'High flow' lines through a QR code on the back of the chart and in a printed quick reference guide. Provide detailed examples in the user guide.</p>
Oxygen saturation	<p>No changes to oxygen saturation scoring.</p>
Heart rate	<p>Provide guidance about the use of the modifications section in the user guide, through a QR code on the back of the chart and in a printed quick reference guide.</p>
Capillary refill	<p>No changes to capillary refill scoring.</p> <p>Emphasise the importance of staff having access to the user guide.</p>
Blood pressure	<p>Expand the lower range of plottable blood pressure to ≤ 19 on the PVSC for tamariki aged 0–11 years.</p> <p>Reinforce the importance of completing blood pressure measurements in the education package and include references to evidence.</p>
Whānau/staff concern	<p>Remove 'staff', ie, make this a place for whānau concerns.</p> <p>Use 'Y' for concern, 'N' for no concern and 'A' if whānau are not present or not asked.</p> <p>Explain how to use the whānau concern box (and how it relates to Kōrero mai) in the user guide, through a QR code on the back of the chart and in a printed quick reference guide.</p>

Level of consciousness	Add a 'level of consciousness' example to the education package, related to the 'always escalate if concerned' message.
Temperature	Ensure all PVSCs have a green temperature line at 37°C and a row for recording temperatures in the 35s. Provide clarification in the user guide about marking temperature as accurately as possible.
Pain score	No changes to the recording of pain score.
PEW score	During implementation, include initial and ongoing education about the utility and limitations of a PEW score, critical thinking and the role of the score as part of a system.
Modifications section	Provide guidance about the use of the modifications box in the user guide, through a QR code on the back of the chart and in a printed quick reference guide. Provide local education for both nursing and medical staff to include how to use modifications.
Mandatory escalation pathway	No changes to the mandatory escalation pathway section on the PVSC. Strengthen guidance about ensuring that a wide range of staff are involved in escalation mapping and do small tests of the escalation pathway before using.
Mandatory escalation pathway – response to escalation	Add clarification to the user guide about the importance of developing and documenting a management plan, which may include expectations about ongoing monitoring, in response to an escalation pathway being triggered. Emphasise the importance of locally suitable escalation pathway actions to project teams.
Back of the PVSCs	Swap sides for national and local tools on the back of the PVSCs and increase the size of the headings. No changes to the front of the chart required for interventions, noting that a hospital can develop an alternative method for documenting interventions that meets their needs, eg, clinical record.
Implementation	
Leadership and governance	Strengthen guidance about the role of clinical leads in the project, especially on engaging with medical and nursing colleagues and role modelling. Strengthen guidance about the role of clinical governance for supporting the project and then having oversight for ongoing sustainability and continuous improvement of the system.
Education	Update the user guide to reflect the actions listed above. Add clarification to the user guide about when to use the newborn observation chart and newborn early warning score. Develop a quick reference guide and access to supporting material at the point of care. Put a QR code on the back of the PVSCs linked to guidance materials. Provide case studies about use of the PVSCs, especially for aspects that are not totally understood (such as partial observations).

	Develop a package for Ministry of Health LearnOnline and local learning management systems.
Preparation and change management	<p>From the beginning of the project, be explicit about the expectations of resourcing from sites, including funded resource for a project lead and quality lead within working hours.</p> <p>Build in more time for the suggested preparation period and consider how the national team can further support project teams during this period.</p>

PEWS = paediatric early warning system; PVSC = paediatric vital signs chart; QR = quick response.

Appendix A Selected paediatric vital signs charts

Figure 17 Front of PVSC 0–11 months, Nelson Hospital

Family Name: _____
Given Name: _____

Gender: _____

APPROXIMATE LABEL HERE:
NHHR: _____

Date of Birth: _____

**PAEDIATRIC VITAL SIGNS CHART
0-11 MONTHS**

HQSC: last PASC 0-11m v2

Vital Signs	Date		PEWS	Date	
	Time (24 hour)			Time (24 hour)	
Respiratory Rate (breaths/min) mark RR with X	≥ 70		4	≥ 70	
	65-69			65-69	
	60-64		2	60-64	
	55-59			55-59	
	50-54		1	50-54	
	45-49			45-49	
	40-44			40-44	
	35-39		0	35-39	
	30-34			30-34	
	25-29		1	25-29	
Respiratory Distress mark RD with X	Severe		4	Severe	
	Moderate		2	Moderate	
	Mild		1	Mild	
	Nil		0	Nil	
	> 4L or > 35% < 4L or < 35%		4	> 4L or > 35% X Room air < 4L or < 35%	
	Room air		2	Room air	
	High flow		0	High flow	
	≥ 95		0	≥ 95	
	91-94		1	91-94	
	≤ 90		2	≤ 90	
Heart Rate (bpm)	≥ 200		4	≥ 200	
	190s			190s	
	180s		2	180s	
	170s			170s	
	160s		1	160s	
	150s			150s	
	140s		0	140s	
	130s			130s	
	120s			120s	
	110s		1	110s	
Blood Pressure (mmHg)	≥ 150		4	≥ 150	
	140s			140s	
	130s		2	130s	
	120s			120s	
	110s		1	110s	
	100s			100s	
	90s		0	90s	
	80s			80s	
	70s		1	70s	
	60s		2	60s	
PEWS TOTAL	7777		4	7777	
	≤ 50		0	≤ 50	
	40s			40s	
	30s		1	30s	
	20s		2	20s	
	10s		3	10s	
	40s		4	40s	
	< 38		7777	< 38	
	< 38			< 38	
	< 38			< 38	
Central Capillary Refill mark CR with X	≥ 3 sec		4	≥ 3 sec	
	< 3 sec		0	< 3 sec	
	≥ 150		4	≥ 150	
	140s			140s	
	130s		2	130s	
	120s			120s	
	110s		1	110s	
	100s			100s	
	90s		0	90s	
	80s			80s	
Temperature (°C)	≥ 40		4	≥ 40	
	39s			39s	
	38s		1	38s	
	37s		2	37s	
	36s		3	36s	
	35s		4	35s	
	34s		7777	34s	
	33s			33s	
	32s			32s	
	31s			31s	
Pain Score write score (0-10)	10		4	10	
	9			9	
	8		1	8	
	7		2	7	
	6		3	6	
	5		4	5	
	4		7777	4	
	3			3	
	2			2	
	1			1	
Consciousness mark LOC with X	Alert		0	Alert	
	Unresponsive		7777	Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
Whānau/staff concern	Alert		0	Alert	
	Unresponsive		7777	Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
	Unresponsive			Unresponsive	
PEWS TOTAL	7777		4	7777	
	≤ 50		0	≤ 50	
	40s			40s	
	30s		1	30s	
	20s		2	20s	
	10s		3	10s	
	40s		4	40s	
	< 38		7777	< 38	
	< 38			< 38	
	< 38			< 38	

Family Name: _____
Given Name: _____

Gender: _____

APPROXIMATE LABEL HERE:
NHHR: _____

Date of Birth: _____

ESCALATE CARE FOR ANY PATIENT YOU OR THEIR WHĀNAU ARE WORRIED ABOUT, REGARDLESS OF VITAL SIGNS OR PEWS

Mandatory escalation pathway NMDHB

Total PEWS	Action
PEWS 1-3	<ul style="list-style-type: none"> Consider increasing vital signs 1-2 hourly Discuss with Senior RN on shift Manage pain, fever, oxygen requirements, fluid status and distress
PEWS 4-5	<ul style="list-style-type: none"> RMO review within 1hr Inform RN in charge of shift Consider informing DNM after hours 9325
PEWS 6-7	<ul style="list-style-type: none"> RMO review in 15 minutes Inform RN in charge of shift Inform DNM – consider 1:1 nursing
PEWS 8+	<ul style="list-style-type: none"> Immediate review by RMO RMO must contact speciality registrar or consultant Inform DNM – 1:1 Nursing Support ABCDE
Any vital sign in the blue zone	<ul style="list-style-type: none"> Immediate emergency call 7777 T - Child emergency L - Paediatric Ward C - Condition

Support

- Airway
- Breathing
- Circulation
- Disability, don't forget glucose

Any treatment limitations must be documented in the patient's clinical record.
A full set of vital signs must be taken, with corresponding PEWS calculated each time, at a frequency stated in hospital policy. If there is no timely response to your request for review, escalate to the next zone.

Modification to PEWS triggers

The PEWS can be changed to prevent inappropriate escalation. All modifications must be made in line with hospital policy and regularly reviewed by the primary team. Query any modification that is not signed and dated.

Vital sign (use abbreviation)	Accepted values and modified PEWS	Date and time	Duration (hours)	Name and contact details
Reason:		/ /		
Reason:		/ /		
Reason:		/ /		
Reason:		/ /		
Allow natural death (Te Wa Aroha)		/ /		

Figure 18 Back of PVSC 0–11 months, Nelson Hospital

National tools

Family Name: _____
 Given Name: _____ Gender: _____
 AFIX PATIENT LABEL HERE.
 Date of Birth: _____ NH#: _____

Assessment of respiratory distress guide			
	Mild	Moderate	Severe
Airway	<ul style="list-style-type: none"> Stridor on exertion or crying Wheeze present 	<ul style="list-style-type: none"> Some stridor at rest Wheeze marked 	<ul style="list-style-type: none"> Stridor at rest New onset of stridor Wheeze severe Silent chest
Behaviour and feeding	<ul style="list-style-type: none"> Normal Talks in sentences 	<ul style="list-style-type: none"> Some or intermittent irritability Difficulty talking or crying Difficulty feeding or eating 	<ul style="list-style-type: none"> Increased irritability and/or lethargy Looks exhausted Unable to talk or cry Unable to feed or eat
Accessory muscle use	<ul style="list-style-type: none"> Mild intercostal and suprasternal recession 	<ul style="list-style-type: none"> Moderate intercostal and suprasternal recession Tracheal tug Nasal flaring Head bobbing 	<ul style="list-style-type: none"> Marked intercostal and suprasternal recession
Other		<ul style="list-style-type: none"> May have brief apnoea 	<ul style="list-style-type: none"> Gaspings, grunting Extreme pallor or cyanosis Increasingly frequent or prolonged apnoea

Score at the level of severest sign.
 Note that not all features are relevant to all conditions.

Respiratory support mode		
NP = Nasal prongs	M = Face mask	HF = High flow
R = Non-rebreather mask	C = CPAP	B = BPaP
TH = Tracheostomy humidification	HO ₂ = Humidified oxygen	

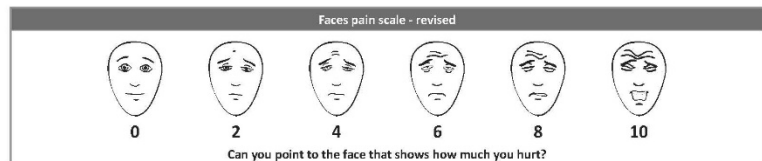
Revised FLACC observational pain tool			
Categories	Scoring		
	0	1	2
Face	No expression or smile	Occasional grimace or frown, withdrawn, or disinterested; appears sad or worried	Frequent to constant frown, clenched jaw, quivering chin; distressed looking face; expression of fight or panic
Legs	Normal position or relaxed; usual muscle tone and motion to arms and legs	Uneasy, restless, tense; occasional tremors	Kicking, or legs drawn up; marked increase in spasticity; constant tremors or jerking
Activity	Lying quietly, normal position, moves easily; regular rhythmic breaths (respiration)	Squirming, shifting back and forth, tense or guarded movements; mildly agitated (head back and forth, aggression); shallow, splinting breaths (respirations); occasional sighs	Arches, rigid, or jerking; severe agitation; head banging; obvious (not rigors); breath holding, gasping, or sharp intake of breaths; severe splinting
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaints; occasional verbal outburst or grunt	Crying steadily, screams or sobs; frequent complaints; repeated outbursts; constant grunting
Consolability	Content, relaxed	Reassured by occasional touching, hugging or talking to; can be distracted	Difficult to console or comfort; pushing away caregivers; resisting care or comfort measures

Rate the child in each of the five measurement categories, add together, and document total pain score (0–10).

Children who are awake: Observe for at least 1–2 minutes. Observe legs and body uncovered. Reposition child or observe activity, assess body for tenseness and tone. Initiate soothing interventions if needed.

Children who are asleep: Observe for at least 2 minutes or longer. Observe legs and body uncovered. If possible, reposition the child. Touch the body and assess for tenseness and tone.

This tool can be used for all non-verbal children. The additional descriptors (in italics) are validated in children with cognitive impairment. The use of descriptors with parents/caregivers the descriptors within each category. Ask the parents/caregivers if there are additional behaviours that are better indicators of their child experiencing pain. Add these behaviours to the tool in the appropriate category.



Local tools

Date		Time		Paediatric assessment triangle	
Coma scale	Eyes open	4 Spontaneously		Eyes closed by swelling = C	Appearance Tone Interactiveness Consolability Look/gaze Speech/cry Circulation to the skin Pa or Motting Cyanosis's Work of breathing Abnormal breath sounds Abnormal positioning Retractions Nasal flaring
	Best verbal response	5 Orientated		Endotracheal tube or tracheostomy = T	
		4 Disorientated			
	Best motor response	3 Inappropriate words		Usually record the best arm response	
		2 Incomprehensible words			
	Infant verbal response	1 None		Pupils	
		6 Obeys commands			
	Glasgow coma scale total	5 Localises pain		+ reacts - no reaction C. eye closed	
		4 Flexion withdrawal			
	Arms	3 Flexion abnormal		Record right (R) and left (L) separately if there is a difference between the two sides	
2 Abnormal extension					
Legs	1 None		Comments		
	5 Flexes/foals/recog/laughs				
Modified Glasgow coma scale for infants and young children	4 F/F/uncertain recog		Glasgow coma scale calculation		
	3 Rousable/no drink				
Eyes opening	2 Unrousable/restless		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale		
	1 Unresponsive				
Best motor response	4		< 1 year 4 spontaneous 3 to shout 2 to pain 1 none		
	5				
Best verbal response	6		> 1 year 5 spontaneous 4 to speech 3 to pain 2 none 1 none		
	5				
Using the coma scale - notes on some terms used					
Orientated	Knows who she is, where she is and the time and date.				
Disorientated	Can converse, but fails orientation questions and answers other with obvious errors.				
Inappropriate words	Cannot converse: exclams, swears or shouts.				
Incomprehensible words	Moans or grunts: no words recognised.				
Localises pain	A limb, not necessarily the one stimulated, moves towards the pain.				
Flexion withdrawal	Normal flexion: pain makes the elbow flex, but there is no movement towards the painful stimulus. Limb exhibits normal flexion (i.e. withdrawal), short-lived.				
Flexion abnormal	Pain makes the elbow flex and the arm adduct in an exaggerated and sustained posture.				
Abnormal extension	Pain makes the elbow or knee straighten, often forcibly, and related joints are also held rigidly (may be decerebrate posturing).				

Figure 19 Front of PVSC 1–4 years, Wairau Hospital

Family Name: _____ Gender: _____
 Given Name: _____
 Date of Birth: _____ NHf#: _____
 AFFIX PATIENT LABEL HERE.

PAEDIATRIC VITAL SIGNS CHART
 1-4 YEARS

HOSC Tech PVSC 1-4-y-2

Vital Signs	Date Time (24 hour)	PEWS	Date Time (24 hour)
Respiratory Rate (breaths/min) mark RR with X	≥ 55	4	≥ 55
	50-54		50-54
	45-49	2	45-49
	40-44	1	40-44
	35-39		35-39
	30-34		30-34
	25-29	0	25-29
	20-24		20-24
	18-19	1	18-19
	15-17	2	15-17
Respiratory Distress mark RD with X	Severe	4	Severe
	Moderate	2	Moderate
	Mild	1	Mild
	Nil	0	Nil
	≤ 4	777	≤ 4
Oxygen (L/min or FIO ₂) write value	≥ 4L or ≥ 35%	4	≥ 4L or ≥ 35%
	< 4L or < 35%	2	< 4L or < 35%
	Room air X	0	X Room air
	Moce		Moce
Oxygen Saturation (%) write SpO ₂	≥ 95	0	≥ 95
	91-94	1	91-94
	≤ 90	2	≤ 90
Heart Rate (bpm) mark HR with X write value if off scale	≥ 180	4	≥ 180
	170s		170s
	160s		160s
	150s	2	150s
	140s	1	140s
	130s		130s
	120s		120s
	110s		110s
	100s		100s
	90s		90s
Blood Pressure (mmHg) score systolic BP value only write value if off scale	≥ 160	4	≥ 160
	150s		150s
	140s		140s
	130s	2	130s
	120s		120s
	110s	1	110s
	100s		100s
	90s		90s
	80s	1	80s
	70s	2	70s
Central Capillary Refill mark CR with X	≥ 3 sec	4	≥ 3 sec
	< 3 sec	0	< 3 sec
	≥ 160	4	≥ 160
	150s		150s
	140s		140s
	130s	2	130s
	120s		120s
	110s	1	110s
	100s		100s
	90s		90s
PEWS TOTAL	≥ 41	4	≥ 41
	40s		40s
	39s		39s
	38s		38s
	37s		37s
	36s		36s
	Rest		Rest
	Movement		Movement
	Initials		

Family Name: _____
 Given Name: _____ Gender: _____
 AFFIX PATIENT LABEL HERE.
 Date of Birth: _____ NHf#: _____

ESCALATE CARE FOR ANY PATIENT YOU OR THEIR WHĀNAU ARE WORRIED ABOUT, REGARDLESS OF VITAL SIGNS OR PEWS

Mandatory escalation pathway	Wairau Hospital
Total PEWS	Action
PEWS 1-3	<ul style="list-style-type: none"> Consider increasing vital signs 1-2 hourly Discuss with Senior RN on shift Manage pain, fever, oxygen requirements, fluid status and distress
PEWS 4-5	<ul style="list-style-type: none"> RMO review within 1hr Inform RN in charge of shift Consider informing DNM after hours - 9959 Monitor vital signs every 30 minutes until PEWS <4 and/or monitoring plan documented Manage pain, fever, oxygen requirements, fluid status and distress
PEWS 6-7	<ul style="list-style-type: none"> RMO review in 15 minutes Inform RN in charge of shift Inform DNM – consider 1:1 nursing RMO consider escalating to speciality registrar or consultant Monitor vital signs every 30 minutes until PEWS <4 and/or follow monitoring plan in place Manage pain, fever, oxygen requirements, fluid status and distress
PEWS 8+	<ul style="list-style-type: none"> Immediate review by RMO RMO must contact speciality registrar or consultant Inform DNM – 1:1 Nursing Support ABCDE Continuous monitoring until a monitoring plan is in place with timeframe and criteria for review Consider ICU admission Consider emergency call and specify type of response - 8888
Any vital sign in the blue zone	<ul style="list-style-type: none"> Immediate emergency call 8888 T - Child emergency L - Paediatric Ward C - Condition Support <ul style="list-style-type: none"> Airway Breathing Circulation Disability, don't forget glucose

Any treatment limitations must be documented in the patient's clinical record. A full set of vital signs must be taken, with corresponding PEWS calculated each time, at a frequency stated in hospital policy. If there is no timely response to your request for review, escalate to the next zone.

Modification to PEWS triggers

The PEWS can be changed to prevent inappropriate escalation. All modifications must be made in line with hospital policy and regularly reviewed by the primary team. Query any modification that is not signed and dated.

Vital sign (use abbreviation)	Accepted values and modified PEWS	Date and time	Duration (hours)	Name and contact details
		/ /	:	
Reason:				
		/ /	:	
Reason:				
		/ /	:	
Reason:				
Allow natural death (Te Wa Aroha) <input type="checkbox"/> / /				

Figure 20 Back of PVSC 1–4 years, Wairau Hospital

National tools

Family Name: _____
 Given Name: _____ Gender: _____
 AFFIX PATIENT LABEL HERE.
 Date of Birth: _____ NH&I: _____

Assessment of respiratory distress guide			
	Mild	Moderate	Severe
Airway	<ul style="list-style-type: none"> Stridor on exertion or crying Wheeze present 	<ul style="list-style-type: none"> Some stridor at rest New onset of wheeze marked Wheeze severe Silent chest 	<ul style="list-style-type: none"> Stridor at rest New onset of stridor Wheeze severe Silent chest
Behaviour and feeding	<ul style="list-style-type: none"> Normal Talks in sentences 	<ul style="list-style-type: none"> Some or intermittent irritability Difficulty talking or crying Difficulty feeding or eating 	<ul style="list-style-type: none"> Increased irritability and/or lethargy Looks exhausted Unable to talk or cry Unable to feed or eat
Accessory muscle use	<ul style="list-style-type: none"> Mild intercostal and suprasternal recession 	<ul style="list-style-type: none"> Moderate intercostal and suprasternal recession Tracheal tug Nasal flaring Head bobbing 	<ul style="list-style-type: none"> Marked intercostal and suprasternal recession
Other		<ul style="list-style-type: none"> May have brief apnoea 	<ul style="list-style-type: none"> Gasp, grunting Extreme pallor, cyanosis Increasingly frequent or prolonged apnoea

Score at the level of severest sign.
 Note that not all features are relevant to all conditions.

Respiratory support mode		
NP = Nasal prongs	M = Face mask	HF = High flow
R = Non-rebreather mask	C = CPAP	B = BPAP
TH = Tracheostomy humidification	HO ₂ = Humidified oxygen	

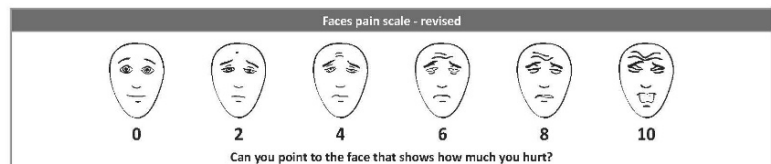
Revised FLACC observational pain tool			
Categories	Scoring		
	0	1	2
Face	No expression or smile	Occasional grimace or frown, withdrawn, distressed; appears sad or worried	Frequent or constant frown, clenched jaw, quivering chin, distressed looking face, expression of fight or panic
Legs	Normal position or relaxed; usual muscle tone and motion to arms and legs	Uneasy, restless, tense; occasional tremors	Kicking, or legs drawn up; marked increase in spasticity; constant tremors or jerking
Activity	Lying quietly, normal position, moves easily; regular rhythmic breaths (respiration)	Squirming, shifting back and forth, tense or guarded movements; mildly agitated (head back and forth, aggression); shallow, splinting breaths (respirations); occasional sighs	Arches, rigid, or jerking; severe agitation; head banging; shivering (not rigors); breath holding; gasping, or sharp intake of breath; severe splinting
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint; occasional verbal outburst or grunt	Crying steadily, screams or sobs, frequent complaints; repeated outbursts; constant grunting
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or talking to; can be distracted	Difficult to console or comfort; pushing away caregiver; resisting care or comfort measures

Rate the child in each of the five measurement categories, add together, and document total pain score (0–10).

Children who are awake: Observe for at least 1–2 minutes. Observe legs and body uncovered. Reposition child or observe activity, assess body for tenseness and tone. Initiate soothing interventions if needed.

Children who are asleep: Observe for at least 2 minutes or longer. Observe legs and body uncovered. If possible, reposition the child. Touch the body and assess for tenseness and tone.

This tool can be used for all non-verbal children. The additional descriptors (in italics) are validated in children with cognitive impairment. The nurse can review with parents/caregivers the descriptors with each category. Ask the parents/caregivers if there are additional behaviours that are better indicators of their child experiencing pain. Add these behaviours to the tool in the appropriate category.



Local tools

Date					
Time					
Coma scale	Eyes open	4 Spontaneously			Eyes closed by swelling = C
	Best verbal response	3 To speech			Endotracheal tube or tracheostomy = T
		2 To pain			
	Best motor response	1 None			Usually record the best arm response
		5 Orientated			
		4 Disorientated			
	Infant verbal response	3 Inappropriate words			Usually record the best arm response
		2 Incomprehensible words			
	Glasgow coma scale total	1 None			Pupils
		6 Obeys commands			
Pupils	5 Localises pain			+ reacts - no reaction C eye closed	
	4 Flexion withdrawal				
Arms	3 Flexion abnormal			Record right (R) and left (L) separately if there is a difference between the two sides	
	2 Abnormal extension				
Legs	1 None			Comments	
	5 Fixes/follows/recog/avoids				
Modified Glasgow coma scale for infants and young children	4 FF/uncertain recog			Glasgow coma scale calculation	
	3 Reusable/no drink				
Glasgow coma scale calculation	2 Unroutable/cleless			Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	1 Unresponsive				
Eyes opening	< 1 year	> 1 year		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	4 spontaneous	spontaneous			
Best motor response	3 to speech	to speech		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	2 to pain	to pain			
Best verbal response	1 none	none		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	6 normal movement	obeys			
Using the coma scale - notes on some terms used	5 localises pain	localises pain		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	4 flexion withdrawal	flex on withdrawal			
Orientated	3 flexion/decoricate	flex on/decoricate		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	2 extension	extension			
Disorientated	1 none	none		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	5 smiles/coos/cries appropriate	appropriate words/phrases			
Inappropriate words	4 cries/consolable	inappropriate words		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	3 cries/scream/irritable/inconsolable	cries/screams			
Incomprehensible words	2 grunts/agitated	grunts		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	1 none	none			
Localises pain	1 none	none		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	5 smiles/coos/cries appropriate	appropriate words/phrases			
Flexion withdrawal	4 cries/consolable	inappropriate words		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	3 cries/scream/irritable/inconsolable	cries/screams			
Flexion abnormal	2 grunts/agitated	grunts		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	1 none	none			
Abnormal extension	1 none	none		Eyes open (E) + Verbal response (V) + Best motor response (M) = Glasgow coma scale	
	5 smiles/coos/cries appropriate	appropriate words/phrases			

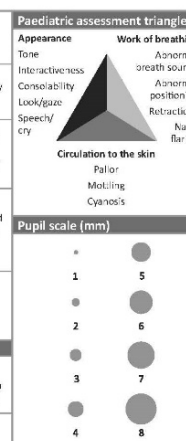


Figure 21 Front of PVSC 5–11 years, Starship

Family Name: _____
 Given Name: _____ Gender: _____
 AFIX PATIENT LABEL HERE
 NHI#: _____
 Date of Birth: _____



PAEDIATRIC VITAL SIGNS CHART
 5-11 YEARS



CR38861 HOSCC Test PVSC 5-11y v2

Vital Signs		Date	PEWS	Date
		Time (24 hour)		Time (24 hour)
Respiratory Rate (breaths/min) mark RR with X	≥ 45		4	≥ 45
	40-44		2	40-44
	35-39		1	35-39
	30-34		0	30-34
	25-29		1	25-29
	20-24		2	20-24
	15-19		3	15-19
	12-14		4	12-14
	10-11		777	10-11
	≤ 9		777	≤ 9
Respiratory Distress mark RD with X	Severe		4	Severe
	Moderate		2	Moderate
	Mild		1	Mild
	Nil		0	Nil
Oxygen (L/min or FiO ₂ %) write value	≥ 4L or ≥ 35%		4	≥ 4L or ≥ 35%
	< 4L or < 35%		2	< 4L or < 35%
	Room air X		0	X Room air
Oxygen Saturation (%) write SpO ₂	High flow		0	High flow
	≥ 95		1	≥ 95
	≤ 90		2	≤ 90
Heart Rate (bpm) mark HR with X write value if off scale	> 170		4	> 170
	160s		2	160s
	150s		2	150s
	140s		1	140s
	130s		0	130s
	120s		1	120s
	110s		2	110s
	100s		4	100s
	90s		777	90s
	< 49		777	< 49
Central Capillary Refill mark CR with X	≥ 3 sec		4	≥ 3 sec
	< 3 sec		0	< 3 sec
Blood Pressure (mmHg) score systolic BP value only write value if off scale	≥ 170		4	≥ 170
	160s		2	160s
	150s		2	150s
	140s		1	140s
	130s		0	130s
	120s		1	120s
	110s		2	110s
	100s		4	100s
	90s		777	90s
	≤ 39		777	≤ 39
PEWS TOTAL				PEWS TOTAL
Whānau/ staff concern X				
Level Of Consciousness	Alert			Alert
mark LOC with X	Voice			Voice
	Pain			Pain
	Unresponsive		777	Unresponsive
Temperature (°C)	≥ 41			≥ 41
mark Temp with X	40s			40s
write value if off scale	39s			39s
	38s			38s
	37s			37s
	36s			36s
Pain Score	Rest			Rest
write score (0-10)	Movement			Movement
Initials				



Family Name: _____
 Given Name: _____ Gender: _____
 AFIX PATIENT LABEL HERE
 NHI#: _____
 Date of Birth: _____

ESCALATE CARE FOR ANY PATIENT YOU OR THEIR WHĀNAU ARE WORRIED ABOUT, REGARDLESS OF VITAL SIGNS OR PEWS

Mandatory escalation pathway	Starship Child Health
Total PEWS	Action
PEWS 1-3	<ul style="list-style-type: none"> Assess child and record PEWS 4 hourly Manage pain, fever, distress or anxiety Consider discussing patient status with nurse in charge Consider discussion with RMO/ NP if concerned Document in notes
PEWS 4-5	<ul style="list-style-type: none"> Discuss patient status with nurse in charge within 1 hour RMO/ NP review within 4 hours Increase observation frequency to 1-2 hourly Manage pain, fever, distress or anxiety Document in notes
PEWS 6-7	<ul style="list-style-type: none"> Discuss patient status with nurse in charge immediately Consider discussion with PaR NS if concerned (021 829 402) [review within 60 minutes] RMO/ NP review within 2 hours Increase observation frequency to 30-60 minutes Manage pain, fever, distress or anxiety Document in notes
PEWS 8+	<ul style="list-style-type: none"> Nurse in charge: review within 15 minutes PaR NS (021 829 402) & RMO/ NP review within 30 minutes Registrar review within 60 minutes Increase observation frequency to every 15-60 minutes If worried, not improving or unclear plan discuss with Follow/ SMO; Consider Code Pink Document in notes
Any vital sign in the blue zone	<ul style="list-style-type: none"> Call 777 State 'Paediatric Code Blue' Support ABCD; check blood glucose; continuous monitoring Stay with and support child and whānau Inform SMO of primary team

Any treatment limitations must be documented in the patient's clinical record. A full set of vital signs must be taken, with corresponding PEWS calculated each time, at a frequency stated in hospital policy. If there is no timely response to your request for review, escalate to the next zone.

Modification to PEWS triggers

The PEWS can be changed to prevent inappropriate escalation. All modifications must be made in line with hospital policy and regularly reviewed by the primary team. **Query any modification that is not signed and dated.**

Vital sign (use abbreviation)	Accepted values and modified PEWS	Date and time	Duration (hours)	Name and contact details
Reason:		/ / : :		
Reason:		/ / : :		
Reason:		/ / : :		
Allow natural death (Te Wā Aroha)	<input type="checkbox"/>	/ / : :		

Figure 22 Back of PVSC 5–11 years, Starship

National tools

Family Name: _____
 Given Name: _____ Gender: _____
 Date of Birth: _____ NH#: _____

Assessment of respiratory distress guide			
	Mild	Moderate	Severe
Airway	<ul style="list-style-type: none"> • Stridor on exertion or crying • Wheeze present 	<ul style="list-style-type: none"> • Stridor at rest • New onset of stridor • Wheeze marked 	<ul style="list-style-type: none"> • Stridor at rest • New onset of stridor • Wheeze severe • Silent chest
Behaviour and feeding	<ul style="list-style-type: none"> • Normal talks in sentences 	<ul style="list-style-type: none"> • Some or intermittent irritability • Difficulty talking or crying • Difficulty feeding or eating 	<ul style="list-style-type: none"> • Increased irritability and/or lethargy • Looks exhausted • Unable to talk or cry • Unable to feed or eat
Accessory muscle use	<ul style="list-style-type: none"> • Mild intercostal and suprasternal recession 	<ul style="list-style-type: none"> • Moderate intercostal and suprasternal recession • Tachycardic • Nasal flaring • Head bobbing 	<ul style="list-style-type: none"> • Marked intercostal and suprasternal recession • Gaspings, grunting • Extreme pallor, cyanosis • Increasingly frequent or prolonged apnoea
Other		<ul style="list-style-type: none"> • May have brief apnoea 	

Score at the level of severest sign.
 Note that not all features are relevant to all conditions.

Respiratory support mode		
NP = Nasal prongs	M = Face mask	HF = High flow
R = Non-rebreather mask	C = CPAP	B = BPaP
TH = Tracheostomy humidification	HO ₂ = Humidified oxygen	

Numerical rating scale

No pain | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Worst pain

On a scale of 0-10, with 0 being no pain and 10 being the worst pain you can imagine, what number are you feeling right now on movement and at rest?

Faces pain scale - revised

0 2 4 6 8 10

Can you point to the face that shows how much you hurt?

Revised FLACC observational pain tool			
Categories	Scoring		
	0	1	2
Face	No expression or smile	Occasional grimace or frown, withdrawn, disinterested; appears sad or worried	Frequent to constant frowns, clenched jaw, quivering chin, distressed looking face, expression of fright or pain Individualised behaviour described by family.
Legs	Normal position or relaxed; usual muscle tone and motion to arms and legs	Uneasy, restless, tense; occasional tremors	Kicking, or legs drawn up; marked increase in spasticity; constant tremors or jerking Individualised behaviour described by family.
Activity	Lying quietly, normal position, moves easily; regular rhythmic breaths (respiration)	Squirming, shifting and fidgeting; marked movements; rigidly agitated (head back and forth, aggressive); shallow, spitting breaths (respirations); occasional sighs	Arches, rigid, or jerking; severe agitation, head banging; shivering (not rigors); breath holding, gasping, or sharp intake of breaths; severe splinting Individualised behaviour described by family.
Cry	No cry (awake or asleep)	Moans or whimpers, occasional complaint; occasional verbal outburst or grunt	Crying steadily, screams or sobs, frequent outbursts; repeated outbursts; constant grunting Individualised behaviour described by family.
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or 'talking to'; can be distracted	Difficult to console or comfort; pushing away caregiver; resisting core or comfort measures Individualised behaviour described by family.

Rate the child in each of the five measurement categories, add together, and document total pain score (0-10).

Children who are awake: Observe for at least 1-2 minutes. Observe legs and body uncovered. Reposition child or observe actively, assess body for tenseness and tone. Initiate soothing interventions if needed.

Children who are asleep: Observe for at least 2 minutes or longer. Observe legs and body uncovered. If possible, reposition the child. Touch the body and assess for tenseness and tone.

This tool can be used for all non-verbal children. The additional descriptors (in italics) are validated in children with cognitive impairment. The nurse can review with parents/caregivers the descriptors within each category. Ask the parents/caregivers if there are additional behaviours that are better indicators of their child experiencing pain. Add these behaviours to the tool in the appropriate category.

Local tools

Modified glamorgan pressure injury risk assessment																																																																																				
Risk factor	Score	Date and time																																																																																		
Every patient has 'risk assessed daily and with any change in condition																																																																																				
Mobility Child cannot be moved without great difficulty or deterioration in condition	20																																																																																			
Child unable to change his/her position without assistance / cannot control body movement	15																																																																																			
Child has some mobility but reduced for age	10																																																																																			
Child has normal mobility for age	0																																																																																			
Device / equipment / object / hard surface pressing or rubbing on skin	10																																																																																			
Total score:																																																																																				
Bundle of care:																																																																																				
Initials:																																																																																				
Bundle of care plan: Bundle 1: 10+ At-risk (Mobility or Device) <ul style="list-style-type: none"> • Inspect skin daily • Protect bony prominences • Keep skin clean and dry and moisturise daily • Relieve pressure by helping the child to move at least every 4 hours. • Reassess medical devices at least every 4 hours • If medical devices CANNOT be repositioned, protect underlying skin Bundle 2: 15+ High risk (Mobility) <ul style="list-style-type: none"> • Inspect skin each shift • Protect bony prominences • Keep skin clean and dry and moisturise daily • Relieve pressure by helping the child to move at least every 2-4 hours Bundle 3: 20+ Very high risk (Mobility and Device) <ul style="list-style-type: none"> • Inspect skin with each position change • Protect bony prominences • Keep skin clean and dry and moisturise daily • Consider an age, weight and condition appropriate pressure redistribution mattress (refer to Mattress Selection Guide) • Relieve pressure by helping the child to move at least every 2 hours • Reposition medical devices at least every 2 hours • If medical devices CANNOT be repositioned, protect underlying skin • If possible, reposition patient or medical device before skin becomes red NOTES: <ol style="list-style-type: none"> 1. Total score and interventions to be communicated at nursing handover 2. Document skin assessment in clinical record 3. Educate child / young person and whānau about potential pressure injury risks and bundle of care interventions 4. Refer as required (e.g. dietitian, physiotherapy, occupational therapy) 																																																																																				
Patient clinical care reviews <table border="1"> <thead> <tr> <th>Date</th> <th>Time</th> <th>Initials (x2)</th> <th>Time</th> <th>Initials (x2)</th> <th>Time</th> <th>Initials (x2)</th> <th>Time</th> <th>Initials (x2)</th> </tr> </thead> <tbody> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>				Date	Time	Initials (x2)	Time	Initials (x2)	Time	Initials (x2)	Time	Initials (x2)																																																																								
Date	Time	Initials (x2)	Time	Initials (x2)	Time	Initials (x2)	Time	Initials (x2)																																																																												
1. Patient Status is assessed: <ul style="list-style-type: none"> • FEWS • Pain • Pressure relief • Pharmacy - Medications/infusions - checked, lines and sites reviewed 																																																																																				
2. Patient Comfort is ensured: <ul style="list-style-type: none"> • Patient position - comfort levels assessed • Parents concerns and reassurance • Patients' needs and environment 																																																																																				
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4. Parental (caregiver) and Patient Care: <ul style="list-style-type: none"> • Plan and negotiate cares together • Patient's normal routines are assisted • Parental (caregiver) breaks are offered and planned 																																																																																				
Rousability score (patients receiving opioid)		Escalation																																																																																		
0	Awake and alert																																																																																			
1	Easily arouses to voice or light touch																																																																																			
2	Arouses to snoring	Doctor review within 30 mins. Consider Code Pink Withhold opioid / sedative until reviewed. Inform Pain Team																																																																																		
3	Unrousable	Stop opioid / sedative and call Code Blue. Inform Pain Team																																																																																		
Nausea and vomiting, rousability and epidural dermatome assessment																																																																																				
Date: _____																																																																																				
Time: _____																																																																																				
N = Nausea																																																																																				
V = Vomiting																																																																																				
Rousability Score																																																																																				
Dermatome																																																																																				
Level																																																																																				
Interventions																																																																																				
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Nurses sample signatures																																																																																				
Print Name	Signature	Initials	Print Name	Signature	Initials																																																																															

Epidural dermatome levels

Figure 23 Front of PVSC 12+ years, Tauranga and Whakatāne Hospitals

Family Name: _____ Gender: _____
 Given Name: _____
 Date of Birth: _____ NHIA: _____
 AFFILIATED LABEL HERE:
 PAEDIATRIC VITAL SIGNS CHART
 12+ YEARS
 HSC last PVSC 12+ y v2

Vital Signs		Date:	PEWS	Date:
Time (24 hour)				
Respiratory Rate (breaths/min) mark RR with X		≥ 35	4	≥ 35
		30-34	2	30-34
		25-29	1	25-29
		20-24	0	20-24
		15-19	0	15-19
		10-14	1	10-14
		6-9	2	6-9
		≤ 5	4	≤ 5
Respiratory Distress mark RD with X		Severe	4	Severe
		Moderate	2	Moderate
		Mild	1	Mild
		Nil	0	Nil
Oxygen (L/min or FiO ₂ %) write value		≥ 4L or ≥ 35%	4	≥ 4L or ≥ 35%
		< 4L or < 35%	2	< 4L or < 35%
		Room air X	0	X Room air
		Modn	0	Modn
		High flow	0	High flow
Oxygen Saturation (%) write SpO ₂		≥ 95	0	≥ 95
		91-94	1	91-94
		≤ 90	2	≤ 90
Heart Rate (bpm)		≥ 150	4	≥ 150
		140s	2	140s
		130s	2	130s
		120s	2	120s
		110s	1	110s
		100s	0	100s
		90s	0	90s
		80s	0	80s
		70s	0	70s
		60s	1	60s
		50s	2	50s
		40s	4	40s
		< 38	777	< 38
Central Capillary Refill mark CR with X		≥ 3 sec	4	≥ 3 sec
		< 3 sec	0	< 3 sec
		≥ 190	4	≥ 190
		180s	2	180s
		170s	2	170s
		160s	1	160s
		150s	1	150s
		140s	1	140s
		130s	0	130s
		120s	0	120s
		110s	0	110s
		100s	0	100s
		90s	1	90s
		80s	2	80s
		75s	4	75s
		60s	4	60s
		50s	777	50s
		40s	777	40s
		≤ 39	777	≤ 39
PEWS TOTAL				PEWS TOTAL
Whānau/ staff concern X				
Level Of Consciousness mark LOC with X		Alert		Alert
		Verbal		Verbal
		Pain		Pain
		Unresponsive	777	Unresponsive
Temperature (°C)		≥ 41		≥ 41
		40s		40s
		39s		39s
		38s		38s
		37s		37s
		36s		36s
Pain Score write score (0-10)		Rest		
		Movement		
Initials				



Family Name: _____
 Given Name: _____ Gender: _____
 Date of Birth: _____ NHIA: _____

ESCALATE CARE FOR ANY PATIENT YOU OR THEIR WHĀNAU ARE WORRIED ABOUT, REGARDLESS OF VITAL SIGNS OR PEWS

Total PEWS	Action
♦ Whakatāne: Consider calling clinical flow nurse within 1 hour. (Wednesday to Sunday 14:00 to 22:30 on 0273185319)	
PEWS 1-3	<ul style="list-style-type: none"> Assess child and record observations 4 hourly Optimise treatments and manage pain, fever and anxiety Consider discussing with senior RN on shift Routine doctor review
PEWS 4-5	<ul style="list-style-type: none"> Senior nurse review within 30 minutes/♦ RMO review within 2 hours/♦ Complete a full set of observations Optimise treatments and manage pain, fever and anxiety Record observations 1-2 hourly
PEWS 6-7	<ul style="list-style-type: none"> Senior nurse review within 15-30 minutes/♦ RMO review within 30-60 minutes/♦ Consider discussing with SMO Complete a full set of observations Optimise treatments and manage pain, fever and anxiety Record observations 30-60 minutes Consider continuous monitoring
PEWS 8+	<ul style="list-style-type: none"> Senior nurse review within 15 minutes RMO review within 30 minutes Consider ICU/PICU review Complete full set of observations Continuous monitoring Optimise treatments and manage pain, fever and anxiety Increase observation frequency to every 15 minutes Consider 777 call
Any vital sign in the blue zone <ul style="list-style-type: none"> Immediate 777 call State 'Paediatric, Medical or Surgical Emergency' Support ABC Check blood glucose Continuous monitoring Stay with and support child and whānau 	

Any treatment limitations must be documented in the patient's clinical record. A full set of vital signs must be taken, with corresponding PEWS calculated each time, at a frequency stated in hospital policy. If there is no timely response to your request for review, escalate to the next zone.

Modification to PEWS triggers

The PEWS can be changed to prevent inappropriate escalation. All modifications must be made in line with hospital policy and regularly reviewed by the primary team. Query any modification that is not signed and dated.

Vital sign (use abbreviation)	Accepted values and modified PEWS	Date and time	Duration (hours)	Name and contact details
Reason:		/ /		
Reason:		/ /		
Reason:		/ /		
Reason:		/ /		
Allow natural death (Te Wa Aroha)		/ /		

Figure 24 Back of PVSC 12+ years, Tauranga and Whakatāne Hospitals

National tools

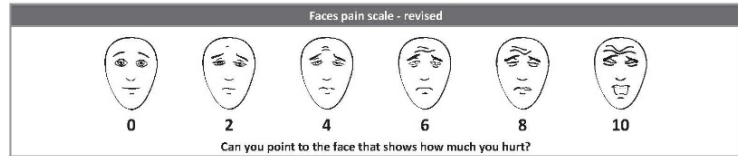
Family Name: _____
 Given Name: _____ Gender: _____
 AFFIX PATIENT LABEL HERE.
 Date of Birth: _____ NHI#: _____

Assessment of respiratory distress guide			
	Mild	Moderate	Severe
Airway	<ul style="list-style-type: none"> Stridor on exertion or crying Wheeze present 	<ul style="list-style-type: none"> Some stridor at rest Wheeze marked Silent chest 	<ul style="list-style-type: none"> Stridor at rest New onset of stridor Wheeze severe Silent chest
Behaviour and feeding	<ul style="list-style-type: none"> Normal Talks in sentences 	<ul style="list-style-type: none"> Some or intermittent irritability Difficulty talking or crying Unable to talk or cry Unable to feed or eat 	<ul style="list-style-type: none"> Increased irritability and/or lethargy Looks exhausted Unable to talk or cry Unable to feed or eat
Accessory muscle use	<ul style="list-style-type: none"> Mild intercostal and supra-sternal recession 	<ul style="list-style-type: none"> Moderate intercostal and supra-sternal recession Tracheal tug Nasal flaring Head bobbing 	<ul style="list-style-type: none"> Marked intercostal and supra-sternal recession
Other		<ul style="list-style-type: none"> May have brief apnoea 	<ul style="list-style-type: none"> Gasping, grunting Extreme pallor, cyanosis Increasingly frequent or prolonged apnoea

Score at the level of severest sign.
 Note that not all features are relevant to all conditions.

Respiratory support mode		
NP = Nasal prongs	M = Face mask	HF = High flow
R = Non-rebreather mask	C = CPAP	B = BPaP
TH = Tracheostomy humidification	HO = Humidified oxygen	

Numerical rating scale	
No pain	Worst pain
0 1 2 3 4 5 6 7 8 9 10	
On a scale of 0-10, with 0 being no pain and 10 being the worst pain you can imagine, what number are you feeling right now on movement and at rest?	



Revised FLACC observational pain tool			
Categories	Scoring		
	0	1	2
Face	No expression or smile	Occasional grimace or frown, with/without arm, disinterested; appear sad or worried	Frequent to constant frown, clenched jaw, quivering chin; distressed looking face; expression of fright or panic Individualised behaviour described by family
Legs	Normal position or relaxed; usual muscle tone and motion to arms and legs	Uneasy, restless, tense; occasional tremors	Kicking, or legs drawn up; marked increase in spasticity; constant tremors or jerking Individualised behaviour described by family
Activity	Lying quietly, normal position, moves easily; regular rhythmic breaths (respiration)	Squirming, shifting back and forth, tense or guarded movements; mildly agitated (head back and forth, aggression); shallow, saltating breaths (respirations); occasional sighs	Arches, rigid, or jerking; severe agitation; head banging/shaking (not rigid); breath holding, gasping, or sharp intake of breath; severe splinting Individualised behaviour described by family
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint; occasional vocal outburst or grunt	Crying steadily, screams or sobs, frequent complaints; repeated outbursts; constant grunting Individualised behaviour described by family
Consolability	Content, relaxed	Reassured by occasional touching, hugging, or 'kissing to' can be distracted	Difficult to console or comfort; pushing away caregiver; resisting care or comfort measures Individualised behaviour described by family

Rate the child in each of the five measurement categories, add together, and document total pain score (0-10).

Children who are awake: Observe for at least 1-2 minutes. Observe legs and body uncovered. Reposition child or observe activity, assess body for tenseness and tone. Initiate soothing interventions if needed.

Children who are asleep: Observe for at least 2 minutes or longer. Observe legs and body uncovered. If possible, reposition the child. Touch the body and assess for tenseness and tone.

This tool can be used for all non-verbal children. The additional descriptors (in italics) are validated in children with cognitive impairment. The nurse can review with parents/caregivers the descriptors within category. Ask the parents/caregivers if there are additional behaviours that are better indicators of their child experiencing pain. Add these behaviours to the tool in the appropriate category.

Local tools

REQUEST URGENT REVIEW IF:	CONSIDER EARLIER ESCALATION OF PATIENTS WITH:	CUSS Communication Tool	
Apnoea/airway threat	Chronic or complex conditions, post-operative patients, pre-existing cardiac or respiratory conditions, or old infections	Concern	Telling your colleague or your team: "I'm concerned about..."
Unexpected seizure		Uncomfortable	If no or mixed response: "I'm uncomfortable with..."
Significant bleeding		Unsafe	If path of action continues: "I'm sorry this is unsafe. We need to..."
Suspect anaethesia's		Stop	Finally if interventions continue you will need to go to the highest level: "Stop!"
Ethnicity Identifier			
M = Māori P = Pacific peoples A = Asian E = European O = Other R = Residual Categories			

Glasgow Coma Scale							Pupil scale (mm)
	Date	Time	Right Eye	Left Eye	Fontanelle	Best Verbal Response	
E = Eyes	-	Reactive	Size (mm)				(Use the pupil legend to indicate the size in mm. Also note the reaction capability of each eye)
			Reaction				
S = Speech	-	Slurred	Size (mm)				
			Reaction				
-	-	Absent	Sunken				
			Soft				
-	-	-	Tense				
			Bulging				
Eye Opening	C = Eyes closed by swelling	4	Spontaneously				
			3	To verbal command			
Best Verbal Response	T = Trache	> 5 years	2	To pain			
			1	No response			
Best Verbal Response	T = Trache	< 5 years	5	Orientated and converses			
			4	Orientated and converses			
Best Motor Response	T = Trache	< 5 years	3	Inappropriate words			
			2	Incomprehensible			
Best Motor Response	T = Trache	< 5 years	1	No response			
			6	Obeys commands. Moves spontaneously and purposefully			
Best Motor Response	T = Trache	< 5 years	5	Localises to pain			
			4	Flexion - withdrawal			
Best Motor Response	T = Trache	< 5 years	3	Abnormal flexion			
			2	Abnormal extension			
Best Motor Response	T = Trache	< 5 years	1	No response			
			6	Obeys commands. Moves spontaneously and purposefully			

Total Glasgow Coma Scale:

Patient clinical care reviews							1. Patient Status is assessed:	2. Patient Comfort is ensured:
Date	Time	Initials (x2)	Time	Initials (x2)	Time	Initials (x2)		
							<ul style="list-style-type: none"> PEWS Pain Pressure relief Pharmacy - medications/infusions - checked, lines and sites reviewed 	<ul style="list-style-type: none"> Patient position - comfort levels assessed Parental concerns and reassurance Patients' needs and environment
							<ul style="list-style-type: none"> 3. Patient Nursing Care is evaluated and discussed: The need for escalation of patient status Anticipate care planning needs and actions Reassess care requirements to be shared 	<ul style="list-style-type: none"> 4. Parental (caregiver) and Patient Care: Plan and negotiate cares together Patients' normal routines are assisted Parental (caregiver) breaks are offered and planned

Interventions (Record intervention administered here and note number in appropriate time column)	Signature
1	
2	
3	
4	
5	
6	
7	
8	
9	

Appendix B

Table 14 Comparison of CDHB and national PEW score escalation bands

Age group	CDHB PEW score band	National PEW score escalation band counts						Proportion in national PEW score escalation band					
		0	1-3	4-5	6-7	8+	Blue	0	1-3	4-5	6-7	8+	Blue
Under 3 months	0	2,804	1,542	12	0	0	0	0.64	0.35	0.00	0.00	0.00	0.00
Under 3 months	1-3	179	2,450	769	208	33	0	0.05	0.67	0.21	0.06	0.01	0.00
Under 3 months	4-5	0	7	77	90	82	0	0.00	0.03	0.30	0.35	0.32	0.00
Under 3 months	6-7	0	0	0	10	48	0	0.00	0.00	0.00	0.17	0.83	0.00
Under 3 months	8+	0	0	0	0	8	0	0.00	0.00	0.00	0.00	1.00	0.00
Under 3 months	Blue	0	0	10	7	11	6	0.00	0.00	0.29	0.21	0.32	0.18
3 to 11 months	0	1,856	3,069	41	1	0	0	0.37	0.62	0.01	0.00	0.00	0.00
3 to 11 months	1-3	189	2,043	458	64	5	0	0.07	0.74	0.17	0.02	0.00	0.00
3 to 11 months	4-5	0	80	253	146	32	0	0.00	0.16	0.50	0.29	0.06	0.00
3 to 11 months	6-7	0	0	27	94	73	0	0.00	0.00	0.14	0.48	0.38	0.00
3 to 11 months	8+	0	0	0	2	49	0	0.00	0.00	0.00	0.04	0.96	0.00
3 to 11 months	Blue	0	0	0	0	0	1	0.00	0.00	0.00	0.00	0.00	1.00
1 to 4 years	0	7,010	3,747	3	0	0	0	0.65	0.35	0.00	0.00	0.00	0.00
1 to 4 years	1-3	364	5,516	1,139	85	10	0	0.05	0.78	0.16	0.01	0.00	0.00
1 to 4 years	4-5	0	156	639	497	124	0	0.00	0.11	0.45	0.35	0.09	0.00
1 to 4 years	6-7	0	2	32	169	364	0	0.00	0.00	0.06	0.30	0.64	0.00
1 to 4 years	8+	0	0	0	2	157	0	0.00	0.00	0.00	0.01	0.99	0.00
1 to 4 years	Blue	2	1	12	2	0	37	0.04	0.02	0.22	0.04	0.00	0.69
5 to 11 years	0	13,125	4,451	4	0	0	0	0.75	0.25	0.00	0.00	0.00	0.00
5 to 11 years	1-3	398	8,599	723	82	9	11	0.04	0.88	0.07	0.01	0.00	0.00
5 to 11 years	4-5	1	102	190	157	37	6	0.00	0.21	0.39	0.32	0.08	0.01
5 to 11 years	6-7	0	0	5	28	60	0	0.00	0.00	0.05	0.30	0.65	0.00
5 to 11 years	8+	0	0	0	1	25	0	0.00	0.00	0.00	0.04	0.96	0.00
5 to 11 years	Blue	0	0	0	0	0	10	0.00	0.00	0.00	0.00	0.00	1.00
12 to 15 years	0	12,157	4,209	4	0	0	0	0.74	0.26	0.00	0.00	0.00	0.00
12 to 15 years	1-3	185	4,508	579	72	3	4	0.03	0.84	0.11	0.01	0.00	0.00
12 to 15 years	4-5	0	25	125	68	19	7	0.00	0.10	0.51	0.28	0.08	0.03
12 to 15 years	6-7	0	1	2	21	27	1	0.00	0.02	0.04	0.40	0.52	0.02
12 to 15 years	8+	0	0	0	0	10	0	0.00	0.00	0.00	0.00	1.00	0.00
12 to 15 years	Blue	0	0	0	0	0	4	0.00	0.00	0.00	0.00	0.00	1.00

Appendix C Review of Starship’s audit data

The Starship team collected 12 weeks of audit data for both wards, from the week beginning 22 November 2021 through to 14 February 2022. The data was cleaned, and no records were removed. In six records (from early in the audit), the clinician used the wrong PVSC. This finding supports the need for the team to discuss ways to ensure the correct PVSC is used.

Process measures

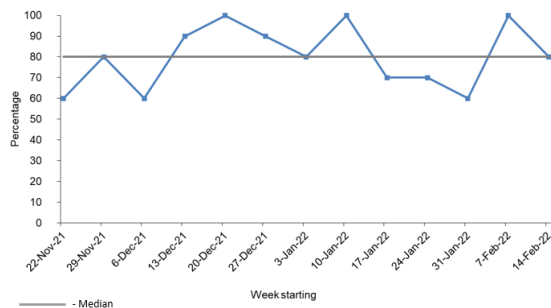
1. Percentage of patients receiving appropriate frequency of vital sign monitoring

This measure relates to the whole PVSC and requires the auditor to review the last 24 hours of vital signs monitoring. Appropriate frequency is determined by the organisational minimum standard, local policy/guidelines, the escalation pathway, procedural requirements or documentation in the plan of care.

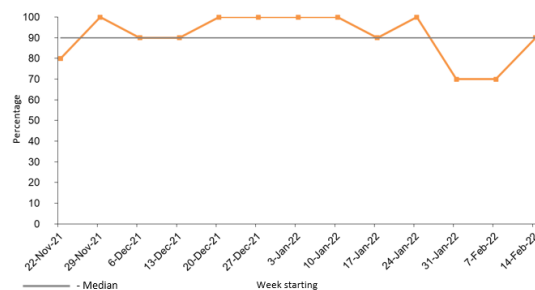
No run chart rules apply to these graphs below (see Figure 26). Ward 27AB has nine data points that do not fall on the median. More data points are required for both ward 25 and ward 27AB.

Figure 25 Percentage of patients receiving appropriate frequency of vital signs monitoring in Starship (a) ward 25 and (b) ward 27AB.

26a



26b

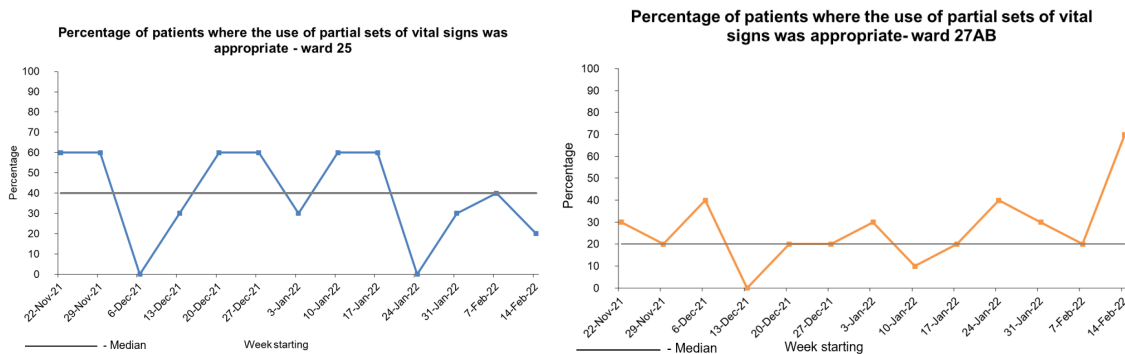


2. Percentage of patients where the use of partial sets of vital signs was appropriate

This measure relates to the whole PVSC and requires the auditor to review the last 24 hours of vital signs monitoring. Appropriateness is determined by reviewing the number of partial sets on the PVSC and determining whether this is in line with local guidelines/policy, escalation pathway or plan of care.

These run charts both have astronomical points – two for Ward 25 and one for Ward 27AB (see Figure 27). More data points are required for both wards. Concern has been expressed that the appropriate use of partial sets is declining in ward 25.

Figure 26 Percentage of patients where the use of partial sets of vital signs was appropriate in Starship (a) ward 25 and (b) ward 27AB.

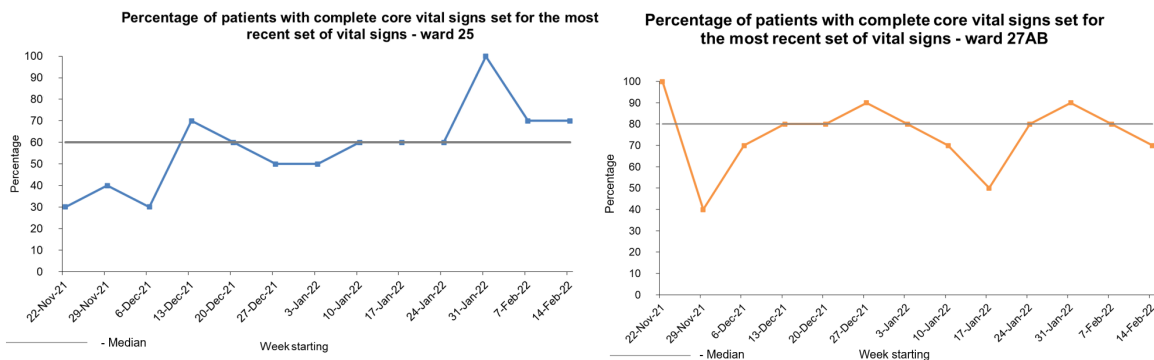


3. Percentage of patients with complete core vital sign set for the most recent set of vital signs

This measure relates to the most recent set of vital signs. The core vital sign set is complete when all the vital signs required to calculate the PEW score are recorded: respiratory rate, respiratory distress, oxygen, oxygen saturation, heart rate, central capillary refill and systolic blood pressure.

These run charts both have one astronomical point each (see Figure 28). More data points are required for both Ward 25 and 27AB. However, the run chart for Ward 25 has increased over the test period.

Figure 27 Percentage of patients with complete core vital signs set for the most recent set of vital signs in Starship (a) ward 25 and (b) ward 27AB.

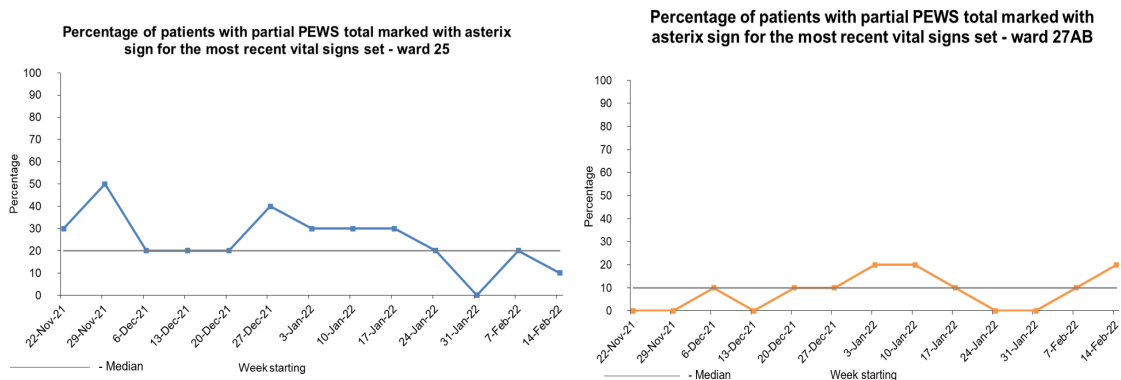


4. Percentage of patients with partial PEW score total marked with an asterisk (*) for the most recent vital signs set

This measure relates to the most recent set of vital signs. An asterisk (*) is used to mark that the vital sign set is a recognised partial recording. A subsequent question is whether the reason for a partial has been documented in the clinical record.

No run chart rules apply to these graphs (see Figure 29). Although the run chart for ward 25 has two runs, only eight data points are not on the median. This means that the run chart rule of too many/too few runs cannot be applied.

Figure 28 Percentage of patients with partial PEWS total marked with asterisk for the most recent vital signs set in (a) ward 25 and (b) ward 27AB

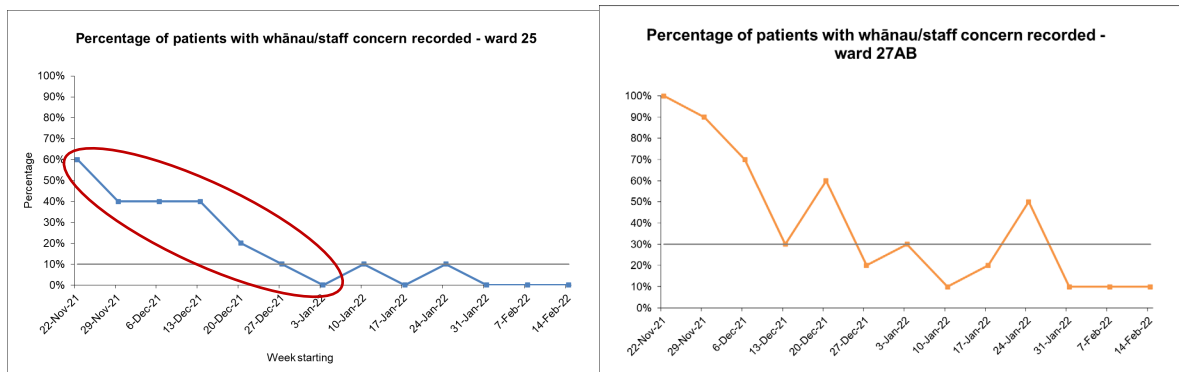


5. Percentage of patients with whānau and/or staff concern recorded

This measure relates to the most recent set of vital signs. There is a row on the PVSC for recording whānau/staff concern using a tick.

Figure 30 shows a downward trend. This aligns with discussions with the project team, who noted during the early part of testing that staff were confused about how to use the box for whānau/staff concern. The team educated staff on both wards about how to document concern. More data points would assist with identifying whether the median line should be reduced.

Figure 29 Percentage of patients with whānau/staff concern recorded in (a) ward 25 and (b) ward 27AB.

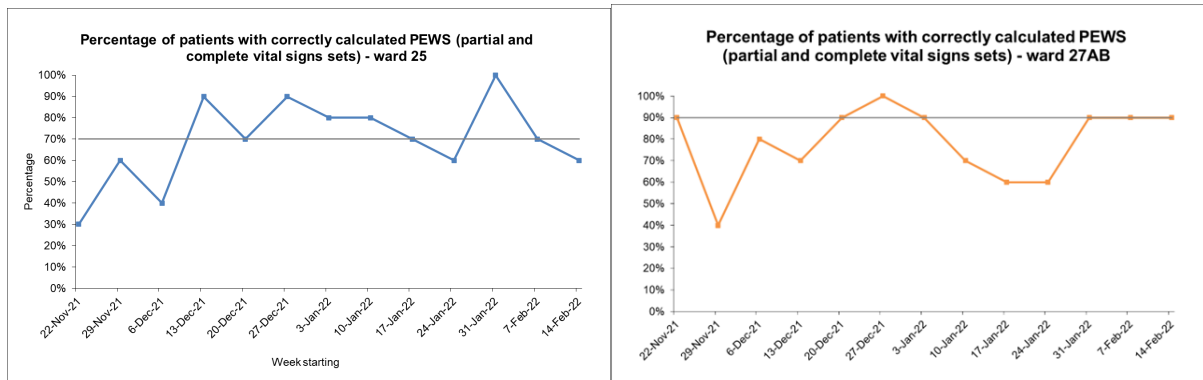


6. Percentage of patients with correctly calculated PEW score (partial and complete vital signs sets)

This measure relates to the most recent set of vital signs. Conditions need to be met for correct calculation: if it is a complete vital signs set or a recognised partial, the PEW score total is calculated correctly, and any valid modification is correctly applied in the PEW score calculation.

These run charts indicate that variations exist (see Figure 31). Given the location of the median line, the outlying points of 100 percent on Figure 31a and 40 percent on Figure 31b are not treated as astronomical points.

Figure 30 Percentage of patients with correctly calculated PEWS (partial and complete vital signs sets) in (a) ward 25 and (b) ward 27AB.

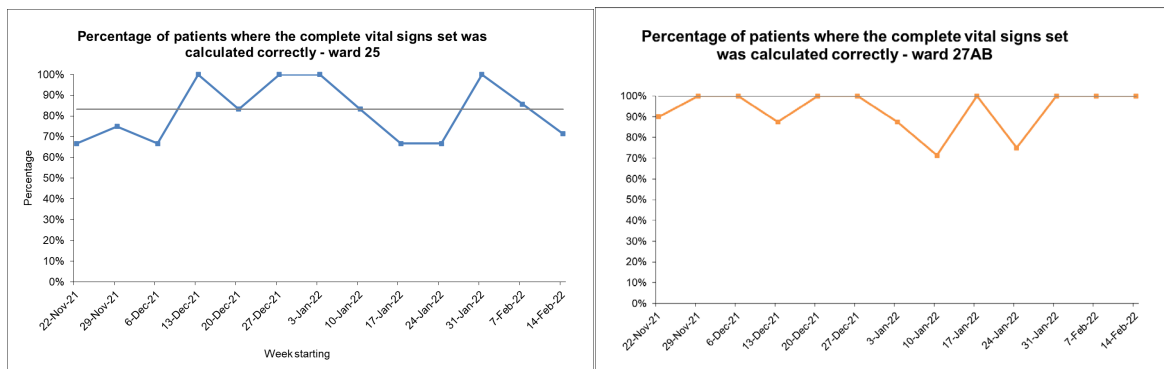


7. Percentage of patients where the complete vital signs set was calculated correctly

This measure relates to the most recent set of vital signs. Conditions need to be met for correct calculation: when it is a complete vital signs set, the PEW score total is calculated correctly, and any valid modification is correctly applied in the PEW score calculation.

No run chart rules can be applied to these run charts (see Figure 32). However, the graphs indicate that complete sets of vital signs are not always being correctly calculated.

Figure 31 Percentage of patients where the complete vital signs set was calculated correctly in (a) ward 25 and (b) ward 27AB

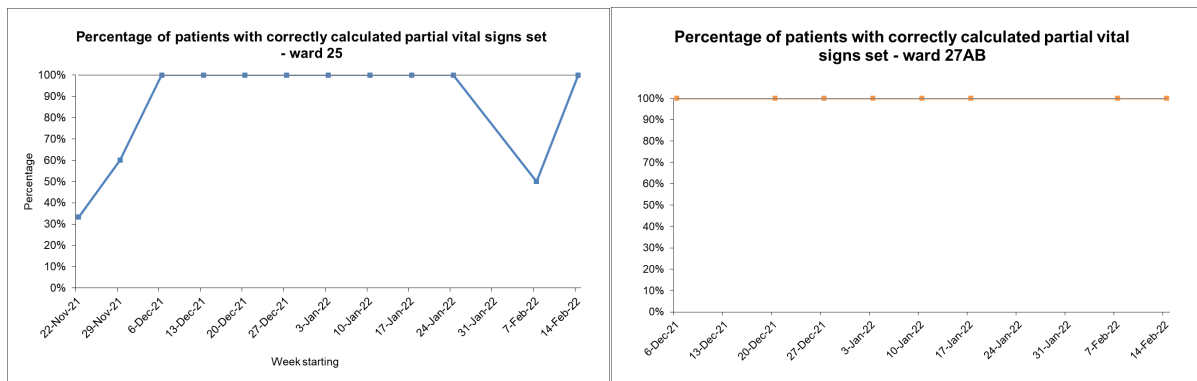


8. Percentage of patients with correctly calculated partial vital signs set

This measure relates to the most recent set of vital signs. Conditions need to be met for correct calculation: when it is a recognised partial, the PEW score total is calculated correctly and any valid modification is correctly applied in the PEW score calculation.

No run chart rules can be applied to these run charts (see Figure 33). However, the graphs indicate that, where recognised partial sets of vital signs are taken (and marked with an asterisk), they are being correctly calculated.

Figure 32 Percentage of patients with correctly calculated partial vital signs set in (a) ward 25 and (b) ward 27AB.

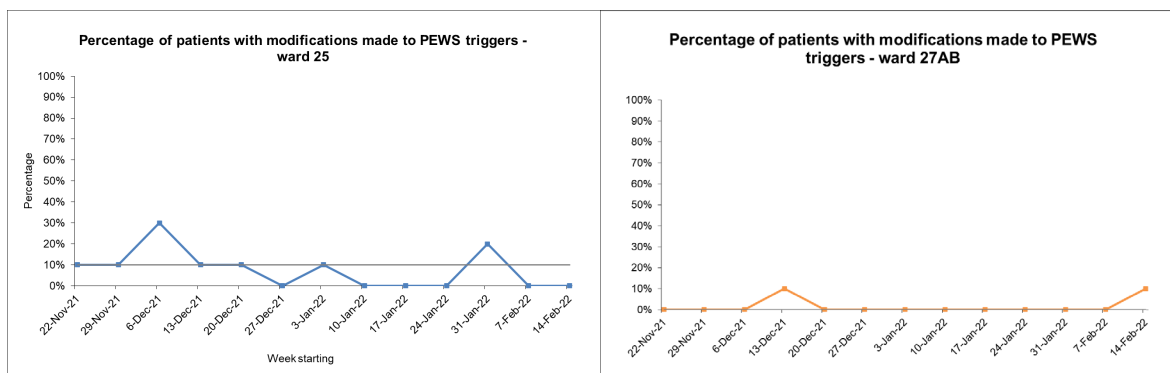


9. Percentage of patients with modifications made to PEW score triggers

This measure relates to the most recent set of vital signs. The PVSC allows for modifications to vital sign triggers using the modifications box. There are three spaces for modifications.

No rules can be applied to these run charts (see Figure 34). However, the graphs indicate that the use of modifications is low across the audited cases. This aligns with the feedback from the project team and is consistent with the adult and maternity vital signs charting. A key point to note is that only 50–60 percent of these are being documented as required for the safe use of these modifications.

Figure 33 Percentage of patients with modifications made to PEWS triggers in (a) ward 25 and (b) ward 27AB

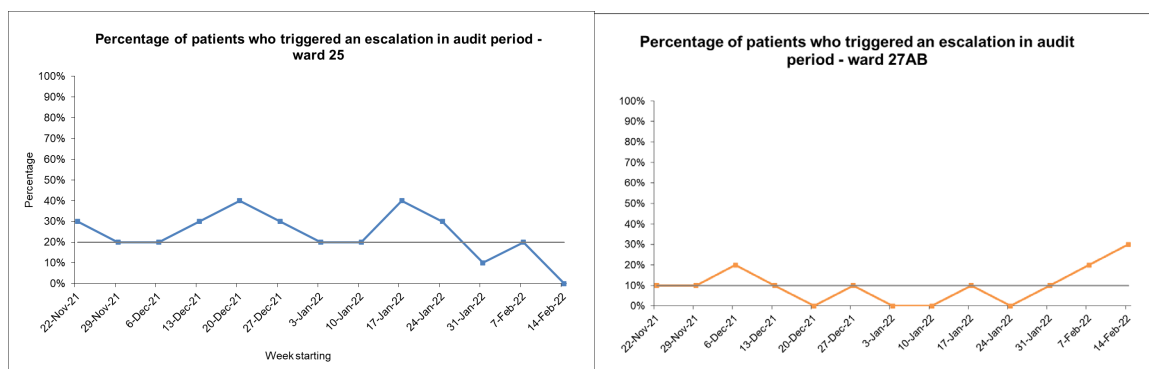


10. Percentage of patients who triggered an escalation in audit period

This measure relates to the 24-hour audit period. Auditors review whether the patient had a PEW score of 4–5, 6–7, 8+ or a single vital sign in the blue zone. If they had more than one, the most recent is reviewed.

No run chart rules can be applied to these run charts (see Figure 35). However, the charts show that the percentage of patients who triggered an escalation was relatively low – 17 percent (44 of the 260 audited cases). This aligns with feedback from the project team that there were few escalations of PEW score of four or more during this period and that the escalation pathway was not tested as much because of this. The key point to note is that not all of these were escalated or responded to as per the pathway, nor were they documented by recognisers and responders as per local policy. Both this and the escalations during winter will need to be monitored by the Starship project team and clinical governance group.

Figure 34 Percentage of patients who triggered an escalation in the audit period in (a) ward 25 and (b) ward 27AB.



11. Percentage of patients marked 'unresponsive' in level of consciousness

This measure relates to the most recent set of vital signs. 'Unresponsive' is an option for level of consciousness, as is a single trigger in the blue. This section does not contribute to the total PEW score. No patients were marked unresponsive in the level of consciousness section during the audit.

Outcome measures

The national team developed outcome measures for testing (see Table 15) based on literature, what hospitals may collect already and discussion with the Scottish paediatric programme leads.

Table 15 National outcome measures for testing PEWS

	National outcome measure	Definition	How to collect
1	Number of escalations to rapid response team (or equivalent)	Number of calls to the hospital's paediatric rapid response team (or equivalent). These escalations could be triggered by any vital sign in the blue zone or by clinical or whānau concern	When it occurs or on retrospective review. Up to the sites how they collect this data and where from
2	Number of unplanned admissions to a higher level of care (intensive care)	Unplanned means when not anticipated as part of the provision of care	For this measure, higher level of care means the intensive care unit
3	Number of unplanned admissions to higher level of care (high dependency unit)		For this measure, higher level of care means the high dependency unit
4	Number of unplanned admissions to higher level of care (transfer to higher acuity hospital)		For this measure, higher level of care means the transfer to a higher acuity hospital

This information may be collected through a review of switchboard call records or directly collected by the rapid response team (or equivalent)

	National outcome measure	Definition	How to collect
5	Number of unplanned admissions to higher level of care (increased 1:1 care)		For this measure, higher level of care means an increase in 1:1 care provided on the ward

The Starship project team used measure one and adapted measures two and three of the national measures and added two additional measures. They did not use measures four and five as there is no higher acuity hospital in Aotearoa New Zealand beyond Starship. No marked increase in these measures were observed during the PEWS testing period (November 2021 to March 2022). See Figures 36–39.

Figure 35 Number of escalations to the rapid response team per month: (a) measure one (code pink) and (b) measure two (code blue).

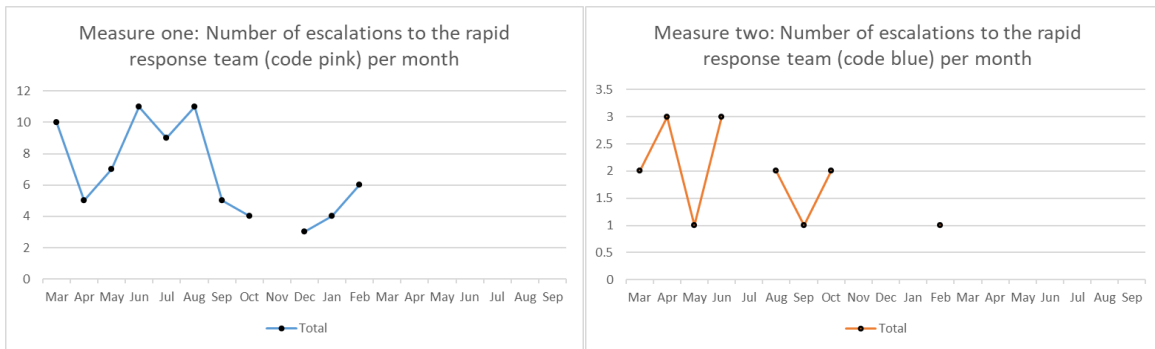


Figure 36 Measure three: number of 'patient at risk' encounters per month.

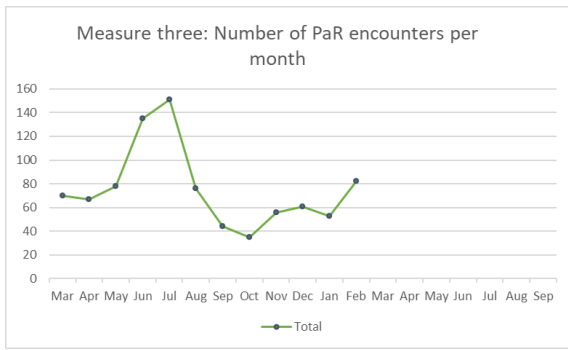


Figure 37 Measure four: number of unplanned admissions to higher level of care (intensive care/high dependency unit) per month.

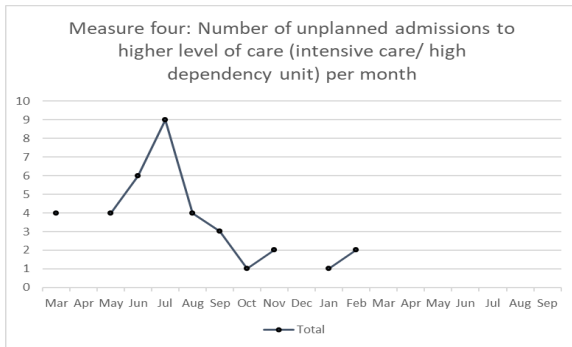
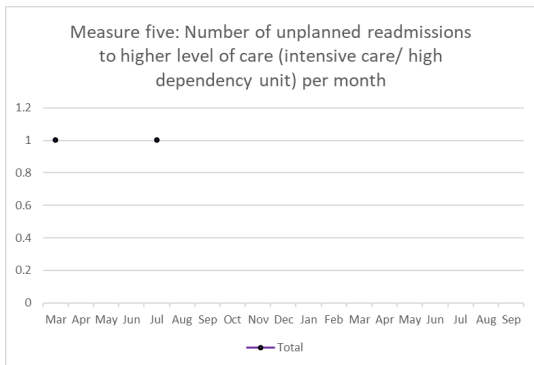


Figure 38 Measure five: number of unplanned readmissions to higher level of care (intensive care/high dependency unit) per month.



Appendix D Review of Tauranga Hospital's audit data

The Tauranga team collected 14 weeks of baseline audit data for their paediatric ward and 15 weeks of implementation audit data (implementation data from week beginning 14 February to 23 May 2022). They also undertook smaller audits for their day stay unit and emergency department over this period. This report uses only the data from their paediatric ward.

The data was cleaned, and no records were removed. In three records, the clinician used the wrong PVSC: two in the baseline and one in the implementation period. This finding supports the need for the team to discuss ways to ensure the correct PVSC is used.

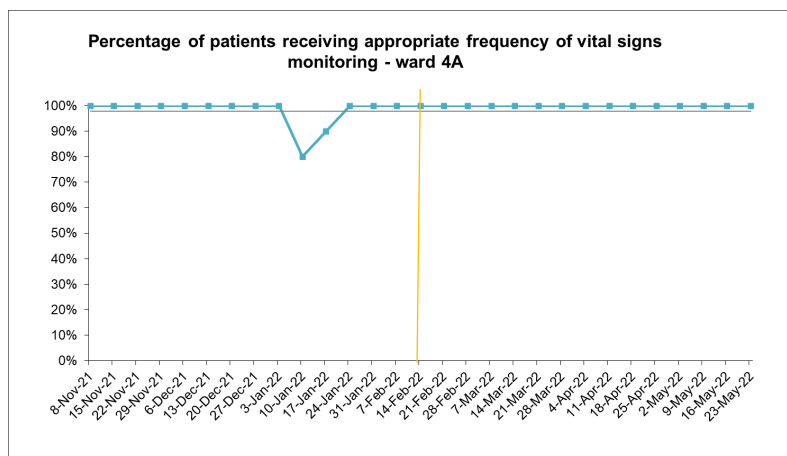
Process measures

In the following graphs, the yellow line denotes the week that implementation started on the ward. See [Appendix C](#) for a description of the process measures.

1. Percentage of patients receiving appropriate frequency of vital signs monitoring

There was little difference in the results for this measure (see Figure 40). It was consistently 100 percent during the implementation period. No run chart rules apply to this graph.

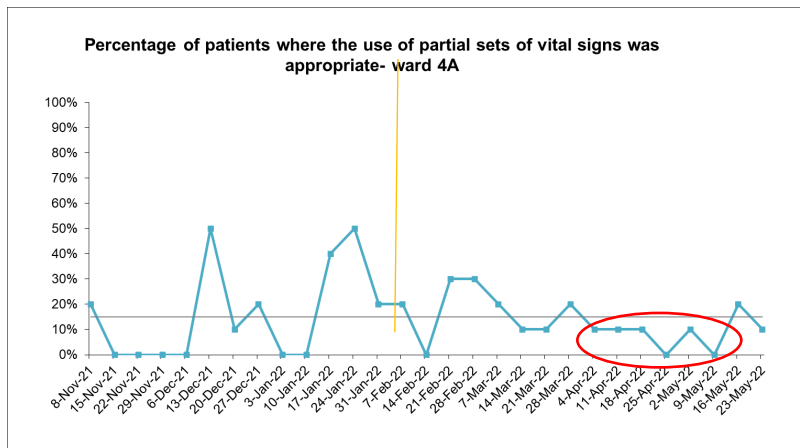
Figure 39 Percentage of patients receiving appropriate frequency of vital signs monitoring: ward 4A.



2. Percentage of patients where the use of partial sets of vital signs was appropriate

The circled area on the graph (see Figure 41) shows a shift as a signal of change and an opportunity for further improvement.

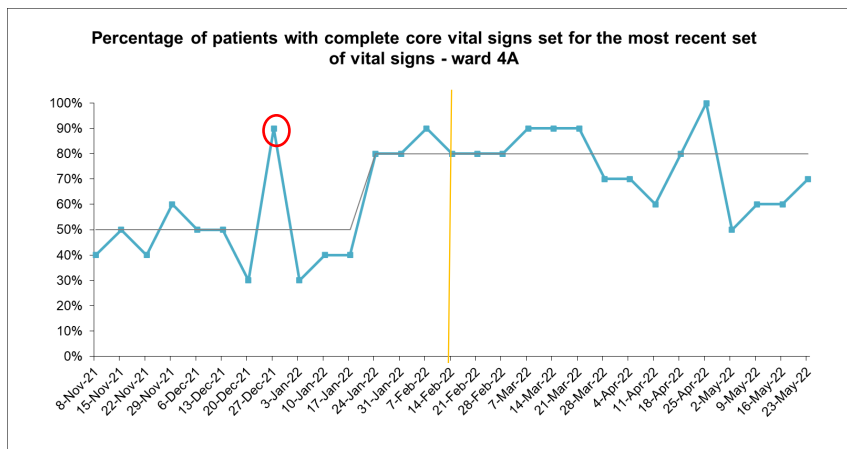
Figure 40 Percentage of patients where the use of partial sets of vital signs was appropriate: ward 4A.



3. Percentage of patients with complete core vital sign set for the most recent set of vital signs

Figure 42 indicates an improvement in the completion of core vital sets. This is represented by the trend shown and has increased the median line to 80 percent. This occurred during the education period being conducted before starting to use the new PVSCs and continued after that. However, the last four data points are below the new median, which indicates that some work is needed to maintain the gains.

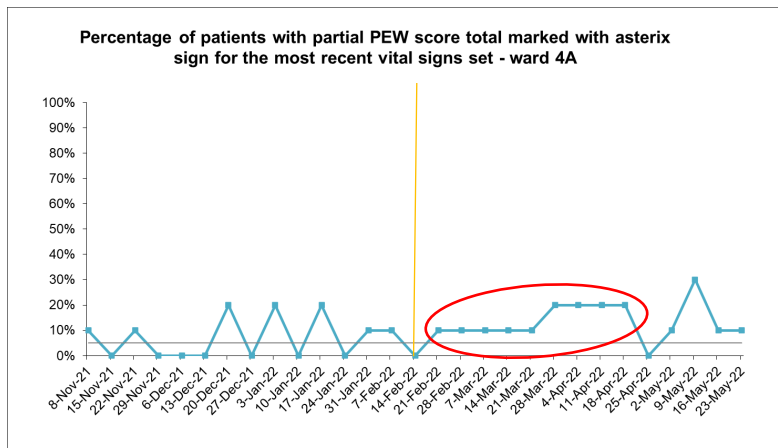
Figure 41 Percentage of patients with complete core vital sign sets for the most recent set of vital signs: ward 4A.



4. Percentage of patients with a partial PEW score total marked with an asterisk (*) for the most recent vital signs set

There was a shift that signalled improvement, as identified during the implementation period (see Figure 43). In the preparation period, there were too many runs. Most of these partials had the reason documented in the clinical record.

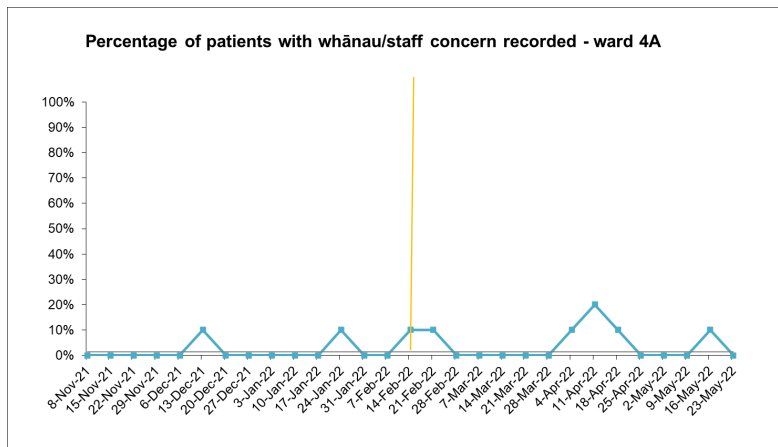
Figure 42 Percentage of patients with partial PEW score total marked with asterisk (*) for the most recent vital signs set: ward 4A.



5. Percentage of patients with whānau and/or staff concern recorded

No run chart rules apply to this graph (see Figure 44). When whānau and/or staff concern was recorded, whether the concern had been acted on and documented was not always recorded in the clinical record.

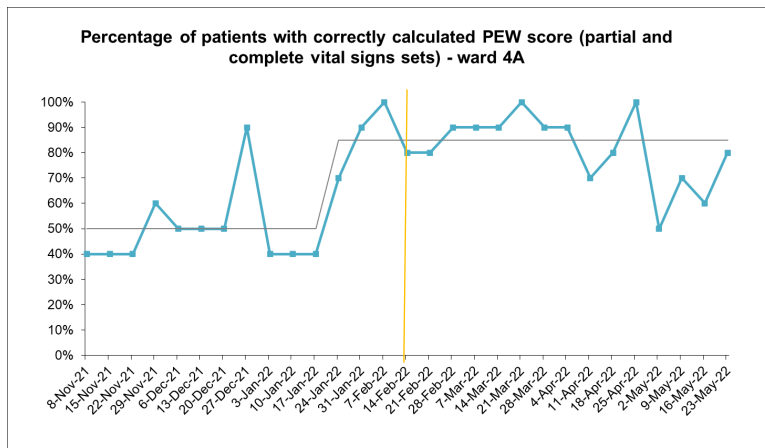
Figure 43 Percentage of patients with whānau/staff concern recorded: ward 4A.



6. Percentage of patients with a correctly calculated PEW score (partial and complete vital signs sets)

Figure 45 signals an improvement in the correct calculation of the total PEW score. This is represented by the shift shown on the graph and moving the median line to 80 percent. This occurred during the education period conducted before starting to use the new PVSCs. However, the data shows that some work is needed to maintain the gains. The shape of the graph closely relates to that shown in the percentage of patients with completed core vital signs set for the most recent set of vital signs.

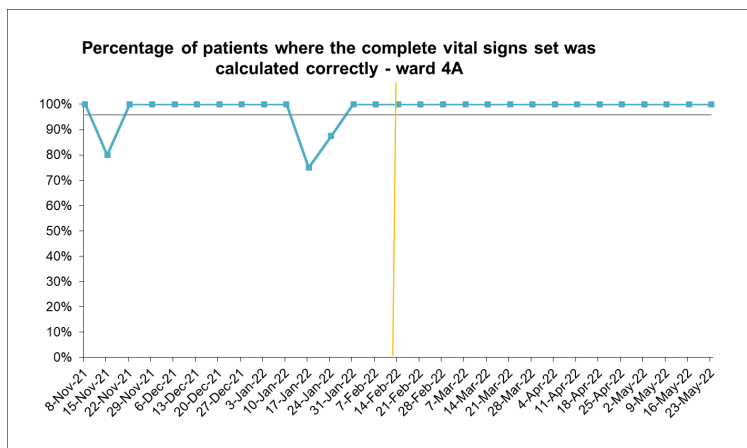
Figure 44 Percentage of patients with correctly calculated PEW score (partial and complete vital signs sets): ward 4A.



7. Percentage of patients where the complete vital signs set was calculated correctly

Results for this measure did not differ much and were consistently 100 percent during the implementation period (see Figure 46). No run chart rules apply to this graph.

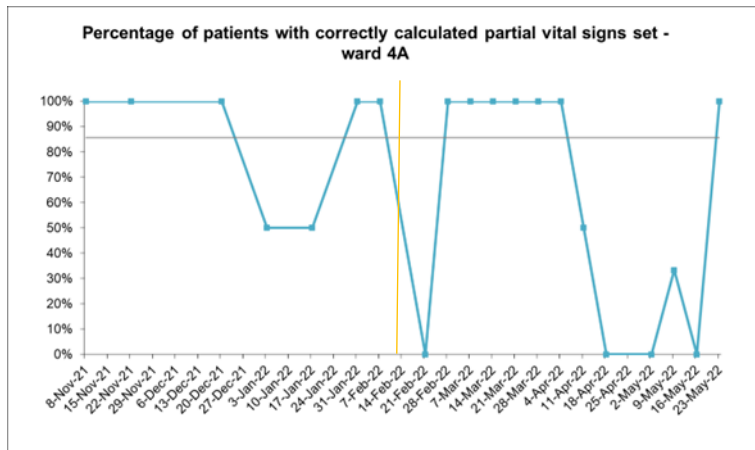
Figure 45 Percentage of patients where the complete vital signs set was calculated correctly: ward 4A.



8. Percentage of patients with correctly calculated partial vital signs set

No run chart rules apply to this graph (see Figure 47). The extremes shown in this graph relate to the small numbers of partial vital signs sets in the auditing.

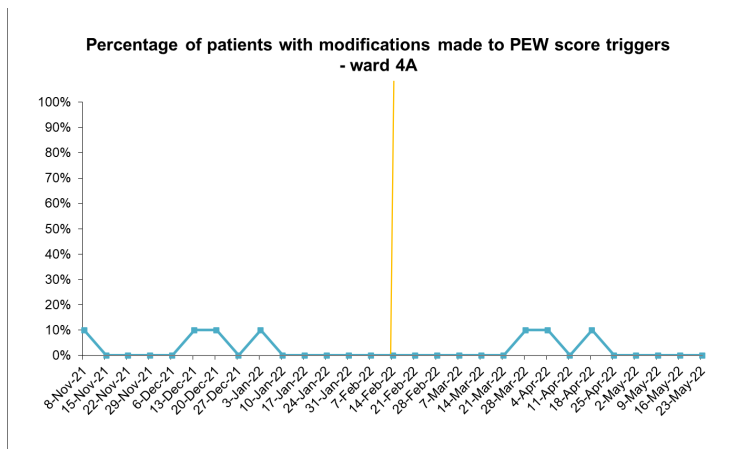
Figure 46 Percentage of patients with correctly calculated partial vital signs set: ward 4A.



9. Percentage of patients with modifications made to PEW score triggers

No run chart rules apply to this graph (see Figure 48). Many data points were zero and fall on the median line (zero percent). Vital signs triggers should be modified only rarely because overuse of modifications can hide patient deterioration. Where modifications were made, 100 percent (n=3) of those made during the implementation period had the rationale, duration, date, signature and contact details documented by the medical staff member. Conversely, in the baseline period, 75 percent (n=4) had this documentation.

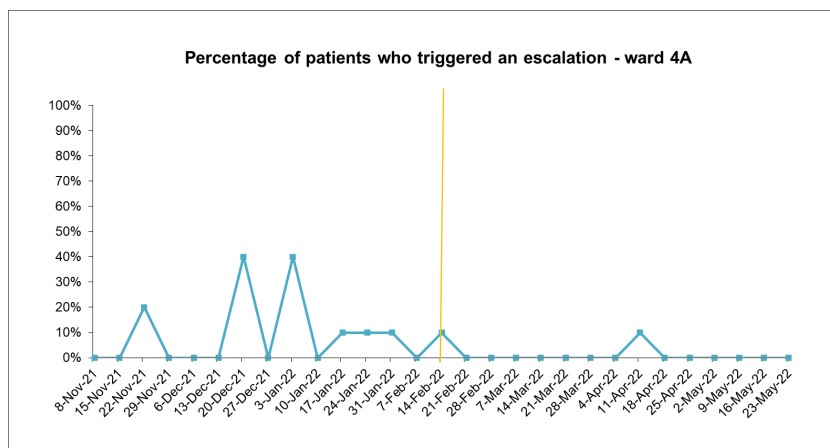
Figure 47 Percentage of patients with modifications made to PEW score triggers: ward 4A.



10. Percentage of patients who triggered an escalation in audit period

No run chart rules apply to this graph (see Figure 49). Many data points were zero and fall on the median line (zero percent). This occurred mostly during the implementation period, indicating that few escalations occurred as per the definition in the 24-hour period. As discussed previously, less than 50 percent (n=13) of the escalations in the preparation period were escalated and responded to according to the pathway and not documented as per local policy. Conversely, in the implementation period, this occurred for 50 percent of escalations (n=2).

Figure 48 Percentage of patients who triggered an escalation: ward 4A.



11. Percentage of patients marked 'unresponsive' in level of consciousness

No patients in the audit were marked unresponsive in the level of consciousness section.

Outcome measures

The Tauranga project team focused on the process measures during the testing (Table 16). They are now investigating how they can collect and report on outcome measures. They felt that they could collect measures one, two and four relatively easily.

Table 16 Tauranga Hospital's approach to the national outcome measures for testing PEWS

National outcome measures		Tauranga Hospital approach
1	Number of escalations to rapid response team (or equivalent)	Could collect monthly
2	Number of unplanned admissions to higher level of care (intensive care)	Could collect monthly
3	Number of unplanned admissions to higher level of care (high dependency unit)	
4	Number of unplanned admissions to higher level of care (transfer to higher acuity hospital)	Could collect monthly with support from the analytics team
5	Number of unplanned admissions to higher level of care (increased 1:1 care)	

Appendix E Review of Whakatāne Hospital’s audit data

The Whakatāne team collected 10 weeks of baseline audit data for their paediatric ward (29 November 2021 to 7 February 2022) and 16 weeks of implementation audit data (14 February to 6 June 2022). They also undertook smaller audits for their acute care unit and emergency department over this period. This report uses only the data from their paediatric ward.

Case load and admissions meant they were unable to audit 10 cases every week. In total, 91 cases were audited for the baseline and 144 cases for the implementation period. The data was cleaned, and one record was removed.

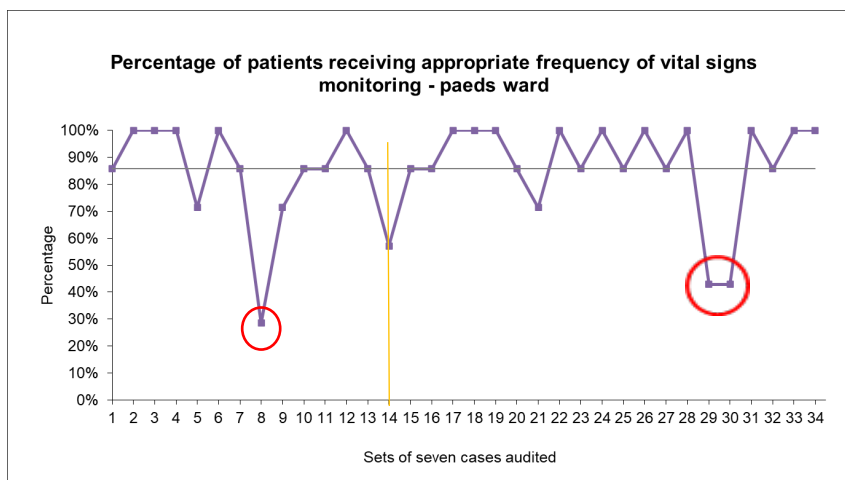
Process measures

In the following graphs, the yellow line denotes the week that implementation started on the ward. See [Appendix C](#) for a description of the process measures.

1. Percentage of patients receiving appropriate frequency of vital sign monitoring

In Figure 50, the three astronomical points (circled areas) signal a change; no other run chart rules apply to this graph. It appears that the variation smoothed during the implementation period. Using cumulative sum (CUSUM) or statistical process control (SPC) chart analysis may provide further insights.

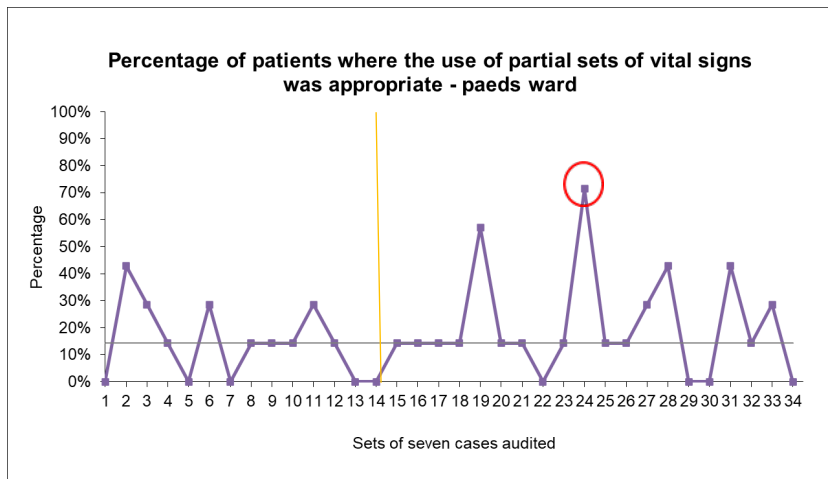
Figure 49 Percentage of patients receiving appropriate frequency of vital signs monitoring: paediatric ward.



2. Percentage of patients where the use of partial sets of vital signs was appropriate

In Figure 51, one astronomical point (circled) signals a change, but this is not supported with subsequent data points. No other run chart rules can apply to this graph. Using CUSUM or SPC chart analysis may provide further insights into this analysis.

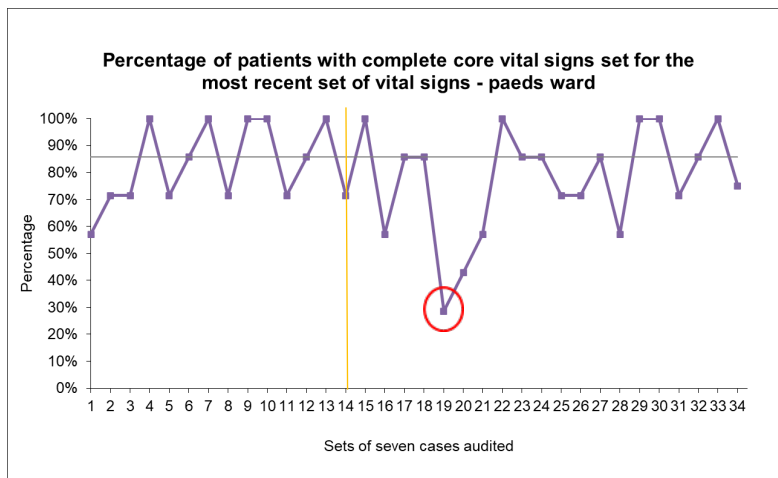
Figure 50 Percentage of patients where the use of partial sets of vital signs was appropriate: paediatric ward.



3. Percentage of patients with complete core vital signs set for the most recent set of vital signs

In Figure 52, one astronomical point (circled) signals a change, but this is not supported with subsequent data points. No other run chart rules can apply to this graph. Using CUSUM or SPC chart analysis may provide further insights.

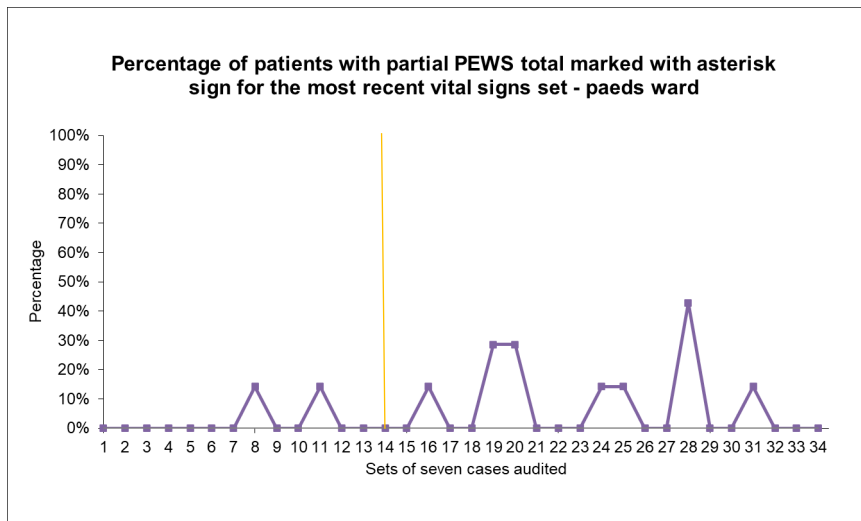
Figure 51 Percentage of patients with complete core vital signs set for the most recent set of vital signs: paediatric ward.



4. Percentage of patients with partial PEW score total marked with asterisk (*) for the most recent vital signs set

Figure 53 shows that the use of an asterisk to mark the partial PEW score increased over the implementation period. No run chart rules apply to this graph.

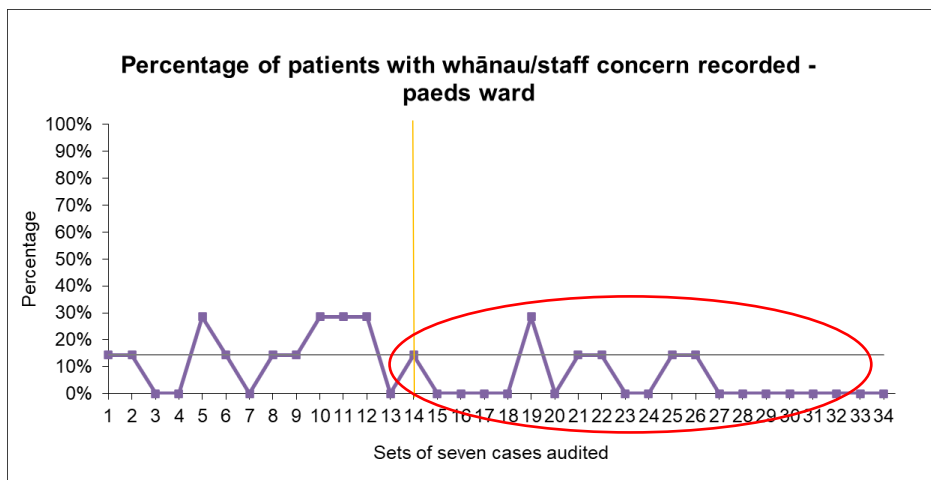
Figure 52 Percentage of patients with partial PEW score total marked with an asterisk for the most recent vital signs set: paediatric ward.



5. Percentage of patients with whānau and/or staff concern recorded

In Figure 54, the circled area shows that the percentage of patients with whānau and/or staff concern recorded decreased during the implementation period. When whānau and/or staff concern was recorded, whether it had been acted on and documented was not always noted in the clinical record.

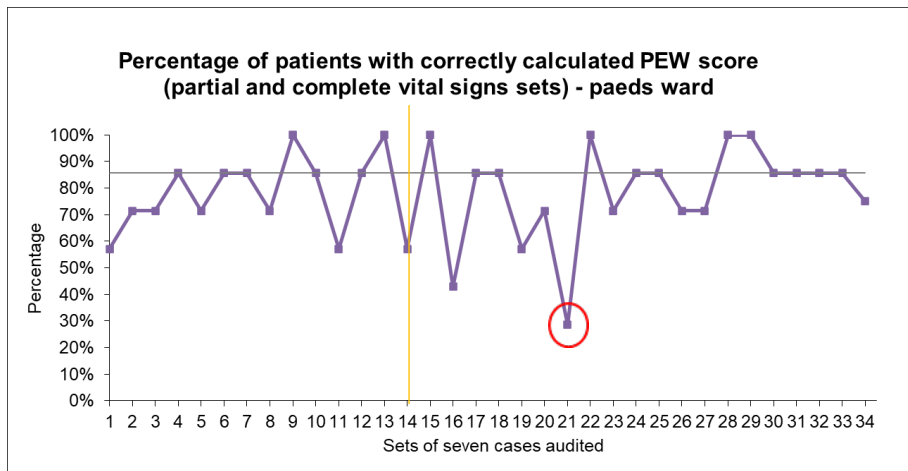
Figure 53 Percentage of patients with whānau/staff concern recorded: paediatric ward



6. Percentage of patients with correctly calculated PEW score (partial and complete vital signs sets)

Figure 55 shows an astronomical point, but this did not result in any further changes. The variation after this point appears to be reducing. Using CUSUM or SPC chart analysis may provide further insights into this analysis.

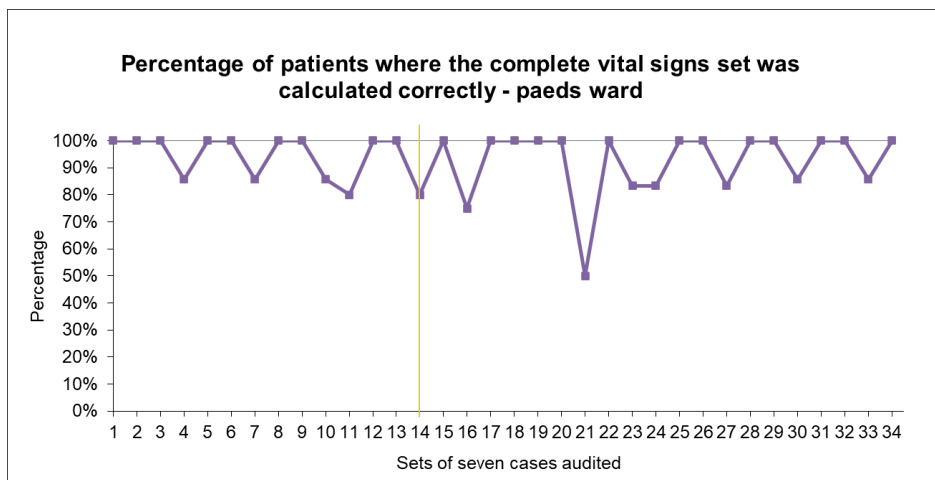
Figure 54 Percentage of patients with correctly calculated PEW score (partial and complete vital signs sets): paediatric ward.



7. Percentage of patients where the complete vital signs set was calculated correctly

Figure 56 shows that complete vital signs sets are being calculated correctly on a regular basis. No run chart rules apply to this graph. There was a low data point for set 21, which relates to the low data point in Figure 55.

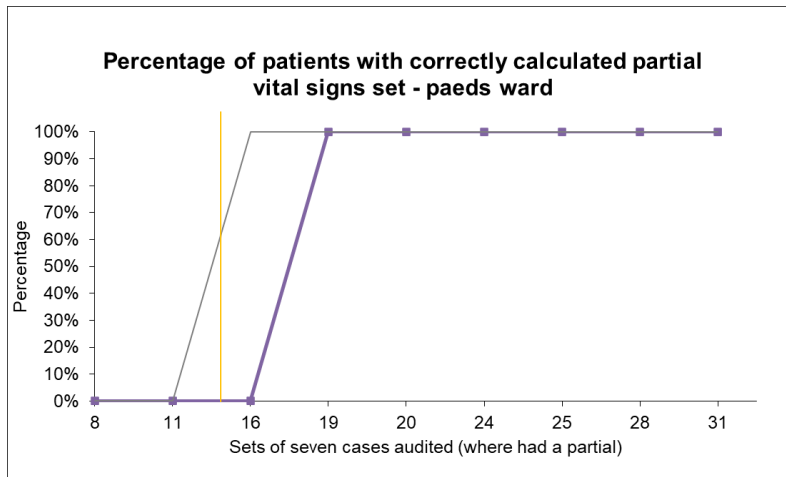
Figure 55 Percentage of patients where the complete vital signs set was calculated correctly: paediatric ward.



8. Percentage of patients with correctly calculated partial vital signs set

There was movement in the median line between baseline and implementation periods. However, the extremes shown in Figure 57 relate to the small numbers of partial vital signs sets in the auditing. This graph shows the data points that had data related to the correctly calculated partial vital signs set.

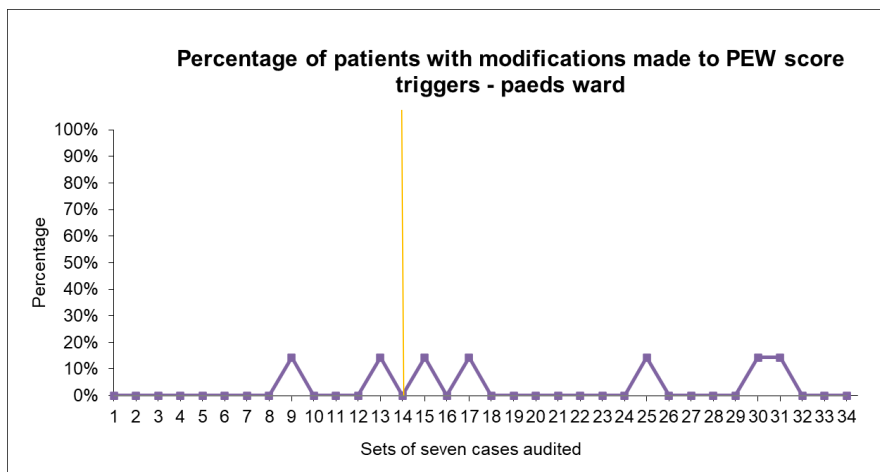
Figure 56 Percentage of patients with correctly calculated partial vital signs set: paediatric ward.



9. Percentage of patients with modifications made to PEW score triggers

In Figure 58, many data points were zero and fall on the median line (zero percent). Vital signs triggers should be modified only rarely as overuse of modifications can hide patient deterioration. Not all modifications had the required documentation. No run chart rules apply to this graph.

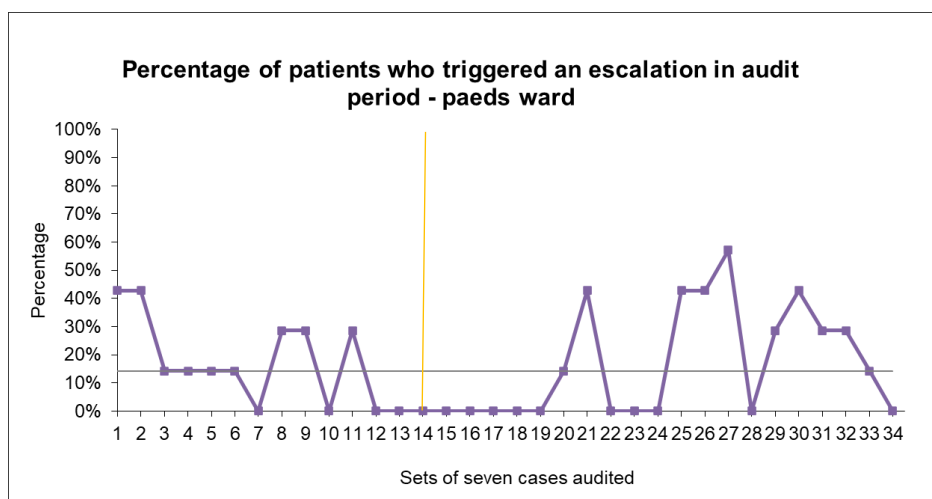
Figure 57 Percentage of patients with modifications made to PEW score triggers: paediatric ward.



10. Percentage of patients who triggered an escalation in audit period

In Figure 59, many data points were zero and fall on the median line (zero percent). As discussed, there was a small increase during the implementation period in the percentage of those who had the escalation and response as per pathway as well as the required documentation. No run chart rules apply to this graph.

Figure 58 Percentage of patients who triggered an escalation in the audit period: paediatric ward



11. Percentage of patients marked 'unresponsive' in level of consciousness

No patients in the audit were marked unresponsive in the level of consciousness section.

Outcome measures

The Whakatāne project team focused on the process measures during the testing (Table 17). They have started looking at how they can collect and report on outcome measures. They reported that they could collect measures one, three and four every month.

Table 17 Whakatāne Hospital's approach to the national outcome measures for testing PEWS

National outcome measures		Whakatāne Hospital approach
1	Number of escalations to rapid response team (or equivalent)	Could collect monthly, noting very few rapid response calls
2	Number of unplanned admissions to higher level of care (intensive care)	-
3	Number of unplanned admissions to higher level of care (high dependency unit)	Could collect monthly using TrendCare
4	Number of unplanned admissions to higher level of care (transfer to higher acuity hospital)	Could collect monthly with support from the analytics team
5	Number of unplanned admissions to higher level of care (increased 1:1 care)	Started collecting using TrendCare

Appendix F Review of Nelson and Wairau Hospitals' audit data

The NMH team collected 11 weeks of implementation audit data (from the week beginning 15 March to 31 May 2022). They combined the weekly retrospective auditing across the paediatric wards at their two hospitals. This meant they were able to audit 10 cases every week; 120 cases were audited for their implementation period. They used an electronic tool to complete the audits.

The team used their Patienttrack data to focus their auditing using the following selection criteria:

- modifications to PEWS trigger
- PEWS greater than or equal to four
- whānau/staff concern marked yes
- unresponsive marked yes.

If there were not enough records to make 10, then a random selection of admissions were added.

This approach meant they were able to test their escalation pathway, and the clinicians doing the auditing could focus on the questions related to the escalation pathway.

The data was cleaned, and no records were removed.

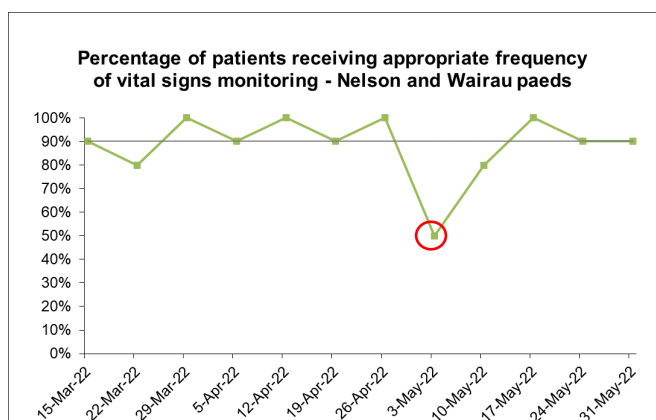
Process measures

See [Appendix C](#) for a description of the process measures.

1. Percentage of patients receiving appropriate frequency of vital sign monitoring

As shown on Figure 60, there was one astronomical point (circled area), which signals a change, but this was not continued in later data points. No other run chart rules can apply to this graph. The percentage of appropriate frequency of vital signs monitoring is high.

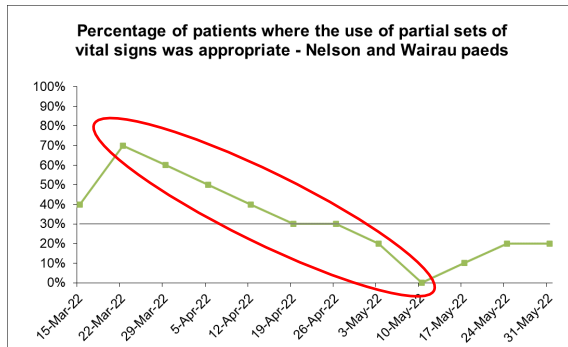
Figure 59 Percentage of patients receiving appropriate frequency of vital signs monitoring: Nelson and Wairau paediatric wards



2. Percentage of patients where the use of partial sets of vital signs was appropriate

Figure 61 shows a trend, with five or more consecutive points all going up or down. This reflects a reduction in appropriate use of partial vital signs sets. If there was another data point below the median line, this would be a shift. These results show that an opportunity exists for improvement activity in the appropriate use of partial sets. This could be looked at with the future amendments to Patienttrack relating to the use of partial vital sign sets (the term 'toggle off' is used in Patienttrack).

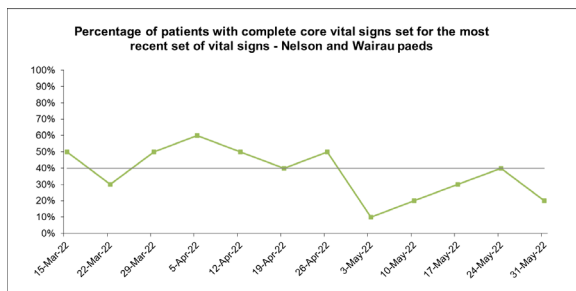
Figure 60 Percentage of patients where the use of partial sets of vital signs was appropriate: Nelson and Wairau paediatric wards



3. Percentage of patients with complete core vital sign set for the most recent set of vital signs

As shown in Figure 62, no run chart rules can apply to this graph. However, the downward slope of the line shows fewer complete core vital sets in the data over time. An opportunity exists for improvement activity in completing core vital signs sets, particularly around observing blood pressure, which was the most frequently missed vital sign.

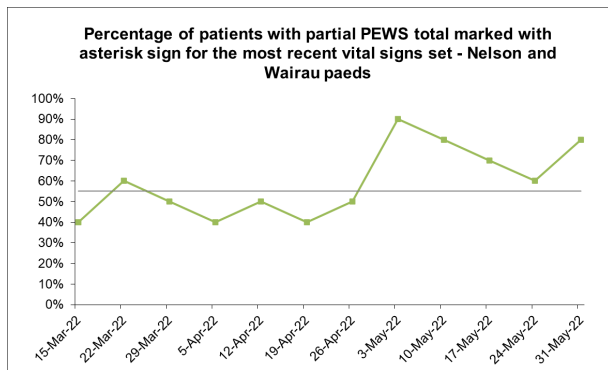
Figure 61 Percentage of patients with complete core vital signs set for the most recent set of vital signs: Nelson and Wairau paediatric wards



4. Percentage of patients with partial PEW score total marked with an asterisk (*) for the most recent vital signs set

No run chart rules apply to this graph (Figure 63), but it is showing an increase in the use of the asterisk marking partial signs ('toggle off' in Patienttrack). One more data point above the median line would signal a shift in the process. Of the 71 partial PEWS, only three had a reason for the partial scoring recorded in the clinical record. When looking at the graph for measure eight, the percentage of correctly calculated partial PEW scores has also increased.

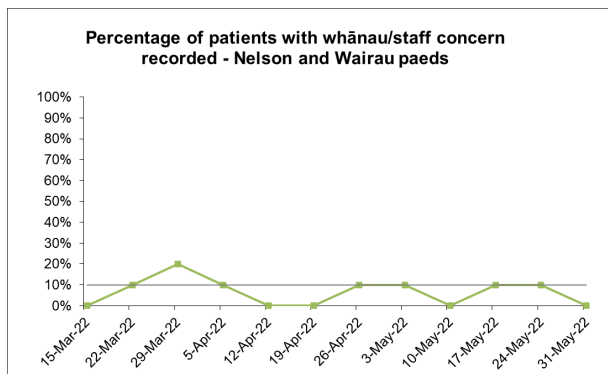
Figure 62 Percentage of patients with partial PEWS total marked with asterisk (*) for the most recent vital signs set: Nelson and Wairau paediatric wards



5. Percentage of patients with whānau and/or staff concern recorded

No run chart rules apply to this graph (Figure 64). Only eight instances of whānau/staff concern were marked; however, seven had the concern acted on and documented.

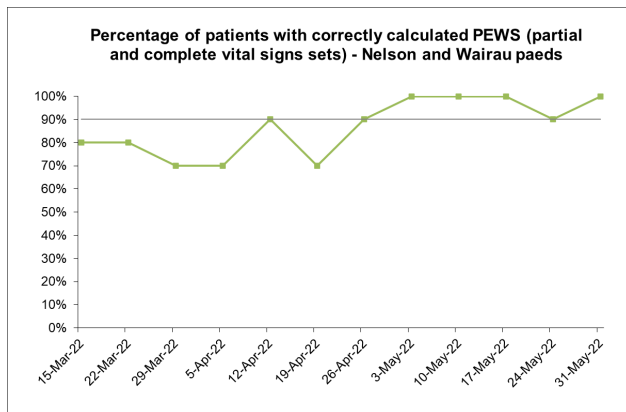
Figure 63 Percentage of patients with whānau/staff concern recorded: Nelson and Wairau paediatric wards



6. Percentage of patients with correctly calculated PEW score (partial and complete vital signs sets)

No run chart rules apply to this graph (Figure 65). There is a high percentage of correct calculation occurring as expected with the use of the electronic system that automatically calculates (also shown in Figure 66). The team report that, where the percentage is not 100 percent, this was because the clinician entered the vital signs set using the existing partial pathway rather than the 'toggle off'. In Patientrack, selecting partial is not calculated.

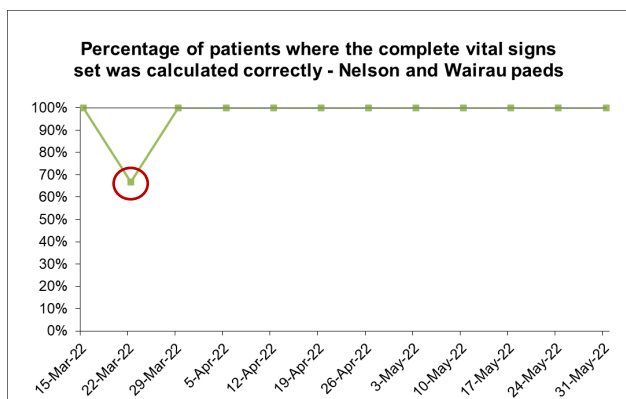
Figure 64 Percentage of patients with correctly calculated PEWS (partial and complete vital signs sets): Nelson and Wairau paediatric wards



7. Percentage of patients where the complete vital signs set was calculated correctly

No run chart rules apply to this graph (Figure 66). The percentage of correct calculations was high, as expected with the use of the electronic system that automatically calculates. The point circled is an anomaly, and there were only three complete vital signs sets for this data point.

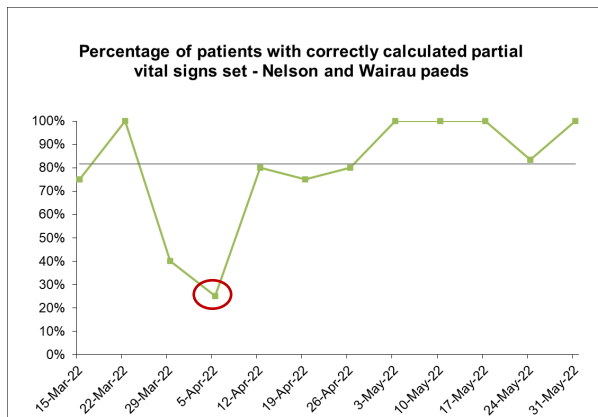
Figure 65 Percentage of patients where the complete vital signs set was calculated correctly: Nelson and Wairau paediatric wards



8. Percentage of patients with correctly calculated partial vital signs set

The data point circled on Figure 67 could be seen as an astronomical point given its distance from the median line. As noted earlier, the team report that, where the percentage is not 100 percent, this was because the clinician entered the vital signs set using the existing partial pathway rather than the 'toggle off'. In Patientrack, selecting partial is not calculated.

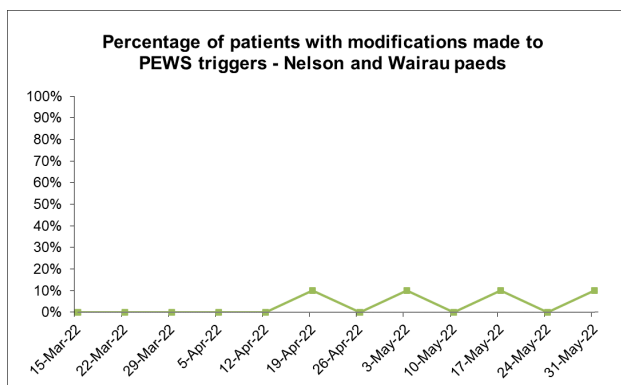
Figure 66 Percentage of patients with correctly calculated partial vital signs set: Nelson and Wairau paediatric wards



9. Percentage of patients with modifications made to PEW score triggers

In Figure 68, many data points are zero and fall on the median line (zero percent). Vital signs triggers should only rarely be modified as overuse of modifications can hide patient deterioration. Only half of the modifications had the required documentation. No run chart rules apply to this graph.

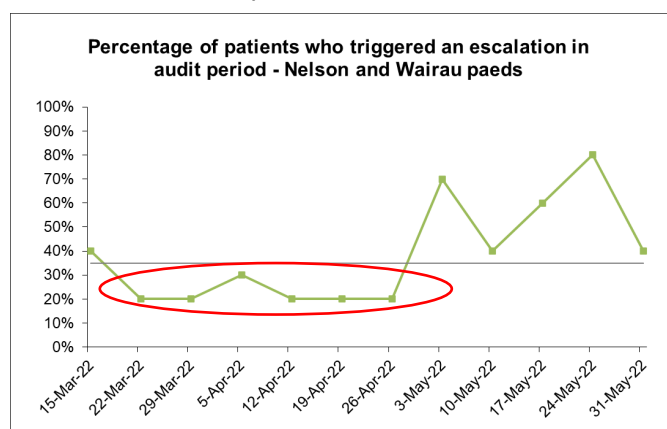
Figure 67 Percentage of patients with modifications made to PEWS triggers: Nelson and Wairau paediatric wards



10. Percentage of patients who triggered an escalation in audit period

The circled area in Figure 69 indicates a shift in the process. If the next data point was above the median, this would also indicate a shift above the median line. This graph shows that being able to prioritise admissions with a PEW score of four or more in the audit selection helps the team to focus on the escalations. The escalation pathway was followed for 41 percent of these, 35 percent had the response as per pathway, 33 percent had the responder completing documentation and 30 percent had the recogniser completing documentation.

Figure 68 Percentage of patients who triggered an escalation in the audit period: Nelson and Wairau paediatric wards



11. Percentage of patients marked ‘unresponsive’ in level of consciousness

No patients in the audit were marked unresponsive in the level of consciousness section.

Outcome measures

Nelson and Wairau Hospitals’ approach to reporting on the national outcome measures is set out in Table 17.

Table 18 Nelson and Wairau Hospitals’ approach to the national outcome measures for testing PEWS

National outcome measures	Nelson and Wairau Hospitals’ approach
Number of escalations to rapid response team (or equivalent)	Already have a system embedded to collect this data, retrospective switchboard data and post-event online audits collected. Can provide monthly data
Number of unplanned admissions to higher level of care (intensive care)	Nelson and Wairau Hospitals do not have paediatric intensive care units
Number of unplanned admissions to higher level of care (high dependency unit)	Nelson and Wairau Hospitals do not have paediatric high dependency units
Number of unplanned admissions to higher level of care (transfer to higher acuity hospital)	Audit coordinators receive monthly reports (from Data and Analytics) for all patients transferred to other hospitals. This needs refining for the purpose of paediatric transfers
Number of unplanned admissions to higher level of care (increased 1:1 care)	Extraction of data from TrendCare – this needs refining