Maternal Morbidity Working Group

Health Quality & Safety Commission New Zealand
Kupu Taurangi Hauora o Aotearoa

Evaluation of the early implementation of the national maternity early warning system

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1. Introduction

Based on the notifications received between 1 September 2016 and 31 August 2018, the Maternal Morbidity Working Group (MMWG) estimates approximately 470 women in New Zealand experience severe maternal morbidity each year.[1] A number of studies[2,3] and the findings of the MMWG's regional review panels suggest that in approximately 50 percent of these cases, improved recognition and response, leading to earlier treatment, could have prevented the woman's illness or condition from becoming severe.

To improve recognition of and response to pregnant women who are deteriorating, the MMWG collaborated with the Health Quality & Safety Commission (the Commission) and the maternity sector to develop a national maternity early warning system (MEWS). At a workshop in December 2017, key stakeholders showed their support for a national MEWS. The workshop also identified the fundamental elements of what could be included in a national maternity vital signs chart and system. The draft maternity vital signs chart was developed with feedback from the sector in early 2018.

The MEWS involves using a national vital signs chart and providing resources for maternity services to develop essential components of the system. These components include a localised escalation pathway, effective clinical governance and leadership, education and ongoing measurement for improvement (audit).

The aim of the MEWS is to reduce harm through having a consistent national process to recognise and respond to deteriorating pregnant women, reduce maternity admissions to high dependency units and intensive care units, and reduce length of stay for maternity patients in high dependency units, intensive care units and maternity services.

Between May and October 2018, the MMWG supported the implementation of the MEWS in three test sites: Auckland District Health Board (ADHB), Nelson Marlborough Health (NMH) and Northland District Health Board (NDHB). This report presents key findings from the evaluation of the MEWS implementation at these three test sites. It will be used to inform the MMWG's decision on whether the MEWS should be implemented nationally and, if so, how this should be done.

Overall, feedback about the MEWS was positive and support was strong for implementing the MEWS nationally. Positive feedback centred on the themes of consistency of process and language, support for clinical judgement and decision-making, and more responsive and appropriate escalation for pregnant women who are deteriorating.

Feedback also highlighted several issues and suggestions for improvement, particularly relating to the vital signs chart and escalation pathways. Clinical staff noted issues relating to insufficient resourcing, the difficulty of completing all observations with limited staff, and modifications.

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[1] Maternal Morbidity Working Group. 2018. *Maternal Morbidity Working Group Annual Report 1 September 2016 to 31 August 2017*. Wellington: Health Quality & Safety Commission. URL: www.hqsc.govt.nz/our-programmes/mrc/pmmrc/publications-and-resources/publication/3369.

[2] Lawton B, MacDonald EJ, Brown SA, et al. 2014. Preventability of severe acute maternal morbidity. *American Journal of Obstetrics & Gynecology* 210: 557.e1–6.

[3] Sadler LC, Austin DM, Masson VL, et al. 2013. Review of contributory factors in maternity admissions to intensive care at a New Zealand tertiary hospital. *American Journal of Obstetrics & Gynecology* 209: 549.e1–7.

Key feedback from the test site project teams centred on common challenges such as leadership and governance, and the need for local guidance and policy. Other common concerns were pre-existing issues that may have been around for a long time, such as resourcing of the hospital after-hours, communication, documentation and teamwork practices.

2. Early implementation test sites

Before implementing a national system, the MMWG agreed to pilot the MEWS in three different sites. The purpose was to test the MEWS vital signs chart and the associated guidance documents to identify how usable, suitable and effective these are in a clinical setting. The findings from the test sites will inform the MMWG on whether the MEWS should be implemented nationally and, if so, whether to request any changes or amendments to the MEWS tools.

2.1 Selecting the three test sites

The maternity services of three DHBs agreed to participate as pilot sites to test the MEWS: ADHB, NMH and NDHB. This section gives specific details about each maternity service and the rationale for selection. The table below summarises the characteristics of these sites.

DHB	Hospital type	Region	Implementation date
Auckland (ADHB)	Tertiary	Northern	17 July 2018
Nelson Marlborough Health (NMH)	Metropolitan	South Island	24 July 2018
Northland (NDHB)	Rural	Northern	3 September 2018

ADHB

National Women's Health, located in Auckland City Hospital,[4] provides a range of national and regional pregnancy-related services, as well as primary, secondary and tertiary care to women who live within the ADHB region, or who are registered with a private lead maternity carer who has an access agreement. Approximately 7,500 births per year occur in a birthing suite with 16 beds and a two-bed high dependency unit for high-risk obstetric cases. A women's assessment unit is open 24 hours a day, seven days a week, providing care for women who experience acute pregnancy complications. It has 77 antenatal/postnatal beds for women and babies who require secondary and tertiary care. Women who are well transfer with their babies to Birthcare Auckland for postnatal care.

In 2017 National Women's Health developed and implemented its own MEWS, which was due to be evaluated in 2018. Because ADHB staff were familiar with an early warning system, they agreed that their workplace could be a test site for the new national MEWS.

National Women's Health initially implemented the national MEWS in its maternity wards for the three-month test period, with a plan to test it in the gynaecology ward in the latter stage of the pilot. The pilot phase did not extend to the gynaecology ward, although the aim is to

[4] National Women's Health also has a walk-in centre and community outpatient services in Greenlane Clinical Centre.

implement the national MEWS throughout Auckland City Hospital once the evaluation of the national MEWS is complete.

Nelson Marlborough Health

NMH comprises two metropolitan hospitals – Nelson and Wairau – and a number of community services.

Nelson Hospital has a secondary-level maternity unit that sees approximately 1,000 births per year. It services the Nelson–Tasman region; some women come from the upper West Coast region as well. The hospital has four birthing rooms, four antenatal/acute assessment beds and 10 postnatal beds. Staff include a charge midwife manager, a clinical coordinator midwife during the week and three core midwives who staff the antenatal, birth and postnatal areas every shift. Theatre and the neonatal unit are both close to the maternity unit. There are 20 lead maternity carers across the Nelson–Tasman region.

Wairau Hospital has a secondary-level maternity unit with approximately 500 births per year, servicing the mainly rural Marlborough and Kaikōura regions. It is the only birthing unit in this area. The unit contains three birthing rooms and seven antenatal and postnatal beds. It has a charge midwife manager, along with two core midwives who staff the antenatal, birth and postnatal areas every shift. Eight lead maternity carer midwives work at the hospital.

Two small primary maternity units in the NMH region are using a primary-modified MEWS chart.

In 2017 NMH notified us that it was developing a local MEWS while it waited for a national MEWS to be developed. NMH implemented its local MEWS in 2017 across the whole of its health service, including across both hospitals and two primary maternity services.

NMH also indicated it would like to be involved in developing and testing the national MEWS. By including NMH as a test site, the MMWG had an opportunity to test the national MEWS in both the hospital and primary maternity settings.

Northland DHB

NDHB tested the national MEWS in the maternity unit in Whangarei Hospital, which provides both primary and secondary care for Northland. NDHB's three other primary maternity facilities in Northland are in Kaitaia, Bay of Islands and Dargaville hospitals. Primary, low-risk women can choose to give birth at home or in any of the four primary facilities. Women with complications (identified either in their previous health history or in their current pregnancy) are referred to Whangarei Hospital for secondary care. Postnatal inpatient care is available at all sites. Nearly all women in Northland are under the care of lead maternity carer midwives, most of whom provide some secondary care if a woman is transferred to hospital.

In the Whangarei maternity unit, approximately 1,600 births occur per year. The unit has seven beds for assessment, labour and birth, and 18 antenatal/postnatal beds. It is mainly staffed by midwives, with good relationships existing between community and employed midwives and medical staff. As NDHB does not employ any medical registrars, it is primarily midwives and obstetricians who provide care, with support from senior house officers.

Unlike the other two sites, NDHB did not have a local MEWS. Its staff used the national adult vital signs chart inconsistently and midwives had identified the need some time ago for a

vital signs chart that reflected physiological changes during pregnancy. NDHB had been thinking about developing a local MEWS and appropriate maternity vital signs chart before it became a national MEWS test site.

NDHB experienced a delay in implementing the national MEWS, so its period of testing extended beyond the timeframe of the MEWS evaluation. For this reason, this report includes NDHB findings for some but not all aspects of the evaluation. Specifically, feedback from NDHB informed the qualitative findings and NDHB staff completed the online survey, but NDHB data is not included in the audit results.

2.2 Test site requirements

Each participating site committed to:

- designate an executive sponsor
- establish a project team with a clinical lead and a project lead
- test the tools and guidance documents we provided
- train clinicians to use the national MEWS
- collect and report data, including from a pre-test audit
- make project staff available for training and attendance at learning sessions and teleconferences throughout the test period
- participate in evaluation activities.

The national MEWS programme team supported the sites by providing:

- a minimum of one site visit from programme team members, along with the offer of more visits as required
- a guidance package to support project teams (eg, evidence summary, planning and education tools, fact sheets, frequently asked questions, guidance on quality improvement activities)
- education on how to use the tools and resources (where needed)
- monthly Zoom (videoconference) meetings
- ad-hoc support by telephone, email and text messaging.

The Commission provided sites with the following tools and guidance materials:

- preparation and implementation guide
- project charter template
- example of maternity vital signs and early warning score policy for sites to adapt locally
- maternity vital signs chart with maternity early warning score and a chart user guide
- escalation mapping tool to develop a local escalation pathway
- PowerPoint presentation on the maternity vital signs chart and maternity early warning score
- clinical governance recommendations
- measurement guidance

- audit guidance, including a paper-based audit tool for monitoring the use of the maternity vital signs chart and maternity early warning score, and an electronic spreadsheet for data entry, analysis and reporting
- post-event case review tool to guide exploration of issues related to the MEWS for individual patients
- frequently asked questions
- seven fact sheets about specific clinical aspects of using the MEWS
- clinical communication tool (Identify Situation, Background, Assessment and Recommendation – ISBAR) with a maternity example.

3. Evaluation approach

Commission staff, together with the MEWS clinical leads, carried out the evaluation. They followed a formative evaluation approach.[5] The purpose of the evaluation was to understand:

- any clinical utility issues with the maternity vital signs chart and the maternity early warning score
- any issues or challenges with the MEWS implementation
- how the MEWS affects early recognition of and response to a pregnant woman's deterioration.

Insights from the evaluation would also be used to refine and improve the tools and guidelines, so we can better support DHBs to implement a national MEWS programme.

The evaluation of the MEWS trial followed a mixed-method approach. That is, the national MEWS evaluation team gathered:

- qualitative data from focus groups, interviews and drop-in sessions with project teams and clinical staff at each site
- quantitative data from audit and measurement activities, as well as survey questions using Likert scales.[6]

For the specific questions that the evaluation was to answer, see Appendix 1.

[5] The purpose of a formative evaluation is to help form or shape an intervention. Used as the intervention evolves, it can provide information about revising and modifying 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.* London: The Health Foundation.)

[6] A common approach to scaling responses in survey research.

4. Qualitative data collection and analysis

In collecting qualitative data on the early implementation of the MEWS, the national MEWS evaluation team used a range of methodologies, including written feedback, focus groups, interviews, an online survey and document review. Although the team did not conduct a formal thematic analysis, it identified clear and repeating themes in the data (see sections 6 and 7).

4.1 Written feedback

Throughout the 12-week implementation period (seven weeks for NDHB), all sites had butcher's paper up on the wall for staff to write down any questions or comments. This feedback was collected and submitted to the Commission throughout the test period, and the comments have informed this report.

4.2 Focus groups and drop-in sessions

Our maternity specialist, accompanied by a Commission colleague or the clinical lead (anaesthesia), facilitated focus groups and drop-in sessions at the three test sites. These sessions ranged in size from one-on-one conversations to groups of six participants, who included doctors, nurses and midwives working clinically; midwifery educators; managers; quality and leadership roles; and project team members.

4.3 Interviews with project team members

The clinical lead (anaesthesia) and the maternity specialist both conducted interviews (telephone and face-to-face) with midwifery educators, senior medical officers and a charge midwife. The notes from these interviews formed part of the qualitative data.

4.4 Online survey

An online staff survey created using SurveyMonkey software was emailed to approximately 110 ADHB staff, 740 NMH staff (all the staff of both hospitals, which are using MEWS throughout) and 118 NDHB staff. The survey included free-text response boxes at the end of each section. Free-text responses were analysed with the other qualitative data. For more information about the survey, see section 5.1.

4.5 Documentation review

Commission staff reviewed a range of documents from the test sites to gain insight into the implementation process, including what went well and any issues that arose. These documents included:

- the project charter of each test site
- extracts from clinical governance meetings
- a sample of clinical charts
- notes from monthly test-site teleconferences.

Information received through the documentation review formed part of the qualitative data.

5. Quantitative data collection and analysis

The national MEWS evaluation team collected quantitative data through the online survey and audits of completed MEWS vital signs charts at the three test sites.

5.1 MEWS staff survey

The MEWS staff survey asked respondents to indicate their level of agreement with a range of statements. Staff could respond with options ranging from 'strongly disagree' or 'never' (weighted 1) to 'strongly agree' or 'always' (weighted 5), and they also had a 'not applicable' option (weighted 0). Free-text response boxes were provided at the end of each survey section as well (see section 4.4).

5.2 Audits

Each site was asked to complete weekly process audits for 10 randomly selected women in each of its implementing wards and to collate monthly outcomes data. To be included, the women needed to have been in the ward or unit for a minimum of six hours. The auditor was asked to review up to the last 24 hours of vital signs charts and associated documentation in the clinical record. The national MEWS team provided sites with an audit form and data collection spreadsheet to collect, enter and analyse their data. It also asked sites to send this data to the team monthly.

Analysis method

Data from NMH and ADHB was combined into an overall spreadsheet. After data was cleaned, four records were excluded from the analysis of the escalation question due to missing fields. The data was then analysed.

ADHB started collecting audit data from the week beginning 16 July 2018 and NMH from the week beginning 23 July. While NMH made changes across its entire service (ie, not just maternity services), audit data was collected only for the maternity-related wards in Nelson and Wairau hospitals. Aggregating the ward data for each DHB gave us 12 weeks of data for each of these DHBs.

Due to its delayed start, NDHB was only in week seven of the MEWS implementation at the time of this evaluation and had limited audit data available. The audit data from NDHB has not been included in this analysis.

6. Qualitative findings – key themes and feedback

This section provides an overview of key themes and feedback relating to the overall MEWS system, vital signs chart, escalation and response, and the back of the chart.

6.1 General

The evaluation team received a range of feedback on the vital signs chart and MEWS. It included positive and negative comments, and a number of helpful suggestions for changes.

Key themes to emerge were that:

- staff in the test sites endorsed a nationally consistent approach
- the maternity vital signs chart is valuable in supporting clinical judgement and decision-making
- the MEWS supported communication and discussion within and across disciplines and teams
- the MEWS helped to identify deteriorating women earlier
- the way the modifications box is used could be improved.

6.2 The vital signs chart

The general consensus across sites and disciplines was that a nationally consistent MEWS vital signs chart was valuable, and important for women's safety. Staff also noted the synergies between the adult vital signs chart and the maternity vital signs chart, which they thought was important.

> 'It is good to have a common language and consistent chart and system across the country.' (Midwife)
>
> 'MEWS is a useful visual way to see deterioration occurring and pick it up early.' (Survey respondent)

Staff communicated a strong sense that the chart supported clinical decision-making and enhanced care for women. They gave positive feedback that the charts were being completed well and that, when used correctly, the charts helped to identify sick women more quickly. Further feedback indicated that the MEWS supported better communication between and across different teams and disciplines.

> 'Good as a junior midwife to prompt collegial discussion.' (Midwife)
>
> 'Good uptake from other departments achieved via 1:1 meetings by manager: manager.' (Senior midwife)

Some were concerned that staff may see the chart as a replacement for clinical judgement, which highlighted the importance of viewing the chart as 'a tool, not a rule' (Registrar).

> 'For some nurses, it can be used to override clinical judgement.' (Registrar)
>
> 'It is a tool, not a replacement for the core care of women and babies. It enhances care and protects us for escalation and expressing our concerns.' (Survey respondent)

Many staff noted that the chart increased their workload in an already constrained environment. For example, they needed to complete all vital signs when they may have only wanted to measure blood pressure and needed to make appropriate intrathecal morphine observations in the post-anaesthetic period.

> ‘There are not enough staff to do the observations required for intrathecal morphine observations. I understand that they are appropriate, but we need more resources to do them.’ (Senior midwife)
>
> ‘It makes more work when caring for women.’ (Senior midwife)

Some noted that sometimes staff did not take or record all observations.

> ‘Midwives are used to only doing temperature/pulse and blood pressure observations.’ (Project team member)
>
> ‘The default should be a full set of observations, unless specifically documented, eg, for blood pressure monitoring.’ (Project team member)

The evaluation team received suggestions for additional parameters, many based on existing practice at specific sites and/or the specialty needs of maternity wards. Examples of additional parameters included: epidural site check, fluid balance, lochia, urine output, fundus, blood sugar level, in-dwelling catheter, ketones and dermatome. Other suggestions were to add a signature box and space for the date. The national MEWS team sought advice from relevant professional colleges on including signatures, which advised that it was considered best practice to include signatures or initials on the chart.

For a summary of additional feedback and suggestions for parameters on the vital signs chart, see Appendix 2.

6.3 Maternity early warning score

Generally staff liked the maternity early warning score and saw it as helpful, although some perceived it as complicated and difficult to calculate.

> ‘The chart is too confusing with the scoring system.’ (Survey respondent)

For some clinicians, calculating the score and understanding the relationship between the score and the escalation pathway took some adjustment and practice. A few people expressed confusion about the different colours and their corresponding scores. For example, they were uncertain whether any score of 1 or 2 on the yellow or orange zones corresponded to the yellow or orange boxes on the escalation pathway. Some queried whether anything in the red or blue zones should be added together, or whether they are only considered as a single-parameter trigger. This confusion was addressed in intensive education throughout the testing phase.

> ‘A colleague did not escalate care with [respiratory rate] of 28, as it did not add up to the value in the red zone (all other observations were fine) – was not clear to her that all signs in red need immediate escalation.’ (Survey respondent)

The team received some specific feedback about how to improve the design of the chart to support correct calculation and escalation. For a summary of this feedback, see Appendix 3.

Feedback suggested that the early warning score supported midwives and their clinical decision-making. However, staff from all participating disciplines strongly emphasised that it should not replace a full assessment.

> ‘Don’t want the score to replace clinical judgement. Look at the woman, and then at the score.’ (Senior medical officer)
>
> ‘The score didn’t prompt us to escalate, but it validated the decision to escalate.’ (Midwife)
>
> ‘There is danger with the score becoming a numbers game. We need to keep saying, “use your clinical judgement”.’ (Midwifery educator)

The evaluation team received feedback that staff thought the MEWS was helping them to recognise deterioration earlier.

> ‘Majority of times calls are not serious (therefore we must be detecting issues early on).’ (Senior medical officer)
>
> ‘Midwives empowered to call early for help before the woman becomes too unwell.’ (Senior medical officer)
>
> ‘The new score hasn't caused any harm, it’s gone down well in terms of recognition.’ (Midwifery educator)

Some commented that the score helped to triage care. They noted this aspect was valuable in busy assessment units. A senior (transfer) nurse also identified it as valuable for discussions about how to transfer women to tertiary care or retrieve them.

Where the tool was used across the hospital (ie, not just in its maternity ward or wards), other departments found it helped staff to understand the different physiology and parameters for pregnant women. One midwifery educator said it was especially helpful to compare the scores on a national adult early warning system chart and a maternity chart and to recognise that, ‘this woman is pregnant and sick, but she doesn’t score on your adult chart’. This feedback highlighted the value and importance of the maternity vital signs chart and score.

> ‘Now it’s the norm in ED [emergency department] to reach for the MEWS chart if a woman is pregnant.’ (Charge nurse, emergency department)
>
> ‘It is good to have maternity-specific parameters.’ (Senior midwife)

Staff mentioned that at times a score could cause a ‘false alarm’, when a woman received a high early warning score for a parameter that was actually in her normal range. This kind of experience drew attention to the importance of the modifications box.

6.4 Modifications box

The modifications box was identified as one of the most challenging aspects of the MEWS. Staff thought it was not being used well. Some senior medical officers seemed apprehensive about using the modifications box and continued to write modifications in the clinical notes. Some also hesitated to modify in some cases as they did not want to mask deterioration.

> ‘There is lots of confusion about who, when, and how to modify.’ (Survey respondent)

> ‘It is very frustrating when acceptable parameters have not been changed.’ (Survey respondent)

The evaluation team was notified of a few situations when a woman repeatedly scored high and triggered an escalation, but the response team only responded the first time and then ignored the calls. Registrars felt they did not need to respond because appropriate action had already been taken. Midwives felt that this attitude compromised the woman’s safety and midwives’ safe practice. In this situation, a short-term modification may have been appropriate, but was not made.

> ‘It is incredibly frustrating when [escalation] is clearly not needed, and your clinical judgement tells you that. When someone has the same issues repeatedly that have been investigated, but no-one wants to change the parameters, they seem less than impressed to be called about the same things. I feel scared to call if I know the problem is not urgent, but MEWS says otherwise.’ (Survey respondent)

In one instance that a staff member described to the evaluation team, the acceptable scores for systolic blood pressure were inappropriately modified, masking the woman’s deterioration.

Some staff reported that some senior medical officers used the modifications box to say ‘refer to clinical notes for modification details’, because they were reluctant to write the same information in two places. Staff identified that this is a practice issue that needs to be addressed locally through clear policy development, education and medical leadership.

The above issues highlight the importance of further education around how to use the modifications box.

6.5 Escalation pathway

Qualitative feedback suggested that, overall, the escalation pathways worked well. Responders were supportive and staff felt enabled to escalate when they had concerns, knowing they would get a response.

> ‘The most important factor is the mandatory escalation pathway… you can actually say ‘right – there is no barrier to calling’… [the escalation pathway] gives you the support and the mandate to have the courage to [call].’ (Midwifery educator)

> ‘[The escalation pathway] enhances standardisation of care across the board.’ (Midwife)

Staff appreciated that the escalation pathways were not prescribed nationally and instead could be developed locally to represent local resources. They saw local development as supporting discussions and planning within and across departments. It also respects the difference in resourcing across different-sized hospitals and in different settings. In addition, positive comments noted that the MEWS aligned with the national adult early warning system and that the escalation actively built on relationships with the wider hospital response team (eg, the patient at risk team).

> ‘Our escalation pathway is specifically developed for our primary unit, which is excellent.’ (Senior midwife, primary care)

Because DHBs developed the escalation pathway locally, staff could also adapt it quickly if any issues arose. One site became aware that the escalation pathway was too rigid – the escalation pathway for a maternity early warning score of 1–4 was too sensitive and clinicians (both midwifery and obstetrics) identified that the response indicated for women scoring 1–4 was often inappropriate. In this situation, the local governance committee could quickly review the pathway and adjust it as needed.

> 'With consultation with the steering group the escalation pathway was modified to... reflect a more appropriate response to clinical conditions generally found with a MEWS 1–4. Clinician feedback was positive following the change.' (Director of midwifery)

This site reworded the escalation pathway for maternity early warning scores of 1–4 as '**consider** consultation and increase observations'. It explicitly identified the appropriate behaviour (to consider and increase observations). As a result of this amendment, 'the clinicians' clinical judgment was valued with more flexibility to respond appropriately to the abnormal vital sign' (Director of midwifery).

This situation demonstrated the importance of developing local pathways with **all** clinicians, who carefully consider the risks associated with the decision not to escalate care in certain situations. Determining the appropriate escalation pathways and response may require challenging existing customs and practices in certain settings, and appropriate actions and responses must be specified in the escalation pathway.

Some staff, particularly in smaller services and after-hours, were apprehensive about escalating care when the woman's score was high. In this situation, midwives discussed the case with their midwifery colleagues and closely monitored the woman to ensure she did not deteriorate further. In one location, the charge midwife saw this as an appropriate response.

> 'Sometimes we don't escalate at night if we aren't concerned, because we don't want to wake the SMO [senior medical officer].' (Midwife)

> 'The pathway does work well, as long as the midwives are initiating the pathway. Sometimes, for whatever reason, they are choosing not to, and not documenting why. I think that is getting better now as the group culture is changing so that would be unacceptable. That is changing, it's just taking some time.' (Midwifery educator)

Some comments described the difficulty of escalating care for women who were under the care of private obstetricians who were lead maternity carers. This difficulty was due to confusion about the appropriate escalation pathway for women under private obstetric care in a public hospital setting.

> 'The patients of private LMC [lead maternity carer obstetricians] aren't escalated appropriately.' (Survey respondent)

6.6 Response to escalation

The majority of the feedback we received about the response to escalation was positive. In general, staff said that the responses are timely and appropriate.

> 'The response is excellent. We call, they come.' (Survey respondent)

> ‘I think [women] are getting seen sooner and they’re getting addressed better. We’re doing less wait-and-see and more action.’ (Midwifery educator)

Some commented on some initial challenges, which made it necessary to clarify roles and amend the escalation pathways, but these were ironed out over the test period. One site described its difficulty in contacting the home team for women during daylight hours, as they were often busy.

> ‘When we started with the MEWS chart, we got a lot of calls to start with, but now they have reduced a lot.’ (Senior medical officer)

Some staff expressed apprehension about escalating care, stating that some responders don’t like being bothered.

> ‘... the consultants are never happy when we phone, especially after hours.’ (Survey respondent)

Another issue staff raised was how to further escalate care if no response occurs or if the response is inappropriate or untimely.

> ‘I do not know how to escalate to the next level if the response is not in a timely manner.’ (Survey respondent)

Some ongoing challenges concerned how best to ensure that the escalation response is documented. One site was trialling the use of stickers to address this issue. A further issue that could present an ongoing challenge was the confusion around the response to women with private obstetricians.

Responders mentioned that the ISBAR was a valuable communication tool when they were being called, but also said they would like staff to use it more often. One responder asked for the ISBAR to be included on the chart as a prompt for this purpose.

> ‘As a responder it helps [when midwives use] ISBAR.’ (Senior house officer)

6.7 The back of the chart

The reverse side of the national MEWS vital signs chart has been left blank, as a space reserved for the test sites to use in whichever way they chose.

NMH left the reverse of the chart blank. Staff wondered whether the back of the chart might be a useful working space, but it was not used during the trial.

ADHB chose to use the space to add a section for intrathecal observation recordings as well as a section to record falls and pressure injury assessment, in line with hospital-wide requirements. Staff tended to see the back of the chart requirements as a part of the national MEWS chart, rather than a local requirement. Feedback from Auckland staff suggested that this perception compromised the national MEWS chart, as it complicated it and increased the workload required.

Some staff said they would like double-sided charts to cut down on how many charts were needed, particularly for women who required observations after a caesarean section.

7. Qualitative findings – lessons from implementation

This section provides insights from the qualitative data into the implementation of the maternity vital signs chart and the MEWS.

7.1 General

As expected with any new programme, the early implementation and uptake involved some challenges, with some initial apprehension and hesitation among staff. These attitudes largely stemmed from concerns about an increase in workload and the addition of new processes. The test sites highlighted the particular importance of effective leadership and governance, education, preparation and change management, strong local policy and regular feedback in supporting the implementation of the MEWS.

7.2 Leadership and governance

Strong leadership and clinical governance were highlighted as important elements in implementing the MEWS. Staff at one site praised the leadership of the clinical lead and the governance systems that allowed issues to be addressed quickly.

> ‘Having a supportive lead who understands the clinical context of our practice [helped the implementation go well].’ (Midwifery educator)

> ‘Need to ensure weekly feedback goes through to governance to assist addressing barriers.’ (Maternity unit manager)

At another site, staff noted that the clinical governance arrangement was strong, but the meetings were regularly being cancelled as the site was short-staffed. They also noted a lack of involvement from the clinical lead and senior medical staff, which made it difficult to raise concerns and address any barriers or issues.

> ‘Changing practice can be challenging… stronger leadership is required… I can highlight the issues to management all I want, but there is no desire to take action.’ (Project team member)

Here the MEWS project team appeared not to be included in the wider deteriorating patient governance group, who seemed to lack awareness of and engagement in the MEWS. This led to a lack of communication and mutual understanding when the MEWS was being implemented.

> ‘The project lead is now on the adult deteriorating patient governance committee – it is important to have this from the start of the project.’ (Project team member)

> ‘Maternity not currently included in the adult [deteriorating patient] committee.’ (Senior midwife)

7.3 Education

At all three sites, the project teams emphasised that the midwifery education component was essential. They praised the midwifery educators highly, including for their commitment to supporting staff throughout the implementation of the MEWS.

> ‘Fantastic midwifery education that is consistent and clear supported the implementation [of the MEWS].’ (Survey respondent)

The midwifery educators began to include the MEWS in their orientation programmes, journal clubs, PRactical Obstetric Multi-Professional Training (PROMPT) and annual midwifery emergency refresher education days.

The educators were happy with the initial documents we supplied and tailored them to meet the specific needs of their hospital and/or staff. They also developed their own additional resources when they identified specific areas to focus on, for example, where things weren’t working well.

7.4 Preparation and change management

The project teams and midwifery educators communicated how important an adequate lead-in time was to help them communicate and manage the change, and to support a shift in culture.

> ‘You need… at least a month to get the word out about it. The only way is to keep being annoying almost. Everywhere you looked it was, “there’s MEWS again”.’ (Midwifery educator)

> ‘I started the project with a “saturation phase”, informing [the staff] of the change.’ (Midwifery educator)

> ‘Once we settle in and get used to it, it will be okay.’ (Registrar)

The midwifery educators explained that most staff were receptive to education and the changes involved, as long as they understood ‘the why’. Presenting the ‘case for change’ was a crucial step in the implementation.

> ‘I applied the principles of forming, storming, norming. I feel like we’re in the norm phase, as there is less noise.’ (Midwifery educator)

> ‘Convincing midwives why women need to have observations recorded on a MEWS chart was challenging.’ (Midwifery educator)

> ‘Midwives are now finding it a normal part of practice.’ (Midwifery educator)

The midwifery educators praised the local champions who helped to shift the culture and could support the implementation on the wards and in practice.

> ‘Enlist champions in each ward area.’ (Midwifery educator)

7.5 Strong local policy

We received comments about the importance of local policy – often because it wasn’t developed or needed some careful updating. Midwives understood the local escalation pathways, which were developed and adapted well, but they identified the need for clearer

guidance about the criteria to start a woman on a maternity vital signs chart and about the frequency of observations.

> ‘Women actually need to be started on a MEWS chart. [There is] significant variability as to how soon after delivery this starts.’ (Survey respondent)
>
> ‘Not having a policy/protocol on the use of the MEWS chart doesn’t support change.’ (Midwife educator)
>
> ‘There was confusion regarding the frequency of observations post-epidural/intrathecal morphine/spinal. We need a confirmed policy.’ (Midwife)
>
> ‘A localised guideline on the frequency of observations is pending and will help.’ (Charge midwife)

7.6 Regular feedback and opportunities to learn

The midwifery educators explained that they found it beneficial to have multiple avenues for feedback from staff during the implementation phase. These avenues included electronic and hard copy formats, along with verbal feedback that was also recorded in writing.

For the educators, the opportunity to provide feedback throughout the process was an important aspect of the implementation, as it supported learning and continual improvement.

> ‘In the education phase, in the try-to-saturate-the-market phase, it was useful, because people really were taking notice. I would stand there and go, “Right, I’m going to be here for the next half an hour. Let me know what you need.”’ (Midwifery educator)

The audit tool and regular measurement provided a useful feedback loop for clinicians to understand how they were getting on. The midwifery educators were proactive in using the audit data to inform focused education and to provide positive feedback.

> ‘The audit tool has worked well since implementation.’ (Midwifery educator)
>
> ‘The audit is hard work, but useful for staff feedback.’ (Midwifery educator)
>
> ‘I have used the audits to demonstrate improvement in weekly updates.’ (Midwifery educator)
>
> ‘I think it was quite good to show the staff this is what we’re doing, and this is what we could do better. This is what we’re missing, some people are forgetting to put x, y, z, and that helps as a visual reminder.’ (Midwifery educator)

One report stated that staff were too busy to use the audit data effectively.

7.7 Project support from the Commission

We liaised with potential maternity test sites in February 2018, with three sites confirmed in March. These early discussions focused on the commitment required by the DHBs, their current MEWS (if they had one) and the support we would provide.

At least two MEWS clinical leads visited the three sites in late April. The purpose of the visit was to discuss the requirements of implementation in more detail, going through the preparation and implementation guide and the checklist for testing.

The national MEWS team held monthly teleconferences with the sites, and then coordinated Zoom meetings with all three sites collectively. These meetings provided opportunities for the sites to learn from one another, share their experiences and collaborate.

An additional site visit occurred on 19 July for the maternity specialist to spend time with midwives in the early implementation period in Nelson Hospital. Unfortunately, due to the New Zealand Nurses Organisation nursing and midwifery strike, the implementation date was postponed. The maternity specialist, and feedback from Nelson Hospital, confirmed that the site visit was valuable in promoting the soon-to-be-implemented MEWS with midwives and comparing the maternity vital signs chart with previous clinical charts.

Throughout the test phase, the national MEWS team was available for input and support through email, phone or extra site visits if required. For example, it provided feedback on the DHBs' project charters. Educators commented favourably on such support.

> 'It was really useful to have the email contact, especially the anaesthetist [clinical lead]. It was really good to have those contacts to ask questions of, and it's really good to have that external perspective.' (Midwifery educator)

The sites praised the Commission for its thorough preparation and resources, and overall felt well equipped to implement the MEWS. They noted that their participation involved a lot of work and initially some felt overwhelmed by the prospect. Some suggested additional resources that could be developed to support the implementation, such as a simpler one-page guide and an e-learning resource.

> 'I was a bit overwhelmed by the volume of what I received. But I'm not saying that's a criticism or that you shouldn't do it. I guess that if anyone's going to be needing to spend a bit of time on it, it should be me, and then I can diffuse it down in terms of what I'm talking to people about.' (Midwifery educator)

> 'It would just be really good to have a "how to" guide that was very simple and could be pinned up in all the midwife stations.' (Midwifery educator)

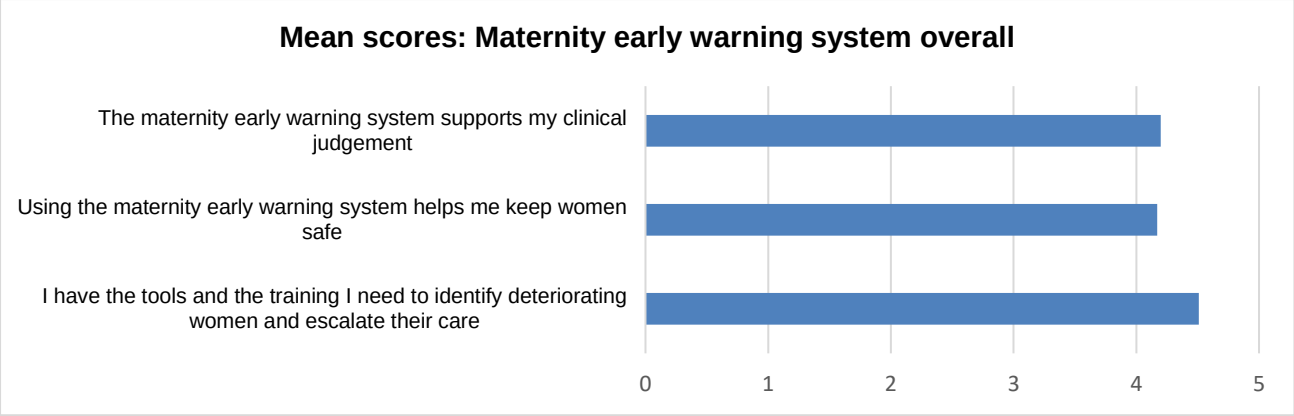
8. Quantitative findings

8.1 Online survey results

Overall the survey results were positive, with weighted average scores ranging from 3.26 to 4.57, as summarised in the charts below.

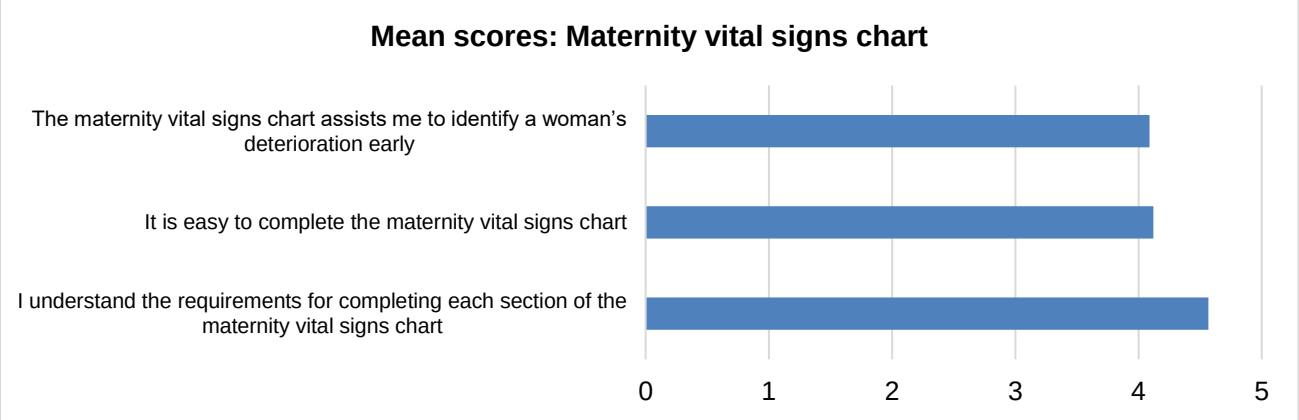
MEWS overall

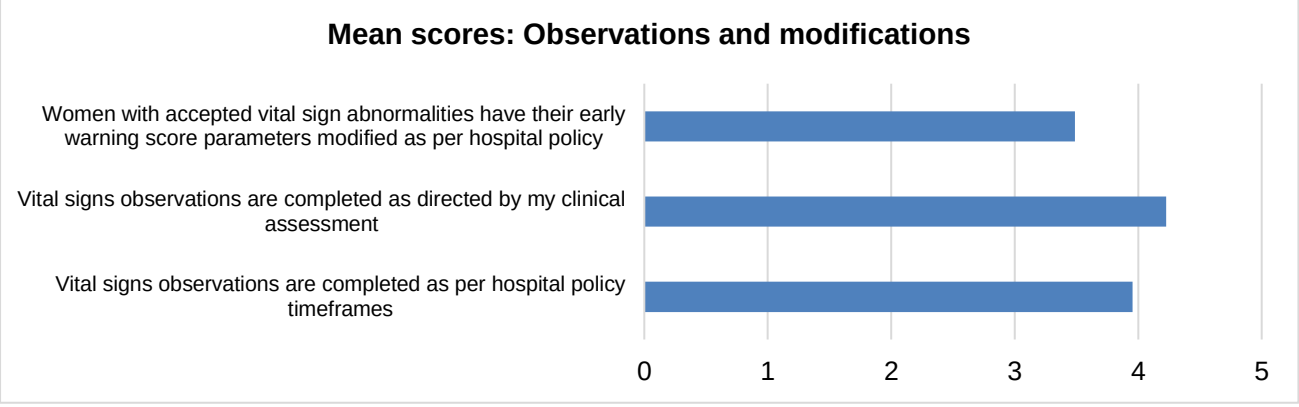
Respondents indicated that they had the tools and training to identify women and escalate care if required. They believed that the MEWS supported their clinical judgement and helped them to keep women safe.



Maternity vital signs chart, observations and modifications

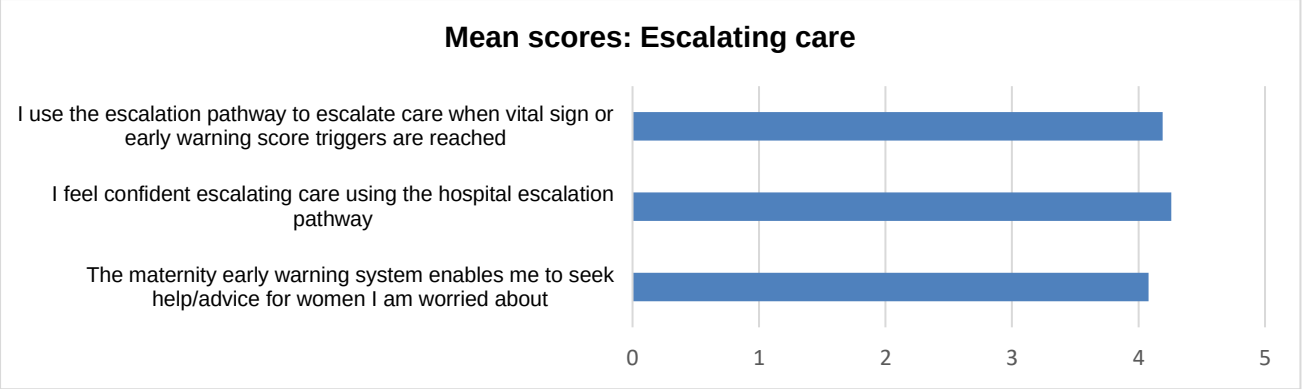
Respondents indicated that the vital signs chart was easy to complete and helped identify deterioration early. Observations were completed as directed by clinical assessment and following hospital policy timeframes. Respondents were more divided over whether modifications to score parameters were completed according to hospital policy.





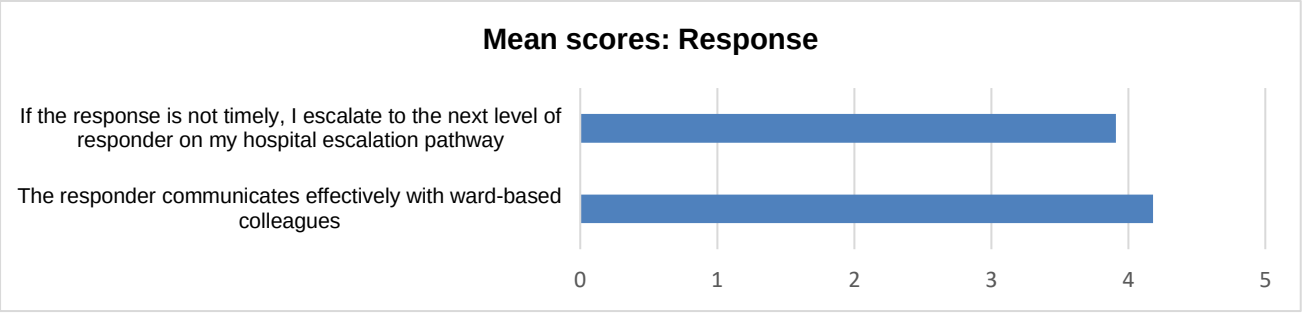
Escalating care

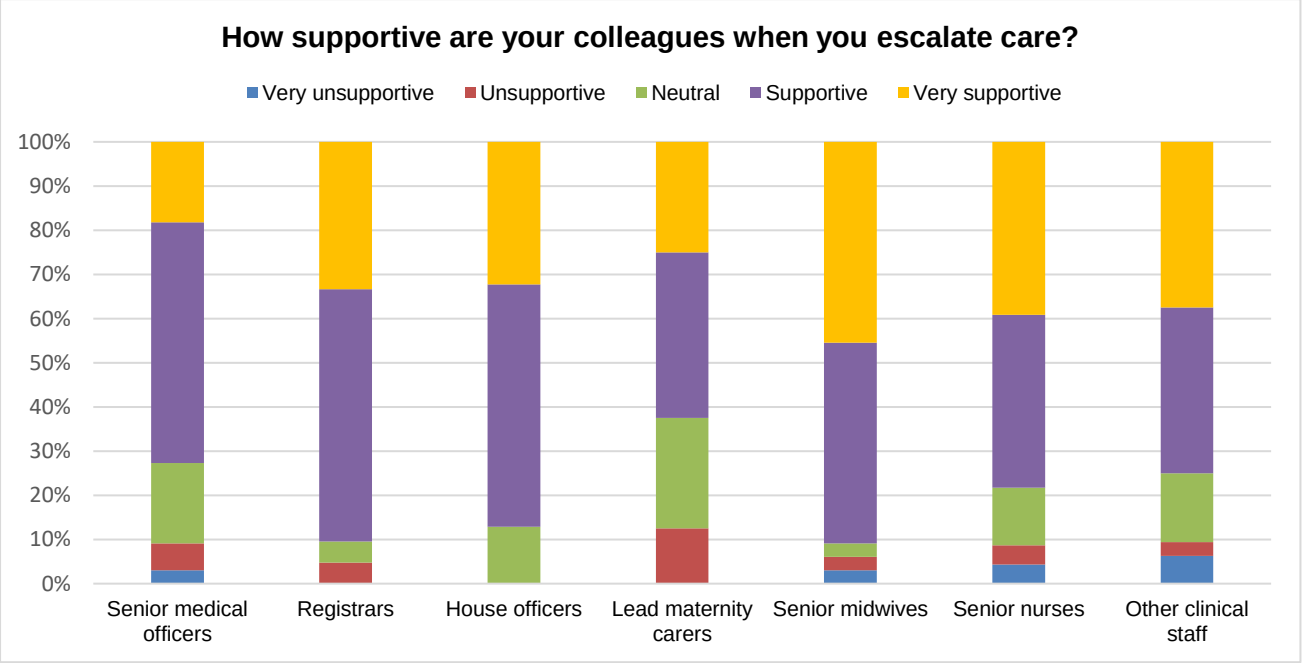
Respondents indicated the MEWS enabled them to seek help and advice, and that they were confident to escalate care when needed. Most colleagues were supportive or very supportive when care was escalated.

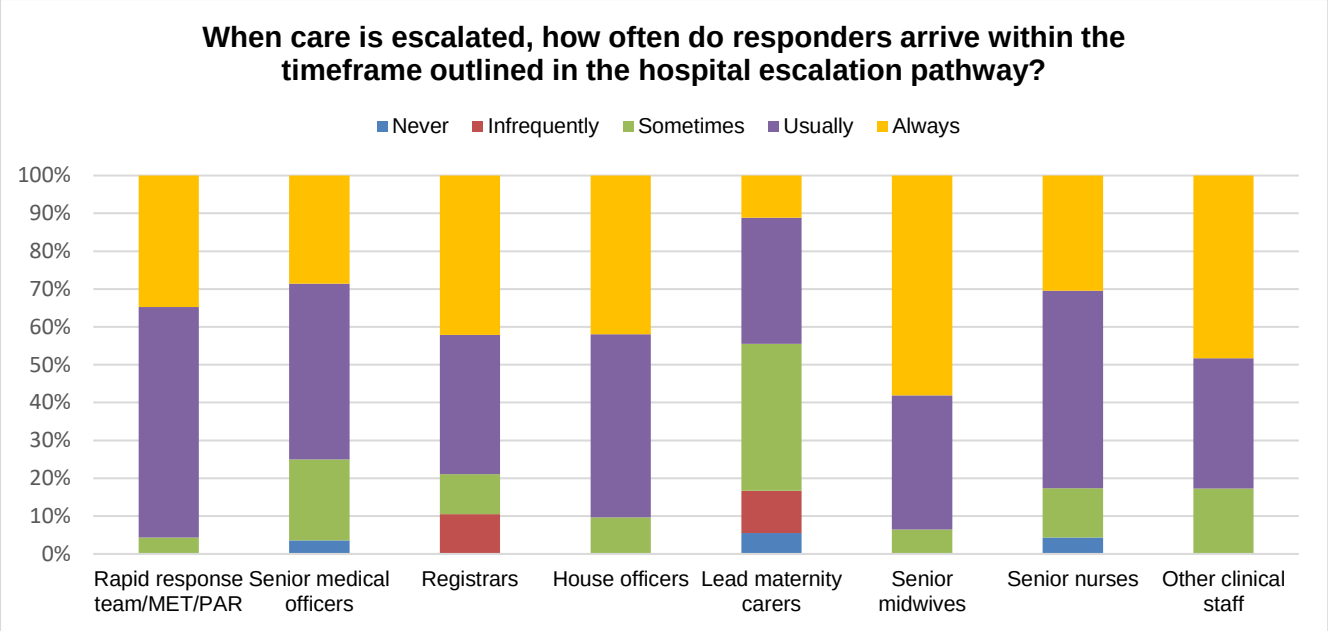


Response

Respondents indicated that escalation pathway responders communicated effectively with ward-based colleagues. If the first level of response was not timely, escalation to the next level of responder did take place. Most escalation pathway responders usually or always arrived within the timeframe indicated in the hospital escalation pathway. Note that lead maternity carers are not directly employed by DHBs and are not hospital-based, which may explain their slower responses compared with other responders.



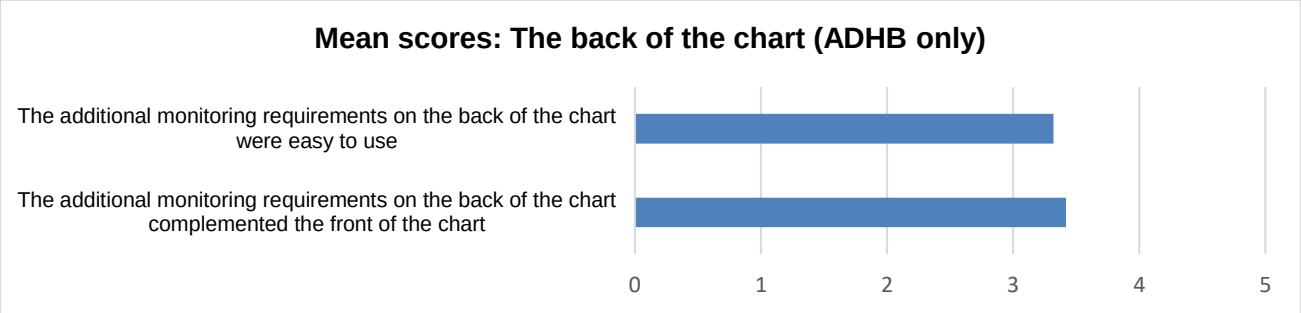




Note: MET = medical emergency team; PAR = patient at risk team

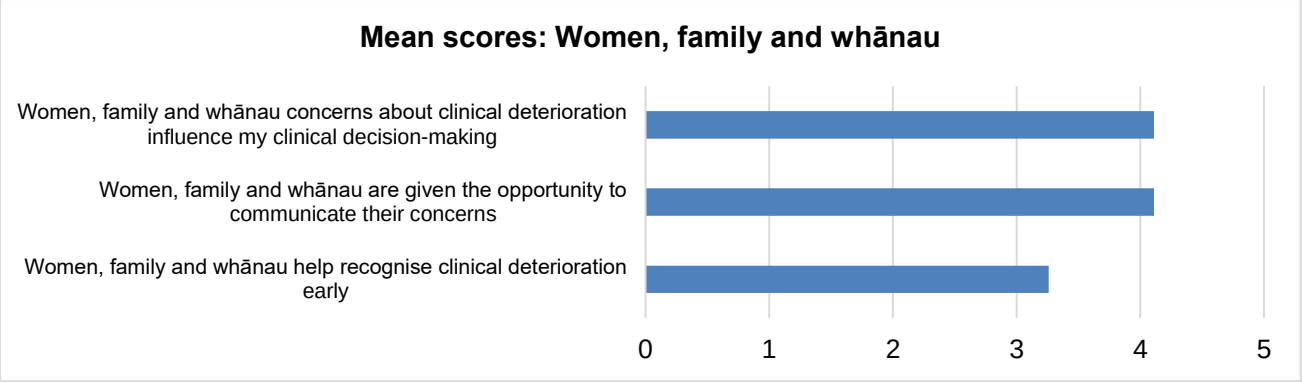
The back of the chart (ADHB only)

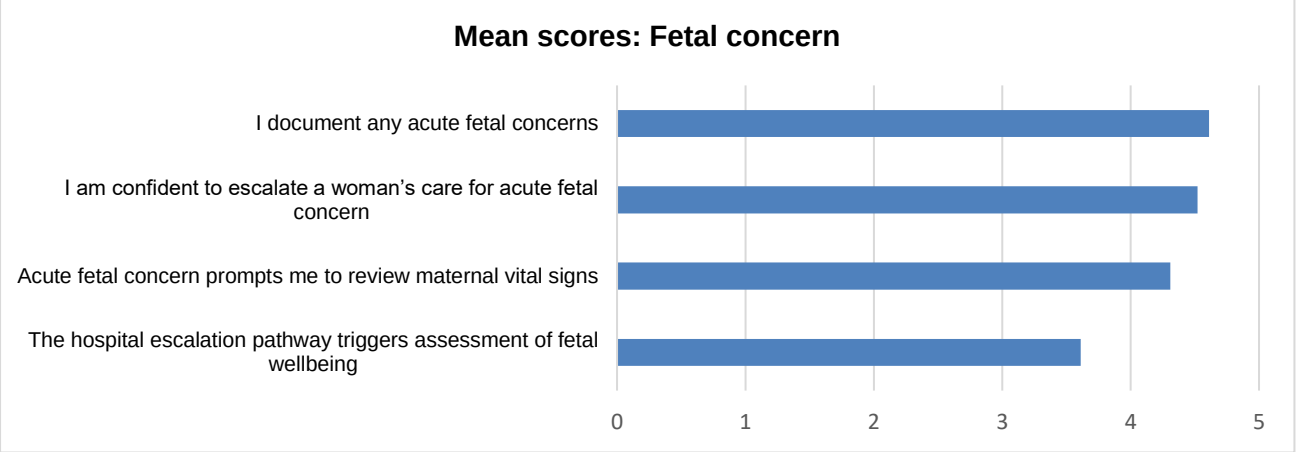
ADHB used the back of the chart for intrathecal morphine monitoring, falls and pressure injuries. Auckland respondents were more divided over whether the additional monitoring requirements were easy to use and whether they complemented the front of the chart.



Women, family and whānau, and fetal concern

Respondents consistently indicated that women, family and whānau were given opportunities to voice their concerns and that these concerns were documented. Their views differed more over whether women, family and whānau helped to recognise clinical deterioration early. Respondents indicated that staff documented acute fetal concerns, which prompted review of maternal vital signs and escalation if required. They were less in agreement over whether the escalation pathway triggered assessment of fetal concern.





Overall survey discussion

The responses to and comments made in the survey indicate that areas of the MEWS needing more work include the consistent use of parameter modifications, how to escalate if response is not timely and clear guidance on the use of single-parameter triggers in the red zone. Actions could include amending or adding to the frequently asked questions provided, and culture change to stress the importance of modifications and following agreed escalation pathways, including information and support for escalation to the next level of responder if required. The use of the back of the chart (whether nationally or left for local decisions) should also be considered.

Pleasingly, many of the early concerns around the design of the chart and the vital signs and parameters used were not reflected in the responses from ADHB and NMH staff, who were 12–13 weeks into the trial when they completed the survey. More of the comments in these areas were made by the NDHB survey responders, who were only seven weeks into their trial.

8.2 Audit and measurement

Process measures

For a process to function effectively, all the critical process steps need to operate at peak efficiency. Inefficiencies in any process step will make it more difficult to achieve the desired outcome. Audit data demonstrated that many of the process steps of the MEWS are operating at a low level on average and vary significantly.

The maternity recognition and response process has been broken into five process measures. The table below sets out these measures as audited numbers and overall percentages.

Process step	Hospital			Total
	Auckland City	Nelson	Wairau	
	n (%)	n (%)	n (%)	n (%)
Appropriate frequency of observation monitoring	192 (61%)	62 (76%)	44 (100%)	298 (68%)
Completed core vital signs set	200 (64%)	64 (78%)	42 (95%)	306 (70%)
Most recent total MEWS score calculated correctly	181 (58%)	54 (66%)	40 (91%)	275 (63%)
Modifications made to MEWS score triggers	3 (1%)	8 (10%)	3 (7%)	14 (3%)
Triggers for escalation reached in the 24-hour audit period	38 (12%)	38 (46%)	7 (16%)	83 (19%)
Total audited records	314	82	44	440

The process measures varied significantly between the two test sites (while the two NMH hospitals have been reported separately in this audit). This indicates that the MEWS is not fully embedded in maternity services and that further work is needed to improve all process steps. However, these measures need to be seen within the context of ward acuity and staffing levels, which can impact on matters such as the completion rate. Staff identified this as an important factor at ADHB, which had a recognised shortage of midwives during the test period.

Note that the difference in ‘triggers for escalation’ between Auckland City Hospital and the other sites may reflect a difference in the auditing method. ADHB’s audit process only recorded escalations if the total MEWS score was 8 or above, or a single-parameter trigger. The other sites recorded escalations for total MEWS scores of 5 or above.

The test sites were asked to provide baseline data for the process measures. However, it is difficult to see any change over time with the current, relatively short-term data. Measuring these process steps over a longer period would likely demonstrate a greater, sustained improvement.

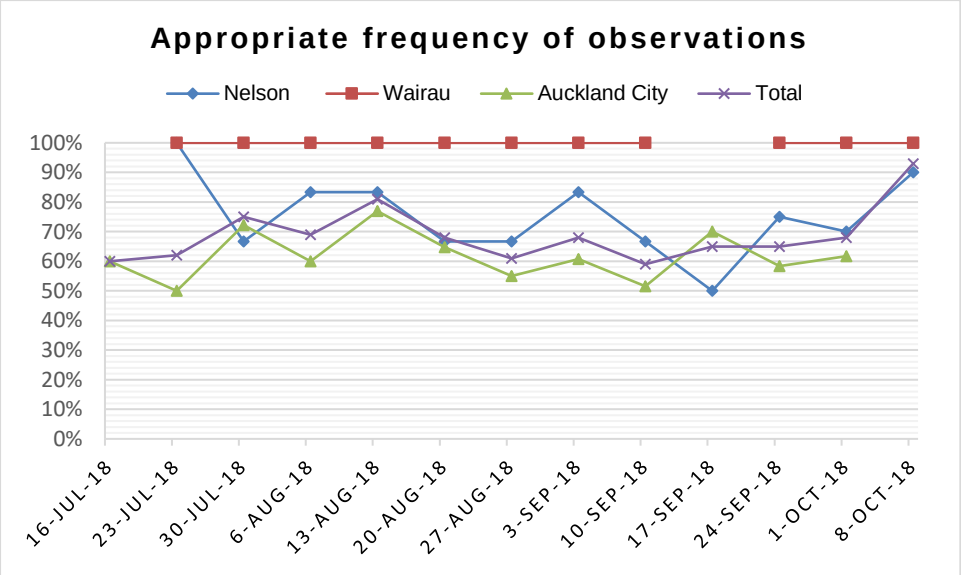
Use of the vital signs chart

The following audit questions related to the use of the vital signs chart.

- Was the frequency of the vital signs monitoring appropriate for the woman?
- Was the core set of vital signs completed for the most recent set of vital signs?
- Was the total MEWS calculated correctly for the most recent set of vital signs?
- Were any modifications made to the MEWS score triggers? (If yes, then two subquestions were asked related to clinical and documentation requirements.)

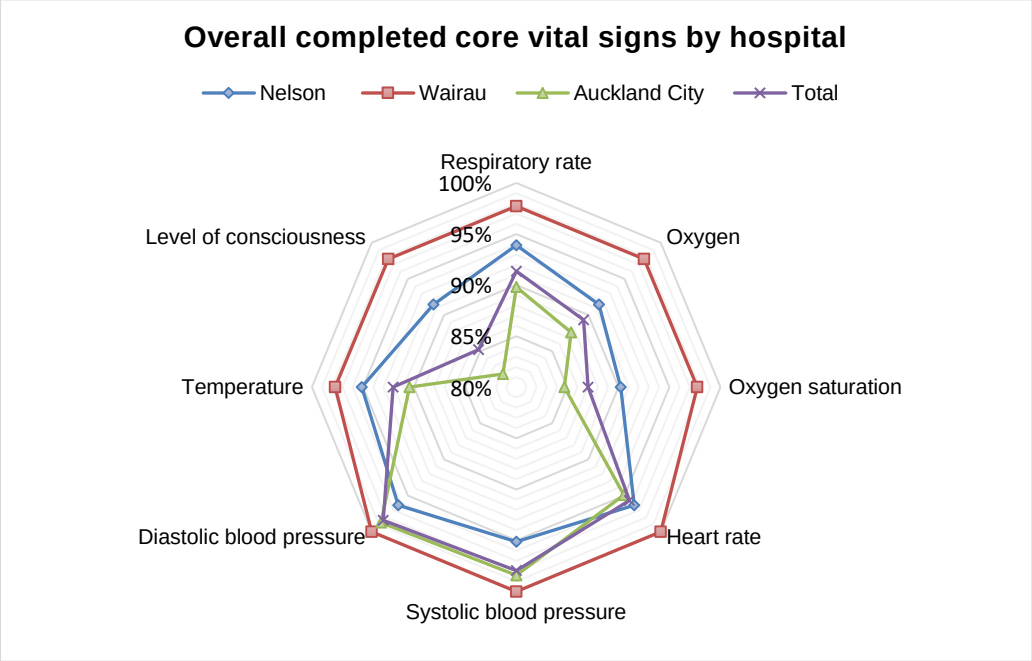
Frequency

The process measures showed that the observation frequency was appropriate in 68 percent of cases overall. Note that the national MEWS does not include specific guidance on the appropriate frequency of observations, but rather expects this guidance to be developed locally.



Vital signs observations

Overall, staff recorded all the vital signs of 70 percent of women recorded in their most recent record. Generally, they completed systolic blood pressure, diastolic blood pressure, heart rate and respiratory rate. The vital signs that were recorded less frequently were oxygen, oxygen saturation, temperature and level of consciousness.



Maternity early warning score

Auditors were asked to check the calculations of the total maternity early warning score for the most recent set of vital signs, to see how many of these were scored correctly.

Overall, 63 percent of the most recent set of vital signs were scored correctly; conversely, 37 percent of the most recent scores were incorrect. Further analysis showed that out of the 165 charts that had incorrect scores, only 19 percent were due to calculation errors and the other 81 percent occurred because the vital signs chart was not complete (ie, staff had not recorded all vital signs).

Modifications

Audits revealed that very few charts had modifications made to the triggers. In total, only 3 percent had modifications recorded on the chart.

Escalation and response

The audit included four questions related to escalation and response.

- Did the woman reach any of the triggers for escalation in, or up to, the 24-hour audit period? (If yes, complete the next three questions.)
- Did escalation occur according to the pathway?
- Did the response occur according to the pathway?
- Did the responder complete documentation requirements (according to local policy)?

The results of the audit showed that significant improvements are required to ensure that escalation and response occur in line with local pathways. Data from the audits reveal that when a woman's vital signs reached a score that triggered an escalation (which occurred for 19 percent of cases, representing 83 women):

- 57 percent were escalated according to the local escalation pathway
- 52 percent received the response according to the local escalation pathway
- 48 percent met the requirements for the responder to document their response according to the local escalation pathway.

One of the challenges with reviewing the audit data has been that staff did not record whether a trigger for escalation was yellow, orange, red or blue.

Outcome measures

The outcome measures for the MEWS are:

- escalations to the obstetrics emergency team
- the number of high dependency and intensive care unit admissions.

Not enough time has passed yet for the outcome measures to show a sustained improvement or to make outcome-related conclusions. However, the ADHB outcome measures indicate that fewer code red calls (ie, escalations due to a total maternity early warning score of 8–9 or a single red parameter) occurred during the testing period compared with historical data.

9. Equity considerations

This formative evaluation considered the clinical utility of the MEWS and associated process measures. The evaluation did not consider the outcome measures, as it is too soon since implementation began and current data is insufficient. For this reason, we are currently unable to evaluate whether the MEWS may contribute to achieving more equitable outcomes for women.

When fully implemented, the MEWS should promote more equitable outcomes for women by ensuring that pregnant women are treated equitably when they receive care in hospital because their care is tailored in response to their individual clinical need.

Implementing the MEWS, with embedded local policy that confirms criteria for use (eg, frequency of observations), should reduce the likelihood of unconscious bias and human error in health care. This improvement should also promote more equitable outcomes.

10. Conclusion

The three test sites that participated in this early implementation pilot provided useful insights into the opportunities and challenges of implementing the MEWS to enhance recognition of and response to deteriorating pregnant women.

Overall, clinical staff found the MEWS to be a helpful system to recognise deterioration and to guide appropriate escalation and response. While sites experienced some initial challenges, these were successfully addressed in the test phase and the MEWS became accepted as the 'new normal'.

The importance of education was consistently recognised as a crucial element in the early implementation, as was strong leadership and effective clinical governance.

The pilot highlighted the need to establish effective clinical governance structures to enable oversight of the MEWS, address any implementation challenges and continue to embed the system across the whole hospital setting. Strong clinical leadership from both midwifery and obstetrics in maternity settings (and nursing and medicine in the wider hospital) is essential to encourage clinical staff to engage in the system, to recognise and respond to deteriorating pregnant women and to improve maternal outcomes.

The MEWS evaluation highlighted the importance of using data to identify areas for quality improvement. It is vital to continue to collect data and report it to the relevant governance and clinical groups to ensure local systems are continually improved.

If the MMWG decides to implement the MEWS nationally, it will apply the lessons learned from the pilot to refine the tools and guidance, and to support implementation in the remaining DHBs.

The Commission gratefully acknowledges the significant work and valuable feedback from the project teams and other staff in the three early implementation sites.

Appendix 1: Evaluation questions

The MMWG set the following questions for the evaluation.

1. What level of support, tools and guidance is needed for district health boards preparing and implementing the MEWS?
    a. Identify whether the project package was helpful for district health boards preparing to incorporate the MEWS into clinical practice.
    b. Do district health boards think we delivered the project package in the best way that we could? Was it usable? Do they have suggestions for improvement?
    c. Identify what other supports are necessary/important for district health boards that are considering using the MEWS.
    d. Identify whether the tools and guidance provided helped in the clinical setting – what was most/least helpful?
2. What changes, if any, are needed before the MEWS package is spreadable?
3. What changes occurred at the test sites with the introduction of the national MEWS (process measures)?
    a. Identify barriers and enablers to implementation of the MEWS and differences between district health boards.
    b. Identify what other changes were necessary to support the success of the MEWS.
4. How were outcomes affected by the introduction of the MEWS? (This will be a short-term focus given time scales.)
    a. Identify whether incorporating the MEWS has made a difference to clinical care (identifying women whose condition is deteriorating) within the district health board through audit processes.
    b. Identify staff perceptions and experience of MEWS in relation to safe practice.
    c. Identify whether introducing the MEWS had any unintended consequences (good or bad).

Appendix 2: Feedback on specific parameters

Vital signs and parameters	
Theme/element	**Specific comments**
Respiratory rate	• We never do respiratory rate post-operatively for intrathecal morphine patients because we don't have time
Oxygen	• Automatic score of 2 when on supplementary O_2 – rationale understood but it shouldn't be routinely prescribed if that's the case • Oxygen is not a vital sign, why is it part of the MEWS score?
Heart rate	[no comments]
Blood pressure (BP)	• Hard to see without a dotted joining line between measurements • Hard to read the small scale/mark exact BP • No score for low diastolic BP • Parameter for BP is too low – very common for a lot of women to have BP 90/60 without it being a concern • Prefer to use a '.' or '^' marker rather than an 'x' • Prefer specific values rather than in the 100s etc as this is confusing • Should systolic BP of 160–170 be in the red zone?
Temperature	• Consider changing colour zones for temperature (needs increased score or red zone)
Level of consciousness (AVPU)	• AVPU scale can be confused with pain score – just use 'alert' or 'not alert' • Should we be waking women during the night for post-anaesthetic assessment?
Pain score	• Elevate pain score into the chart rather than as an afterthought below the MEWS score

Appendix 3: Feedback on the vital signs chart design

Design	
Theme/element	**Specific comments**
Colours	• Colour coding in the escalation part is confusing because red/blue zone means act – some thought any vital sign in an orange or yellow zone meant act too • Colours are too pale, there's not a big enough difference between yellow and orange • Red should be highest alert, not blue • Consider a score attributed to blue zone for cumulative scoring • Change where it says 'red' to 'pink'
Size	• Page folding is complicated • The chart is too big and too busy • Not enough observations on one sheet – may use 2x sheets for one patient in one day • Why are there two labels? No-one puts two on
Space	• No space for initials/signatures • No space for dates • No space for epidural site check • No space for lochia and wound • No space for urine output • In the middle of the chart some struggle with accurately documenting observations • Intrathecals on the front would be simpler than on the back (ADHB) • What is the 'RRT' field for? • Not enough room for modifications
Lines – numbers	• Numbering in groups of 10s is confusing, numbers on the line could be better (may confuse escalation colour) – some people write the value, others just tick • There are inconsistencies with what to document – eg, some observations require actual values, others just a mark in a range