



Safer Care
Victoria

Paediatric
Network

Victorian Children's Tool for Observation and Response (ViCTOR) Newborn Project

Final report, April 2017

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Contents

Preface	2
Acknowledgements	2
Executive summary	3
Chart development	3
Pilot implementation and evaluation	4
Evaluation findings	4
Recommendations	6
1: Introduction	8
1.1 Overview and rationale	8
1.2 Project governance	9
1.3 Project objectives	11
1.4 Project logic model	11
2: Development of pilot newborn charts	13
2.1 Sector engagement and process mapping	13
2.2 Pilot site recruitment	14
2.3 Chart design	14
2.4 Development of local escalation processes	19
3: Pilot implementation	20
3.1 Pilot wards/units	20
3.2 Printing coordination and chart distribution	21
3.3 Education resources	21
3.4 Ongoing support	21
4: Pilot evaluation	22
4.1 Evaluation objectives	22
4.2 Evaluation methods	22
4.3 Evaluation findings	31
4.4 Barriers and enablers	44
5. Chart and resource finalisation	47
5.1 Chart amendments	47
5.2 ViCTOR newborn package	49
6. Project conclusion and recommendations	50
References	52

Preface

This report was prepared by the Victorian Children's Tool for Observation and Response project team for the Victorian Paediatric Clinical Network, Safer Care Victoria, Victoria, Australia.

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Executive summary

The Victorian Children's Tool for Observation and Response (ViCTOR) Newborn Project is a quality improvement project funded by the Victorian Paediatric Clinical Network and Victorian Maternal and Newborn Clinical Network. It builds on a previous project involving the development of standardised observation and response charts for paediatric patients aged 0–18 years treated in ward and urgent care settings; these are now implemented in the majority of Victorian health services.

The ViCTOR Newborn Project has sought to develop observation charts that complement the existing suite of ViCTOR charts and provide a consistent, standardised and evidence-based approach to recognising and responding to deterioration in the Victorian newborn setting. The existing '0–3 month' paediatric chart was not intended, nor considered adequate for newborns, who may require additional clinical observations and whose vital sign ranges are likely to differ from older infants. For the purpose of this project a newborn was defined as '32 weeks to term (corrected)' and 'term (corrected) to 28 days'.

As experienced with the earlier phases of the ViCTOR project, there was found to be considerable variation in practice in Victoria. This variation related to the nature of observations, as well as the frequency and duration of observations after a baby was born. Observation routines ranged from one set of observations post birth, to more frequent observations for two to four hours. Few services involved in the initial mapping process and the subsequent pilot conducted regular ongoing observations after the initial four hour period.

Chart development

As for the original ViCTOR charts, a robust development process was instigated, drawing on current evidence and involving in-depth consultation with the sector, including mapping of current practice and securing input from an Expert Advisory Group.

Two newborn observation charts were developed in order to meet the needs of the two main groups of patients:

- ViCTOR Birth Suite/Postnatal (BS/PN)– for use in all newly delivered babies, with the knowledge that the majority would be well, but to assist in detection and response to clinical deterioration when it occurred
- ViCTOR Neonate – for use in the special care nursery environment, emergency department or paediatric wards where neonates are often premature and already identified as being unwell or at risk of deterioration.

A key consideration in the development of the charts was establishing a standardised approach to determining the frequency and duration of observations, particularly in the birth suite or postnatal ward. For this group of generally 'well' newborns, it was agreed to trial the completion of hourly observations for the first four hours of life, then once per shift (eight-hourly), unless more frequent observations were warranted. A risk assessment was also incorporated into the chart to guide decision making in regards to increasing the frequency of observations.

The selection of the type of clinical observations for inclusion on the charts was based on recommendations from the National Safety and Quality Health Service Standards, the Royal Australian and New Zealand College of Obstetricians and Gynaecologists guidelines, the Neonatal e-handbook the existing New South Wales *Standard newborn observation chart* and the Australian Capital Territory *General observation chart neonatal 0 – < 1 month*. Some of these observations were new requirements for health services.

As for the original ViCTOR charts, the newborn charts incorporated generic principles for escalation of care, which were operationalised at individual services through local escalation procedures.

Pilot implementation and evaluation

The charts were piloted across a range of settings in 12 health services, including 11 public (six metropolitan, five regional) and one private health service.

Each participating service developed local escalation of care procedures, with support from the project team. Implementation was facilitated by site champions and supported by the project team, who provided a clinician education package, feedback of audit data and direct support as required.

A multi-method evaluation was conducted to examine the utility and appropriateness of the charts for recording clinical observations of hospitalised neonates and the suitability of the escalation of care processes, thus informing further changes to the chart and escalation processes. In particular, the evaluation sought to establish the suitability of the observation frequency and duration and the usefulness of the newborn risk assessment.

The evaluation methods included chart audits, clinician surveys and focus groups. Participating health services conducted monthly chart audits over a three-month period, resulting in 401 BS/PN and 537 Neonate charts being audited. Clinician surveys were completed by 240 respondents (118 midwives, 93 nurses, 20 doctors and 9 students/other). Participants in the focus groups ($n = 226$) included 218 midwives/nurses, five medical staff and three midwifery students.

Evaluation findings

Utility and appropriateness for recording clinical observations

The two trial newborn observation charts were generally found to be suitable for recording clinical observations, detecting patient deterioration and communicating clinical care in neonatal patients. This was evidenced by chart audits demonstrating high levels of compliance with chart completion requirements and consistency with expected levels of escalation. This was also supported by feedback via the surveys and focus groups, which assisted in identifying a range of specific issues relating to chart design and content. This feedback has informed development of the final versions of the charts as outlined in this report.

The evaluation also identified the importance of effective change management and education to support initial implementation as well as sustained practice change across the diversity of settings and services.

In terms of specific content issues, the need to integrate an input/output chart to assist in interpreting observations was the most frequent suggestion from the survey responses and focus group participants.



A chart design concern identified for both the BS/PN and Neonate charts related to the temperature increments. Subsequently, the revised charts allow a written temperature value to be recorded (rather than graphing the observation).

The most consistently reported issue with the Neonate chart related to the different oxygen saturation (SpO₂) trigger thresholds required for preterm infants, which would then necessitate a doctor to modify the oxygen saturation targets on a daily basis. As a result, the option of an altered SpO₂ target for premature infants and/or those on respiratory support has been integrated into the revised chart. This change presents an opportunity for further evaluation to ensure there is no increased risk associated with having two options (that is, the standard or altered SpO₂ targets).

The inability to clearly document bradycardic and desaturation events was frequently identified as a problem in the Neonate chart. A format change that allowed for SpO₂ to be graphed, rather than written numerically, and a clearer instruction for documenting desaturation and bradycardic events was added to the revised charts.

Suitability of the coloured trigger thresholds

Overall, the coloured zones were found to reflect suitable trigger thresholds. Importantly, when a breach did occur, which sometimes resulted in more than one action, the responses were generally consistent with the hospital's escalation of care procedure.

The pilot found that the orange trigger threshold for the onset of jaundice after 24 hours should be reviewed, since newborns could remain jaundiced for several days after onset but care did not need to be escalated after the initial treatment plan was put in place. In the revised charts an assessment of jaundice with every observation is no longer a requirement. Similarly, for the newborn scalp check, bruising has been replaced with increasing swelling, reflecting that it was the change in bruising that was important to act upon.

Chart audits revealed that the percentage of newborns with heart and respiratory rates in the orange or purple zones was consistent with the expectations based on the percentile ranges they were derived from.

Appropriateness of the frequency and duration of observations and newborn risk assessment

In relation to the frequency and duration of observations, there were initial concerns about the impact on clinician workload, and concerns about a perceived move away from a wellness model of care for otherwise well babies. The frequency and duration of observations for the well newborn (BS/PN chart) was however found to be suitable by the majority of clinicians, and the risk assessment was found to be helpful in alerting clinicians to potential circumstances where the frequency of observations should be increased. However, clinicians regularly reported that there was lack of clarity about the frequency and duration of observations once a newborn risk had been identified. There remains a lack of evidence in this area and there was difficulty in reaching consensus about observation frequencies for newborns identified at risk, thus the frequency and duration of observations is proposed to remain guided by local procedure. Ongoing review of the newborn risk assessment may be required.

To address concerns regarding unnecessary duration of monitoring for the well newborn, an additional instruction has been included in the revised charts indicating that observations should continue for 48 hours or until hospital discharge (whichever occurred earlier) then as per hospital procedure. Although the risk of clinical deterioration is low for these infants, the consequences are potentially severe when not detected early, therefore the observation plan is considered realistic and feasible.

Other findings

Consensus was reached that the title of the BS/PN chart would remain the same, and that the Neonate chart would be renamed the 'Special Care Nursery' chart, reflecting the environment that it would be used in. During the pilot period the specific Neonate chart was rarely used in the paediatric ward or emergency department settings. Of these users the majority preferred the existing '0–3 month' ViCTOR paediatric chart because it was reportedly easier to use and more consistent with the other ViCTOR paediatric charts.

The evaluation identified the importance of ongoing education, especially for the continuing transition of new staff. Clinicians also identified that a statewide guideline that complemented the charts would be beneficial in promoting further consistency of practice, particularly in relation to the required frequency and duration of observations when a newborn risk factor was identified.

Ensuring adequate site-specific procedures were in place to facilitate escalation of care and incorporating specific guidance about appropriate modification practices were also considered essential. Ideally, these local escalation of care procedures should include the ability to discuss with the 'midwife/nurse in charge' when an orange zone is triggered, rather than always seeking a medical review. Incorporating a de-escalation process into this procedure and guiding clinicians how to best respond to neonates who consistently remain in the orange zone following medical review, should also be taken into consideration.

Recommendations

In light of the above findings, a number of recommendations are outlined below.

Chart release

1. It is recommended that the updated Birth Suite/Postnatal and Special Care Nursery charts are released for statewide use in birth suite and postnatal environments and special care nurseries.
2. It is recommended that the trial Neonate chart be removed from paediatric wards and emergency departments and that the existing '0–3 month' ViCTOR chart continue to be used in these settings.

Escalation of care

3. It is recommended that local escalation of care procedures consider the specific needs of neonatal patients including careful consideration of the ability to discuss with the 'midwife/nurse in charge' when an orange zone is triggered, and that the procedure provides guidance about appropriate modification practices.



Implementation resources

4. It is recommended that consideration be given to including a clinical guideline in the *Neonatal e-handbook* to provide guidance and a standardised approach to the conduct of observations and monitoring of newborns in Victoria.
5. It is recommended that a separate ViCTOR 'back to basics' neonatal video is developed to demonstrate best practice vital sign measurement in newborns, including preterm infants.

Further developments

6. It is recommended that a standardised input/output chart for postnatal units and a fluid balance chart for the special care nursery are developed to complement the ViCTOR chart.
7. It is recommended that consideration be given to developing a standardised information leaflet for parents that clarifies the role of parents in recognising and responding to deterioration of their newborn.

Ongoing evaluation

8. It is recommended that further evaluation or research is conducted to establish the most appropriate monitoring plan (frequency and duration of observations) based on the newborn risk profile.
9. It is recommended that a review of these revised charts is undertaken within one year from release, with particular attention to the use of the altered oxygen saturation targets for prematurity and/or for infants on respiratory support.

1: Introduction

1.1 Overview and rationale

Best practice stipulates that patient observation charts should identify thresholds for vital signs (such as respiratory rate) and incorporate a 'track and trigger' system to escalate care when deterioration occurs (ACSQHC 2011; Preece et al., 2012). In 2012, the Australian Commission for Safety and Quality in Health Care (ACSQHC) developed a suite of standardised observation and response charts for adult patients; however, there have been no plans to develop charts for paediatric or newborn patients.

In Victoria, lack of consistency in the parameters for identifying deterioration, and lack of consistency in design and format of paediatric observation charts, have highlighted the need for a standardised statewide approach.

In 2013, the Statewide Paediatric Observation and Response Chart Project was jointly initiated by the Royal Children's Hospital and Monash Children's Hospital with funding from the Victorian Paediatric Clinical Network (VPCN). Following sector-wide engagement and drawing on the most recent evidence of respiratory rate and heart rate percentiles for hospitalised children, a set of standardised charts was developed, incorporating age-related vital signs for children across five age groups. In October 2014 the Victorian Children's Tool for Observation and Response (ViCTOR) charts were approved for use in Victorian health services with dedicated paediatric beds.

Following the initial ViCTOR rollout, it became clear that smaller health services without dedicated paediatric beds often provided the first level of care to paediatric patients and could therefore benefit from using the ViCTOR charts. A five-month pilot to trial the original ViCTOR charts for their suitability in Victorian regional and rural hospitals was conducted across 12 sites. The pilot project resulted in a further series of ViCTOR charts, 'ViCTOR Urgent Care' being released in late 2015. To date more than 75 Victorian health services, both public and private, are using the ViCTOR suite of charts (Project Health 2016).

Since the inception of ViCTOR, the newborn sector has also recognised the need for a similar standardised approach to recognition and response to deteriorating newborns. Other Australian jurisdictions had separately released variations of newborn observation charts with reportedly high acceptability. Newborn charts were a logical next step for the ViCTOR team. With funding from the Victorian Maternity and Newborn Clinical Network (VMNCN) and the VPCN at Safer Care Victoria, the ViCTOR Newborn Project was initiated in early 2016 with the goal to develop, pilot, evaluate and revise a newborn chart, or charts, in preparation for statewide use.

This report describes the ViCTOR Newborn Project conducted between January 2016 and March 2017.



1.2 Project governance

The ViCTOR Newborn Project has been overseen by a governance group, which has been responsible for all decision making regarding project implementation including:

- reviewing and approving the project scope and objectives
- reviewing and approving an appropriate evaluation framework and key performance indicators for monitoring progress and assessing project success
- reviewing and assessing any project risks rated as either 'high' or 'extreme' and agreeing a course of action to mitigate or resolve these
- reviewing and approving reports and signing off on project milestones.

The group met six-weekly during the project, and membership was drawn from various paediatric, maternity and newborn specialists from across Victoria (Table 1). All decisions made by the governance group were subject to endorsement by an officer of Safer Care Victoria with appropriate delegation.

Table 1: ViCTOR Newborn Governance Group

Representative	Representation/role
Annie Moulden	VPCN Quality Lead
David Armstrong	VPCN Co-Clinical Lead (co-chair)
Peter McDougall	VPCN Co-Clinical Lead (co-chair)
Julie Noorman	Consumer
Rod Hunt	Neonatal Advisory Group
Charles Barfield	Neonatologist, Monash Health
Simon Fraser	Chief Medical Officer, Latrobe Regional Hospital/VMNCN neonatal adviser
Kirriy Fasham	Maternity and Newborn Program Lead, Safer Care Victoria
Sharon Kinney	Nurse Consultant, Research, The Royal Children's Hospital Senior Lecturer, The University of Melbourne
Cheree Jukes	Nurse Unit Manager, Maternity, Mildura Base Hospital
Bree Bulle	Director, Regional Perinatal Mortality and Morbidity Committees

In attendance	Representation/role
Paulette Kelly	VPCN Manager
Jen Sloane	ViCTOR Statewide Project Coordinator
Lisa Oro	VMNCN Manager
Pam McGrath	VMNCN Project Officer

In addition to the governance group, the ViCTOR Newborn Expert Advisory Group was formed comprising 11 Victorian neonatologists, paediatricians, nurses and midwives (Table 2). Minutes were kept from each of these meetings or teleconferences.

The Expert Advisory Group was responsible for:

- providing input into the design and format of the charts
- identifying the appropriate 'escalation of care' process to trial in newborn settings
- outlining specific information that would facilitate successful local implementation
- working in conjunction with the pilot sites to implement the charts.

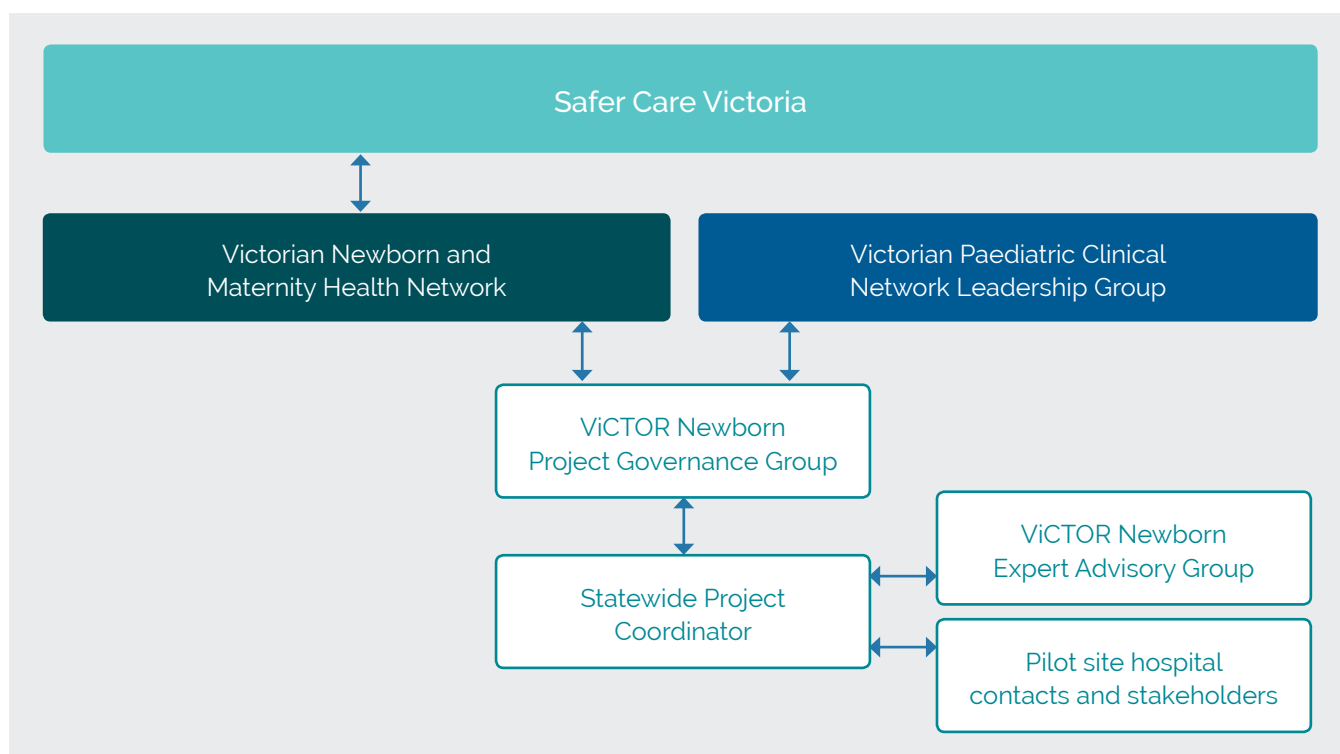
Figure 1 provides a visual depiction of the project's reporting and governance structure.

Table 2: ViCTOR Newborn Expert Advisory Group

Representative	Representation/role
Michael Stewart	Medical Director, Neonatal PIPER
Rosemarie Boland	Nurse Educator/Post Doc Research Nurse, PIPER / Murdoch Children's Research Institute
Julia Coshan	General Practitioner, Swan Hill District
Simon Fraser	Chief Medical Officer, Latrobe Regional Hospital / VMNCN neonatal adviser
Isaac Marshall	Paediatrician, Geelong Hospital
Sue Jacobs	Neonatal Paediatrician, The Royal Women's Hospital
Charles Barfield	Neonatologist, Monash Children's Hospital
Cath Fox	Neonatal Nurse Practitioner, PIPER
Mark Norden	Paediatrician, Albury Wodonga Paediatric Group
Martha Thio Lluch	Neonatologist, The Royal Women's Hospital / PIPER
Lauren Newman	Midwifery Education, Portland District Health
Jim Holberton	Neonatologist, Mercy Health



Figure 1: Summary of ViCTOR Newborn Project reports and governance



1.3 Project objectives

The ViCTOR Newborn Project aimed to develop a Victorian newborn chart (or charts) that would complement the existing suite of ViCTOR charts, providing a consistent, standardised and evidence-based approach to recognising and responding to deterioration in Victorian newborn settings. For the purpose of this project a newborn was defined as '32 weeks to term (corrected)' and 'term (corrected) to 28 days'.

The project involved:

- chart development through a robust consultation process involving the newborn sector and drawing on the best available evidence to inform trigger thresholds for escalation of care
- chart piloting and evaluation to establish utility and appropriateness to the Victorian newborn environment
- revision of chart design and content in light of the pilot findings and sector feedback
- reporting to the sector regarding recommendations for future statewide rollout.

1.4 Project logic model

Figure 2 demonstrates the ViCTOR Newborn Project logic model. This logic model describes the overall process and planned outcomes in the development, piloting and evaluation of the ViCTOR Newborn Project. This logic model has formed the fundamental guide throughout the project lifespan, including the project development, flow, timeline and evaluation.

Figure 2: ViCTOR Newborn Project logic model





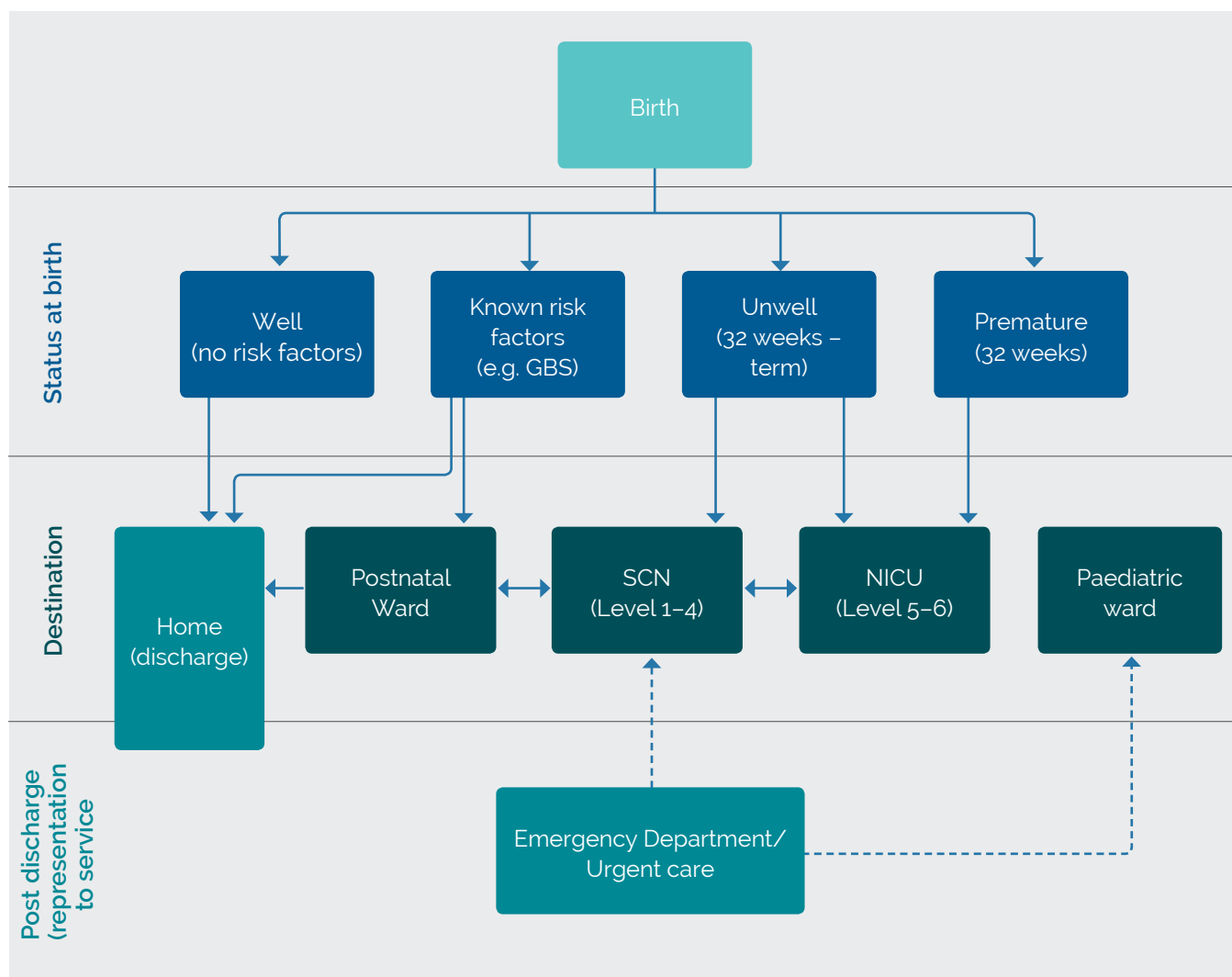
2: Development of pilot newborn charts

2.1 Sector engagement and process mapping

As part of the initial project scoping and stakeholder engagement process, a mapping exercise was undertaken across 15 public and private newborn services in order to gain an understanding of where newborns were being seen within the Victorian health system and therefore which units or speciality areas should be involved in the project. The exercise also provided a valuable opportunity to promote the upcoming pilot project and engage with potential pilot sites.

Figure 3 shows the pathways from birth to the various settings in which a newborn may be cared for, based on the mapping exercise.

Figure 3: Victorian newborn services process mapping



Unwell babies that are 32 weeks to term are likely to be transferred to a special care nursery (the level of nursery being dependent on the severity of illness). Premature infants of less than 32 weeks' gestation are usually transferred directly to level 5 or 6 nurseries which are capable of providing advanced levels of care. It was also found that some babies, following discharge home, would present to an emergency department or urgent care centre and may require an admission to a paediatric ward and in some instances directly to the special care nursery.

2.2 Pilot site recruitment

Beginning in January 2016, a statewide expression of interest to participate in the pilot project generated 28 applications from a variety of health services across the state. Of these, 12 were selected to participate by a panel consisting of the ViCTOR Newborn Project members and representatives from the VPCN and VMNCN (Table 3). The selected hospitals included six metropolitan services, five regional public hospitals and one metropolitan private hospital.

Table 3: ViCTOR Newborn pilot site hospitals

Metropolitan	Regional
Epworth Health Care (Freemasons) (Private)	Albury Wodonga Health
Mercy Hospital for Women	Latrobe Regional Hospital
Monash Children's – Casey	Mildura Base Hospital
The Northern Hospital	South West Healthcare
The Royal Women's Hospital	West Gippsland Healthcare Group
Peninsula Health	
Western Health (Sunshine)	

2.3 Chart design

Building on the previous ViCTOR chart development methodology, extensive stakeholder consultation was undertaken with medical, nursing and midwifery clinicians from January to July 2016. Pilot site clinicians were actively engaged in this process, initially via a teleconference, then through a series of face-to-face meetings from April to June at the Royal Children's Hospital. The Expert Advisory Group provided further advice as previously described.

2.3.1 Types of charts

Following the initial process mapping, sector feedback and the first pilot site face-to-face workshop, the decision was made to develop two newborn observation charts to trial during the pilot period:

- 'ViCTOR Birth Suite/Postnatal' (BS/PN) for piloting in birth suite and postnatal units
- 'ViCTOR Neonate' for piloting in special care nurseries, paediatric wards and emergency departments.



The two charts reflected the need to accommodate two very different clinical situations. The BS/PN chart is intended for all newly delivered babies, with the knowledge that the majority will be essentially 'well'. The goal of the chart is to help detect and respond to clinical deterioration, which is known to occur infrequently, but may have serious or devastating consequences.

The Neonate chart is intended for 'unwell' babies, who are often premature and are usually closely monitored in a special care nursery environment. These babies are at greater risk of clinical deterioration, although the purpose of the chart remains the same as for the BS/PN chart.

The existing version of the 0–3 month ViCTOR chart was retitled 'ViCTOR 1–3 months' in order to avoid confusion about which chart to use for children under one month old in paediatric wards and emergency departments. This chart was not included in the evaluation.

The development of the ViCTOR newborn charts was in accordance with the National Safety and Quality Health Service Standards, National Standard 9: *Recognition and response of the deteriorating patient* (ACSQHC 2011) and was consistent with the guiding principles outlined in the *National Consensus Statement: Essential elements for recognising and responding to clinical deterioration* (ACSQHC 2010).

2.3.2 Observations and trigger thresholds

Core vital signs incorporated in the Neonate chart included the traditional measures of cardiorespiratory function and thermoregulation including respiratory rate, oxygen saturation (SpO₂), heart rate, blood pressure and temperature, in line with existing national standards.

For otherwise well babies, the monitoring of blood pressure was not considered necessary and thus this vital sign was not included in the BS/PN chart. One screening SpO₂ measurement prior to discharge, as outlined in the *Neonatal e-handbook* (Department of Health and Human Services 2016), was included to improve the detection of critical congenital heart disease. This was a new requirement for most health services.

Other clinical observations considered appropriate for both charts included an assessment of respiratory effort, colour, jaundice onset, level of activity, and blood glucose level, which again were new chart elements for many health services. These clinical observations were commonly assessed by nurses, but not necessarily regularly documented in a systematic way. Their inclusion was based on review of the New South Wales *Standard newborn observation chart* (Clinical Excellence Commission 2016), the existing ViCTOR paediatric charts, and in consultation with pilot site clinicians and the Expert Advisory Group. A newborn scalp check, to assist with the prevention, detection and management of a potentially lethal subgaleal haemorrhage (RANZCOG 2015) was integrated into the BS/PN chart and muscle tone was included in to the Neonate chart. Additional rows were provided for optional observations (for example, pain score).

As per the original ViCTOR charts, the newborn pilot charts were designed to incorporate a single parameter trigger with a two-colour escalation response. The abnormal values on the new charts are indicated by two coloured zones (orange and purple). Concerning changes in any one parameter (vital signs such as heart rate or respiratory rate) triggers a midwifery/nursing or medical review. The type and urgency of the review depends on the degree of abnormality and the individual health service protocol, which is supported by standardised minimum escalation of care guidelines outlined on the trial charts.

Trigger thresholds for respiratory rate, heart rate and oxygen saturation (SpO₂) were derived from a variety of international studies (Davignon et al. 1979; Dawson et al. 2010a; Dawson et al. 2010b; Goel et al. 2016; Schwartz et al. 2002; Tveiten et al. 2016). This evidence was reviewed, discussed and ratified as suitable for piloting by the Expert Advisory Group (see *Summary of evidence*, Appendix 1). Modification of trigger thresholds was permitted for the Neonate chart only. A section that enabled medical staff to alter trigger thresholds when there was a clear underlying clinical reason to do so, was included next to the relevant vital sign parameter. A deliberate decision was made by the ViCTOR team, pilot site champions and Expert Advisory Group to not allow for modification of parameters on the BS/PN chart. It was considered that if a neonate breached these parameters in the birth suite or postnatal ward, then the safer option was for the neonate to be transferred to a special care nursery.

2.3.3 Baseline frequency and duration of observations

For well babies – BS/PN chart

Determining the baseline frequency and duration of observations for newborns was a key aspect of the chart build. During the chart development phase, the pilot hospitals provided information about their existing practice regarding frequency, type and duration of observations conducted on 'otherwise well' babies.

Findings from this exercise found the practice was highly variable, with observation routines ranging from every 15 minutes (very frequent) to a single set of observations post birth (see Table 4 and Table 5). Three of the 12 sites required only one set of observations post birth. Only three sites continued observations beyond 24 hours, usually once per shift. The variation reflected the lack of evidence regarding the frequency of observations for newborns. It also appeared to be associated with service capacity, and/or a response to a previous clinical incident.



Table 4: Observation frequency and duration for well full-term newborn babies – metropolitan

Pilot site	Observations on a well, term baby	Frequency and duration of observations
Epworth Health Care (Freemasons) (Private)	HR, RR, Temp	Every 30 minutes for 2 hours after birth
Mercy Hospital for Women	HR, RR, Temp	At birth (within 1 hour of birth)
	Temp, general appearance, behaviour and respiratory effort	On transfer to postnatal ward
Monash Casey	HR, RR, Temp, colour and cord check	Hourly for 4 hours after birth
The Northern Hospital	HR, RR, Temp Soon to implement SpO ₂ prior to discharge	Every 15 minutes for the first hour after birth, then hourly for 4 hours, then 4-hourly until 24 hours, then once a shift
The Royal Women's Hospital	HR, RR and Temp for baby not admitted to neonatal unit All have postductal saturation screening	Hourly for 4 hours after birth, then 4-hourly if under neonatal medical care or if a trigger is identified Between 6 and 24 hours
Peninsula Health Frankston	HR, RR, Temp	Every 30 minutes for 2 hours after birth and then once per shift
Western Health (Sunshine)	HR, RR, Temp	Every 30 minutes for 2 hours afterbirth

HR = heart rate, RR = respiratory rate, Temp = temperature

Table 5: Observation frequency and duration for well full-term newborn babies – regional

Pilot site	Observations on a well, term baby	Frequency and duration of observations
Albury Wodonga Health (Wodonga Campus)	HR, RR, Temp, Colour, skin, activity, eyes, mouth, cord and identification tags	After birth, if normal, no further observations Check each shift
Latrobe Regional Hospital	HR, RR, Temp and colour	Hourly for 4 hours after birth; if stable no further observations
Mildura Base	HR, RR, Temp	Hourly for 4 hours after birth
South West Healthcare	HR, RR, Temp and SpO ₂	At 1 hour of age
West Gippsland Healthcare Group	HR, RR, Temp and signs of respiratory distress	Hourly for 4 hours after birth, then 8-hourly to discharge

HR = Heart Rate, RR = Respiratory Rate, Temp = Temperature

As for the other jurisdictions, the NSW *Standard newborn observation chart* requires that all newborns have a set of observations and 'Newborn Risk Assessment' completed before discharge from the "birthing environment". Observations are then continued if the newborn has any Blue, Yellow or Red Zone observations or additional criteria and/or any newborn risk factors. The ACT *General observation chart neonatal 0 – <1 month* stipulates a set of observations and risk assessment within an hour of birth. Neonates without risk factors require 8 hourly observations, unless they have identified risk factors, in which case they are placed on a variable frequency of observations from 4–8 hours.

In the absence of definitive evidence as to the most appropriate frequency and duration of observations for well newborns, consensus was reached by pilot site representatives and the Expert Advisory Group to trial hourly observations for the first four hours of life, then once per shift (eight-hourly) unless more frequent observations were warranted based on the identification of newborn risks, (as described above) and/or local policy. Although the risk of clinical deterioration was low for these infants, the consequences were potentially severe when not detected early, therefore the observation plan was considered realistic and feasible for health services.

For unwell or premature babies

For the Neonate chart, it was agreed that the observations should be performed routinely with cares (at least four-hourly) and a section was provided to write any altered frequency.



2.3.4 Newborn risk assessment – BS/PN chart

In developing the chart for use in otherwise well babies, it was recognised that the requirements for observation frequency were risk dependent. In order to support clinicians in identifying otherwise well babies that may be at greater risk of clinical deterioration and may therefore require more frequent or extended monitoring, the BS/PN chart was designed to include a risk assessment (see Appendix 2).

The risk assessment is completed following the first set of observations and informs decisions about the frequency of subsequent observations based on the hospital's local procedure.

The assessment was based on that included in the New South Wales *Standard newborn observation chart* (Clinical Excellence Commission, 2016). Additionally, the relevant Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) guidelines were consulted (RANZCOG, 2016). The resulting ViCTOR newborn risk assessment incorporated screening criteria related to respiratory distress/depression, prematurity, sepsis, jaundice, hypoglycaemia, birth trauma and neonatal abstinence.

2.3.5 Other chart features

Additional features for both charts included:

- an events/comments section to document event details, interventions and parental concerns
- a guide regarding the assessment of respiratory effort
- a general escalation response that explained clinical review by the nurse/midwife in charge or medical staff was necessary for any observation in the orange zone, and a mandatory emergency call was required for any observation in the purple zone or other criteria, such as, staff or parents being very worried about the newborn's clinical state.
- an A3 portrait orientation to incorporate smaller scale increments chosen to enhance the identification of trends in vital signs and to enable viewing of all the observations on the same page.
- Pilot sites also had the option of purchasing custom designed folders to house the charts that facilitated writing on the charts in the absence of a large bench space.

The BS/PN chart also included sections for recording Apgar scores, resuscitation details and handover and double check aspects. The Neonate chart included a frequency of observations section, which was stipulated at a minimum of '4 hourly, with cares' unless documented otherwise.

2.4 Development of local escalation processes

As for existing ViCTOR charts, the generic escalation principles contained on the chart were supported by specific local procedures appropriate to local systems and staffing arrangements. Each pilot site was responsible for developing a newborn escalation of care procedure and for ensuring endorsement by relevant organisational committee(s) or key stakeholders.

The project team supported the pilot sites by providing a workshop, template and examples of escalation flowsheets in which to create their procedures. Prior to receiving their pilot charts, each site was required to provide their internally approved escalation of care procedure to the pilot team for review, feedback and final approval before proceeding into pilot phase.

3: Pilot implementation

3.1 Pilot wards/units

The pilot sites began implementing the charts in July 2016. The special care nurseries represented levels 3–6A as described in the *Defining levels of care for Victorian newborn services guide* (Department of Health and Human Services 2015).

Trial areas within the pilot hospitals are shown in Table 6 and Table 7 and included:

- special care nurseries (all 12 sites)
- postnatal units (11 sites)
- birth suites (11 sites)
- paediatric units (four sites)
- emergency departments (three sites).

Table 6: Pilot sites and pilot clinical areas – metropolitan

Hospital	Special care nursery	Postnatal	Birth suite	Paediatric ward	Emergency
Epworth Health Care (Freemasons) (Private)	x	x	x		
Mercy Hospital for Women	x	x	x		
Monash Children's – Casey	x	x	x		
The Northern Hospital	x	x	x		
The Royal Women's Hospital	x				
Peninsula Health	x	x	x	x	x
Western Health (Sunshine)	x	x	x		

Table 7: Pilot sites and pilot clinical areas – regional

Hospital	Special care nursery	Postnatal	Birth suite	Paediatric ward	Emergency
Albury Wodonga Health	x	x	x	x	
Latrobe Regional Hospital	x	x	x	x	x
Mildura Base Hospital	x	x	x		
South West Healthcare	x	x	x		
West Gippsland Healthcare Group	x	x	x	x	x



Each pilot site was represented by at least two clinicians (often more), known as pilot site champions. They attended workshops and regularly participated in teleconferences and were actively engaged in the design of the charts. They were also responsible for: selecting clinical areas at their hospital to trial the charts; developing/revising local escalation of care procedures; implementing the charts at their local site, including providing education to all relevant staff; and undertaking monthly chart audits.

3.2 Printing coordination and chart distribution

Trial charts were supplied throughout the project at no cost to the individual sites. Pilot sites were required to estimate how many charts they would require, based on chart type for the duration of the pilot project (August 2016 – January 2017). The project coordinator organised the printing in conjunction with Allanby Press Printers, who were responsible for printing and delivering the charts to each site.

Due to fluctuations in birth numbers and a significant under-calculation at a larger health service, two printing orders were required. The second order ensured that sites had enough pilot charts until the end of April 2017 when the final project deliverables would be completed. Thereafter, the pilot sites were advised that they could transition to the revised statewide charts, estimated to be released in May 2017, or return to their original organisational charts, if necessary.

3.3 Education resources

Implementation support was provided via a face-to-face meeting dedicated to providing education resources and guidelines for implementation at the site level. A guest speaker from the Royal Children's Hospital nursing education team spoke with the pilot sites about the many practical considerations and expectations for the implementation phase. A teaching plan and PowerPoint template was discussed and provided to each pilot site, which outlined the implementation focus points including how to educate and prepare staff to use the pilot charts (see Appendix 3, *Educational resources*).

3.4 Ongoing support

Chart implementation was also supported through:

- regular teleconferences with the pilot sites (weekly for the first three weeks)
- site visits by members of the ViCTOR team to discuss specific implementation issues and observe the pilot charts in action
- feedback to the project team via email and phone
- monthly chart audit comparisons detailing the individual health service results compared with the total combined pilot site results.

These activities allowed for an informal formative evaluation and provided an understanding of how the charts were initially used and accepted.

4: Pilot evaluation

4.1 Evaluation objectives

The ViCTOR Newborn Project evaluation focused on the utility and appropriateness of the two pilot charts in each of the trial areas (as outlined in Table 6 and Table 7 in section 3). The evaluation sought feedback on issues relating to the content, design and implementation of the charts. It also sought clinician feedback about the perceived benefits and limitations of the charts in guiding clinical care.

Importantly, this evaluation did not assess the clinical outcomes associated with the introduction of the charts, which requires a separate, prospective clinical outcome evaluation.

The specific objectives of the evaluation were:

1. To examine the utility and appropriateness of the charts and associated processes for the:
 - recording of clinical observations of hospitalised neonates
 - appropriateness of the frequency of observations as outlined on the charts
 - usefulness of the newborn risk assessment section in determining the frequency of observations for the otherwise well newborns
 - suitability of the coloured zone trigger thresholds
 - communication and escalation of clinical care for deteriorating newborns
 - usefulness and appropriateness of escalation processes.
2. To determine the barriers and enablers for:
 - use of the charts
 - escalation of care processes.
3. To identify recommendations for:
 - chart content and design
 - escalation processes
 - chart implementation.

4.2 Evaluation methods

The ViCTOR Newborn Project was considered a quality improvement project and as such did not seek ethics approval from each site to collect data. A consultant from Project Health reviewed and contributed to the evaluation framework and the ViCTOR Newborn Governance Group approved the evaluation methods. The governance group met six-weekly throughout the project.

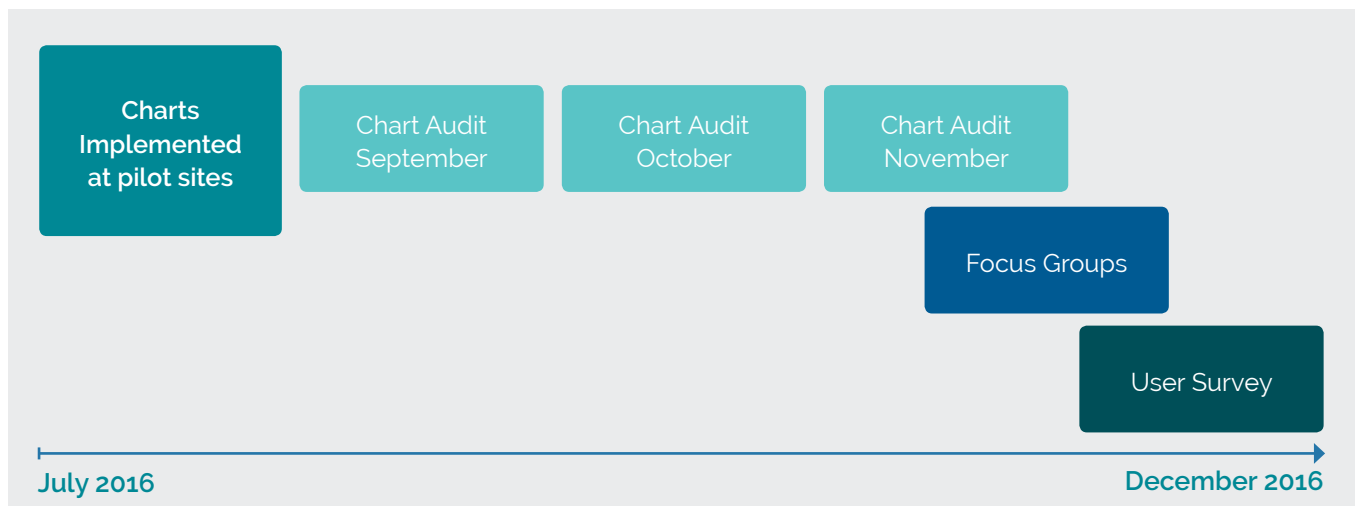
The three data collection methods used for the evaluation were:

- chart audits
- clinician (user) surveys
- focus groups.

Each pilot site had implemented the trial charts for a period of at least three months prior to conducting the clinician (user) surveys and focus groups (Figure 4).



Figure 4: Summary of evaluation timeline and methods



4.2.1 Chart audit

The chart audit had two purposes:

- to assist with the implementation process by providing feedback to sites regarding chart completion
- to help determine utility, acceptability and appropriateness by identifying aspects of the chart that were not used as intended and by monitoring the number of breaches of the trigger thresholds.

Data was collected about the completeness of documentation and appropriateness of actions in the following areas:

- patient and chart identification
- birth details and Apgar scoring (BS/PN chart only)
- newborn risk assessment (BS/PN chart only)
- core observations and additional observations
- observations plotted and joined with a line
- observations documented according to the frequency plan
- modification of trigger thresholds
- breaching of trigger thresholds (orange and purple zones)
- actions if trigger thresholds were breached and whether the action matched the escalation of care procedures.

The data collection tool was based on recommendations made by the ACSQHC (2011) and is consistent with health services' requirements to undertake regular audits to achieve National Standard requirements. The audit tool also targeted elements that were identified as problem areas in the previous ViCTOR projects (such as plotting observations with a dot and joining with a line to enable trending of observations), as well as elements that were specific to the Newborn chart (completion of the newborn risk assessment section).

The audit tool was originally developed in hardcopy (Appendices 4 and 5) then integrated into an electronic tool using LimeSurvey. It was tested by three pilot sites prior to being released to all pilot sites. No information that identified patients was collected.

ViCTOR pilot site champions (a key project contact at each pilot site) were provided with instructions to submit random monthly chart audits during September, October and November 2016 via the electronic link (Appendix 6). For each audit, the observation charts for the preceding 24-hour period were reviewed. A minimum of 10 chart audits per pilot clinical area (e.g. postnatal ward or special care nursery) was required. Data was collated centrally by the project team. Each month, local data, along with summary data from the combined sites was sent back to each health service to enable a comparison of their findings with the combined 12 pilot sites (Appendices 7 and 8). In September, it was noted that information differentiating the upper and lower breaches (purple or orange zones) for heart rate, respiratory rate and temperature was missing. To capture this data, a supplementary Excel spreadsheet was provided to the pilot site champions (Appendix 9).

The number of chart audits completed each month is summarised in Table 8 and Table 9. Some sites reported 'ViCTOR champions' being on leave at the time the chart audits were due. Often, if a site did not submit the 10 required chart audits, they would account for this during the following month. In some instances, more than the required chart audits were submitted; this was often the case for the higher acuity newborn services (level 5 and 6A) and may account for a possible over-representation of these services, particularly for the Neonate chart audit (Table 9). It should be noted that the majority of Neonate chart audits were submitted from special care nurseries (87 per cent), with limited audit data submitted from paediatric units (4 per cent) or emergency departments (none).

Table 8: Completed chart audits – Birth Suite/Postnatal

Birth Suite/Postnatal		September	October	November	Total
Metropolitan	Epworth Health Care (Freemasons) (Private)	11 (10.2%)	5 (3.4%)	9 (6.2%)	25 (6.2%)
	Mercy Hospital for Women	17 (15.7%)	15 (10.1%)	16 (11.0%)	48 (12.0%)
	Monash Children's – Casey	9 (8.3%)	11 (7.4%)	10 (6.9%)	30 (7.5%)
	The Northern Hospital	28 (25.9%)	10 (6.8%)	31 (21.4%)	69 (17.2%)
	The Royal Women's Hospital	N/A	N/A	N/A	NA
	Peninsula Health	9 (8.3%)	10 (6.8%)	12 (8.3%)	31 (7.7%)
	Western Health (Sunshine)	11 (10.2%)	20 (13.5%)	20 (13.8%)	41 (12.7%)
Regional	Albury Wodonga Health	0 (0.0%)	11 (7.4%)	10 (6.9%)	21 (5.2%)
	Latrobe Regional Hospital	10 (9.3%)	10 (6.8%)	10 (6.9%)	30 (7.5%)
	Mildura Base Hospital	0 (0.0%)	20 (13.5%)	5 (3.5%)	25 (6.2%)
	South West Healthcare	13 (12.0%)	16 (10.8%)	12 (8.3%)	41 (10.2%)
	West Gippsland Healthcare Group	0 (0.0%)	20 (13.5%)	10 (6.9%)	30 (7.5%)
Monthly subtotal & total		108	148	145	401



Table 9: Completed chart audits – Neonate

Neonates		September	October	November	Total
Metropolitan	Epworth Health Care (Freemasons) (Private)	2 (1.4%)	5 (2.2%)	6 (3.5%)	13 (2.4%)
	Mercy Hospital for Women	41 (28.9%)	54 (24.1%)	56 (32.8%)	151 (28.1%)
	Monash Children's – Casey	13 (9.2%)	10 (4.5%)	10 (5.9%)	33 (6.2%)
	The Northern Hospital	10 (7.0%)	11 (4.9%)	10 (5.9%)	31 (5.8%)
	The Royal Women's Hospital	20 (14.1%)	26 (11.6%)	24 (14.0%)	70 (13.0%)
	Peninsula Health	10 (7.0%)	21 (9.4%)	15 (8.8%)	46 (8.6%)
	Western Health (Sunshine)	21 (14.8%)	20 (8.9%)	10 (5.9%)	51 (9.5%)
Regional	Albury Wodonga Health	13 (9.2%)	18 (8.0%)	10 (5.9%)	41 (7.6%)
	Latrobe Regional Hospital	8 (5.6%)	10 (4.5%)	10 (5.9%)	28 (5.2%)
	Mildura Base Hospital	0 (0.0%)	20 (8.9%)	2 (1.1%)	22 (4.1%)
	South West Healthcare	4 (2.8%)	11 (4.9%)	8 (4.7%)	23 (4.3%)
	West Gippsland Healthcare Group	0 (0.0%)	18 (8.0%)	10 (5.9%)	28 (5.2%)
Monthly subtotal & total		142	224	171	537

4.2.2 Clinician (user) survey

Nursing, midwifery and medical staff working on the pilot wards were invited to complete an anonymous online survey (see Appendix 10) to explore their experience with the chart. This included rating the following measures.

Usability/appropriateness

- Ease of use
- Use of colour to assist in the recognition of deterioration
- Chart layout and size
- Usefulness of general instructions to use the chart, generic escalation of care guide and newborn risk assessment
- Frequency of observations (appropriateness)
- Preference for original hospital chart or trial chart

Benefits/limitations

- Perceptions regarding impact on awareness, clinical judgment, confidence and escalation processes in relation to recognising and responding to a deteriorating newborn
- Perceptions regarding improvement in communication between clinicians
- Usefulness for inexperienced staff
- Perceived improvement in consistency and standardisation of documentation across newborn services
- Workload impact

The survey was a modified version of a previously developed survey used to evaluate the Australian adult observation and response charts (Elliott, 2011). It also built on previous ViCTOR evaluation surveys and a clinician feedback survey that was developed to evaluate the implementation of the ViCTOR paediatric charts approximately two years post release of the ViCTOR paediatric charts (Project Health, 2016).

The survey enabled a greater proportion of the workforce to provide feedback (compared with the numbers able to attend the focus groups). This was especially relevant for medical staff who were less likely to be available to participate in the focus groups.

Staff working on the trial wards were sent an invitation email to complete the survey via their pilot site champion. Included in the invitation email was a web link to the survey. The survey was available for two weeks over November and December 2016. One week prior to the survey closing, a reminder email was sent. The survey was expected to take approximately 7–10 minutes to complete. It consisted of six demographic questions. Questions relating to the use of the charts, including usability and benefits and limitations, were presented as a five-point Likert agreement scale. One open question sought any final comments and suggestions (Appendix 11).

The number of surveys completed ($n = 240$) according to type of profession and pilot sites are shown in Table 10 and Table 11, respectively.



Over half the survey respondents were using the Neonate chart (56 per cent) or both charts (23 per cent), and only 20 per cent of the respondents were using the BS/PN chart alone. Results for the different charts were analysed separately to establish any differences in clinician experience. Two hospitals accounted for almost a third of survey respondents; the Mercy Hospital for Women (16 per cent) and the Royal Women's Hospital (14 per cent). This is also taken into consideration in the analysis.

Table 10: Clinician survey responses by profession (n = 240)

Professional	Metropolitan	Regional	Total (%)
Midwife	57 (23.8%)	61 (25.4%)	118 (49.2%)
Nurse	83 (34.6%)	10 (4.2)	93 (38.8%)
Doctor	20 (8.3%)	0 (0%)	20 (8.3%)
Other (for example, student)	6 (2.4%)	3 (1.3)	9 (3.8%)
Total	166 (69%)	74 (31%)	244

Table 11: Clinician survey responses by pilot site – ordered by number of responses (n = 240)

Hospital	Number (%)
Mercy Hospital for Women	38 (15.6%)
The Royal Women's Hospital	33 (13.5%)
Peninsula Health	31 (12.7%)
West Gippsland Healthcare Group	30 (12.3%)
Western Health (Sunshine)	26 (10.7%)
Monash Children's – Casey	20 (8.2%)
Albury Wodonga Health (Wodonga Campus)	17 (7.0%)
The Northern Hospital	16 (6.6%)
Mildura Base Hospital	11 (4.5%)
Latrobe Regional Hospital	9 (3.7%)
South West Healthcare	7 (2.9%)
Epworth Health Care (Freemasons) (Private)	4 (1.6%)
No organisation identified	2 (0.8%)

4.2.3 Focus groups

Twenty focus groups were conducted, involving 226 nursing, midwifery and medical staff from participating units/wards (see Table 12 and Table 13). The focus groups explored chart useability and appropriateness and identified recommendations for resolving any issues, including discussion of some issues that were raised through the clinical audits and the surveys.

Table 12: Focus group participants (n = 178) – metropolitan

Pilot site and clinical area	Nursing/ midwifery participants	Medical participants	Midwifery student	Total
Epworth Health Care (Freemasons) <i>BS/PN</i>	10	0	0	10
Epworth Health Care (Freemasons) <i>SCN</i>	3	0	0	3
Mercy Hospital for Women – Heidelberg (two sessions) <i>SCN</i>	18	0	0	18
Mercy Hospital for Women – Heidelberg <i>BS/PN</i>	19	0	0	19
Monash Children’s – Casey <i>BS/PN</i>	11	0	1	12
Monash Children’s – Casey <i>SCN</i>	11	0	0	11
The Northern Hospital <i>BS/PN</i>	19	0	0	19
The Northern Hospital <i>SCN</i>	6	0	0	6
The Royal Women’s Hospital (two sessions) <i>SCN</i>	25	3	0	28
Peninsula Health – Frankston (combined <i>BS/PN, SCN, ED,</i> <i>paediatric ward</i>)	23	0	0	23
Western Health (Sunshine) <i>BS/PN</i>	12	1	0	13
Western Health (Sunshine) <i>SCN</i>	14	1	1	16
Total	171	5	2	178

ED - Emergency Department; BS/PN -Birth suite or Postnatal ward; SCN - Special Care Nursery



Table 13: Focus group participants (n = 48) – regional

Pilot site and clinical area	Nursing/ midwifery participants	Medical participants	Midwifery student	Total
Albury Wodonga Health (Wodonga Campus) <i>BS/PN,SCN</i>	10	0	0	10
Albury Wodonga Health (Albury Campus <i>paediatric ward</i>)	4	0	0	4
Latrobe Regional Hospital – Traralgon <i>BS/PN,SCN</i>	13	0	0	13
Mildura Base Hospital <i>BS/PN,SCN</i>	4	0	0	4
South West Healthcare – Warrnambool <i>BS/PN,SCN</i>	8	0	0	8
West Gippsland Healthcare Group – Warragul <i>BS/PN,SCN</i>	8	0	1	9
Total	47	0	1	48

BS/PN = Birth suite or Postnatal ward; SCN = Special Care Nursery

A 'claims, concerns and issues' framework was used to facilitate group discussion, which was guided by three broad themes:

- **claims** that were explored by asking the participants to identify favourable aspects of the charts (What was working well?)
- **concerns** that were explored by asking participants to identify any unfavourable aspects of the charts (What could be better?)
- **ways forward**, which were drawn from the claims and concerns discussion. Priority issues were established via group consensus and the 'ways forward' were identified.

At the beginning of each focus group the participants were also asked to consider the following six topics:

- chart design and content including perceived appropriateness of the coloured zones
- the appropriateness of the escalation process
- the frequency of observations – specifically, the impact on workload
- the usefulness and completeness of the newborn risk assessment
- the overall suitability of the chart(s) for the clinical area
- improvements on previous observation charts.

One or more focus groups, of approximately 30 minutes' duration, involving between three and 25 staff were conducted at each site on a date and time negotiated with the pilot site champion. The focus groups were conducted in a meeting room or tearoom at the participating hospital. Advertising of the focus group was the responsibility of the pilot site champion and was generally promoted via a poster/flyer on noticeboards in the tearooms.

Participants spent a few minutes writing their individual 'claims' and 'concerns' on sticky notes. They were then divided into two groups to organise the data into themes, which formed the basis of the remaining discussion. One of the ViCTOR team members facilitated the discussion and another team member took notes.

4.2.4 Data analysis

For the chart audits and user survey, descriptive data analyses were undertaken using Microsoft Excel (via LimeSurvey), including frequency counts and percentages for all outcome variables. In addition, the open-ended survey responses were summarised and themes generated. These themes were reviewed collectively, and then separately, according to the profession of the responder (for example, medical, nursing, midwifery, student).

Sticky notes from the focus groups were collected, and the data was collated and entered into an Excel spreadsheet by the project coordinator directly after each session. Written notes were also taken throughout each session by the second ViCTOR team member, who recorded the key discussion points. Final analysis of the data included clustering of similar topics, which were then grouped into categories.

Once all focus groups were completed, the qualitative data was categorised under four broad themes: recognition, response, education and useability. These broad themes had also been identified in previous ViCTOR evaluations.

The qualitative data from the user surveys were also considered under these themes.



4.3 Evaluation findings

4.3.1 Utility and appropriateness for recording clinical observations

The findings from the survey are shown in Table 14 overleaf.

Most respondents (78 per cent) found the chart easy to use (*agreed* or *strongly agreed* with the statement) and 84 per cent found the coloured zones helpful in identifying patient risk. The information about how to use the chart was valuable for 77 per cent of respondents.

There was some variation between users of the different charts, with those using the Neonate chart alone being less likely to find the chart easy to use (69 per cent) compared to 96 per cent for those using the BS/PN chart and 94 per cent for those using both.

Reinforcing the general findings, the flow and layout of the chart was viewed positively by many focus group participants:

'The flow – it just works. I know everything is on one page.'

'Having all the parameters on the one page it's easy to follow and flows logically.'

'Initially I found this hard to use but it's become easier and the flow works well.'

'The events/comments section is very useful.'

Other key areas that were identified as 'working well' related to the ease of identifying trends, which led to an increased ability to interpret the clinical state of the neonate, and the use of coloured zones:

'So much clearer than what we had previously; it's much easier to recognise deterioration.'

'Visually, it just works better.'

'Provides a clear visual trend.'

'It's a great visual tool.'

The fact that the chart design was also consistent with other observation charts used for adult and paediatric patients was also viewed positively.

Table 14: Clinician survey responses to useability of charts according to type of chart (n = 240)

Comment	Type of chart	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Overall the charts are easy to use	Neonate (n=135)	31 (23)	62 (46)	16 (12)	17 (13)	9 (7)
	BS/PN (n=49)	24 (49)	23 (47)	2 (4)	0 (0)	0 (0)
	Both (n=56)	20 (36)	27 (48)	5 (9)	3 (5)	1 (2)
	Total	75 (31)	112 (47)	23 (10)	20 (8)	10 (4)
The colours help me to identify when my patient is at risk	Neonate (n=135)	53 (39)	50 (37)	13 (10)	16 (12)	3 (2)
	BS/PN (n=49)	27 (55)	20 (41)	0 (0)	2 (4)	0 (0)
	Both (n=56)	24 (43)	28 (50)	4 (7)	0 (0)	0 (0)
	Total	104 (43)	98 (41)	17 (7)	18 (8)	3 (1)
The newborn charts are large and difficult to manage	Neonate (n=135)	26 (19)	26 (19)	33 (24)	46 (34)	4 (3)
	BS/PN (n=49)	4 (8)	10 (20)	11 (22)	19 (39)	5 (10)
	Both (n=56)	4 (7)	12 (21)	13 (23)	20 (36)	7 (13)
	Total	34 (14)	48 (20)	57 (24)	85 (35)	16 (6)
The chart's format is better than our previous charts	Neonate (n=135)	21 (16)	37 (27)	28 (21)	22 (16)	27 (20)
	BS/PN (n=49)	18 (37)	24 (49)	6 (12)	1 (2)	0 (0)
	Both (n=56)	19 (34)	15 (27)	16 (29)	4 (7)	2 (4)
	Total	58 (24)	76 (32)	50 (21)	27 (11)	29 (12)
The generic escalation process described on the charts is clear and actionable	Neonate (n=135)	19 (14)	76 (56)	19 (14)	14 (10)	7 (5)
	BS/PN (n=49)	14 (29)	24 (49)	6 (12)	5 (10)	0 (0)
	Both (n=56)	12 (21)	36 (64)	7 (13)	1 (2)	0 (0)
	Total	45 (19)	136 (57)	32 (13)	20 (8%)	7 (3)
The information about how to use the charts is valuable	Neonate (n=135)	20 (15)	77 (57)	28 (21)	8 (6)	2 (1)
	BS/PN (n=49)	12 (24)	31 (63)	3 (6)	3 (6)	0 (0)
	Both (n=56)	10 (18)	33 (59)	12 (21)	1 (2)	0 (0)
	Total	42 (18)	141 (59)	43 (18)	12 (5)	2 (1)

continued...



Comment	Type of chart	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
I would prefer to go back to our original charts	Neonate (n=135)	27 (20)	27 (20)	20 (15)	34 (25)	27 (20)
	BS/PN (n=49)	0 (0)	2 (4)	8 (16)	22 (45)	17 (35)
	Both (n=56)	3 (5)	5 (9)	10 (18)	23 (41)	15 (27)
	Total	30 (13)	34 (14)	38 (16)	79 (33)	59 (25)

The size of the chart was an issue for 34 per cent of survey respondents and almost a quarter of respondents were unsure about this aspect. Not all pilot sites chose to use the custom developed folders (additional cost) which may have contributed to the difficulty in managing the larger charts.

Just over half of the respondents thought the chart format was better than their previous charts, however 27 per cent indicated that they would prefer to go back to their previous charts. A greater proportion of respondents who used the Neonate chart preferred their original chart (40 per cent) compared to users of the BS/PN chart (4 per cent) or both charts (14 per cent). Similarly, respondents who used the Neonate chart expressed greater concern about the size of the chart (38 per cent) compared to those using the BS/PN chart alone (24 per cent) or those using both charts (28 per cent). When considering the survey responses from the two large tertiary metropolitan hospitals, half of the respondents preferred their original chart. As highlighted in the comment below the change process can be challenging particularly when the previous charts were serving a good purpose.

'Our previous charts were also good and had a direct relationship to feeds and all fluids. Overall, happy with trial charts – just need to get used to them.'

Common concerns identified for both the BS/PN and Neonate charts about content and design related to the temperature increments and inability to record the baby's position on the chart.

'The temperature increments need to be smaller.'

'Not much room for temperature variations, so a big drop or big increase in temperature for a newborn is not picked up well.'

'Nowhere to write the baby's position.'

Some findings related to the utility of particular charts as described below.

Birth Suite/Postnatal chart

Overall the BS/PN chart was found to be appropriate for recording clinical observations in newborns. This was reflected in chart audit results ($n = 401$) which showed that core observations were completed on 93 per cent of occasions. Core observations were defined as respiratory rate, respiratory effort, heart rate, colour temperature and level of activity. The most commonly missed observations were respiratory effort (2 per cent) and jaundice (2 per cent), most likely because these were fairly new parameters for midwives to document.

Nearly 75 per cent of the observations were plotted with a dot and joined with a line, demonstrating good adherence to the principle of trending data, rather than writing a number. The additional observation section was used 20 per cent of the time, with SpO₂ monitoring the most commonly identified additional variable. However, the post-ductal discharge SpO₂ reading was completed on only 69 (17 per cent) of occasions. Given that this observation was a 'one-off' observation, to be taken prior to discharge, it is likely that the neonate may not have yet had this measurement taken at the time of the audit. Further discussion arising from the focus groups also identified that it was easy to miss this observation due to its location on the chart; it was suggested to move it to the bottom of the chart. The instruction about when to complete the SpO₂ measurement was also found to be confusing, with some staff seeking clarification about the best time to take the measurement (for example, at 24 hours, or earlier, or just prior to discharge).

Neonate chart

Similar, to the BS/PN chart, there was high compliance with the recording of clinical observations. Core observations, defined as respiratory rate, respiratory effort, heart rate, colour, temperature, level of activity and SpO₂ (dependent on patient diagnosis) were completed for 472 (88 per cent) of the 537 chart audits.

The most frequent missing core observation was respiratory effort (5 per cent) and temperature (5 per cent). Again, respiratory effort was not routinely documented for neonates prior to the trial of the ViCTOR chart. For 23 per cent of the charts, observations were performed more frequently than four-hourly (for example, one- or two-hourly). The most commonly used additional observation was position.

Corrected age and day of life (unique to the neonate chart) were completed on nearly 90 per cent of occasions. Focus group feedback from nurses in paediatric wards indicated that corrected age and day of life would not be routinely recorded in a paediatric setting. For some, there was confusion about how to calculate corrected age.

The most consistently reported problem with the Neonate chart was the different SpO₂ zones required for preterm infants and therefore the lack of applicability of the SpO₂ zones for this cohort of patients. This was predominantly reported by staff in the higher-level nurseries where the majority of neonates were preterm, or on some type of respiratory support. This would then require the doctor to modify the saturation targets daily. Chart audits revealed that 9 per cent ($n = 50$) of babies had a SpO₂ modification in place.

'These charts are theoretically helpful but are not tailored to the SCN environment with preterm infants. We constantly have to make variations, in fact variations are routine – every baby every day has to have at least one 24-hour variation written in because the babies do not fit the basic parameters – particularly for SpO₂.'

'The saturation values in preterm infants are particularly challenging and result in frequent modification.'

The inability to clearly document bradycardic and desaturation events was frequently identified as a problem in both the survey responses and focus group discussion:

'It doesn't let me graph desats and bradys – all SCN babies need this graphed.'

The inclusion of the muscle tone section on the newborn chart was considered unnecessary and rarely used. Documentation of this particular observation was not included in the chart audits.



During the pilot period the specific Neonatal chart was rarely used in the paediatric ward and emergency department settings. Many preferred the existing '0–3 month' ViCTOR paediatric chart because it was easier to use and was consistent with the other ViCTOR paediatric charts.

4.3.2 Appropriateness of the frequency and duration of observations

As previously described, prior to commencement of the project there was significant variation in practice among the pilot sites in terms of the frequency and duration of observations for well newborns (see Table 4 and Table 5). This, and the absence of definitive evidence in this area presented a challenge for developing a standardised approach for the frequency and duration of observations for the BS/PN chart. As previously described, consensus was reached by pilot site representatives and the Expert Advisory Group to trial the completion of hourly observations for the first four hours of life, then once a shift (eight-hourly) unless more frequent observations were warranted (for example, identification of newborn risks).

BS/PN chart audits found that the frequency requirements were well adhered to and that the observations were documented hourly, for four hours post birth, on 88 per cent of occasions (352/401 audits) and eight-hourly (or according to local hospital procedure for identified newborn risks) for 88 per cent of the chart audits.

The survey found 77 per cent of respondents felt 'the initial frequency of observations (hourly for 4 hours) was appropriate' and 69 per cent felt 'the ongoing frequency of observations was appropriate (8 hourly/once per shift).

These results were analysed further to identify whether responses were different for sites that had previously conducted only one set of observations after birth. While the numbers are small, survey respondents at these sites were less likely to respond favourably to the new observation frequencies, with 57 per cent (25/44 responders) indicating 'the initial frequency (hourly for 4 hours) of observations was appropriate' and 62 per cent (28/45 responders) thought 'the ongoing frequency of observations was appropriate (8 hourly/once per shift). This is not unexpected given the significant change, and this is highlighted by some of the open-ended comments:

'Before I didn't like that we had to do 8-hourly obs – now I think it is worthwhile.'

'I hated it in the beginning but I'm getting used to it and can see the benefits.'

Some midwives were concerned that the BS/PN chart was a move away from the wellness model of care, with the trial chart requiring a greater focus on observation and, for most at an increased frequency and/or duration compared with previous practice.

'We are making well babies seem unwell.'

'We have had parents pinching thermometers off the ward because they think they need to keep checking their baby's temperature at home.'

'Mothers find this intrusive.'

This was a particular issue at the private hospital where the length of stay for a mother and her baby was typically longer than at the other hospitals.

Conversely, focus group participants also recognised the importance of educating parents about why the observations were being conducted. The role that parents had in alerting staff to concerns about their baby's clinical state was also appreciated. At the beginning of the project, one of the pilot sites shared a parent information leaflet, which explained concerning changes in a baby's condition that parents should look out for after discharge. There was interest among the pilot site champions in introducing a similar leaflet to complement the trial charts; however, the revisions and work required to adopt it as a statewide initiative was considered beyond the scope of the project.

For the Neonate chart, the observation frequency was stipulated at a minimum of '4 hourly, with cares'. If the observations were to be performed more (or less) frequently, this was to be documented in the *Frequency of observations* plan. Chart audits ($n = 401$) revealed that the frequency of observations was adhered to on 95 per cent of occasions. On 23 per cent of occasions the observations were performed at an increased frequency (for example, two-hourly) and only 2 per cent of chart audits showed a less frequent observation regimen (for example, eight-hourly).

This high adherence to the monitoring plan likely reflects the commonly practised four-hourly observations frequency in the special care nursery setting, which was not a change to existing practice for the majority of units. No issues regarding this minimum frequency on the Neonate charts were identified in either the focus groups or the user surveys.

4.3.3 Usefulness of the newborn risk assessment

The newborn risk assessment was well accepted by clinicians as a valuable tool for guiding newborn observations.

81 per cent of survey respondents (127 of 156 responders) thought the 'Newborn risk assessment section improved the identification of potential newborn deterioration' and 74 per cent (115 of 155 responders) agreed that the 'Newborn risk assessment section assisted in determining the frequency of observations'.

Feedback via the focus group participants was also positive, indicating that the assessment provided a quick 'prompt' for busy midwives. Many focus group participants reported that the concise list was a good reminder of possible conditions that put the newborn at risk.

Despite this positive feedback clinicians regularly reported confusion about the frequency and duration of observations to be established once a newborn risk had been identified. There were no specific instructions provided on the trial charts, and the frequency was to be determined by local practice or procedure. However, there was a lack of consistent guidance provided at a local level. Some pilot sites had local procedures that varied depending on the identified risk factor. Few sites had a procedure that indicated the duration of observations (for example, up to 48 hours) and staff were concerned that some babies were unnecessarily maintained on four-hourly observations until discharge.

Many focus group participants suggested that it would be valuable to have a statewide guideline that addressed this particular issue and other aspects of observation and further suggested that the *Neonatal e-handbook* would be the best repository for such a guideline.

Additionally, a number of midwives reported the over sensitivity of the newborn risk assessment:

'While the risk assessment is really good at identifying babies who need increased observation, it makes it very unclear as to what sort of observation is needed and for how long.'

'The risk assessment is too tight. Why is a baby that had a small amount of meconium-stained liquor (and no symptoms) at birth, a risk?'



In terms of the frequency of identification of risks, in total, 220 babies (55 per cent) triggered a newborn risk; some of these babies had more than one risk identified. Table 15 shows that the most common risk factors identified were meconium-stained liquor (13 per cent), vacuum/forceps/unsuccesful instrumental birth (12 per cent) and maternal diabetes (12 per cent).

Table 15: Newborn risks identified in order of frequency – Birth Suite/Postnatal chart audit (n = 220)

Risk identified	Number (%)
Meconium-stained liquor	53 (13.2%)
Vacuum/forceps/unsuccesful instrumental birth	48 (12.0%)
Maternal diabetes	47 (11.8%)
Maternal prolonged rupture of membranes > 18 hours	32 (8.0%)
Unknown GBS status	28 (7.0%)
Maternal opiates for pain relief < 4 hours prior to birth	20 (5.0%)
Maternal GBS positive with inadequate antibiotic cover (< 4 hours at birth)	20 (5.0%)
Bruising	16 (4.0%)
Any trauma related to birth	13 (3.2%)
Maternal pyrexia (equal to or greater than 38 degrees)	8 (2.0%)
Raised lactate	7 (1.8%)
< 37 weeks	7 (1.8%)
Small for gestational age	7 (1.8%)
Apgar score < 7 at 5 minutes	6 (1.5%)
Large for gestational age	6 (1.5%)
Birthweight < 2.5 kg	5 (1.3%)
Maternal drug and/or alcohol use	5 (1.3%)
Maternal general anaesthetic	4 (1.0%)
Cord pH < 7.1	1 (0.3%)
Newborn naloxone use	1 (0.3%)
Family history of G6PD or severe jaundice in the newborn	1 (0.3%)
Blood group incompatibility or known maternal antibodies	0

The chart audits revealed that:

- 81 per cent of the time the newborn risk assessment was completed within four hours of life as required
- 88 per cent of the time the observations were attended as per the procedure of the individual hospital
- 63 per cent of the time the newborn risk assessment was completed in full – the most frequently missed field was recording of the 'observation frequency required' once a risk had been identified. This reflects the comments made above regarding lack of clarity about frequencies required for particular risks.

4.3.4 Suitability of the coloured zone trigger thresholds

The coloured zone trigger thresholds were based on the limited evidence informing neonatal heart rate and respiratory rate percentile ranges (as outlined in Appendix 1), along with the expert opinions from the Expert Advisory Group. The coloured zones were set at identical thresholds for both charts. For example, the upper respiratory rate range was 60–80 breaths/min (orange zone) and more than 81 breaths/min (purple zone) for both charts. There was much debate among the Expert Advisory Group members about the most appropriate ranges, especially for lower heart rate, given the fluctuations in heart rate that occurred with day of life or whether the baby was sleeping.

Overall the coloured zones seemed to be suitable trigger thresholds. Chart audits revealed that the percentage of newborns with heart rate and respiratory rates in the orange or purple zones was consistent with the expectations based on the percentile ranges they were derived from. For example, the lower and upper respiratory rate purple trigger zones represent approximately the first percentile (25 breaths/min) and 99th percentile (80 breaths/min), respectively. Therefore, one would anticipate that approximately 1 per cent of babies would breach either of these parameters.

The number of observations (two or more consecutive observations, excluding brief episodes of bradycardia and desaturation) that were recorded in the orange and purple zones is presented in Table 16 (BS/PN chart) and Table 17 (Neonate chart).



Table 16: Birth Suite/Postnatal chart – orange zone and purple zone breaches (n = 401)

Orange zone (excludes apnoea and brief bradycardia and desaturation events)		Purple zone (excludes apnoea and brief bradycardia and desaturation events)	
Temperature	30 (7.5%)	Respiratory rate	3 (<1%)
Scalp check	19 (4.8%)	Temperature	1 (<1%)
Blood glucose level	13 (3.3%)	Respiratory effort	0
Jaundice	10 (2.5%)	Heart rate	0
Respiratory rate	9 (2.5%)	Colour	0
Respiratory effort	2 (0.5%)	Jaundice	0
Colour	2 (0.5%)	Level of activity	0
Heart rate	1 (0.3%)	Blood glucose level	0
Level of activity	0 (0%)	Scalp check	0
SpO ₂ (spot)	0 (0%)	SpO ₂ (spot%)	0
Orange zone reported actions: 39 occasions = Nurse/midwife review 17 occasions = Doctor review in person 19 occasions = Medical review via phone 1 occasion = MET/Code 15 occasions = Not documented		Purple zone reported actions: 0 occasions = Nurse/midwife review 3 occasions = Doctor review in person 0 occasions = Medical review via phone 1 occasion = MET/Code 0 occasions = Not documented	

Table 17: Neonate chart – orange zone and purple zone breaches (n = 537)

Orange zone (excludes apnoea, and brief bradycardia and desaturation events)		Purple zone (excludes apnoea, and brief bradycardia and desaturation events)	
Respiratory rate	65 (11.4%)	Respiratory rate	10 (1.8%)
Heart rate	36 (6.3%)	Heart rate	9 (1.6%)
Colour	36 (6.3%)	SpO ₂	6 (1.0%)
SpO ₂	18 (3.2%)	Temperature	2 (0.4%)
Temp	18 (3.2%)	Respiratory effort	0
Respiratory effort	5 (0.9%)	Colour	0
Blood glucose level	5 (0.9%)	Level of activity	0
Level of activity	4 (0.7%)	Muscle tone	0
Muscle tone	3 (0.5%)	Blood glucose level	0
Orange zone reported actions: 47 occasions = Nurse/midwife review 52 occasions = Doctor review in person 15 occasions = Medical review via phone 2 occasions = MET/Code 43 occasions = Not documented		Purple zone reported actions: 7 occasions = Nurse/midwife review 3 occasions = Doctor review in person 12 occasions = Medical review via phone 3 occasions = MET/Code 5 occasions = Not documented	

For the BS/PN chart (n = 401) there were 68 (17 per cent) orange and four (1 per cent) purple zone breaches. For the Neonate chart (n = 537) there were 123 (23 per cent) orange and 19 (3 per cent) purple zones breaches. Temperature was the most frequently breached orange parameter (7.5 per cent), and respiratory rate was the most frequently breached purple parameter (0.75 per cent) on the BS/PN chart. In contrast, respiratory rate was the most frequently breached parameter for both the purple (1.4 per cent) and orange (11.4 per cent) zones on the Neonate chart.

Of note, data differentiating the upper and lower values for temperature, heart rate and respiratory rate breaches was collected for only a two-month period. This data is presented in Table 18 and Table 19. As expected, a low temperature occurred more frequently than an elevated temperature.

Importantly, when a breach did occur, which sometimes resulted in more than one action, the responses were generally consistent with the hospital's escalation of care procedure.



Table 18: Orange and purple zone breach data according to upper and lower parameter values – Birth Suite/Postnatal chart

Orange zone		Purple zone	
↑ RR	7	↑ RR	0
↓ RR	0	↓ RR	0
↑ HR	0	↑ HR	0
↓ HR	1	↓ HR	0
↑ Temp	1	↑ Temp	0
↓ Temp	11	↓ Temp	1

Table 19: Orange and purple zone breach data according to upper and lower parameter values – Neonate chart

Orange zone		Purple zone	
↑ RR	6	↑ RR	3
↓ RR	4	↓ RR	1
↑ HR	3	↑ HR	3
↓ HR	2	↓ HR	0
↑ Temp	1	↑ Temp	0
↓ Temp	8	↓ Temp	2

Additional feedback from the surveys and focus groups highlighted inappropriately coloured zones for:

- 'jaundice onset > 24 hours' as an orange zone (BS/PN chart)
- 'bruising' as an orange zone in the newborn scalp check
- low temperature fluctuations into the orange zone when environmental issues should be addressed before escalating care.

'Neonates can remain jaundiced after phototherapy for quite a while without SBR being high; however, they are constantly in the orange zone.'

4.3.5 Communicating and escalating clinical care

Table 20 shows the survey responses relating to the impact of the charts on supporting recognition and response to deterioration and facilitating escalation of care.

69 per cent of respondents believed the charts resulted in clearer escalation of care processes. Responses varied for those using the Neonate chart (58 per cent) compared to those using the BS/PN (80 per cent). Similarly, 66 per cent of survey respondents overall felt the charts helped to improve communication between team members, with variations in responses for users of different charts.

Half of respondents (50 per cent) felt that using the charts made them feel more confident about recognising deterioration and responding/escalating appropriately. This was more likely to be the case for clinicians using the BS/PN charts alone (65 per cent) compared to those using the Neonate chart (40 per cent), possibly reflecting the greater experience of staff in special care nursery. Despite this, 67 per cent of those using the Neonate chart agreed that it supported their clinical judgement, which was similar to the BS/PN chart (73 per cent). Respondents using the Neonate chart were possibly more likely to have a postgraduate qualification in their neonatal specialty and therefore perceived the charts to be less helpful.

'As I am NICU trained, I don't feel these charts raise my own personal awareness of patient deterioration as I use my own clinical judgement, however it is useful (particularly for junior staff) to raise their concerns with medical staff.'

Positive sentiments were reflected in the focus group discussions and the open-question responses in the survey:

'It gives us permission and confidence to escalate.'

'Very helpful for the nurse in charge of the shift.'

A high proportion of survey respondents also indicated that standardisation of the charts across Victorian newborn services is helpful for clinicians (85 per cent overall). Even when there was greater commitment to their previous charts (see Table 11) respondents could see the value in standardisation.

As for other ViCTOR charts, there were some concerns regarding unnecessary escalation of care. For example, among survey respondents, while 78 per cent indicated that the orange and purple zones helped facilitate the escalation of care processes, there were a considerable number (44 per cent) who thought the charts had resulted in unnecessary escalation of care. These concerns were similar for respondents irrespective of the type of chart used.

At two sites, the focus groups identified concerns regarding unnecessary MET calls. While the general escalation of care processes outlined on the chart suggest consulting with the nurse/midwife in charge and deciding if a medical review is required in the orange zone, the escalation of care processes at these sites required medical review of all neonates who had breached orange zone, which contributed to an increased medical workload and to concerns about lack of ability for staff to use their clinical judgement.

'We have to call a pre MET in orange – we can't use our clinical judgement.'



Experience from the prior VICTOR projects indicates that these concerns are generally best addressed through ongoing review of site procedures. Engaging staff in refining and discussing their local procedures is necessary to help ensure the procedures work for all concerned. To date, at least one of these pilot sites is in the process of reviewing their escalation of care procedures.

Table 20: Communicating and escalation of care – clinician survey responses according to type of chart (n = 240)

Comment	Type of chart	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
Implementation of the charts has resulted in clearer escalation processes for managing deteriorating newborn patients in our service	Neonate (n=135)	19 (14)	59 (44)	27 (20)	21 (16)	9 (7)
	BS/PN (n=49)	15 (31)	24 (49)	7 (14)	2 (4)	1 (2)
	Both (n=56)	16 (28)	31 (55)	7 (13)	0 (0)	2 (4)
	Total	50 (21)	114 (48)	41 (17)	23 (10)	12 (5)
Using the charts makes me feel more confident that I will recognise deterioration and respond/escalate appropriately	Neonate (n=135)	13 (10)	41 (30)	35 (26)	34 (25)	12 (9)
	BS/PN (n=49)	12 (24)	20 (41)	10 (20)	6 (12)	1 (2)
	Both (n=56)	11 (20)	24 (43)	15 (27)	4 (7)	2 (4)
	Total	36 (15)	85 (35)	60 (25)	44 (18)	15 (6)
The orange and purple zones for deterioration help facilitate the escalation process	Neonate (n=135)	20 (15)	73 (54)	17 (13)	21 (16)	4 (3)
	BS/PN (n=49)	20 (41)	24 (49)	2 (4)	2 (24)	1 (2)
	Both (n=56)	14 (25)	37 (66)	5 (9)	0 (0)	0 (0)
	Total	54 (23)	134 (56)	24 (10)	23 (10)	5 (2)
The charts help to improve communication between members of our clinical team	Neonate (n=135)	12 (9)	66 (49)	26 (19)	24 (18)	7 (5)
	BS/PN (n=49)	12 (24)	26 (53)	7 (14)	3 (6)	1 (2)
	Both (n=56)	11 (20)	30 (54)	9 (16)	4 (7)	2 (4)
	Total	35 (15)	122 (51)	42 (18)	31 (13)	10 (4)
Using the charts supports my clinical judgement	Neonate (n=135)	16 (12)	70 (52)	19 (14)	26 (19)	4 (3)
	BS/PN (n=49)	11 (22)	25 (51)	8 (16)	4 (8)	1 (2)
	Both (n=56)	12 (21)	36 (64)	6 (11)	0 (0)	2 (4)
	Total	39 (16)	131 (55)	33 (14)	30 (12)	7(3)

continued...

Comment	Type of chart	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
The charts have resulted in unnecessary escalation of care	Neonate (n=135)	20 (15)	43 (31)	27 (20)	39 (29)	6 (4)
	BS/PN (n=49)	9 (18)	11 (22)	10 (20)	18 (36)	1 (2)
	Both (n=56)	5 (9)	18 (32)	12 (21)	16 (28)	5 (9)
	Total	34 (14)	72 (30)	49 (20)	73 (30)	12 (5)
Standardisation of the charts across Victoria newborn services is helpful for clinicians	Neonate (n=135)	39 (29)	67 (50)	14 (10)	12 (9)	3 (2)
	BS/PN (n=49)	24 (49)	23 (47)	2 (4)	0 (0)	0 (0)
	Both (n=56)	24 (43)	27 (48)	5 (9)	0 (0)	0 (0)
	Total	87 (36)	117 (49)	21 (9)	12 (5)	3 (1)

4.4 Barriers and enablers

While specific questions about barriers and enablers for using the charts and escalation of care processes were not explicitly asked in the survey or focus groups, some were subsequently identified following analysis of the data.

4.4.1 Lack of education

A key barrier to uptake, acceptability and correct use of the charts was lack of clinician education. Although most pilot sites conducted extensive education and promotion of the charts in the early stages of the three-month trial, it is possible that new staff, or staff who were on leave during this time, missed out on specific education. The main form of education was delivered by the existing ViCTOR paediatric implementation video and supplementary site specific PowerPoint presentation (a template was provided to each pilot site) and/or through discussion at the bedside.

'Education at the introduction would have made the implementation go much more smoothly.'

'Follow-up education is recommended.'

'More education including follow-up education – prefer face to face.'

One survey respondent suggested that sample copies of correctly completed charts should be made available. Some pilot sites had also successfully used this strategy during the implementation phase of the project:

'Copies of correctly filled out charts to be circulated to team and talked through at a team meeting/handover to ensure we are correctly documenting and utilising the full scope of the ViCTOR chart.'

The ViCTOR project team recognised that sustainable education would be enhanced by making available a similar video to the 'ViCTOR implementation' video that had previously been developed to support implementation of the paediatric charts. As such, the 'ViCTOR implementation' video (11 minutes) has been modified to demonstrate and explain how to use these new charts.



Table 20: Communicating and escalation of care – clinician survey responses according to type of chart (n = 240) (cont)

4.4.2 Chart content

Duplication of pre-existing hospital paperwork was regularly reported as an issue with the BS/PN chart. The patient demographic and Apgar score sections were frequently identified as being unnecessarily duplicated. Furthermore, the chart audits identified that the 'handover' and 'double check' sections were completed on only 31 per cent of occasions; unnecessary duplication was the main explanation offered for this lack of adherence to documentation. These concerns resulted in changes to the finalised BS/PN chart including revising the Apgars section and removing the handover and double checks.

Conversely, findings from the evaluation identified content that would ideally be included in the chart. The need to integrate an input/output chart to assist in interpreting observations was the most frequent suggestion from the survey responses and focus group participants:

'There is no feeding chart incorporated. I can't easily interpret what is happening with the baby without this...for example, poor feeding can be a sign of sepsis.'

'No FBC – hard to interpret what's going on.'

The scope of the current project did not allow further work to be undertaken in this area. It is recognised that substantial work needs to be undertaken before a standardised approach to documenting fluid management in newborns can be achieved.

4.4.3 Escalation of care processes

As identified in [section 4.3.5](#), concerns were expressed about inappropriate escalation of care. These concerns were often linked to the fact that the trigger thresholds would sometimes not be appropriate for an individual baby, and to the modification practices. For the Neonate chart, modification of a relevant trigger threshold could be made by a doctor if the baby was stable and there was a clear underlying clinical reason to do so. Modifications needed to be ordered by a doctor and were valid for a maximum of 24 hours. Therefore, a baby who chronically breached the trigger thresholds would require daily modifications by medical staff.

Accessing medical staff to order a modification, and the perception that some medical staff were reluctant to modify parameters, were identified as barriers. Educating medical staff and encouraging medical staff to anticipate the need for modifications in certain infants (for example, chronic lung disease) would help to minimise this issue. Incorporating a regular review of the trigger thresholds into the daily ward round would also be beneficial. These are important issues to be considered in education and local escalation of care procedures.

'Doctor not modifying charts and regularly breaching orange zone, which is impacting on workload.'

'Medical staff not modifying.'

'This criteria does not cater for certain babies, in particular, newborns with chronic lung disease in the special care nursery who have abnormal baseline respiration, requiring us to get altered limits every 24 hours from the doctors.'

Furthermore, the lack of clarity about how to manage the breaching of an orange or purple zone observation that did not have a defined value to be modified (for example, respiratory effort, level of activity, newborn scalp check) was also a potential barrier. As suggested by one survey respondent, establishing a consistent procedure to manage this situation is needed:

'Once a pre MET has been called for a neonatal issue identified, e.g. head swelling, there should be a clear de-escalation process so that once reviewed by the Paediatric team, the pre MET does not continue to be called every shift/handover.'

The intention is that when these parameters are breached, an assessment and management plan is made by the nursing/midwifery or medical staff, and it is documented in the events/comments section of the chart. Ideally, repeated requests to call medical staff would not normally be required unless a later medical review was planned for, or the condition of the baby changed. Specific education about these issues and incorporation of a de-escalation process into the local escalation of care procedures are important factors to consider when implementing the charts.

Finally, some staff suggested it would be beneficial to incorporate modifications into the BS/PN chart. Feedback from the pilot sites indicated there were occasions where it would be appropriate to modify a parameter in these settings – for example, in a newly delivered baby whose temperature had not yet stabilised and where it would be expected to normalise over a few hours.

'Altered pre MET and MET criteria on the postnatal charts could be helpful.'



5: Chart and resource finalisation

5.1 Chart amendments

From January to March 2017, extensive consultation took place to consider the evaluation findings and decide on the chart amendments. Tables 21 and 22 summarise the amendments which are based on the evaluation findings and subsequent, extensive sector engagement and feedback that occurred between January to March 2017.

While most amendments were straight forward, there was considerable debate among the Expert Advisory Group members regarding establishing suitable SpO₂ targets for premature newborns and the corresponding wording that should be included on the charts. Distinguishing SpO₂ targets for premature newborns were not identified in the New South Wales *Standard newborn observation chart*, nor the Australian Capital Territory, *General observation chart neonatal 0 – < 1 month*. The majority of experts, based on evidence that was mostly related to extremely preterm infants (BOOST II 2013; Schmidt et al. 2013; SUPPORT Study Group 2010), agreed that both a preterm neonate and a neonate of any gestation on respiratory support should have a targeted SpO₂ of 91–95 per cent. However, there was not consensus and further consultation was required before an agreement was reached on the final wording 'preterm neonates and/or those on respiratory support'.

Table 21: Summary of chart amendments – Birth Suite/Postnatal chart

Page	Change made	Type of change/ rationale
Front page	Insertion of head circumference and length	New content
	Removal of full breakdown of Apgar scores	Duplication
	Removal of handover and double checks	Duplication
	Insertion of modification box	New content
Inside page (observation page)	Instructions revised	Improve clarity
	Switching of initials and time	Format change
	Jaundice removed with every observation	Content change
	Temperature changed to a written value	Format change
	Amendment to level of activity	Content change
	Addition of text for extra risks	Format change
	Scalp check updated to include bruising and removal of the word 'abrasion'	Content change
	In the newborn risk assessment section: Removal of the observation frequency panel – replaced with text	Format change
	Addition of a tick box for 'no risk'	Format change
	Updates to risk assessment profile including preterm, sepsis and other categories	Content change
	SpO ₂ screen prior to discharge moved to the bottom of the chart and clearer instructions provided	Format

Table 22: Summary of chart amendments – Neonate chart

Page	Change made	Type of change/rationale
Inside page (observation page)	Change of title from 'Neonate' to 'Special Care Nursery' chart	Content change
	Combination of day of life and corrected age and removal of date/time area	Format change
	Flipping of name and time rows	Format change
	Insertion of altered target saturation tick box with altered parameter option to be signed by medical officer	Content change
	Oxygen saturation graph to allow for trending of data	Format change
	Level of activity moved above temperature	Format change
	Temperature written, not trended and cot temperature combined into the temperature section	Format change
	'Colour' and 'Level of activity' flipped to have white zone rows first and purple zones last	Format change
	Muscle tone removed	Content change
	BGL area condensed into one row	Format change
	Three rows of additional observations added	Format change
	Events comments moved to the end of the page	Format change

The final BS/PN and Special Care Nursery charts were ratified by the Expert Advisory Group and pilot site champions on 27 March 2017, with a sign-off to proceed to statewide implementation. The Neonate chart was renamed the Special Care Nursery chart to reflect the clinical area that it would be used in.



5.2 ViCTOR newborn package

Following the finalisation of the redrafted charts, a ViCTOR newborn package has been prepared for a statewide launch. Interested organisations need to register to use the charts and associated resources via the ViCTOR website. During this process, a disclaimer needs to be selected where, among other things, the registering user agrees to develop their own escalation of care procedure prior to implementing the charts.

Building on previous chart launches, the ViCTOR newborn package is designed as a complete implementation resource, equipping the registered user to design their local escalation of care procedure, promote the implementation of the charts and audit the charts once in use. The ViCTOR newborn package contains:

- the ViCTOR newborn implementation guideline
- chart order codes including a step-by-step process of how to order
- an educational video (how to use the charts)
- promotional posters
- a suggested bedside folder including step-by-step process of how to order
- an audit tool for each type of chart.

6: Project conclusion and recommendations

The two trial newborn observation charts that were implemented in a range of clinical settings were generally found to be suitable for recording clinical observations, detecting patient deterioration and communicating clinical care in neonatal patients.

Findings from the multi-method evaluation have informed changes to chart design and revision of specific content as described in this report. There remain a number of areas where there is limited evidence, thus ongoing review is suggested.

The frequency of observations for well newborns (BS/PN chart) was found to be suitable. An additional instruction was added to the chart stating that the duration of observations would continue for 48 hours or until hospital discharge (whichever occurred earlier), then as per hospital procedure. However, because of the lack of evidence and difficulty reaching consensus for when a newborn risk was identified, the frequency and duration of observations will remain guided by local procedure.

During the pilot period the specific Neonate chart was rarely used in the paediatric ward or emergency department settings. Of these users, the majority preferred the existing '0–3 month' ViCTOR paediatric chart because it was reportedly easier to use and was more consistent with the other ViCTOR paediatric charts.

The evaluation identified the importance of ongoing education, especially for the continuing transition of new staff. Clinicians also identified that a statewide guideline that complemented the charts would be beneficial in promoting further consistency of practice, particularly in relation to the required frequency and duration of observations when a newborn risk factor was identified.

Ensuring adequate site-specific procedures were in place to facilitate escalation of care and incorporating specific guidance about appropriate modification practices were also considered essential. Ideally, these local escalation of care procedures should include the ability to discuss with the 'midwife/nurse in charge' when an orange zone is triggered, rather than always seeking a medical review. Incorporation of a de-escalation process into this procedure, guiding clinicians how to best respond to neonates who consistently remain in the orange zone following medical review should also be taken into consideration.

In light of the findings described in this report, a number of recommendations are outlined below.

Chart release

1. It is recommended that the updated Birth Suite/Postnatal and Special Care Nursery charts are released for statewide use in birth suite and postnatal environments and special care nurseries.
2. It is recommended that the trial Neonate chart be removed from paediatric wards and emergency departments and that the existing '0–3 month' ViCTOR chart continues to be used in these settings.

Escalation of care

3. It is recommended that local escalation of care procedures consider the specific needs of neonatal patients including careful consideration of the ability to discuss with the 'midwife/nurse in charge' when an orange zone is triggered, and that the procedure provides guidance about appropriate modification practices.



Implementation resources

4. It is recommended that consideration be given to including a clinical guideline in the *Neonatal e-handbook* to provide guidance and a standardised approach to the conduct of observations and monitoring of newborns in Victoria.
5. It is recommended that a separate ViCTOR 'back to basics' neonatal video is developed to demonstrate best practice vital sign measurement in newborns, including preterm infants.

Further developments

6. It is recommended that a standardised input/output chart for postnatal units and a fluid balance chart for the special care nursery are developed to complement the ViCTOR chart.
7. It is recommended that consideration be given to developing a standardised information leaflet for parents that clarifies the role of parents in recognising and responding to deterioration of their newborn.

Ongoing evaluation

8. It is recommended that further evaluation or research is conducted to establish the most appropriate monitoring plan (frequency and duration of observations) based on the newborn risk profile.
9. It is recommended that a review of these revised charts is undertaken within one year from release, with particular attention to the use of the altered oxygen saturation targets for prematurity and/or for infants on respiratory support.

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