



An Roinn Sláinte
Department of Health

Emergency Medicine Early Warning System (EMEWS)

National Clinical Guideline No. 18

October 2018



**NATIONAL
CLINICAL
EFFECTIVENESS
COMMITTEE**

This National Clinical Guideline has been developed by the Emergency Medicine Early Warning System (EMEWS) Guideline Development Group (GDG), as a work stream of the HSE National Clinical Programme for Emergency Medicine. The National Clinical Programme for Emergency Medicine was established by the HSE in 2010 with the overarching aim of improving the safety and quality of care for patients in Emergency Departments (EDs) throughout the country. The National Emergency Medicine Programme Report was published in June 2012 and launched by the Minister for Health.

Using this National Clinical Guideline

This National Clinical Guideline (NCG) applies to adults patients (16 years and older) attending an ED in Ireland who meet the inclusion criteria detailed later in their phase of care from triage to discharge or decision to admit. It should be used in conjunction with other NCEC NCGs, see page 14. This NCEC NCG is relevant to all healthcare professionals working in EDs.

EMEWS was developed in response to a recommendation of the HIQA Tallaght Report, 2012. EMEWS is recommended for use in all EDs to support the recognition of, and appropriate response to, the deteriorating patient as required by the National Standards for Safer Better Healthcare. It represents the commitment of the EMP, the Emergency Nursing Interest Group (ENIG) (the nursing work stream of EMP), and the GDG to improve the quality and safety of all patients in the ED who are at risk of physiological deterioration. Implementation of EMEWS will result in significant changes in how care is delivered to patients in EDs and will require ever closer collaboration within the ED team of nurses, doctors, and other clinical and administrative staff. The scale of this change should not be underestimated. EMEWS will require on-going refinement as further research evidence emerges but it is a significant step towards safer care for patients who are at risk of physiological deterioration in the ED setting.

Disclaimer

NCEC National Clinical Guidelines do not replace professional judgement on particular cases, whereby the clinician or health professional decides that individual guideline recommendations are not appropriate in the circumstances presented by an individual patient, or whereby an individual patient declines a recommendation as a course of action in their care or treatment plan. In these circumstances the decision not to follow a recommendation should be appropriately recorded in the patient's healthcare record.

Users of NCEC National Clinical Guidelines must ensure they have the current version (hardcopy or softcopy) by checking the website: www.health.gov/patient-safety/ncec

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Membership of the Guideline Development Group (GDG)

The GDG was co-chaired by Mr Fergal Hickey, Consultant in Emergency Medicine and Ms Fiona McDaid, Nurse Lead, National Emergency Medicine Programme.

Membership nominations were sought from a variety of clinical and non-clinical backgrounds so as to be representative of all key stakeholders within the health and emergency care arenas. The GDG consisted of a Working Group (GDWG) and a broader Advisory Group (GDAG) to most efficiently bring the project to completion. GDG members included those involved in clinical practice, education, administration and research methodology.

Working Group Membership

The function of the Guideline Development Working Group (GDWG) was to oversee the project including; adherence to National Clinical Effectiveness Committee (NCEC) criteria, communication with the NCEC and HSE, managing timelines, documentation of the decision-making process, reviewing evidence from the systematic review and agreeing recommendations generated by the GDAG based on the systematic and economic reviews (see table 1).

Advisory Group Membership

The purpose of the GDAG was to advise the GDWG on the views of the constituency each member represented on various aspects of EMEWS, review evidence generated by the systematic review and suggest recommendations based on the evidence (see table 2).

Credits

The role of the NCEC is to prioritise, quality assure and recommend clinical guideline to the Chief Medical Officer for endorsement by the Minister for Health. It is intended through Ministerial endorsement that full implementation of guidelines will occur through the relevant service plans.

The NCEC and the Department of Health acknowledge and recognise the Co-Chairs and members of the Guideline Development Group (GDG) for development of the guideline. The NCEC and Department of Health wish to express thanks and sincere gratitude to all persons contributing to this National Clinical Guideline; especially those that give of their time on a voluntary basis.

Acknowledgments

The Co-chairs would like to thank the GDWG and GDAG, the National Emergency Medicine Programme and the National University of Ireland, Galway for their continued support and assistance with the development of this guideline. Special thanks to the staff of the Emergency Departments in Connolly Hospital, Blanchardstown; Naas General Hospital; University Hospital, Waterford; University Hospital, Galway; Sligo University Hospital and St James's Hospital who pilot tested the guideline at various stages during its development.

Guideline developers note:

The working title used during the development of this guideline was the Emergency Department Monitoring and Clinical Escalation (ED MACE) Protocol for Adults. This was changed to the Emergency Medicine Early Warning System to better align it with other national systems and guidelines.

Table 1: Working Group

Name	Title	Role
Ms Fiona McDaid	Nurse Lead, National Emergency Medicine Programme	Co-Chairs
Mr Fergal Hickey	Consultant in Emergency Medicine	
Dr Gerard McCarthy	Clinical Lead, National Emergency Medicine Programme	Clinical Expert
Ms Breda Naddy	Programme Manager, National Emergency Medicine Programme	Programme/Project Management
Dr Una Geary	Consultant in Emergency Medicine with Hospital Quality Improvement Role	Clinical Expert
Mr Gethin White	Research, Information and Economic Expert	Clinical Librarian
Ms Sinead Reilly	Administrator, National Emergency Medicine Programme	Administration
Dr Vida Hamilton	Clinical Lead, National Sepsis Programme	Clinical Lead National Sepsis Programme and Consultant in Intensive Care Medicine
Ms Christina Doyle	Programme Manager, National Sepsis Programme	Programme/Project Management
Dr John Fitzsimons	Director for Quality Improvement and Clinical Lead, Paediatric Early Warning Score (PEWS)	Paediatric Early Warning System representative
Dr Karen Power	National Programme for Obstetrics and Gynaecology – Irish Maternity Early Warning System (IMEWS)	Irish Maternity Early Warning System representative
Ms Ruth Greene	Clinical Nurse Manager II Emergency Department	Clinical Expert
A representative of the Acute Medicine Programme and Lead for NEWS project was a member of the GDG until resigning in April 2016.		

Table 2: Advisory Group

Name	Title	Role
Ms Norma O’Sullivan	Clinical Nurse Manager, Cork University Hospital	Clinical Expert
Ms Helena Hanrahan	ADoN, University Hospital, Galway	Clinical Expert
Ms Fiona Brady	ADoN, Our Lady of Lourdes Hospital, Drogheda	Clinical Expert
Ms Helen O’Shea	Clinical Nurse Manager, Sligo University Hospital	Clinical Expert
Ms Rosie Quinn	Therapies Lead/ EMP Therapies Lead	Health and Social Care Professionals
Prof Garry Courtney	Clinical Co-Lead, National Acute Medicine Programme	Clinical Expert
Prof Frank Keane	Clinical Co-Lead, National Programme for Surgery	Clinical Expert
Ms Brid Boyce	Quality, Risk and Patient Safety, HSE	HSE, National Lead for Policies, Procedures, Protocols and Guidelines
Ms Angela Fitzgerald	Assistant National Director, Acute Hospitals Division, HSE	HSE, Senior Management Representative
Ms Eileen Whelan	Group Director of Nursing (DoN), Dublin Mid-Leinster Group	HSE, Hospital Group Management
Ms Ann Martin	Client Director, Acute Hospitals, Communications, HSE	Communication Planning
Mr Michael Brophy	Service User	Service User
Mr Damian McGovern	Service User	Service User
Ms Fiona Culkin - replaced by Ms Mairead Twohig in Sept 2016	Clinical Risk Advisor	State Claims Agency
Prof Eilish McAuliffe	Professor of Health Systems	Human Factors and Patient Safety
Dr Éidin Ni Shé	Health Systems Researcher	Human Factors and Patient Safety
Dr Gareth Quin	Chair, Irish Committee for Emergency Medicine Training	EM training
Dr Colm Henry	National Clinical Advisor, Group Lead Acute Hospitals, HSE	GDG Sponsor
A/Prof Conor Deasy	Consultant in Emergency Medicine / Principal Investigator	Clinical expert
Dr Frances Drummond	Researcher Support Officer	Health Systems Researcher
Ms Liz Roche	Area Director NMPD	Practice Development / Service Planning
Dr David Menzies	Consultant in Emergency Medicine / National Adult Retrieval Programme	Pre-hospital expertise
Dr Jo Kelliher	Emergency Medicine Trainee	Emergency Medicine Trainee
Prof Julie Considine	Professor of Nursing, Deakin University, Australia	International Expert
Prof Peter Cameron	Academic Director of the Emergency and Trauma Centre, The Alfred Hospital, Australia	International Expert
Dr Taj Hassan	Consultant in Emergency Medicine, Leeds, UK / President, Royal College of Emergency Medicine	International Expert

National Clinical Effectiveness Committee (NCEC) National Clinical Guidelines

Providing standardised clinical care to patients in healthcare is challenging. This is due to a number of factors, among them variations in environments of care and complex patient presentations. It is self-evident that safe, effective care and treatment are important in ensuring that patients get the best outcomes from their care.

The Department of Health is of the view that supporting evidence-based practice, through the clinical effectiveness framework, is a critical element of the health service to deliver safe and high quality care. The National Clinical Effectiveness Committee (NCEC) is a Ministerial committee set up in 2010 as a key recommendation of the report of the Commission on Patient Safety and Quality Assurance (2008). The establishment of the Commission was prompted by an increasing awareness of patient safety issues in general and high profile health service system failures at home and abroad.

The NCEC on behalf of the Department of Health has embarked on a quality assured National Clinical Guideline development process linked to service delivery priorities. Furthermore, implementing National Clinical Guidelines sets a standard nationally, to enable healthcare professionals to deliver safe and effective care and treatment while monitoring their individual, team and organisation's performance.

The aim of NCEC National Clinical Guidelines is to reduce unnecessary variations in practice and provide a robust basis for the most appropriate healthcare in particular circumstances. As a consequence of Ministerial mandate, it is expected that NCEC National Clinical Guidelines are implemented across all relevant services in the Irish healthcare setting.

The NCEC is a partnership between key stakeholders in patient safety. NCEC's mission is to provide a framework for national endorsement of clinical guidelines and audit to optimise patient and service user care. The NCEC has a remit to establish and implement processes for the prioritisation and quality assurance of clinical guidelines and clinical audit so as to recommend them to the Minister for Health to become part of a suite of National Clinical Guidelines and National Clinical Audit. The aim of the suite of National Clinical Guidelines is to provide guidance and standards for improving the quality, safety and cost-effectiveness of healthcare in Ireland. The implementation of these National Clinical Guidelines will support the provision of evidence-based and consistent care across Irish healthcare services.

NCEC Terms of Reference

1. Provide strategic leadership for the national clinical effectiveness agenda.
2. Contribute to national patient safety and quality improvement agendas.
3. Publish standards for clinical practice guidance.
4. Publish guidance for National Clinical Guidelines and National Clinical Audit.
5. Prioritise and quality assures National Clinical Guidelines and National Clinical Audit.
6. Commission National Clinical Guidelines and National Clinical Audit.
7. Align National Clinical Guidelines and National Clinical Audit with implementation levers.
8. Report periodically on the implementation and impact of National Clinical Guidelines and the performance of National Clinical Audit.
9. Establish sub-committees for NCEC workstreams.
10. Publish an annual report.

Table of contents

Section 1: National Clinical Guideline summary	8
1.1 Summary of recommendations	8
Section 2: Development of the National Clinical Guideline	13
2.1 Overview	13
2.2 Background	13
2.3 Aim and objectives of EMEWS	14
2.4 Guideline scope	14
2.5 Rationale for a National Clinical Guideline	15
2.6 Evidence to support the development of this guideline	16
2.6.1 Development and testing of EMEWS – Overview of the initial development project	16
2.7 Clinical and financial impact of deterioration in EDs	18
2.8 Elements of EMEWS	20
2.8.1 Development and testing of EMEWS	20
2.8.2 The Manchester Triage System interface with EMEWS	20
2.8.3 Inclusion and exclusion criteria for the EMEWS	21
2.9 Post-Triage Emergency Nursing Review Process	22
2.9.1 Starting Post-Triage Emergency Nursing Review	22
2.9.2 Post-Triage Emergency Nursing Reviews – MTS Categories 1 and 2	22
2.9.3 Post-Triage Emergency Nursing Reviews – MTS Category 3	22
2.9.4 Post-Triage Emergency Nursing Reviews – MTS Category 4	23
2.9.5 Post-Triage Emergency Nursing Reviews – MTS Category 5	23
2.9.6 Post-Triage Emergency Nursing Reviews and Red-Flag conditions	23
2.9.7 Post-Triage Emergency Nursing Review – Updated Triage Priority	23
2.9.8 Post-Triage Emergency Nursing Review	23
2.9.9 Reducing the Frequency of Post-Triage Emergency Nursing Reviews	24
2.9.10 Patient Pathway for Post-Triage Emergency Nursing Review and Clinical Escalation	24
2.10 EMEWS observation chart for adult patients	26
2.11 The interface of EMEWS with other NCEC NCGs	27
2.12 Alignment of the EMEWS observation chart with other systems	27
2.12.1 Pre-hospital patient monitoring	27
2.12.2 NEWS chart	27
2.12.3 IMEWS chart	28
2.13 NEWS and IMEWS scoring at patient admission to In-patient areas	28
2.14 Impact of oxygen therapy on NEWS scoring	29
2.15 Document management for admitted patients	29
2.16 The ISBAR communication tool	29
2.17 The Patient-Specific Monitoring Plan	30
2.17.1 What is a Patient-Specific Monitoring Plan?	30
2.17.2 Determining a Patient-Specific Monitoring Plan following review by Treating Clinician	30
2.17.3 Patient-Specific Monitoring Plan Template and Event Log	30
2.17.4 Patient-Specific Monitoring Plan document management	31
2.18 Clinical Escalation in the Emergency Department	31
2.18.1 Defining Clinical Escalation	31
2.18.2 Responding to the deteriorating patient in the ED	31
2.18.3 Recommended approach to Clinical Escalation in the ED	31
2.18.4 ED team-work supports effective Clinical Escalation	32
2.18.5 Clinical Escalation across the patient journey through the ED	32

2.18.6	Guiding principles for implementation of Clinical Escalation	32
2.18.7	Clinical Escalation triggers	33
2.18.8	Clinical risk associated with repeat review without Clinical Escalation	36
2.18.9	Communication of Clinical Escalation	36
2.18.10	Involving patients, families and carers	36
2.18.11	Documentation of Clinical Escalation	36
2.18.12	Transition of Care	36
2.18.13	Learning from Clinical Escalation practice	36
2.19	EMEWS Implementation and future development	38
2.19.1	Implementation - Organisational responsibility	38
2.19.2	Implementation steps	39
2.19.3	Implementation plan	39
2.19.4	Enablers and barriers impacting on the implementation of EMEWS	39
2.19.4	Tools to assist implementation of EMEWS	41
2.19.5	EMEWS training	41
2.19.6	Training programme for EMEWS	41
2.20	Monitoring and evaluation	42
2.20.1	Audit	42
2.20.2	Key performance indicators	43
2.21	Sources of learning to support the further development and improvement of EMEWS	44
2.22	Sources of funding	44
2.23	Stakeholder consultation	44
2.24	External review	44
2.25	Procedure to update this National Clinical Guideline	45
2.26	Methodology and literature review	45
2.26.1	Development and grading of recommendations	46
2.27	Conflict of interest declarations	47
2.28	Copyright and permissions	47

Section 3: National Clinical Guideline recommendations 48

3.1	Key questions and evidence statements	48
1.	Overarching Recommendations	49
2.	Measurement and Documentation of Vital Signs	51
3.	Escalation of Care and Clinical Communication	59
4.	Adult Sepsis	68
5.	Governance	69
6.	Education	72
7.	Supporting Practices	74
8.	Evaluation and Audit	75
9.	Electronic Monitoring Technology	77

Section 4: Appendices	79
Appendix 1: EMEWS observation chart	79
Appendix 2: GDG Terms of reference	83
Appendix 3: Guideline development timeline	89
Appendix 4: Report of the consultation process	90
Appendix 5: Tools to assist implementation and FAQs	95
Appendix 6: Audit tool and guidance	102
Appendix 7: Systematic review - Abstract	105
Appendix 8: Budget impact analysis	106
Appendix 9: Summary tables	113
Appendix 10: Resource implications of implementing EMEWS	132
Appendix 11: Glossary of terms and abbreviations	138
 References and bibliography	 140

Annex 1: Systematic review

List of figures

Figure 1 Components of the EMEWS	20
Figure 2 Process steps for Post-Triage Emergency Nursing Review by Triage category	22
Figure 3 Emergency Nursing Review process following triage to time assessed by Treating Clinician	25
Figure 4 The interface of EMEWS with other NCEC National Clinical Guidelines	27
Figure 5 Clinical Escalation in the Emergency Department	35
Figure 6 Clinical Escalation following review by a Treating Clinician	37

List of tables

Table 1 Working group	2
Table 2 Advisory group	3

1 National Clinical Guideline summary

1.1 Summary of recommendations

1: Overarching Recommendations

Recommendation 1

EMEWS is recommended for use in EDs when patients are waiting longer for review by a Treating Clinician than is recommended based on their Manchester Triage System (MTS) Category. Based on international experience, if patient flow into and through the hospital were more optimal, there would be little need to introduce a schedule of on-going monitoring. It is the responsibility of the Hospital Chief Executive Officer (CEO)/General Manager (GM) to optimise patient flow and to ensure timely and appropriate action is taken to eliminate/minimise ED crowding.

Quality of evidence: **High**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Hospital Chief Executive Officer (CEO)/General Manager (GM)**

Recommendation 2

Patients should be assigned to the track and trigger system appropriate to their age, condition and stage of their journey through the health system.

Quality of evidence: **Expert Opinion**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

2: Measurement and Documentation of Vital Signs

Recommendation 3

Monitoring, using EMEWS, should be considered for all adult patients (≥ 16 years) in any ED setting following prioritisation using the Manchester Triage System.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 4

To reduce risk in the ED environment the internationally recognised “heat” colour scheme should be used on the vital sign chart to denote parameter ranges.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 5

EMEWS should complement care, not replace clinical judgement. Any concern about an individual adult patient warrants escalation, irrespective of the presence or absence of a trigger. The level of escalation should reflect the degree of clinical concern.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 6

The core EMEWS physiological parameters must be recorded as a baseline at triage. These are: Respiratory Rate (RR), Oxygen Saturation (SpO₂), Fraction of inspired Oxygen (FiO₂), Heart Rate (HR), Systolic Blood Pressure (SBP), Temperature (T) and Level of Consciousness (ACVPU: **A**lert/**C**onfused/**R**espond to **V**oice/**R**espond to **P**ain/**U**nresponsive). The subsequent frequency of observations is initially determined by the triage category and presenting complaint until a Patient-Specific Monitoring Plan is in place.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 7

The technique of recording, measuring and monitoring of vital signs should be undertaken in line with recognised, evidence-based practice.

Quality of evidence: **High**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Recommendation 8a

Staff concern is an important indicator of the level of illness/clinical status of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.

Quality of evidence: **Moderate**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Recommendation 8b

Family concern is an important indicator of the level of illness of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.

Quality of evidence: **Moderate**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

3: Escalation of Care and Clinical Communication

Recommendation 9

The EMEWS escalation protocol identifies the clinical escalation steps that should be taken in the event of any parameter/s being triggered.

Quality of evidence: **High**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Recommendation 10

The ISBAR and ISBAR₃ communication tools should be used when communicating clinical concern.

Quality of evidence: **High**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Recommendation 11

Following review by a treating clinician, a clinical management plan must be put in place and clearly documented as part of the EMEWS response.

Quality of evidence: **High**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Recommendation 12a

Any amendment to the Post-Triage Monitoring Plan, such as frequency of vital sign measurement or trigger point, for a given patient with a pre-existing condition that affects their baseline physiological status, e.g. Chronic Obstructive Pulmonary Disease should only be decided by a doctor of Registrar grade or above.

Quality of evidence: **Very Low / Expert Opinion**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 12b

In a situation where an unwell but stable adult would normally have triggered escalation using EMEWS, a Medical Escalation Agreement may be made by a doctor of Registrar grade or above for a maximum period of four hours.

Quality of evidence: **Very Low / Expert Opinion**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 12c

Any amendment to the Post-Triage Monitoring Plan or Medical Escalation Agreement must be clearly communicated and documented in the patient's ED chart.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

4: Adult Sepsis

Recommendation 13

In patients with a clinical suspicion of sepsis adherence to the NCEC National Clinical Guideline No. 6 Sepsis Management is strongly recommended.

Quality of evidence: **High**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

5: Governance

Recommendation 14a

The Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN) of each hospital or hospital group are accountable for the operation of the EMEWS. A formal governance structure, such as a “Management of the Deteriorating Patient” governance committee, should oversee and support the local resourcing, implementation, operation, monitoring and assurance of the EMEWS.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: Hospital **Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

Recommendation 14b

The “Management of the Deteriorating Patient” governance committee should identify a named individual/s to coordinate local EMEWS implementation e.g. a clinical facilitator.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

Recommendation 15a

An appropriately experienced and trained nursing resource is required 24 hours a day for post-triage assessment as this is new work distinct from triage and other current emergency nursing roles. The use of the latest technological developments in patient monitoring should be explored.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 15b

An appropriately trained senior Emergency Medicine doctor should be available 24 hours a day to support junior medical and nursing staff in the ED.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

6: Education

Recommendation 16

The Hospital Chief Executive Officer (CEO)/General Manager (GM) and Director of Nursing (DoN) in each hospital must ensure that EMEWS education is provided to all clinicians who work in the ED.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

7: Supporting Practices

Recommendation 17

Hospitals should implement safety practices that enhance EMEWS and lead to greater situational awareness among clinicians and multidisciplinary teams.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

8: Evaluation and Audit

Recommendation 18a

Clinical audit should be used to aid implementation and quality-assure EMEWS.

Quality of evidence: **High**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Recommendation 18b

EMEWS should be supported through the application of quality improvement methods, such as engagement strategies, testing and measurement to ensure successful implementation, sustainability and future progress.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

9: Electronic monitoring technology

Recommendation 19

Electronic monitoring technology should be utilised, where possible, to record physiological parameters.

Quality of evidence: **Moderate**

Strength of recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

2

Development of the National Clinical Guideline

2.1 Overview

The Emergency Medicine Early Warning System (EMEWS) has been developed in response to concerns that Emergency Department (ED) patients are at risk of clinical deterioration between the time they are triaged and the time they are assessed by a Treating Clinician and that there may be a delay in recognising this deterioration if the patient is not appropriately monitored. These patients have undifferentiated, undiagnosed conditions with the potential for rapid change in their physiological status and have only been assessed once in the ED i.e. at triage.

The development of such a system is a specific recommendation in the *Report of the investigation into the Quality, Safety and Governance of the care provided by the Adelaide and Meath Hospital, Dublin incorporating the National Children's Hospital (AMNCH) for patients who require Acute Admission* (Health Information and Quality Authority, May 2012) (hereafter referred to as the HIQA Tallaght Report).

Crowded and under-resourced EDs will have relatively larger numbers of such patients waiting for longer periods of time thereby increasing the clinical risk. The international literature and media report tragic examples of ED patients who have deteriorated and died in ED waiting rooms. While EMEWS reduces the risk of a patient's clinical deterioration going unnoticed in the ED setting, it does not and cannot address the root cause of this risk which requires appropriate demand-capacity management and resourcing of EDs. EMEWS should not be seen as either a legitimisation of ED crowding or a means of obviating the urgent need to properly address this unsafe phenomenon.

The financial cost of implementing EMEWS (or any other early warning system) could be significantly reduced if patient egress from the ED to in-patient areas was optimised. The post-triage nursing reviews for patients in the waiting area would then only be required during periods where there was a surge in activity.

The EMEWS guideline has been designed to interface seamlessly with the Manchester Triage System which is the nationally recommended ED triage approach for adult patients and, insofar as this is practical or appropriate, align with other tools in use for patients at different stages of their journey through the hospital system.

2.2 Background

EMEWS has been developed in response to staff concerns that certain adult patients in EDs are at risk of clinical deterioration between the time they have been prioritised using the Manchester Triage System and the time they are assessed by a Treating Clinician. There may be a delay in recognising this deterioration if the patient is not appropriately monitored. It is also a specific recommendation in the Tallaght HIQA Report, 2012. These are patients with undifferentiated presentations with the potential for rapid change in their physiological status that have only been assessed once in the ED i.e. at triage. The guideline is intended to add structure to the often *ad hoc* nursing review process in EDs. Crowded and under-resourced EDs will have relatively larger numbers of such patients waiting for longer periods of time, thus increasing the clinical risk. The international literature reports increased rates of adverse events (Hendrie et al, 2017) and in-hospital mortality at 10 days (Richardson, 2006; Bernstein et al, 2009; Richardson and Mountain, 2009; Sun et al, 2013) in patients who are admitted at times of crowding.

2.3 Aim and objectives of EMEWS

The purpose of this NCEC National Clinical Guideline is to implement a standardised Emergency Medicine early warning system in order to improve the recognition and response to clinical deterioration in adult patients in the ED.

EMEWS will:

- (a) Ensure the safe, timely and appropriate monitoring and management of adult patients from triage through to assessment by a Treating Clinician and until they are discharged or admitted under the care of an in-patient consultant.
- (b) Enhance the quality of adult patient care through a standardised, structured approach to ED patient monitoring.
- (c) Integrate with other early warning systems to enable seamless patient monitoring across the entire patient pathway.
- (d) Assist in the overall management of clinical risk and improved quality of patient care.
- (e) Reduce patient concerns and enhance satisfaction with the service.
- (f) Represent a standard for service provision and facilitate service auditing and monitoring of the safety and quality of care in the ED.

2.4 Guideline scope

This NCEC National Clinical Guideline (NCG) applies to adult patients (16 years and older) attending an Emergency Department in Ireland. Following the application of Manchester Triage as a prioritisation filter the target population for the guideline is further refined through the use of the inclusion criteria detailed in Section 2.8.2. The guideline covers the phase of care from triage to discharge or decision to admit. This NCG should be used in conjunction with the following NCEC NCGs:

- No. 1 National Early Warning Score (NEWS) in non-pregnant admitted adult patients
- No. 4 Irish Maternity Early Warning System (IMEWS) in women with a confirmed pregnancy and for up to 42 days post-natally
- No. 5 Communication (Clinical Handover) in Maternity Services
- No. 6 Sepsis Management
- No. 11 Communication (Clinical Handover) in Acute and Children's Services
- No. 12 Paediatric Early Warning System (PEWS) in Paediatric in-patients.

This guideline makes recommendations on the process of implementation and utilisation of EMEWS. It is relevant to hospital management, healthcare professionals, patients and their families. It is intended to complement, not replace, clinical judgement. Cases should be considered individually and, where necessary, discussed with a senior or more experienced colleague.

The intended audience for this guideline is primarily the clinical staff in the ED. However successful implementation requires support from the Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN) at both hospital group and hospital level.

Healthcare professionals attending to patients in the ED should be aware that there are a number of charts in use for different patient populations and phase of care as detailed in the following table:

Patient Group	Phase of care
Children (under 16 years)	Irish Childrens' Triage System (ICTS) is used for Triage Paediatric Early Warning System (PEWS) is used for children (under 16 years) following the decision to admit.
Pregnant Women	Irish Maternity Early Warning System (IMEWS) – is used for women with a confirmed pregnancy and up to 42 days post-partum (some presentations will also require the use of the Glasgow Coma Scale Score aspect of the EMEWS chart).
In-patients	National Early Warning Score (NEWS) – is used for adult patient (16 years and over) following the decision to admit.

2.5 Rationale for a National Clinical Guideline

Analysis of 576 hospital deaths reported to the UK's National Patient Safety Agency's (NPSA) National Reporting and Learning System (NRLS) over a one-year period identified that 11% were as a result of deterioration not recognised or acted upon. Failures were identified at a number of points in the care process (NPSA Reports 2007 cited in Patient Safety First, 2008). EMEWS is intended to address the risk of a patient's clinical deterioration going unnoticed in the ED setting. The recording system currently used by the State Claims Agency is unable to identify specific cases of clinical deterioration during the phase of the patient's journey from triage to review by a treating clinician.

Prior to the HIQA Tallaght Report (2012) the development of an ED-specific system of physiological monitoring had already been seen by the National Emergency Medicine Programme (EMP) as an important area for development.

Through NCEC endorsement of EMEWS, there is a complete suite of tools for use in acute hospitals for the detection of deteriorating patients from their presentation in the ED through to discharge from hospital. EMEWS has been designed to align closely with the other systems for the detection of deterioration in patients within the context of the undifferentiated, undiagnosed nature of presentations to ED. Adult patients will transfer to the NEWS (NCEC NCG No. 1) following the decision to admit. Women who are deemed to require post-triage monitoring with a confirmed pregnancy or who are up to 42 days post-partum will be commenced on the IMEWS (NCEC NCG No. 4) following triage (the Glasgow Coma Scale score component of the EMEWS may also be required depending on the presenting complaint). Children are triaged using the Irish Children's Triage System (ICTS) and transfer to the PEWS (NCEC NCG No. 12) following the decision to admit.

Whereas other NCGs are considered the appropriate track and trigger systems (TTS) for particular settings or patient cohorts e.g. general hospital wards or pregnant women, expert consensus concluded that clinical escalation in the ED requires an approach that recognises the needs of patients in the unique environment of the ED. The EMP therefore explored an ED-specific monitoring and escalation system cognisant that any such ED system should be aligned with existing tools to the greatest extent possible.

Tools for monitoring and escalation in hospital in-patient wards have been in use for a number of years both in Ireland and internationally. The NEWS (NCEC NCG No. 1) and the Compass[®] Training Programme, developed in Australia, have been implemented across acute hospitals in Ireland. An investigation of track and trigger type systems - both single and aggregate scoring, was undertaken by EMP which found that there was no international standard or system specifically for the ED and while early warning

system tools were in use in some EDs and in some countries, the prevalence of their use in the ED environment was low.

Recognising and responding to clinical deterioration is an essential element of effective care, according to Standard 2.2 of the National Standards for Safer Better Healthcare (HIQA, 2012) which requires that “Care is planned and delivered to meet the individual service user’s initial and on-going assessed healthcare needs, while taking account of the needs of other service users”.

EMEWS is designed to be compatible with NEWS (NCEC NCG No. 1) and IMEWS (NCEC NCG No. 4). It will align with pre-hospital systems of physiological monitoring and clinical escalation when developed. This will facilitate the continuity of physiological monitoring from pre-hospital care through to hospital discharge for all patient groups, reducing clinical risk and improving the quality of care.

2.6 Evidence to support the development of this guideline

2.6.1 Development and testing of EMEWS – Overview of the initial development project

The initial development of EMEWS was supported by the Office for Nursing and Midwifery Services Directorate (ONMSD) through the release of the EMP Nurse Lead. The preliminary work evolved through five testing cycles to prove the concept and test its feasibility.

Testing Cycles

(i) Phase 1 - Testing Cycle 1

The first draft of the Patient Chart, Monitoring Process, ISBAR tool was piloted in two EDs, an adult only and a mixed ED. The pilot was run for seven days and included all patients.

Phase 1 findings:

- The chart required refinement but did combine the key components of the charts currently used.
- The concept of a structured approach was welcomed but would need refinement to ensure that it would capture the patients with the greatest risk of clinical deterioration.
- Concern was raised about the nursing resources required to allocate a nurse to review the patients in the waiting room, as increased patient numbers in the waiting room were associated with extended delays for treating clinician review and ED crowding.
- ISBAR was considered to be a valuable tool especially in difficult communication situations.

(ii) Phase 2 - Testing Cycle 2

Phase 2 was undertaken in another adult only ED and focussed on the amount of time taken to complete Emergency Nursing Reviews of patients allocated to the waiting room to wait for assessment by a Treating Clinician as this was area of greatest concern raised by Phase 1.

Phase 2 findings:

- The length of time required for the nursing review of Manchester Triage System (MTS) Category 3 and 4 patients was identified, thus enabling an estimation of the nursing resource requirement.
- Of note the Emergency Nursing Review process identified a patient in the waiting room whose clinical condition had deteriorated.
- Nursing staff who undertook the Emergency Nursing Reviews stated that it was important that the patients were informed at the point of triage that a new process was in place as many patients thought they were being called to be reviewed by a Treating Clinician rather than for an Emergency Nursing Review.

(iii) Phase 3 - Testing Cycles 3, 4 & 5

The full protocol was formally evaluated in three pilot sites. The sites chosen were a large Dublin ED, a large rural/urban ED and a mid-sized rural/urban ED. The duration of each pilot was two weeks, commencing on a Wednesday. An interval of a week was scheduled between one pilot ending and the next beginning to enable learning from the previous pilot to feed into the subsequent pilot. A train-the-trainer model was used whereby the Project Lead undertook the initial training of staff (nursing, medical and administrative staff) who would then train the remaining ED staff. Across the three pilots, over 13 staff received train-the-trainer instruction and approximately 75% of all staff in each ED received training on the tool. The train-the-trainer module was three hours duration and local staff training was delivered in two hours. Evaluation tools were developed for both levels of training. The Nursing and Midwifery Board of Ireland awarded two Category 1 Continuous Education Units for nursing participants. A project information pamphlet was used to inform ED staff, business managers, clinical directors, ward managers, clinical nurse specialists, clinical placement co-ordinators, and nursing management of the purpose of and procedures involved in the pilot. Each ward in the pilot hospital was visited by a CNM3 from the ED or a clinical facilitator to ensure that they were aware the pilot was commencing in the ED.

Pilot Evaluation

Feedback from staff was collected through a comment book and a formal evaluation questionnaire. Focus groups were set up to solicit more detailed feedback. Evaluation of the training approach was very positive with the only suggestion for improvement being that the training scenarios should be addressed in small groups rather than in a single group.

Over the three pilot sites the chart was used in 2,200 patient care episodes. Quantitative and qualitative methodologies were used in the formal evaluation. Learning from the testing of the tool informed refinement of the tool and indicated areas where further design, testing and research were required.

Following successful guideline prioritisation by the NCEC, a systematic review was commissioned by the NCEC to support the development of the guideline. The aim of the review was to provide a rapid systematic review of the evidence of the clinical and cost-effectiveness of physiologically based early warning systems and TTS for the detection of post-triage deterioration in adult patients presenting to ED. The full systematic review is available in Annex 1.

The search strategy used the Population, Intervention, Comparison, Outcome (PICO) format:

- a. To describe the use internationally, including the level of use and the variety of systems in use, of physiologically based early warning systems or TTS or scoring systems for the detection of deterioration in adult patients presenting to Emergency Departments.
- b. To evaluate the clinical effectiveness of physiologically based early warning systems or TTS or scoring systems in adult patients presenting to the ED.
- c. To describe the development and validation of such systems.
- d. To evaluate the cost effectiveness, cost impact and resources involved in physiologically based early warning systems or TTS or scoring systems for the detection of deterioration in adult patients presenting to the ED.
- e. To describe the education programmes, including their evaluation that have been established to train healthcare professionals, and other non-professional staff, in the delivery of such systems.

The conclusions of the systematic review are presented in two sections

- (i) Implications for practice
- (ii) Implications for research

(i) Implications for practice

Five objectives were addressed in this review. The first objective was to describe the use of early warning systems in the ED. Multiple early warning systems were identified but the extent to which they are used in the ED varies in different countries from which data was available (UK and Australia). Ten descriptive studies included in this review demonstrated that the use of early warning systems in ED was linked with an increase in escalation protocol activation but incorrect calculation of scores was common. Compliance with recording early warning system scores was relatively low, although the vital signs HR and BP were usually recorded. This finding emphasises the importance of effective implementation strategies. However, no studies examining educational programmes for early warning systems (objective 5) were identified. Existing guidelines regarding the use of early warning systems to monitor acute patients in hospital did include educational tools, but were not specific to the ED. The three guidelines identified all recommend inclusion of the following six parameters: respiratory rate, heart rate, systolic blood pressure, temperature, oxygen saturations, and level of consciousness.

Evidence from 35 validation and development studies, assessing 27 different systems, demonstrated that early warning systems used in ED settings seem to be able to predict adverse outcomes including mortality, admission to hospital or ICU, and length of hospital stay, but there is variability between studies (objective 3). All but two early warning systems were aggregated scores. This limited the ability to compare comprehensively between single, multiple parameter and aggregated scores. The APACHE II score, PEDS, VIEWS-L, and THERM scores were relatively best at predicting mortality and ICU admission, providing excellent discrimination ability (AUROC > 0.8) (Hosmer and Lemeshow, 2000), but differences between studies may, in part, account for this. The MEWS was the most commonly used and assessed system, but findings of this review suggest a relatively lower ability to predict mortality and ICU admissions compared to the four scores mentioned above, with only some studies indicating acceptable discriminatory ability of the MEWS (AUROC > 0.7) and other studies indicating a lack of discriminatory ability (AUROC < 0.7) (Hosmer and Lemeshow, 2000) especially for the outcome ICU admission. The exception was one study that found excellent discriminatory ability of MEWS for the outcome of in-hospital mortality (AUROC 0.89) (Dundar et al, 2015). However, the ability of early warning systems to predict adverse outcomes does not mean that early warning systems are effective at preventing adverse outcomes. Only one study was identified that addressed this question and it found that the introduction of an early warning system may make little or no difference in detecting deterioration or adverse events however the evidence was of a very low quality making it impossible to draw any strong conclusions (Objective 2). No studies examining the cost-effectiveness of early warning systems and TTS (Objective 4) were found.

(ii) Implications for research

There is a clear need for high quality effectiveness studies to test the impact of using early warning systems or TTS in the ED on patient outcomes. The cost-effectiveness of such interventions; the effectiveness of related educational programmes and the barriers and facilitators to implementation all need to be examined, as currently there is a clear lack of evidence.

2.7 Clinical and financial impact of deterioration in EDs

Alongside the clinical literature review, a systematic search for evidence of economic evaluation (cost-effectiveness analysis, cost-utility analysis and cost-benefit analysis), cost impact and resource impact studies of early warning systems or TTS in hospital EDs was conducted. The search of published and unpublished economic literature, including scientific databases and numerous grey literature resources, did not identify any studies for inclusion in this review. Notably, there were no formal economic evaluations that examined the cost effectiveness of early warning systems in hospital EDs. That said, implementing any form of early warning systems or TTS does require a healthcare resource investment. However, the degree to which such systems may or may not result in cost savings elsewhere in the

healthcare system or in improved patient outcomes, remains unclear. As described earlier, there is a limited evidence base suggesting that early warning systems are effective in, for example, identifying deteriorating patients, reducing cardiac arrests and reducing unplanned intensive care unit admissions. Such effects, should they exist, provide the potential for healthcare cost savings which could go to fund, at least to some degree, the implementation costs of early warning systems in ED clinical practice. While this theory is open to question, it does go to highlight the need for primary research studies to be conducted to directly evaluate the cost effectiveness of either ED and ward based early warning systems. Such studies should focus on the monitoring of resource use, costs and patient outcomes in order to determine whether early warning systems are likely to deliver a return on investment.

The GDG recommends the application of this tool at times of surge, when the rate of new patients attendances outstrips the available clinical resource to maintain optimal patient flow. Appendix 10 refers to the potential resource implications of introducing EMEWS based on the recommendations. The implementation of EMEWS will required the following once-off and recurring resources.

	Once-off*	Recurring*
Education and training**		
Development of training module	€1,294	
Development of e-learning programme	€50,000	
Train-the-trainer	€25,844	
Staff training	€286,228	
Human resources and staffing		
Option 1 6WTE per 26EDs		€7,878,143
Option 2 3WTE per 26EDs		€3,939,072
Option 3 1WTE per 26EDs		€1,313,024
Equipment, health technologies, materials and consumables***	€4,557,710	
Evaluation and Audit at 4 and 12 weeks post-implementation	€12,586	

*December 2016 costs

**Excludes updating of training materials and staff

***Excluding material and consumables

2.8 Elements of EMEWS

The EMEWS is composed of five different elements as shown in figure 1 below:

- Triage
- A process for Post-Triage Emergency Nursing Reviews
- A method for inter-professional communication using the ISBAR Tool
- A template for prescribing a Patient-Specific Monitoring Plan
- An approach to Clinical Escalation in the ED.



Figure 1: Components of the EMEWS

2.8.1 Development and testing of EMEWS

The proof of concept and feasibility of EMEWS was developed under the governance of the EMP with the support of ONMSD. A Health Research Board sponsored participatory action research project is being undertaken in the ED of Cork University Hospital in association with University College, Cork and University College, Dublin. This project has not been completed and although there have been no outputs reported as yet, Ward et al (2017) have published on the approach taken for the research which is believed to be the first study combining Participatory Action Research (PAR), Socio-technical systems (STS) and multiple Plan, Do, Study, Act (PDSA) cycles to evaluate the implementation of an ED-specific longitudinal patient monitoring system and to determine (through process and outcome evaluation) whether this system can significantly improve patient outcomes by early detection and appropriate intervention for patients at risk of clinical deterioration. It is hoped that the project’s outputs and insights may be of assistance in aiding implementation of EMEWS nationally.

2.8.2 The Manchester Triage System interface with EMEWS



The MTS prioritisation category assigned to patients at the time of triage will guide the patient monitoring requirements. Monitoring will occur from the time of triage to when the patient is examined by a Treating Clinician i.e. a doctor or an Advanced Nurse Practitioner.

The MTS is a 5 point acuity scale. The categories are as follows:

- Triage Category 1 Immediate/Life-threatening i.e. cardiac arrest
- Triage Category 2 Very Urgent/Urgent e.g. cardiac-sounding chest pain
- Triage Category 3 Urgent/Semi-urgent e.g. moderate pain
- Triage Category 4 Standard/Routine e.g. mild pain
- Triage Category 5 Non-urgent e.g. no recent pain. The complaint/injury is present for more than one week.

Following assignment of a triage category by the triage nurse, the patient should be assigned to an appropriate clinical area for treatment or to wait for treatment.

All patients presenting to the ED will have vital signs recorded at triage, with the exception of patients with non-life or limb threatening injury as described in the exclusion criteria. The vital signs recorded are: respiratory rate, heart rate, blood pressure, oxygen saturation, temperature and level of consciousness. In addition, the triage nurse may screen for “red flag” conditions e.g. suspected acute myocardial infarction, sepsis (NCEC NCG No. 6), delirium, hyperkalaemia in haemodialysis patients etc.

2.8.3 Inclusion and exclusion criteria for the EMEWS

Triage is a process of determining the priority of patient treatment based on the severity of the presenting condition. It is undertaken directly after registration of the patient on arrival at the ED and aims to ensure that patients receive critical intervention in order of their clinical urgency. Patients who are scheduled to return to the ED do not undergo the triage process. The MTS is the methodology used to triage adult patients in all EDs in Ireland. MTS triage categories range from 1 to 5, with MTS 1 being the category for the most critical condition and MTS 5 the category for the least critical complaint.

Not all ED patients will be commenced on EMEWS. It is their MTS category that determines which ED patients should be commenced on EMEWS and which level of review they should receive from the moment of triage until they leave the ED to be discharged home, or the decision to admit.

Patients who are critically ill receive immediate attention when they arrive at ED and one-to-one care from the ED team. These patients therefore receive higher intensity care than is described in EMEWS. Equally, adult patients with very low acuity conditions, where there is minimal risk of any change in their condition occurring while waiting for review by a Treating Clinician, will not be managed using EMEWS. This enables the appropriate concentration of resources on the care of patients who are most acutely ill and most likely to experience physiological deterioration.

Inclusion criteria:

All patients aged 16 years and older assigned to MTS Triage Categories 2, 3 and 4 will be managed using EMEWS except for the exclusions outlined below.

Exclusion criteria:

- (a) MTS Triage Category 1: As described above, EMEWS does not apply to adult patients who are assigned Triage Category 1 as these patients have sustained a life-threatening injury or illness and should receive immediate treatment in the Resuscitation Room where they will be attended to by multiple members of the ED team. Specific charts, developed and applied locally, are used for the management of these patients.
- (b) Patients who are assigned MTS Triage Category 3 or 4 who present with a non-life or limb-threatening injury and who require no more than over-the-counter (OTC) analgesia are excluded. These patients will be advised to notify the triage nurse should they require further analgesia at a later time and this advice will be documented in the patient’s care records. All other patients, including those with a requirement for stronger analgesia and/or the need for treatment or intervention while waiting for review by a Treating Clinician, will be managed using EMEWS.
- (c) MTS Triage Category 5: According to the MTS scoring criteria, these patients have had their presenting complaint for more than one week and are therefore not acutely ill. If however, the patient’s condition changes they will be re-triaged and commenced on EMEWS, if appropriate.

2.9 Post-Triage Emergency Nursing Review Process



2.9.1 Starting Post-Triage Emergency Nursing Review

The steps in the process of triage and the recommended frequency of Post-Triage Emergency Nursing Review are outlined in the diagram below.

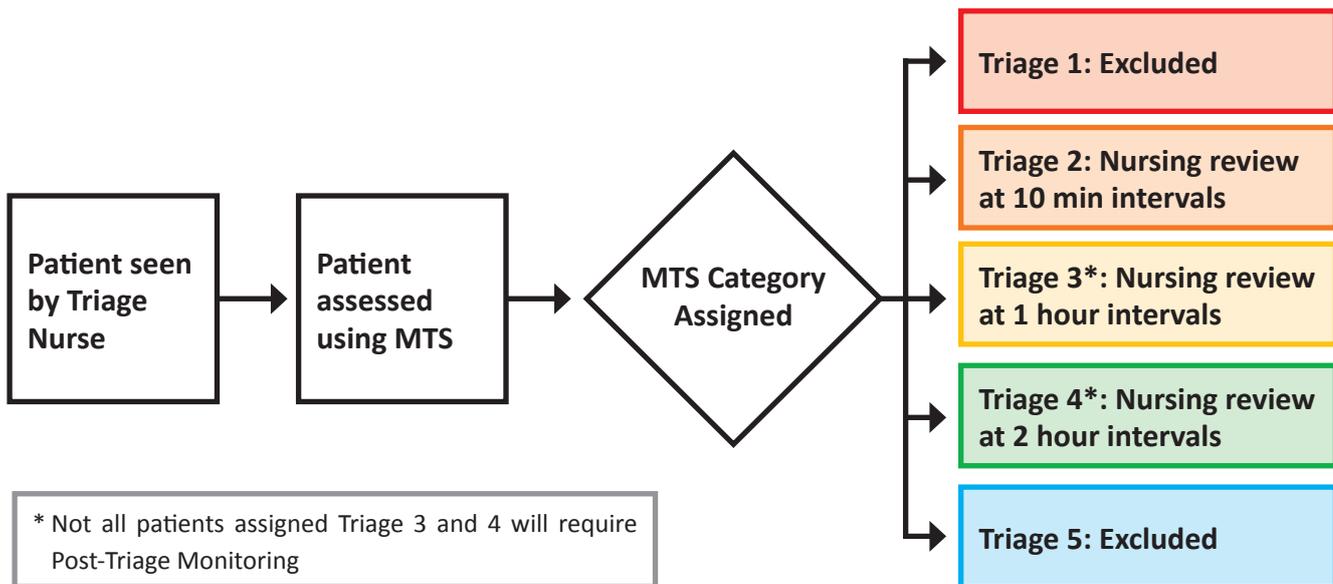


Figure 2: Process steps for Post-Triage Emergency Nursing Review by Triage category.

2.9.2 Post-Triage Emergency Nursing Reviews – MTS Categories 1 and 2

The Nurse-in-Charge should be informed of all patients assigned Triage category 1 or 2 and allocate appropriate nursing resources to the patient’s care.

If a patient receives a MTS triage category 1, monitoring will occur according to the local protocol for patients requiring treatment for life-threatening conditions. These patients will receive one-to-one medical and nursing care. Their pathway of care is therefore not covered by EMEWS.

If the patient receives a MTS triage category 2, they should be reviewed by a doctor within 10 minutes. If this does not occur, the patient will have an Emergency Nursing Review every 10 minutes until they are assessed by a Treating Clinician and a Patient-Specific Monitoring Plan is developed unless the frequency of review can be safely reduced, as described in section 2.9.9.

2.9.3 Post-Triage Emergency Nursing Reviews– MTS Category 3

If a patient receives a MTS triage category 3 and is not excluded from EMEWS, they should be reviewed by a Treating Clinician within 1 hour. The patient will be commenced on EMEWS, unless they meet the exclusion criteria described above and have an Emergency Nursing Review if they have not been seen by a Treating Clinician within an hour. This will occur every hour until the patient is assessed and their Patient-Specific Monitoring Plan is defined.

2.9.4 Post-Triage Emergency Nursing Reviews – MTS Category 4

If the patient receives a MTS triage category 4 and is not excluded from EMEWS, they should be reviewed by a Treating Clinician within 2 hours. If this does not occur the patient will commence on EMEWS, unless they meet the exclusion criteria and have an Emergency Nursing Review every 2 hours until they are assessed by a Treating Clinician and their Patient-Specific Monitoring Plan is defined.

2.9.5 Post-Triage Emergency Nursing Reviews – MTS Category 5

Patients who receive a MTS triage category 5 will not routinely receive an Emergency Nursing Review prior to clinician review unless clinical judgement informed by additional information indicates otherwise or analgesia other than “over the counter” medication is required.

2.9.6 Post-Triage Emergency Nursing Reviews and Red-Flag conditions

A Red Flag system may be in use in the ED to identify salient presentations for prioritisation and commencement on a specialist care pathway (e.g. ST-elevation myocardial infarction, delirium, sepsis (NCEC NCG No. 6), or other locally defined specialist care pathways). Post-Triage Emergency Nursing Reviews may be adapted to reflect specific monitoring requirements for Red Flag conditions according to local guidance and/or care pathways, such as referring to time critical transfer for Primary Coronary Reperfusion Therapy. Any patient in whom sepsis is suspected should not have the frequency of vital sign recordings decreased until they have been reviewed by a Treating Clinician.

2.9.7 Post-Triage Emergency Nursing Review – Updated Triage Priority

A patient’s MTS triage prioritisation can be updated or amended by a nurse trained in MTS at any point prior to receiving review by Treating Clinician. This may be prompted by a change in a patient’s clinical condition or symptoms identified through the Review process. The patient’s Post-Triage Emergency Nursing Review frequency should be adjusted according to their revised Triage Priority.

2.9.8 Post-Triage Emergency Nursing Review

This will be undertaken by an ED MTS nurse trained in the use of EMEWS within the time-frames outlined above and may include:

- Vital signs i.e. respiratory rate, heart rate, blood pressure, oxygen saturation, temperature and level of consciousness.
- Pain management.
- Additional monitoring, as indicated by presenting complaint e.g. mental health, falls risk etc.
- Assessment of the need for ‘comfort care’ e.g. oral fluids, toileting etc.
- A review of all clinical data and point-of-care test (POCT) results with communication of known abnormal findings to a senior clinician on-duty, according to local protocol.

A decision may be made, according to clinical judgement and local protocol as to whether further investigations are undertaken and/or their results reviewed at this time. It will also be a matter for local decision-making and protocol whether or not a plan of care should be drawn up for the patient at this point. This may involve discussion with the Nurse-in-Charge and/or senior EM Clinician. In cases where the patient’s MTS triage score changes, the frequency of review should also be changed according to their updated triage score.

2.9.9 Reducing the Frequency of Post-Triage Emergency Nursing Reviews

The nurse assigned to a patient undergoing Post-Emergency Nursing Triage Reviews may, in consultation with the Nurse-in-Charge, apply their clinical judgement to determine if the frequency of Post-Triage Emergency Nursing Reviews can be safely reduced. This facility is recommended to ensure that nursing resource in the ED is optimally deployed and is focussed on the care of high priority patients rather than repeating vital signs on apparently stable patients without any benefit to their care. Reducing review frequency can be considered for patients when a minimum of two reviews (including triage) have been undertaken and there has been no evidence of significant physiological abnormality or clinical deterioration over the patient's two sets of vital signs. This situation is likely to arise where there are prolonged waiting times for assessment by a Treating Clinician. The frequency of recording can then be adjusted as considered appropriate to the patient's care, in consultation with the Nurse-in-Charge. Notwithstanding this, reviews should occur at a minimum of 4 hour intervals while a patient is under the care of the Consultant in Emergency Medicine because of the undifferentiated, undiagnosed condition of patients waiting for assessment. If deterioration in the patient's clinical condition is identified in a subsequent recording of their vital signs, their triage category and the frequency of reviews should be re-assessed and the need for clinical escalation should be discussed with the Nurse-in-Charge (Fig 3). Evidence of discussion and rationale for change in frequency needs to be documented in the healthcare record.

2.9.10 Patient Pathway for Post-Triage Emergency Nursing Review and Clinical Escalation

Figure 3 outlines how patient care follows a clinical pathway from Triage through Post-Triage Monitoring until the development of a Patient-Specific Monitoring plan following review by a Treating Clinician.

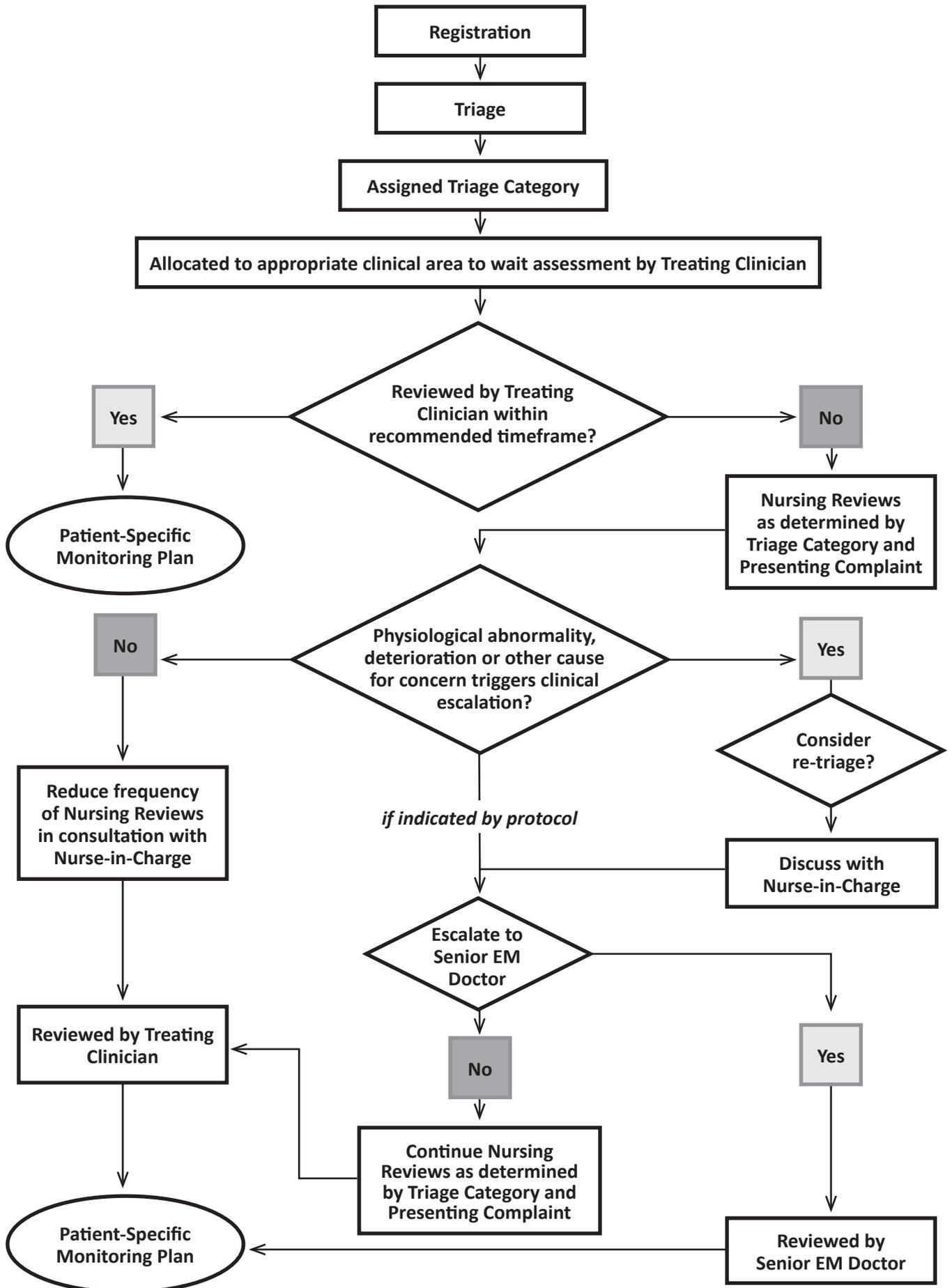


Figure 3: Emergency Nursing Review process following triage to time assessed by Treating Clinician

2.10 EMEWS observation chart for adult patients

The EMEWS observation chart has been developed through extensive consultation with ED nurses, doctors and administrative staff and has been piloted in over 2,200 patient care episodes. The EMEWS chart combines several features that previously had been located in individual documents thus reducing the clinical risk associated with management of patients using multiple, loose sheets of paper.

Key features of the chart intended to support safer, higher quality patient care include:

- A record that a patient identity bracelet has been applied in line with the HSE *Positive Patient Identification* Guideline in Management of Healthcare Records (Health Service Executive, 2011).
- Documentation of allergies and drug sensitivities.
- A record that a falls risk bracelet has been applied where the patient is considered to have an increased risk of falling while in hospital. A full falls risk assessment will need to be undertaken when the patient's condition permits and they are in a suitable environment.
- Pain management documentation to support best practice in pain management and to assist with audit relating to the timeliness of administration of analgesia.
- Post-triage nursing notes.
- Sepsis guidance.
- A record of other documents in use for the patient to assist with safe document management.
- Inclusion of pre-hospital vital signs data to assist with the identification of trends in patients' physiological parameters from the point of first assessment by PHECC registered practitioners to their ED arrival.
- Ranges of vital signs appropriate to the ED setting.
- An ISBAR communication tool reminder.
- A table highlighting patients final NEWS or IMEWS score in the ED.

This will be the standard patient observation chart for use on adult patients in all EDs in Ireland (see Appendix 1). The "free text" sections on pages 1 and 4 and the "Other documents in use for this patient" can be customised to include local documentation but the essential components of the chart must be preserved. The chart can be printed in A4 or A3 format. Clinical escalation procedures will be documented on a separate sheet as the pilot sites identified that a separate sheet allowed for more effective tracking of escalations in the ED setting.

It is intended that future ED Information Systems should enable electronic capture of ED monitoring data and the range of patient information included in the EMEWS Chart.

2.11 The interface of EMEWS with other NCEC NCGs

EMEWS is designed to interface with other National Clinical Guidelines as shown in Figure 4 below.

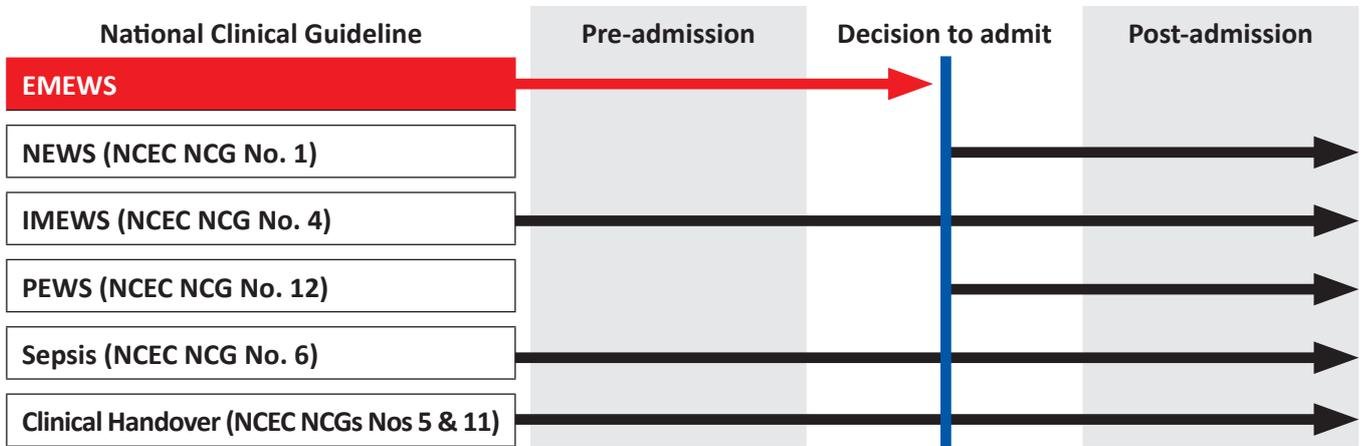


Figure 4: The interface of EMEWS with other NCEC National Clinical Guidelines

2.12 Alignment of the EMEWS observation chart with other systems

2.12.1 Pre-hospital patient monitoring

The EMEWS observation chart facilitates the review and transcription of ambulance-borne patients’ pre-hospital physiological monitoring data. PHECC-registered practitioners should transcribe the first and most recent physiological data they capture to indicate the patient’s initial physiological status at the time of ambulance arrival into the designated columns on the EMEWS charts. The patient’s progress during ambulance transport and the impact, if any, of pre-hospital treatment administered is recorded on the Patient Care Report (PCR). The structured approach to ambulance handover recommended by the EMP and outlined in the EMP Ambulance Patient Handover Protocol (2013), allows time for clarification of information being handed over between Ambulance and ED teams. All pre-hospital physiological data will be available in the ambulance service PCR, a copy of which will be included in the patient’s ED care record.

2.12.2 NEWS chart

The vital sign chart used in EMEWS is designed to be compatible with the NEWS chart which is used for adult in-patients in acute hospitals (see Appendix 1). The physiological parameters in the chart are the same in both, though the heart rate and temperature ranges are broader in EMEWS. It is therefore possible for patients’ vital signs to be recorded using the EMEWS observation chart irrespective of whether the NEWS chart will ultimately be used when they are admitted. This allows patterns of physiological observations to be tracked across the transition of care from the ED to in-patient ward admission and will allow for easier identification of physiological trends.

Modifications of the elements of the NEWS chart that were required for the ED setting included:

- Inclusion of Glasgow Coma Scale (GCS) score monitoring.
- Inclusion of capillary refill monitoring.
- Broader ranges of physiological variables, particularly temperature, heart rate and respiratory rate. This is necessary because ED patients are more likely to experience physiological instability and critical illness compared to ward-based patients, e.g. hypothermia requiring lower temperature ranges or supraventricular tachycardia requiring higher ranges of heart rate to be documented.

- Replacing the blue colour with orange, as blue is associated with Triage Category 5 and therefore the lowest priority in emergency practice. Use of blue would inevitably create confusion and add an avoidable risk to patient care in the ED setting. The approach taken in EMEWS aligns with the clinical risk scales and other “traffic light” alert systems used in emergency healthcare nationally and internationally such as *The 1000 Lives Campaign in Wales* (Hancock, 2013).
- A4 or A3 paper size, portrait orientation for printing and modification of hues to comply with existing ED document scanning equipment for document management systems.
- Staff who use clipboards for holding documentation on ED patient trolleys preferred A4 portrait orientation format as it was easier to handle. A3 sized paper can also be used.

2.12.3 IMEWS chart

The EMEWS chart does not include vital signs trigger points for IMEWS (NCEC NCG No. 4). ED staff are advised to insert the IMEWS vital signs chart for pregnant women and women who are up to 42 days post-partum in place of page 2 on the EMEWS chart. The other elements of the EMEWS chart such as GCS and pain management are recommended for use with pregnant women in the ED setting.

IMEWS uses an escalation system where escalation to a clinical decision-maker (an Obstetrician) occurs on the basis of two “yellow” scores or one “pink” score. In the ED setting this escalation would occur firstly to the most senior EM doctor present in the ED and Nurse-in-Charge and then to an Obstetrician (or alternative clinical team identified locally in sites where an Obstetrician is not available). The IMEWS key is included in the chart so that the documentation of vital signs for pregnant women who are admitted and have an escalation plan prescribed by their admitting team using IMEWS can be continued on the EMEWS chart while the patient is in the ED. Each admitted pregnant woman will have an IMEWS calculated and documented prior to leaving the ED.

2.13 NEWS and IMEWS scoring at patient admission to in-patient areas

The GDG recommends the following measures to optimise the tracking of physiological measures across the care transition from the ED to admitting specialties.

- Performing one cumulative score using NEWS or IMEWS in the ED prior to a patient being transferred to an in-patient area enhances the continuity and quality of monitoring, providing clear evidence of the patient’s physiological status prior to transfer.
- It may not always be appropriate or feasible to document a cumulative score e.g. when a triage category 2 trauma patient is being transferred expeditiously to the operating theatre and documentation of a score could delay time-critical treatment.
- ED teams may calculate a cumulative NEWS or IMEWS score at the time of referral to assist admitting teams in prioritising referred patients according to their physiological status. Any such practice should be supported by local protocols and agreed with local Consultants in EM.
- Local protocols should consider additional measures to increase the likelihood that physiological observations taken in a prior care setting (e.g. the ED for admitted patients) are reviewed by staff receiving a new patient’s care. Strategies to assure that these reviews have occurred may include the transcription of the last two sets of physiological observations recorded in the ED onto the ward-based NEWS chart at the time of commencing the NEWS chart. The transcribed sets of vital signs should be clearly identifiable on the new chart. Ideally this should be facilitated by a specific design feature such as column shading on the chart. Consideration should also be given to transcribing the last 2 sets of observations when a second observation chart is commenced, though the **risks associated with transcription errors must also be carefully managed**.
- Clear guidance should be developed locally to ensure patient safety and quality of care is protected during all transitions of care, particularly for patients experiencing delays in ward transfer and in-patients cared for in crowded ED settings.

2.14 Impact of oxygen therapy on NEWS scoring

All clinical staff must be aware of the influence of oxygen therapy, commonly applied in the ED setting, on the calculation of NEWS scores. Further information is available on the NEWS website (<http://www.hse.ie/eng/about/Who/clinical/natclinprog/acutemedicineprogramme/earlywarningscore/>).

2.15 Document management for admitted patients

The EMEWS chart should be included in the patient’s hospital chart at the time of admission and a copy retained in the patient’s ED medical record according to local practice if these are stored separately to the hospital chart.

2.16 The ISBAR communication tool



The use of structured communication tools has been shown to improve communication during handover and in stressful situations. ISBAR is the structured communication tool identified for use in Acute and Children’s Hospital Services (NCEC NCG No. 11).

Two types of ISBAR are used in the ED:

ISBAR	ISBAR₃
Urgent Escalation of Care	Shift and interdepartmental clinical handover
I – Identify	I – Identify
S – Situation	S – Situation
B – Background	B – Background
A – Assessment	A – Assessment
R – Recommendation	R – Recommendation
	R – Read back
	R – Risk

Further information: National Clinical Guideline No. 11 (2015) <http://health.gov.ie/wp-content/uploads/2015/12/NCG-No-11-Clinical-Handover-Acute-and-Childrens-Hospital-Services-Full-Report.pdf>

2.17 The Patient-Specific Monitoring Plan

Triage	Process for Emergency Nursing Reviews	Communication Methods – ISBAR & ISBAR ₃	Patient-Specific Monitoring Plan Template	Approach to Clinical Escalation
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2.17.1 What is a Patient-Specific Monitoring Plan?

A Patient-Specific Monitoring Plan is an individualised plan developed to guide a patient’s care following review by the Treating Clinician. It describes what vital signs should be monitored as part of the patient’s on-going care and how often these vital signs should be recorded. The Patient-Specific Monitoring Plan is developed through consultation between the Treating Clinician and the nurse assigned to the patient’s essential nursing care. The plan may be changed at any time in response to a change in the patient’s condition. The plan may be changed by the doctor responsible for the patient’s care, a senior EM doctor or by a senior decision-maker from the admitting on-call team responsible for the patient’s further care. All monitoring plan revisions must be documented, signed, dated and timed.

2.17.2 Determining a Patient-Specific Monitoring Plan following review by Treating Clinician

The structured process for patient monitoring is modified following review by a Treating Clinician; at this point the Emergency Nursing Reviews are replaced by a Patient-Specific Monitoring Plan. The Patient-Specific Plan will be influenced by the patient’s provisional diagnosis, the presence of co-morbidities and the patient’s treatment needs.

Evidence-based guidance is available to inform Patient-Specific Monitoring Plans in some conditions e.g. the NICE Head Injury guidelines. It will not always be possible to have specific guidance relating to every patient’s working diagnosis because of the spectrum of undifferentiated presentations to EDs. ED nurses and Treating Clinicians should always seek the advice of the most senior EM doctor on duty in the ED if there is uncertainty as to the most appropriate monitoring plan for a patient. Consultants in EM should provide local guidance and supervision to doctors in training with regard to prescribing patients’ monitoring plans.

2.17.3 Patient-Specific Monitoring Plan Template and Event Log

A template for recording a Patient-Specific Monitoring Plan and an Event Log for recording monitoring events and actions taken are available in Appendix 5. A notes section is included for documentation of a standard guideline being followed in the Monitoring Plan and any additional precautions recommended. The recommended frequency options for physiological monitoring and/or assessing vital signs in the ED setting are:

Critically ill or physiological unstable patients treated in Resuscitation Room

- Continuous Monitoring; (The frequency of documentation of vital signs should be specified and should be, at minimum, every 15 minutes)
- Every 15 mins
- Every 30 mins.

General/non-critically ill patient cohort

- 1-hourly
- 2-hourly
- 4-hourly (This is the minimum recommended frequency for patients under the care of a Consultant in EM).

2.17.4 Patient-Specific Monitoring Plan document management

The Patient-Specific Monitoring Plan should be agreed by the Treating Clinician and the nurse assigned to the patient’s care with input, as required, from the Nurse-in-Charge and the most senior EM doctor on site. The ISBAR approach should guide communication regarding the monitoring plan. The Monitoring Plan should be revised whenever a Treating Clinician review is triggered. The plan should also define any patient-specific considerations for escalation, as explained in Section 2.18. If a parameter is triggered, this should be reported to the Treating Clinician and documented in the Event Log. The Patient-Specific Monitoring Plan and Event Log should be attached to, and stored with, the patient’s ED clinical record.

2.18 Clinical Escalation in the Emergency Department

Triage	Process for Emergency Nursing Reviews	Communication Methods – ISBAR & ISBAR ₃	Patient-Specific Monitoring Plan Template	Approach to Clinical Escalation
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2.18.1 Defining Clinical Escalation

Clinical Escalation describes a process, whereby a change in the patient’s physiological status or a clinical concern that need not be specified, prompts a team response such that, a clinician with appropriate competencies and diagnostic skills attends to the patient in an appropriate time-frame (usually immediately in the ED setting) and manages the physiological problem or clinical cause for concern. Clinical Escalation may be necessary at any stage in a patient’s episode of ED care and all ED staff need to be vigilant for patient deterioration given the time-critical and highly complex nature of their practice. ED patients may present with abnormal vital signs and/or may deteriorate from having what appeared to be “normal” physiological parameters during their ED episode of care. The Clinical Escalation approach recommended in the ED setting also emphasises the importance of Clinical Escalation for non-specific concerns i.e. a nurse or doctor is not required to have a specific abnormal vital sign to escalate but is encouraged to do so on the basis of any concern, even if they can only describe their concern as a feeling or intuition. It is safer to escalate to a senior clinician and be reassured than to delay escalation and risk that a patient’s physiological status may deteriorate. In addition, all escalation events are opportunities for learning – clinicians may gain new knowledge through escalation and the ED can learn how to continuously improve its Clinical Escalation approach.

2.18.2 Responding to the deteriorating patient in the ED

Providing a timely and effective clinical response to a patient’s physiological condition or deterioration is at the core of EM practice. The ED team will provide immediate resuscitative care for all patients who require it within the ED. Indeed, the ED team will provide resuscitative care to all patients in the ED whether they are under the care of a Consultant in EM, an admitting team or are in the process of referral.

2.18.3 Recommended approach to Clinical Escalation in the ED

Currently there is insufficient clinical evidence to set standardised response thresholds/trigger points on the basis of cumulative physiological scoring systems in the ED setting. The safety of Clinical Escalation based on NEWS-equivalent cumulative scoring for EM patients is uncertain at this time. There is a view that lower or single parameter escalation thresholds may be more appropriate for EM patients given the higher likelihood of physiological abnormality and clinical deterioration among this patient cohort and the wider spectrum of presenting complaints and undifferentiated presentations in the ED compared to a ward setting. Trigger thresholds that are set too high may miss patient deterioration and opportunities to escalate, whereas triggers that are set too low will place an unnecessary burden of work on ED nurses

and doctors and may distract from significant clinical deterioration in a patient or other essential clinical activity. This is an important issue if the best possible care is to be provided for as many patients as possible within the resource constraints under which all EDs operate. Clinical Escalation in the ED setting is an area where high-quality research is urgently needed.

The Clinical Escalation component of this clinical guideline was developed through an expert clinician consensus approach in the absence of high-quality generalisable evidence from the emergency care setting. The approach taken is based on the agreed views of a group of experts in EM and Emergency Nursing in Ireland. The group has recommended essential elements of Clinical Escalation for the prompt and reliable recognition of, and response to, physiological abnormality and/or deterioration in ED setting. Implementation of the Clinical Escalation framework will ensure:

- an agreed approach to the recognition of and response to clinical deterioration for adult patients in all EDs in Ireland
- alignment of Clinical Escalation with triage practice
- a consistent approach to Clinical Escalation from patient triage to discharge or admission
- inclusion of criteria that are particularly clinically significant in the ED setting.

2.18.4 ED team-work supports effective Clinical Escalation

The immediate availability of EM doctors and experienced nursing staff within the ED is also a factor in the application of Clinical Escalation protocols in this setting. In EDs, teams of nurses and doctors work together on a daily basis and the Nurse-in-Charge of an ED team is recognised as a clinical leader in the ED. Ward-based nurses generally have to page doctors to attend patients, particularly out-of-hours, whereas ED nurses and doctors are working side-by-side and doctors are more immediately available to become involved in patient care.

2.18.5 Clinical Escalation across the patient journey through the ED

Clinical Escalation for patients who have been triaged but are waiting to be assessed by a Treating Clinician will be directed through the Nurse-in-Charge in most circumstances. That said, any ED staff member should feel empowered to escalate to the most senior doctor in the ED if a trigger is attained or on the basis of their judgment of the situation or clinical concern. A patient may be re-triaged due to a change in their clinical status if they have not yet been seen by a Treating Clinician or a patient may be escalated without re-triage, depending on the specifics of the situation.

Escalation after a patient has been seen by a Treating Clinician will be routinely progressed through the Nurse-in-Charge and then directly to the Senior Doctor or to the doctor caring for the patient. This doctor should request Senior Doctor Review if he/she is concerned regarding the patient's condition and management, Figure 5 outlines this process. Middle-grade doctors i.e. Registrars and Specialist Registrars should escalate to the Consultant in EM on site if they have any concerns regarding a patient's care, who may consult with their in-patient Consultant colleagues in response to concerns regarding a patient's physiological status that is not responding to treatment. No one clinician has all the answers all the time and effective clinical team-work is key to delivering the best outcomes for patients.

2.18.6 Guiding principles for implementation of Clinical Escalation

The recommended clinical escalation process for EDs (Figure 5) can be modified to reflect the local terminology relating to role titles and areas/zones of the ED. Local guidance may also include additional triggers, e.g. specific physiological parameters relating to priority or "red-flag" conditions such as ST-segment ECG changes in suspected Acute Coronary Syndrome. Guiding principles include:

- Concern regarding the clinical status of any patient should prompt timely notification of the most senior EM doctor on site and treatment as clinically indicated.
- All ED staff should be empowered to raise concerns regarding a patient's condition and to escalate patient care to the most senior clinician responsible for the patient's care at any time. There should be a supportive and learning culture in the ED and across specialty interfaces to encourage such behaviour and to promote a culture of safety.
- Patients' families and carers should be encouraged to inform a member of staff if they have any concerns.
- The clinical judgment of ED nurses, doctors and other clinicians is crucial to ensuring the detection of, and appropriate response to, physiological abnormalities in ED patients.
- The response to any individual patient care concern will be influenced by the volume, acuity and relative acuity of other patients who require care at that time and the available ED resources – it will not be possible for a lone senior clinician to respond to two or more simultaneous critical events, and prioritisation of responses will be required. The maxim "to do the most for as many patients as possible" applies. Clinical judgment will determine the relative prioritisation of patients if multiple patients trigger escalation at the same time in the ED.
- Physiological data should be interpreted in the context of the patient's overall clinical presentation and senior clinicians may define exceptional patient-specific response thresholds e.g. lower oxygen saturation limits in patients with COPD, but should be able to justify all such clinical exceptions with regard to the safety and quality of the patient's care.
- Condition-specific triggers should also be considered. These may include, *inter alia*:
 - Protocols supported by available evidence e.g. GCS \leq 14 as per NICE head injury guidelines; hypoventilation in opiate poisoning.
 - Conditions requiring time-critical intervention according to evidence-based condition-specific guidelines e.g. STEMI changes on ECG.
 - Pain management requiring intervention by a senior doctor e.g. intravenous opiate administration or regional anaesthesia.
 - 'Red flag' conditions according to local protocols e.g. abdominal pain in pregnancy; suspected sepsis (NCEC NCG No. 6).
 - Abnormal clinical investigation results in point-of-care testing before assessment by a Treating Clinician e.g. low blood sugar or high lactate.
 - Psychological, psychiatric or behavioural emergencies requiring Senior EM Doctor input.

2.18.7 Clinical Escalation triggers

The Clinical Escalation approach highlights that patient safety is always the first priority. It explains that Clinical Escalation can be triggered at any time by physiological deterioration, non-specific clinical concerns and patient concerns. Clinical Escalation involves:

- Monitoring the patient using the EMEWS chart
- Managing the clinical problem
- Informing a senior member of staff.

Special considerations that are important in the ED setting are outlined in Figure 5 and include:

- Presenting complaint
- Clinical context
- Past Medical History/co-morbidities
- Pain management
- Age and frailty
- Response to treatment
- Patient and/or family concerns
- Deteriorating level of consciousness

- Clinical judgement – if concerned, always escalate to Nurse-in-Charge
- Pregnancy / post-partum status.

Triggers have been set by physiological colour bands. The transition to each colour range for the physiological parameter that triggers a response are the same as those used in NEWS but cumulative scoring is avoided to remove the risk of error due to calculation (NCEPOD, 2005; Gordon & Beckett, 2011). This approach is envisaged to be easier for staff to use in the high-pressure ED environment. It is also similar to the approach used in IMEWS.

The Clinical Escalation protocol for ED patients may be triggered by any of the considerations listed above and when physiological parameters fall into coloured ranges. The range determines the minimum response:

- there is one physiological variable in the yellow range – manage and monitor in light of the clinical context
- there are two variables in the yellow range – inform Nurse-in-Charge
- the patient's physiological parameters change from the white to the orange range or from the yellow to the orange range – Inform Nurse-in-Charge and Senior EM Doctor on site
- there is one or more parameter in the red range – Inform Nurse-in-Charge and Senior EM Doctor on site.

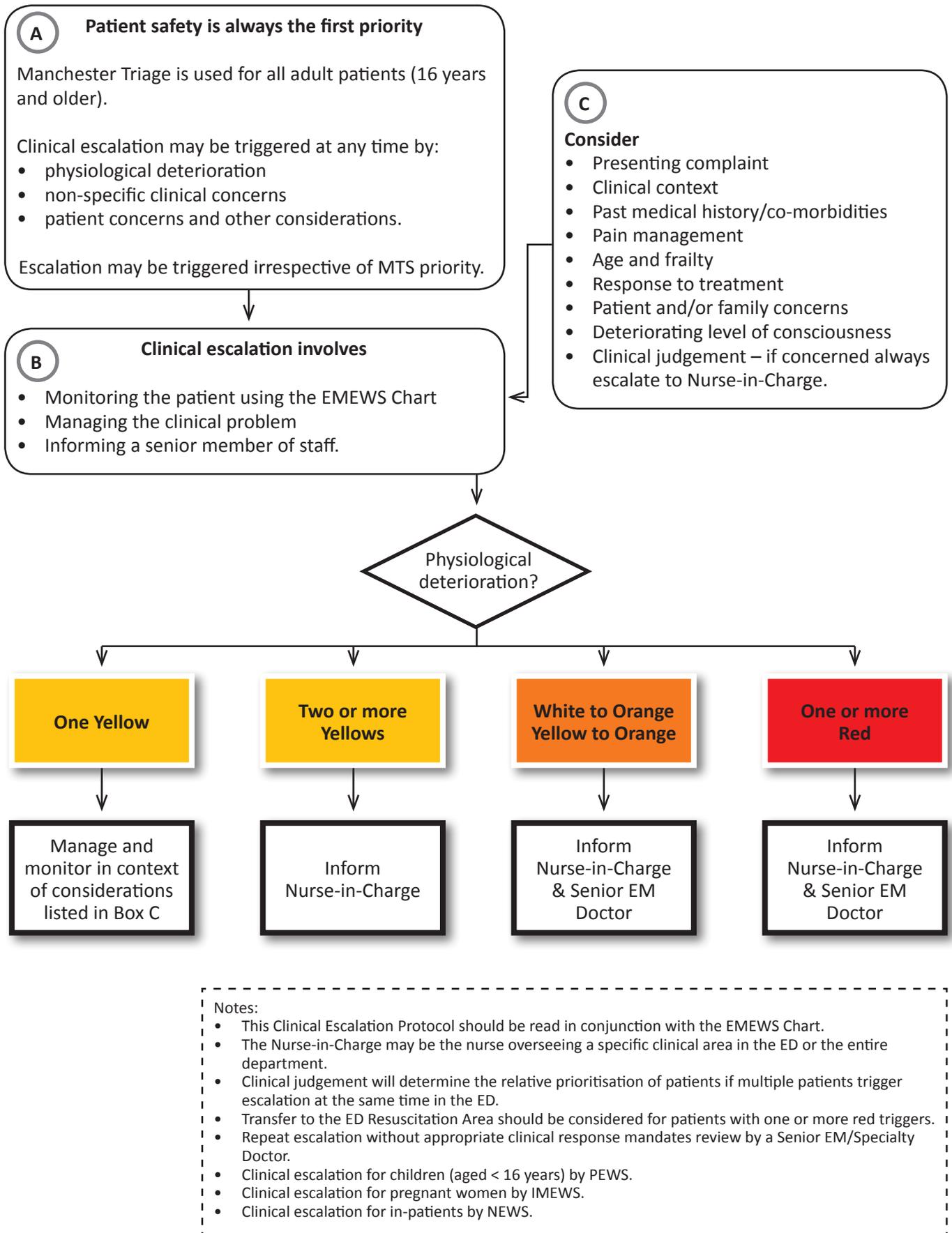


Figure 5: Clinical Escalation in the Emergency Department

2.18.8 Clinical risk associated with repeat review without Clinical Escalation

There is a risk that repeat review of a patient without timely escalation in care may lead to adverse patient outcomes due to delays to diagnosis and/or definitive treatment. More than one call for advice from the Nurse-in-Charge or ED clinician review should prompt the involvement of the most Senior EM clinician available on site. Critical care teams should be involved early in the clinical management of patients with life-threatening physiological abnormality. ED and Critical Care practice should support early escalation and assessment with de-escalation, as appropriate, after review by a senior EM doctor and/or critical care specialist (figure 6).

2.18.9 Communication of Clinical Escalation

ISBAR & ISBAR₃ should be used by care providers to communicate the need for clinical escalation and responses thereafter.

2.18.10 Involving patients, families and carers

Patients and their families should also be encouraged to alert staff members to any concerns they may have as to a patient's clinical status. Local procedures should be developed to enable patient and family engagement in patient monitoring and clinical escalation.

2.18.11 Documentation of Clinical Escalation

All alerts and responses must be documented in the escalation Event Log (attached to the ED clinician's notes if held separately to the patient's ED notes during this phase of care) and medical interventions should be recorded in patient's ED notes. The date, time and name of the senior clinician to whom the patient's care was escalated should be recorded. A template Event Log, as illustrated in Appendix 5, may facilitate this documentation.

2.18.12 Transition of Care

ED clinicians need to be aware of the risks to patients that are associated with transitions of care between clinicians e.g. at the end of shift and across services when patients are being referred or transferred between hospitals or wards. It is important that information regarding escalation events is effectively communicated and indeed highlighted at the time of transition of care as such events are likely pointers to increased clinical risk for the patient during their on-going care. To minimise the risk, adherence to NCEC NCG No. 11 - Communication (Clinical Handover) in Acute and Children's Hospital Services and NCEC NCG No. 5 - Communication (Clinical Handover) in Maternity Services is strongly recommended.

2.18.13 Learning from Clinical Escalation practice

Review of clinical escalation events in the ED setting should be included in routine quality and patient safety audit. Audit findings should be reviewed as part of the quality assurance and improvement activities undertaken in the ED under the governance of the Clinical Operational Group (EMP Report Chapter 3 p90) and aligned to Clinical Director (CD) and hospital-level structures as envisaged in the National Standards for Safer Better Healthcare (Standard 2.2). Learning from clinical escalation events may be shared with ED staff through Safety Huddles and more formal educational activities. Important learning is likely to emerge that can, if utilised effectively, assist ED teams in developing safer, more reliable care processes.

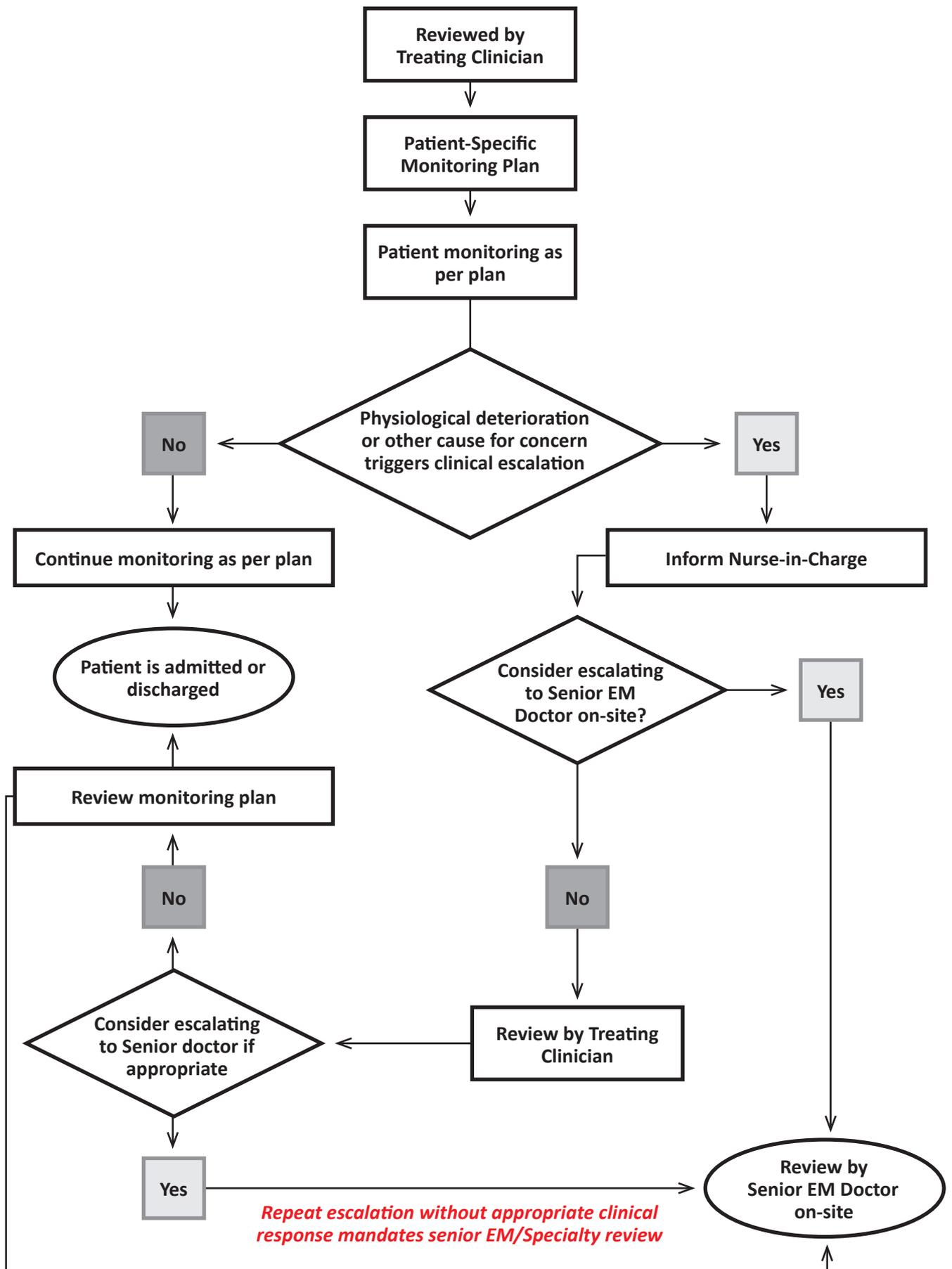


Figure 6: Clinical Escalation following review by a Treating Clinician

2.19 EMEWS implementation and future development

2.19.1 Implementation - Organisational responsibility

In very simple terms any health system has essentially four options available to it in response to patients at risk of deterioration in an ED

- Do nothing
- Adopt a tool developed for a different environment
- Develop an ED specific early warning system
- Resolve the major contributing factor of crowding.

The consensus view taken by clinical experts was that the preferable approach was to develop an ED-specific fit-for-purpose early warning system.

The Chief Executive Officer (CEO)/General Manager (GM), Director of Nursing (DoN) and the Clinical Director (CD) of the hospital have corporate responsibility for the implementation of EMEWS and to ensure that all relevant staff are appropriately supported to implement the guideline. The EMEWS guideline should be reviewed by the multidisciplinary clinical team and senior management in the hospital to implement the recommendations. All clinical staff with responsibility for the care of patients in the ED are expected to:

- Comply with the EMEWS guideline and any related procedures or protocols
- Adhere to their code of conduct and professional scope of practice as appropriate to their role and responsibilities
- Maintain their competency for the management and treatment of patients in the ED.

Implementing change in the healthcare environment can present many challenges. Implementation of EMEWS in EDs in Ireland represents a major change in the practice of ED nursing and medical care. The complexity and challenge of this intervention should not be underestimated. It will affect the care of a significant proportion of the 1.2 million patients who attend Ireland's EDs each year and the daily work of approximately 1,500 nurses and 500 doctors, clerical staff and other support staff in EDs across the country. It is clear that extensive training, on-going refinement and considerable support will be needed to ensure the success of this practice change. It is imperative that all EDs should be adequately resourced to enable the full implementation of all elements of EMEWS but this cannot be done at the expense of other important elements of clinical care. The resource implications of implementing this guideline are set out in Appendix 10. The full budget impact analysis is in Appendix 8.

EMEWS represents guidance developed by experienced ED nurses and doctors based on best-evidence where available and "field-tested" by front-line ED clinical staff. Experience gained during pilot testing of EMEWS in three major EDs identified a number of key enablers and barriers to effective implementation and sustainable practice of the EMEWS. All ED and Hospital Group Management teams will need to manage these and other factors specific to their local environments to enable the best possible use of EMEWS. ED staffing constraints and excessive demands placed on nursing staff resources by ED crowding are major concerns, particularly with regard to the 24/7 provision of Post-triage patient monitoring. These challenges will need to be addressed, for the successful introduction on EMEWS.

The EMP Emergency Department Nursing Workforce Planning Framework (HSE 2016) and the work undertaken by the Taskforce on Staffing and Skill Mix for Nursing Phase II – Emergency Care Settings (Chief Nursing Office, Department of Health) can be utilised by hospital management and EDs to assist in identifying the appropriate level of resources required for the implementation of EMEWS.

The EMEWS Guideline will be circulated and disseminated through the professional networks who participated in developing and reviewing this document. The guideline will also be available on the HSE, NCEC and professional bodies' websites.

2.19.2 Implementation steps

While the CEO/GM, DoN and the CD of the hospital have responsibility for the implementation of EMEWS, a project team consisting of ED staff and senior management should be established to facilitate implementation. This team would set the local timeline for achieving full implementation. It is recommended that hospitals use quality improvement (QI) methodology when implementing EMEWS. Such methods enhance stakeholder engagement and support local adoption through the use of provision testing, measurement and feedback of the key interventions. Recognition must also be given to the complex task of improving patient safety climate (beliefs and attitudes) and culture (actions) that successful implementation of the EMEWS depends upon.

2.19.3 Implementation plan

- Establish a steering group under the governance of the hospital's "Management of the Deteriorating Patient Governance Committee". The steering group needs to have representation from all stakeholders involved with the local implementation of EMEWS.
- Identify the one-off costs and recurring costs at ED level that impact on the implementation of EMEWS and source relevant funding.
- Review pages one and four of the EMEWS chart to identify any local modifications required. Arrange for testing of the modifications if required.
- Arrange with procurement for the printing of the new documentation.
- Identify trainers and champions for the project.
- Develop a training plan. Ideally the training should be undertaken in a multidisciplinary format.
- Plan to "go-live" when a minimum of 75% of each discipline are trained.
- Ensure trainers/champions are available on each shift following "go-live" to troubleshoot issues that arise in practice.
- Set a review date for 1 month after the "go-live".
- Have a comment book available for staff to record challenges faced during implementation. Items raised by staff should be discussed at post-implementation review and a consensus developed to resolve issues.
- Keep staff informed of progress.

2.19.4 Enablers and barriers impacting on the implementation of EMEWS

The successful implementation of EMEWS will be dependent on many factors, of which the key areas are:

- Nurse staffing
- Infrastructure and equipment
- ED flow
- ED Information systems
- Documentation
- ISBAR implementation
- Triage skills
- Post-triage training
- Clinical Escalation
- Audit and improvement
- Interface with other early warning systems.

Implementation of Emergency Medicine Early Warning System		
Issue	Enablers	Barriers
Nurse Staffing	Appropriate staffing levels and skill-mix at all times	Nurse staffing shortages
		Over-reliance on agency staff who may not be trained on EMEWS
Nurse Staffing	Sufficient CNM staffing levels to allow Nurse-in-Charge consultation as required	ED crowding resulting in increased demand for nursing care
		Excessive workload demands on Nurse-in-Charge of ED/zone
Infrastructure and equipment	Appropriate environment and equipment for Post-Triage Monitoring	Lack of mobile equipment for vital signs
		Lack of resources to explain Post-Triage Emergency Nursing Review to patients e.g. waiting room media
		Lack of cubicle access for Post-Triage Emergency Nursing Review
ED flow	Reduced volume of Post-Triage Emergency Nursing Review workload as a result of better ED flow and improved compliance with MTS Triage recommended times to be seen by a clinical decision-maker	Prolonged waiting times for patients to see a clinical decision-maker increases monitoring demand.
		ED medical staffing shortages
		ED crowding placing excessive competing demands on nurse staffing resource
		Ineffective communication with patients on function of Post-Triage Emergency Nursing Review and involvement in Escalation
		Patients are frustrated by repeated monitoring during delays to be seen by a treating clinician
Information systems	ED Information Systems (EDIS)	Lack of EDIS with difficulty identifying which patients need MTS and when Post-Triage Emergency Nursing Review is due.
Documentation	Good documentation of Post-Triage Emergency Nursing Review practice	Insufficient focus on documentation of MTS and Post-Triage Emergency Nursing Review practice
	Robust, ideally electronic, systems to support documentation of escalation events	Lack of EDIS
ISBAR	All staff trained in ISBAR / ISBAR ₃ at induction	Lack of training and re-enforcement of ISBAR / ISBAR ₃ practice
Triage skills	ED nurses trained in MTS	Under-resourcing of training
		Over-reliance on agency staff
Post-Triage Training	ED nursing staff trained in Post-Triage Emergency Nursing Review with regular updates	Nursing staff not released for training
		Lack of training in Post-Triage Emergency Nursing Review including patient communication

Implementation of Emergency Medicine Early Warning System		
Issue	Enablers	Barriers
Clinical Escalation	Multidisciplinary scenario-based training and simulation of clinical escalation practice and communication	Training is not resourced or organised Over reliance on Locum EM Staff
	Learning is shared through ED Safety Huddles and at shift handovers	Clinical escalation is not embedded in the daily work of EDs
Audit and Improvement	Clinical audit of Post-Triage Emergency Nursing Review and Clinical Escalation practice	Under-resourcing of clinical audit in the ED
Interface with other early warning systems	Training and audit support effective alignment of all early warning system used in ED setting	Failure to adapt all tools to optimise alignment and co-usability in the ED setting

2.19.4 Tools to assist implementation of EMEWS

A selection of tools to assist in the implementation of the National Clinical Guideline is available in Appendix 5.

2.19.5 EMEWS training

A dedicated training programme will be required to support implementation and effective use of EMEWS and all ED clinical staff must undertake this training programme and subsequent updates to ensure the appropriate use of EMEWS. Clinical escalation is a key focus of the training programme aimed at nursing and medical staff. Administrative staff will also require in-service training on document management issues. Other clinical staff such as Health and Social Care Professionals (HSCP) will also require training so that they too are enabled to escalate patients if they are concerned regarding the potential for clinical deterioration in the ED setting.

2.19.6 Training programme for EMEWS

Training for the implementation of EMEWS should be delivered through a train-the-trainer model. Each ED needs to identify nurses who have the skills required to be trainers. Emergency Nursing Clinical Facilitators have a key role in providing clinical support to qualified staff and the wider multidisciplinary team during the training and implementation of EMEWS. Each hospital should have one or more members of staff who are trainers for all the tools for the early recognition of the deteriorating patient – EMEWS, NEWS, IMEWS, ICTS and PEWS as these trainers will understand how all the tools relate to each other and help front-line ED staff gain competence in their combined use for ED patient cohorts. Emergency Nursing Clinical Facilitators and Resuscitation Training Officers may be able to fulfil this important role. Following initial implementation EMEWS training should be incorporated into ED orientation for new staff.

An e-learning platform has potential to facilitate access to training; however it should ideally be accompanied by simulated case scenarios. The costings for the development of such an e-learning programme is included in the BIA (Appendix 8).

The HSE has established a national Deteriorating Patient Quality Improvement Programme which is currently reviewing the training modalities for all the Early Warning Systems with the possibility that a common core module will be developed. If this proposal comes to fruition there will be a positive

impact on the training costs incurred with EMEWS implementation. A core e-learning module applicable to the general principles of all Early Warning Systems with a specific module for EMEWS would be the preferred way of delivering such training. Ideally the on-site training should be multidisciplinary to facilitate full discussion, though it is recognised that this may be difficult to achieve. In the future it is anticipated that EMEWS training will be incorporated into Emergency Medicine and Emergency Nursing training programmes.

The standard training module will include:

- Why we need to monitor patients
- Overview of EMEWS
- Overview of the EMEWS chart
- Patient-Specific Monitoring Plans
- Clinical Escalation in the Emergency Department
- Using the Event log
- Communication and using ISBAR
- Audit
- Case scenarios.

The assistance of the Nursing Practice Development Department or Centre for Nursing Education may be required for resource support for the delivery of the training module. EDs will require a minimum of 75% of staff trained in EMEWS prior to going live to ensure that there is sufficient staff trained in the use of EMEWS on each shift.

2.20 Monitoring and evaluation

Following the introduction of EMEWS, updates on any issues arising with the implementation should be included at the ED huddles thus keeping staff informed and facilitating early resolution of any issues.

It is important that both the implementation of the guideline and patient outcomes are audited to ensure that this guideline positively impacts on patient care. See Appendix 6 for suggested audit criteria. Assessments of the effectiveness of the use of EMEWS should be included in the ED's clinical audit programme. Patient safety and quality of care issues identified through audit should be immediately reported in the standard way and addressed. On-going learning achieved through audit of the use of EMEWS should be shared with other EDs, Emergency Care Networks and at national level.

2.20.1 Audit

An audit tool is provided to assist implementation teams assess and improve the effectiveness of their use of the 5 components. Further guidance on the use of the Audit Tool is outlined in Appendix 6. The outcome of such audit should be included in routine governance and quality assurance work within the ED and the hospital. This activity will provide evidence to support the hospital's self-assessment for implementation of the National Standard for Safer Better Healthcare (HIQA, 2012) Standard 2.2.

To ensure that this guideline positively impacts on patient care, it is important that implementation is audited. Audit is recommended to support continuous quality improvement in relation to the implementation of the National Clinical Guideline. EMEWS can be audited as a whole or by each element of the system (see Appendix 6).

Frequency of audits

Following initial roll-out of EMEWS a review at four weeks and twelve weeks is recommended. If compliance issues arise, further charts should be reviewed. When EMEWS has become embedded into clinical practice the frequency of audit can be reduced to a minimum of six-monthly and incorporated into the regular departmental audit programme.

Number of charts to be reviewed

The recommended sample size is one-third of ED patient charts. One approach that could be taken during roll-out would be to review one-third of charts on all shifts, discussing any issues that arose with the staff at the shift change/huddle or with individual members of staff. When EMEWS is established a minimum of one-third of EMEWS charts should be reviewed twice a year. Patient charts from triage categories 2, 3 & 4 should be included in all audits.

Compliance

100% in all aspects of the audit.

Non-compliance

If the non-compliance affects the same aspects of EMEWS or a pattern appears over successive audits, an action plan should be formulated to address the deficits.

Suspending the Post-Triage Emergency Nursing Review process in ED

If the ED is obliged to suspend the Post-Triage Emergency Nursing Review process (e.g. due to staff shortages) a National Incident Reporting Form (NIRF) should be completed. It is the policy of the Health Service Executive that all safety incidents are identified, reported and investigated. Safety Incidents include serious reportable events (SRE). Incidents should be disclosed in accordance with the HSE National Guidelines on Open Disclosure (HSE, 2013). This Policy is in line with the provisions of Part 4 of the Civil Liability (Amendment) Act 2017.

All incidents should be monitored at departmental level and reviewed at the ED Clinical Operational group meetings and action plans formulated when the suspension stems from recurrent themes, i.e. inadequate staffing levels, competing needs of emergency patients and in-patients.

All incidents/near misses should be entered onto the National Incident Management System (NIMS).

2.20.2 Key Performance Indicators

Key performance indicators (KPIs) are evaluative criteria which inform a process and have the potential to identify or flag further issues or questions which require review.

KPI	Goal
The percentage of ED clinical staff trained in the use of EMEWS	Minimum of 75% per discipline
EMEWS is applied to the eligible population	100%
Patients are assigned to the correct post-triage monitoring regime	100%
Where patient deterioration occurs care is escalated to the appropriate level and this is documented	100%
Where care is escalated the response is appropriate and documented	100%

It is recommended that once EMEWS is established, charts are reviewed twice a year applying the KPI criteria. A minimum of 10 charts from each triage category should be reviewed ensuring that the charts identified span the 24 hours of the day and 7 days of the week. Some of the KPIs can also be used for individual case reviews.

2.21 Sources of learning to support the further development and improvement of EMEWS

Key sources of learning to support the further development and improvement of clinical escalation practice in the ED will include:

- Local implementation and on-going learning experiences shared through Emergency Care Networks and the EMP.
- Local and network-level audit of use of EMEWS.
- Safety and risk management data monitored within hospitals and national safety data sources including the HSE and the State Claims Agency.
- Refining of key performance indicators relating to the EMEWS.
- Research on the use of the EMEWS in EDs in Ireland.
- National and international research on physiological monitoring and clinical escalation in the emergency care setting.
- Use of HIQA's (2014) guideline for Evaluating the Clinical Effectiveness of Health Technology in Ireland, when assessing the use of wireless disposable wearable technology for the electronic recording of physiological parameters.

2.22 Sources of funding

The systematic review *Clinical effectiveness and cost-effectiveness of physiologically based early warning or track and trigger or scoring systems after triage in adult patients presenting to Emergency Departments: A systematic review* was commissioned by the Clinical Effectiveness Unit (CEU) in the Department of Health. Prof Declan Devane, of National University of Ireland, Galway and his team carried out the independent systematic review. This was the only part of the process for which funding was specifically provided. The CEU as commissioner and funder did not influence the result of the systematic review or the recommendations of this guideline.

2.23 Stakeholder consultation

The GDG endeavoured to ensure that all stakeholders had an opportunity to contribute to the development of EMEWS. The GDG would like to acknowledge the significant contribution made by the various stakeholders from professional, academic and patient groups (see Appendix 4).

2.24 External review

In January 2017, the draft of this National Clinical Guideline was circulated for review to the EMEWS Clinical Advisory Group, the ONMSD in the HSE, and other national stakeholders, with a defined period to provide feedback. Sepsis considerations were developed in collaboration with Dr. Vida Hamilton, HSE National Sepsis Lead. In addition, the draft National Clinical Guideline was externally peer reviewed by three international experts in emergency care. Prof Julie Considine, Prof Peter Cameron and Dr Taj Hassan were identified based on their clinical practice and contribution to the academic literature, as well as their involvement with the Australasian College of Emergency Medicine and Royal College of Emergency Medicine.

Prof Julie Considine	Professor of Nursing, Deakin University, Australia. Founding Fellow, College of Emergency Nursing, Australasia and representative on Australian Resuscitation Council. Member of the International Liaison Committee on Resuscitation Basic Life Support Taskforce.
Prof Peter Cameron	Academic Director of the Emergency and Trauma Centre, The Alfred Hospital, Australia. Former President, International Federation of Emergency Medicine.
Dr Taj Hassan	Consultant in Emergency Medicine, Leeds, UK and President, Royal College of Emergency Medicine, UK.

The GDG is very grateful to these reviewers and appreciates the time commitment and expertise that was involved in their review. The external reviewers were requested to consider the guideline in accordance with the questions outlined in the NCEC/HIQA Quality Assurance Criteria for Clinical Guidelines (Version 2) (2015). The questions and the external reviewers consensus response to the questions are available in Appendix 4. Overall, the external reviewers concluded that this National Clinical Guideline represented a genuine attempt to address a significant issue faced by Irish EDs. Although eliminating the cause of the delays experienced by ED patients would be the optimal solution and would allow all patients be seen and treated by a clinician on arrival to the ED, this was unlikely to occur in the short to medium term. The consensus was that it was preferable to use a fit-for-purpose ED-specific tool rather than use an alternative tool intended for a very different environment.

The external reviewers commented specifically on:

- the high quality of the guideline
- the fact that this area is an evolving one in emergency care
- the commendable effort being taken to address a problem that extends beyond Ireland
- the emphasis on staff, patient and family concern
- having a simple trigger which alerts and empowers the junior nurse to call for help when faced with a potentially critically ill patient; something that has been shown to be useful in a number of studies.
- In keeping with those in Ireland who reviewed and commented on the draft document, the external reviewers also strongly suggested that there needed to be greater efforts to address the underlying causes of ED crowding.

2.25 Procedure to update this National Clinical Guideline

The GDG agreed that this National Clinical Guideline will be reviewed on a 3-yearly basis and updated as appropriate. Therefore, this National Clinical Guideline will be reviewed again in 2021. If the same GDG is unavailable, persons with the equivalent expertise will be recruited to participate in the review process. An updated systematic literature search will be undertaken at this time and the National Clinical Guideline amended, as appropriate, to incorporate any relevant new evidence and feedback from national and international experts on the current guideline. Findings from audits performed by hospital groups will also be reviewed. Following this, it will be submitted to the NCEC for review.

2.26 Methodology and literature review

The published abstract of the *Clinical effectiveness and cost-effectiveness of physiologically based early warning or track and trigger or scoring systems after triage in adult patients presenting to Emergency Departments: A systematic review* is available in Appendix 7. The full systematic review is available in Annex 1. Summary tables are in Appendix 9.

2.26.1 Development and grading of recommendations

In Section 3, evidence for each of the 19 recommendations is outlined. For recommendations 1-19 the GDG formulated a series of clinical questions to organise the evidence from the literature review and to structure this National Clinical Guideline.

The evidence considered for each recommendation comprised the available published evidence from the systematic literature review, experiential evidence from the EMEWS pilot and expert consensus from the GDG and consultation processes. The quality of all the available evidence was then assessed by the GDG according to the GRADE criteria described in the table below.

Quality of evidence	Description
High quality	Further research is very unlikely to change our confidence in the estimate of effect <ul style="list-style-type: none"> • Several high-quality studies with consistent results • In special cases: one large, high-quality multi-centre trial
Moderate quality	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate <ul style="list-style-type: none"> • One high-quality study • Several studies with some limitations
Low quality	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate <ul style="list-style-type: none"> • One or more studies with severe limitations
Very low quality	Any estimate of effect is very uncertain <ul style="list-style-type: none"> • Expert opinion • No direct research evidence • One or more studies with very severe limitations

The strength of each recommendation was decided following a process of considered judgement by the GDG that took into account the potential benefits and harms of implementation, the available evidence as described above, the values and preferences of the target audience including clinicians, the patient and family and finally the cost implications of implementation as described below.

Other factors that were taken into account when forming the recommendations included relevance to the Irish healthcare setting, applicability of published evidence to the target population, consistency of the body of evidence and the balance of benefits and harms of the options.

- A **strong** recommendation reflects the GDG's consensus that based on the available evidence, the expected benefits outweigh any potential harm, the values and preferences of patients and professionals are represented and cost implications are justified.
- A **conditional** recommendation reflects the GDG's consensus that although the evidence base is limited in some aspects, the GDG remains confident of the likelihood of benefits outweighing harm.

Practice points that denote recommended best practice based on the clinical expertise of the GDG are also included. In addition, the GDG has offered practical guidance where it is felt that this may aid implementation. The implementation of recommendations 1-19 is supported by a dedicated EMEWS education programme (Section 2.19.5). All recommendations are of equal importance and should be implemented without preference or bias.

The recommendations are presented under the following themes:

1. Overarching recommendations
2. Measurement and documentation of vital signs
3. Escalation of care and clinical communication
4. Adult sepsis
5. Governance
6. Education
7. Supporting practices
8. Evaluation and audit
9. Electronic monitoring technology

Responsibility for Implementation of Recommendations

The Chief Executive Officer (CEO) /General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN) of each hospital (and/or hospital group) are accountable for the operation of EMEWS for adult patients. While the Senior Management Team of each hospital has corporate responsibility for the implementation of the recommendations within this National Clinical Guideline, each member of the multidisciplinary team is responsible for the implementation of individual guideline recommendations relevant to their role.

2.27 Conflict of interest declarations

A conflict of interest form was signed by all GDG members and reviewers, including those on the Working and Advisory Groups. Members of the GDG declared no conflicts of interest. The GDG was managed by the Co-chairs to promote the highest professional standard in the development of this guideline.

2.28 Copyright and permissions

No copyrights or permissions were required to assist in the development of the EMEWS guideline.

3 National Clinical Guideline recommendations

3.1 Key questions and evidence statements

The following table demonstrates how the clinical questions identified by the GDG relate to the PICOs used for the systematic review.

Clinical Question No	PICO
1. In what circumstances should EMEWS be activated? 2. Should EMEWS be used for all adults in ED settings for the early identification of, and response to, clinical deterioration? 4. What physiological parameters should be included in an assessment to generate a valid EMEWS assessment? How and when should these vital signs be performed?	a. To describe the use internationally, including the level of use and the variety of systems in use, of physiologically based early warning systems or track and trigger system (TTS) or scoring systems for the detection of deterioration in adult patients presenting to the ED.
3. If an adult does not trigger escalation but a clinician is concerned about the patient’s clinical status, does EMEWS replace clinical judgement?	b. To evaluate the clinical effectiveness of physiologically based early warning systems or TTS or scoring systems in adult patients presenting to the ED.
7. What are the appropriate amendments (variances) that can be made to a patient’s EMEWS parameters or escalation response? 8. What additional investigations should be performed for adults with suspected sepsis?	c. To describe the development and validation of such systems.
6. What mechanism and communication tool should be used for the escalation of clinical care?	d. To evaluate the cost effectiveness, cost impact and resources involved in physiologically based early warning systems or TTS or scoring systems for the detection of deterioration in adult patients presenting.
5. Should staff/family concern be included as a core parameter in the EMEWS tool for the identification of clinical deterioration of adults in ED settings?	e. To describe the education programmes, including the evaluation of such programmes that have been established to train healthcare professionals, and other non-professional staff, in the delivery of such systems.

1: Overarching Recommendations

Clinical question 1

In what circumstances should EMEWS be activated?

PICO a

To describe the use internationally, including the level of use and the variety of systems in use, of physiologically based early warning systems or track and trigger systems (TTS) or scoring systems for the detection of deterioration in adult patients presenting to the ED.

Summary of evidence

Over the past decade, the acute hospital system has experienced an on-going access block that has primarily manifested as crowding in EDs. The resulting limitation of access to clinical assessment areas for new ED patients leads to post-triage delays for definitive treatment for these patients. This increases clinical risk for patients and the potential for deterioration in a patient's condition to go unnoticed. There is an increasing body of evidence emphasising the many diverse negative impacts of ED crowding and boarding, including: an increase in the hospital length of stay and hospital mortality (Singer et al, 2011; Sun et al, 2013) a large proportion of orders either completed late or not completed in the boarder cohort (Coil et al, 2016) and decreased ED satisfaction ratings and lower satisfaction rates with entire hospitalisation (Pines et al, 2008). Evidence from the systematic review undertaken as part of guideline development suggests that crowding in EDs increased the length of time in the ED but decreased the rate of monitoring.

Evidence statement

Data from the HSE's Business Intelligence Unit, Special Delivery Unit and the Irish Nurses and Midwives Organisation show an on-going problem of crowding in most EDs in Ireland. A pragmatic approach is required to the selection of an appropriate track and trigger system based on age and phase of the patient's journey in the healthcare system as there is currently no evidence to contradict this approach.

Recommendation 1

EMEWS is recommended for use in EDs when patients are waiting longer for review by a Treating Clinician than is recommended based on their Manchester Triage System (MTS) Category. Based on international experience, if patient flow into and through the hospital were more optimal, there would be little need to introduce a schedule of on-going monitoring. It is the responsibility of the Hospital Chief Executive Officer (CEO)/General Manager (GM) to optimise patient flow and to ensure timely and appropriate action is taken to eliminate/minimise ED crowding.

Quality of evidence: **High**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

Practice points

- When the time to clinician review for MTS category 2-4 is exceeded, EMEWS should be implemented.
- Proactive use of escalation protocols to eliminate/minimise crowding.
- Use of hospital data to identify patterns in patient flow that can be used to pre-empt periods of crowding.

Recommendation 2

Patients should be assigned to the track and trigger system appropriate to their age, condition and stage of their journey through the health care system.

Quality of evidence: **Expert Opinion**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice point

The correct chart for the patient should be identified

- EMEWS chart for adult ED patients (16 years and over) in the period between triage and discharge or the decision to admit.
- IMEWS chart in women with a confirmed pregnancy and for up to 42 days post-natal.
- NEWS chart in non-pregnant admitted adult patients.
- PEWS chart in paediatric in-patients.

2: Measurement and Documentation of Vital Signs

Clinical question 2

Should EMEWS be used for all adults in ED settings for the early identification of, and response to, clinical deterioration?

PICO a

To describe the use internationally, including the level of use and the variety of systems in use, of physiologically based early warning systems or track and trigger systems (TTS) or scoring systems for the detection of deterioration in adult patients presenting to the ED.

Summary of evidence

EDs in Ireland use the Manchester Triage System to prioritise adult (≥ 16 years) patients for treatment. Currently there is no TTS or Early Warning System that is linked to the patient's priority categorisation although internationally there appear to be some tools in development for use in ED settings. Many of the tools currently used in EDs were designed for use in an in-patient setting.

Ten descriptive studies were included of which five examined the extent of using early warning systems (Challen and Goodacre, 2011; Considine et al, 2012; Griffiths and Kidney, 2012; Wilson et al, 2013; Correia et al, 2014) and four examined compliance with such systems (Christensen et al, 2011; Austen et al, 2012; Johnson et al, 2014; Hudson et al, 2015). One report was a conference abstract in which an early warning system was described but limited data was available (Coughlan et al, 2015).

Extent of use

Six reports published in the last six years described the use of early warning systems (Challen and Goodacre, 2011; Considine et al, 2012; Griffiths and Kidney, 2012; Wilson et al, 2013; Correia et al, 2014; Coughlan et al, 2015). Challen and Goodacre (2011) reported the results of a scoping review, which identified 119 tools related to outcome prediction in the ED; however the majority were condition-specific tools ($n=94$) rather than a generic tool that could be applied to all undifferentiated, undiagnosed patients of varying acuity following triage. They found the APACHE II score to have the highest reported area under the receiver operating characteristic (AUROC) curve (0.984) in patients with peritonitis. The remaining five reports involved data collection from medical records (Considine et al, 2012; Correia et al, 2014), a survey (Griffiths and Kidney, 2012), a prospective observational cohort study (Wilson et al, 2013) and participatory action research (Coughlan et al, 2015). One report was a conference abstract in which the authors refer to a new monitoring system to identify the need for escalation of care but the system was not described fully in the abstract (Coughlan et al, 2015). Considine et al, (2012) described a pilot study in a hospital in Australia examining the use of an early warning system that consisted of criteria related to a patient's airway, circulation, disability and any sudden deterioration. The escalation protocol used consisted of a review of the patient by an emergency physician within five minutes if any of the criteria were met, followed by additional interventions, if appropriate. The systematic review identified no other studies reporting any aspects of escalation protocols. Wilson et al, (2013) included the parameters heart rate, blood pressure, respiratory rate, peripheral oxygen saturation, temperature and the GCS in their TTS chart and compared TTS scores recorded in the charts with scores calculated retrospectively. They found that 20.6% ($n=211$) were incorrect, mainly because of incorrect assignment of the score to an individual vital sign leading to underscoring of the total TTS and reduced escalation activation. Correia et al, (2014) did not provide details on the content of the early warning system they used in a small study ($n=69$) in Portugal but found a threshold score ≥ 3 would have increased early medical attention by 40% compared to clinical judgement alone. A survey of 145 clinical leads of EDs in the UK carried out in 2012 (57% response rate) showed that 71% used an early warning system, with the Modified Early Warning Score (MEWS) being the most commonly used system (80%).

In conclusion, multiple different early warning systems are available and seem to be used widely, but appropriate escalation activation depends on accuracy of calculating/recording and limited data is available on their use in other countries.

Compliance

Three retrospective studies (Christensen et al, 2011; Austen et al, 2012; Johnson et al, 2014) and one audit (Hudson et al, 2015) conducted respectively in the UK, Denmark, the USA and New Zealand in the past five years examined compliance with recording early warning system parameters and escalation of care. The parameters included in the early warning system were respiratory rate (RR), heart rate (HR), systolic blood pressure (SBP), temperature and level of consciousness (LOC) for one study (Christensen et al, 2011) but Hudson et al, (2015) also included urinary output, pain score and the presence of recurrent/prolonged seizures or uncontrollable/new pain in addition to the vital sign parameters and Austen et al, (2012) also included urine output and oxygen saturations. Christensen et al, (2011) reported a rate of 7% (22/300) of calculated scores in the clinical notes; however, only 16% of records included all five vital signs and although HR, SBP and LOC were reported in 90-95%, compliance with escalation of care varied. All nine trauma call activation criteria had triggered a trauma call but only 24 of the 48 emergency call activation criteria prompted an emergency call. Austen et al, (2012) found a much higher compliance rate with 66% of records containing an aggregate score although only 72.6% of these were accurate.

Johnson et al, (2014) examined the factors that impact on vital sign monitoring. The patient's triage category was the strongest predictor of frequency of vital sign monitoring ($p=0.037$) but crowding level ($p=0.021$) and the length of time a patient remained in the ED ($p=0.008$) were both associated with increased time between vital signs observations.

In summary, only four studies examined compliance and the factors affecting monitoring vital signs in an ED setting. Compliance with recording and responding to early warning systems seems relatively low although this varied greatly in different studies. The rate of vital sign monitoring for some individual vital signs is high with the frequency of HR and BP monitoring being particularly high but poor for many others.

Evidence statement

The systematic literature review (Wuytack et al, 2016) details evidence that physiologically-based early warning or track and trigger or scoring systems after triage in adult (≥ 16 years) patients presenting to EDs have shown positive trends in improving clinical outcomes, e.g. reduced admission rate to intensive care units. Consequently, while many TTS and Early Warning Systems have been developed and implemented locally, uncertainty remains as to which system is most effective for the detection and/or timely identification and response to deterioration in adult patients (≥ 16 years) in ED settings. This uncertainty is largely as a consequence of the lack of "level one" evidence and mixed outcomes from other evidence.

Recommendation 3

Monitoring using EMEWS should be considered for all adult patients (≥ 16 years) in any Emergency Department (ED) setting following prioritisation using the Manchester Triage System.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 4

To reduce risk in the ED environment the internationally recognised “heat” colour scheme should be used on the vital sign chart to denote parameter ranges.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Practice points

- Use of the “heat” colour scheme is consistent with other prioritisation systems used in EDs such as the Manchester Triage System (MTS), Irish Children’s Triage System (ICTS) and the Post-Triage Mental Health Tool.
- EMEWS is **not** intended for use in children (< 16 years) or on in-patients.
- It is recommended that EMEWS should be used until the patient is either discharged from the ED or a decision is made that they require admission. Adults progress to the NEWS for monitoring and clinical escalation following the decision to admit.
- The Irish Maternity Early Warning System (IMEWS) is used for women with a confirmed pregnancy and up to 42 days post-partum chart. However for women who require neurological observations the GCS component of the EMEWS chart is used as IMEWS does not have GCS.
- To assist with trending of vital signs the first and last set of pre-hospital vital signs should be transferred on the EMEWS chart.
- If a second EMEWS chart is required the last set on the previous chart should be transferred to the new chart and denoted accordingly.
- The national EMEWS chart replaces existing vital sign charts in ED settings.
- All patients should have a Pain Score recorded at triage – if the level of pain experienced by the patient requires opioid analgesia they should be commenced on EMEWS.

Clinical question 3

If an adult does not trigger escalation but a clinician is concerned about the patient’s clinical status, does EMEWS replace clinical judgement?

PICO b

To evaluate the clinical effectiveness of physiologically based early warning systems or track and trigger systems (TTS) or scoring systems in adult patients presenting to the ED.

Summary of evidence

There is little evidence relating to clinician judgement as a trigger for escalation. However in the escalation guide associated with EMEWS, clinical judgement has equal standing with an abnormal physiological parameter. Expression of concern is a representation of situational awareness. In their qualitative work, Brady and Goldenhar (2013) discussed situational awareness as supplementing early warning systems, most notably acknowledging the tacit knowledge of experienced clinicians in recognising deterioration and the need for critical care through a process of better assessment skills, critical thinking and clinical judgement.

Evidence statement

Recognition of “clinical concern” is universally regarded as important. EMEWS is a safety net designed to detect deterioration in vital signs but should not prevent action or falsely reassure any clinician. Some patients may present with a condition that is concerning, though they are not displaying abnormal physiological parameters. It is imperative that all clinicians understand that they should escalate to a

senior/more experienced colleague or higher level of care if there is any concern regarding a patient's condition. EMEWS is intended to complement the practices of experienced clinicians, not to undermine their expertise. It is also intended to assist a less experienced clinician practice safely and refer to a senior colleague in the event of any concern.

Recommendation 5

EMEWS should complement care not replace clinical judgement. Any concern about an individual adult patient warrants escalation, irrespective of the presence or absence of a trigger. The level of escalation should reflect the degree of clinical concern.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Clinical question 4

What physiological parameters should be included in an assessment to generate a valid EMEWS assessment? How and when should these vital signs be performed?

PICO a

To describe the use internationally, including the level of use and the variety of systems in use, of physiologically based early warning systems or track and trigger systems (TTS) or scoring systems for the detection of deterioration in adult patients presenting to the ED.

Summary of evidence relating to physiological parameters

The systematic literature review (Wuytack et al, 2016) identified a wide selection of physiological parameters that were being measured. The Challen and Goodacre (2011) study aimed to carry out a scoping review of the literature relating to outcome prediction in adult non-trauma patients in order to identify the number and range of risk scores developed for acutely ill adults and to identify the outcomes these scores predict. The study identified 17 broad conditions with 80 different inclusion criteria. The most consistently recommended were respiratory rate, oxygen saturation, fraction of inspired oxygen, heart rate, systolic blood pressure and temperature as the core physiological parameters as identified in both the Department of Health (UK) (2009) *Competencies for Recognising and Responding to Acutely Ill patients in Hospital* and the Department of Health (2013) *National Early Warning Score (NCEC National Clinical Guideline No. 1)*.

Johnson et al, (2014) examined the factors that impact on vital sign monitoring. The patient's triage category was the strongest predictor of frequency of vital sign monitoring ($p=0.037$), but ED crowding ($p=0.021$) and the length of time a patient remained within the ED ($p=0.008$) were both associated with increased time between vital signs observations.

Evidence statement relating to physiological parameters

There is a paucity of evidence relating to the appropriate level/frequency of monitoring for the undiagnosed, undifferentiated adult (≥ 16 years) patient of varying acuity who presents to the ED. The pragmatic approach therefore was to use the time to clinician recommended by the Manchester Triage System for each prioritisation category with the option to de-escalate if the patient was deemed "stable" following the recording of two sets of vital signs in the ED. The core physiological parameters recommended in EMEWS reflect those identified in the majority of studies in the systematic review.

Recommendation 6

The core EMEWS physiological parameters must be recorded as a baseline at triage. These are: Respiratory Rate (RR), Oxygen Saturation (SpO₂), Fraction of inspired Oxygen (FiO₂), Heart Rate (HR), Systolic Blood Pressure (SBP), Temperature (T) and Level of Consciousness (ACVPU: **A**lert/**C**onfused/**R**espond to **V**oice/**R**espond to **P**ain/**U**nresponsive). The subsequent frequency of observations is initially determined by their triage category and presenting complaint until a Patient-Specific Monitoring Plan is in place.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Practice points

- The core physiological parameter observations should be completed and recorded
- EMEWS is a single trigger system, therefore no score needs to be calculated
- Recording of a GCS should be considered even if they score “A” on ACVPU
- Where the patient has either a history of or a currently altered neurological status, ACVPU should be replaced by GCS
- All entries should be dated, signed (including MCRN/NMBI PIN) and timed
- All patients whose pain score at triage is ≥ 5 should have their score repeated
- Patients who present with “collapse”, altered level of consciousness, abscesses/local infection should have a baseline bedside blood glucose test.

Summary of evidence for standardisation of vital sign recording and monitoring practices in adults

It is important that measures are taken to improve recognition and management of serious illness across the health service. The Department of Health in the UK (2009) published competencies for the recognition and response to the deteriorating patient, which stated:

“Staff caring for patients in any acute hospital setting should have competences in monitoring, measurement and interpretation of vital signs, equipping them with the knowledge to recognise deteriorating health and respond effectively to acutely ill patients, appropriate to the level of care they are providing.”

Standardisation of equipment and practices will maintain or improve patient safety by providing consistency in the quality of physiological findings and interpretation. The Australian Commission on Safety and Quality in Healthcare has published a National Consensus Statement (ACSQH, 2010) which outlines key tasks that all doctors and nurses should be able to perform. These include, among other things, being able to systematically assess a patient and understand and interpret abnormal physiological parameters and other abnormal observations.

EMEWS has a single trigger system rather than the aggregate score to reflect the often subtle change in a single parameter that would not generate a trigger with an aggregate scoring system. Furthermore, there is some evidence of inaccurate calculation of aggregate scores typically underscoring, which has led to patients not having their care escalated appropriately (Austen et al, 2012; Wilson et al, 2013).

Evidence statement for standardisation of vital sign recording and monitoring practices in adults

Monitoring and clinical escalation is at the core of ED practice, the aim of the national guideline is to formalise and standardise the recording, monitoring and escalation of vital signs in emergency nursing and medical care in Ireland. The guideline has been developed to reflect the unique characteristics of ED practice – particularly the initial assessment and treatment of patients with undifferentiated, undiagnosed conditions of variable acuity; the relatively high potential for physiological instability

among this patient cohort and the need for critical-care type interventions in a significant number of ED patients. Great care has been taken to develop a guideline that is as safe as possible and yet applicable, as required, to the broad range of ED presentations. However, other international early warning systems have developed standard operating procedures for assessing and recording observations. IMEWS clearly sets out standard practices for physiological assessment of women with a confirmed pregnancy and up to 42 days post-partum.

In their systematic review of 124 papers related to patient vital sign monitoring, Lockwood et al, (2004) noted limited evidence for the optimal frequency of vital sign measurement. Indeed in some situations, visual observation rather than vital sign measurement may be more appropriate but no studies have evaluated the role and effectiveness of visual observation to monitor the patient as an alternative to traditional vital signs. In a descriptive paper, Schulman and Shaul (2010) contend that the frequency of measuring vital signs should be based on each patient's individual need rather than on specific time intervals. They further recommend that hospitals develop local standards which set minimum frequency standards for vital sign measurement that meet the needs of the majority of patients in the clinical area while also allowing opportunities for deviation based on the clinician's judgement and/or individualisation based on a particular patient's situation.

Recommendation 7

The technique of recording, measuring and monitoring of vital signs should be undertaken in line with recognised, evidence-based practice.

Quality of evidence: **High**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice points

- The measurement and frequency of the recording of vital signs is initiated by the patient's presenting complaint. The frequency of the recordings will depend on the patient's individual clinical circumstances. Patients presenting to the ED are, by definition, undiagnosed and undifferentiated with varying acuity, therefore it is recommended that vital signs are recorded at a minimum of 4 hourly intervals, while under the care of the Consultant in Emergency Medicine, though the majority of patients will require more frequent monitoring.
- Staff should be trained in the correct technique for recording vital signs.

Clinical question 5

Should staff/family concern be included as a core parameter in the EMEWS tool for the identification of clinical deterioration of adults in ED settings?

PICO e

To describe the education programmes, including the evaluation of such programmes that have been established to train healthcare professionals, and other non-professional staff, in the delivery of such systems.

Summary of evidence for concern as a core parameter

There is little evidence relating to staff/family concern as a trigger in the adult patient cohort, though it is included in many of the TTS and early warning systems as a factor to be considered. “Worried?” was a critical instability criterion included in the tool evaluated by Considine et al (2012). Although the published study does not actually report the number of activations that were triggered by the “Worried?” criteria, personal communication with the author has confirmed that there were six activations related to the “Worried” criteria, four of whom had physiological derangement. The other two patients seemed to have no physiological triggers. None of the six went to ICU or died.

Evidence statement for concern as a core parameter

Though it is noted that the evidence is not conclusive in demonstrating the effectiveness of family activated response systems, there is evidence to support the value of family or clinician concern as a diagnostic aid and a reasonable prompt for action. In their study relating to general wards in acute hospitals Douw et al, (2015) concluded that “nurses’ worry or concern suggests potential for improving care in the early stages of deterioration”, as it is present before changes in vital signs. This reflects the findings of the aforementioned study by Considine et al (2012).

Recommendation 8a

Staff concern is an important indicator of the level of illness/clinical status of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.

Quality of evidence: **Moderate**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Recommendation 8b

Family concern is an important indicator of the level of illness of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.

Quality of evidence: **Moderate**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice points

- EMEWS should never undermine the intuition of the patient's family or clinician. Open communication and active engagement in the care partnership with the patient and family from arrival will facilitate participation in EMEWS and enable and encourage expression of clinical concern.
- Communication between all multidisciplinary team members is essential for the effective interpretation of clinical concern.
- Clinicians should use their clinical judgement when determining the level of response required to the concern expressed and act accordingly.

Practical guidance for implementation

- Family concern may not be explicit; clinicians are encouraged to engage with the patient and their family regarding EMEWS with the aim of enhancing the value of the concern parameter. Open ended questioning techniques may elicit responses from the family member that indicate the presence and degree of concern for the patient.

3: Escalation of Care and Clinical Communication

Clinical question 6

What mechanism and communication tool should be used for the escalation of clinical care?

PICO d

To evaluate the cost effectiveness, cost impact and resources involved in physiologically based early warning systems or track and trigger systems (TTS) or scoring systems for the detection of deterioration in adult patients presenting to the ED.

Summary of evidence escalation of care

Providing a timely and effective clinical response to a patient's physiological condition or deterioration is at the core of EM practice. Clinical escalation describes a process whereby a change in a patient's physiological status, or a clinical concern that need not be specified, prompts a team response such that a clinician with appropriate competencies and diagnostic skills attends the patient in an appropriate time-frame (usually immediately in the ED setting) and manages the physiological problem or clinical cause for concern. Clinical escalation is at the core of early warning or TTS systems – monitoring is undertaken so that physiological deterioration is detected early. The systematic review identified a number of studies which documented the benefit of having well-structured clinical escalation plans. ED patients may present with abnormal vital signs and/or may deteriorate at any stage during their ED episode of care. All ED staff need to be vigilant for patient deterioration given the time-critical and highly complex nature of emergency care. Whereas in the ward setting cumulative scoring using NEWS has been validated as a means to set triggers for escalation, cumulative scores have not been validated on ED populations and there is a concern among ED clinicians that cumulative scoring may result in too high a threshold for ED escalation. ED work practices and culture differs from ward-based care and ED nursing and medical teams are used to working closely together on a 24/7 basis with working relationships that are less hierarchical than may occur on wards.

Evidence statement for escalation of care

Clinical escalation and resuscitative care

It has been stated in the National Emergency Medicine Programme Report (HSE, 2012) that the ED team will provide immediate resuscitative care for all patients who require it within the ED. This applies to patients under the care of Consultants in EM, those under the care of other specialists, patients in the process of referral and patients transferred from other hospitals who may be waiting for specialty review in the ED. The EM team will commence resuscitation for patients under the care of other Consultants but the team responsible for the patient's care will be contacted as soon as feasible and will be expected to contribute to the patient's immediate care.

Clinical escalation testing feedback

Two algorithms were developed to direct clinical escalation in the ED setting, based on feedback gathered during the pilot testing of the EMEWS. The first (Figure 3) deals with clinical escalation from patient triage to when they are assessed by a Treating Clinician and the second (Figure 6) from the time of Treating Clinician assessment to the time they leave the ED for admission or discharge. Post-triage monitoring and Patient-Specific Monitoring Plans enable clinical escalation to be available to ED patients throughout their ED pathway of care. The ready availability of the Nurse-in-Charge and a Senior EM doctor is crucial to effective clinical escalation in the ED.

Feedback during testing centred on concerns that the escalation guidance for EMEWS would result in an unmanageable number of notifications to the ED Nurse-in-Charge and that this role could become overwhelmed in a busy ED. It is important that the escalation process does not needlessly complicate a

situation where senior clinician assistance is immediately available. The need for dedicated training for ED doctors in clinical escalation was identified through the pilot tests. Communication with doctors on different shifts and with locum medical staff was also identified as a key issue for implementation.

Anticipated impact on current practice

Implementation of the EMEWS represents an unprecedented systematic approach to patient care in the ED. It will formalise practice with regard to escalation that was previously based on local guidance and custom. The standardisation of clinical escalation will assist in improving the quality of patient care in the ED. Staff moving from one ED to another will require minimal induction with regard to escalation as the EMEWS algorithms will be followed nationally. As with all changes on this scale, further refinement of clinical escalation may well be needed following extended experience in using the system.

Future development of clinical escalation

Further research is needed to inform practice and further develop learning in this area, especially in relation to appropriate trigger points and escalation pathways. Support from ICT and patient information systems needs to be investigated to identify health technology tools to assist the clinician in using EMEWS.

Recommendation 9

The EMEWS escalation protocol identifies the clinical escalation steps that should to be taken in the event of any parameter/s being triggered.

Quality of evidence: **High**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice points

- If, at any time, there is clinical concern, a higher level of alert and response may be activated regardless of the EMEWS.
- The Clinical Escalation algorithms describe clear pathways for the notification of patient deterioration to the Nurse-in-Charge and Senior EM doctor on site in the ED.
- The algorithms support escalation on the basis of clinical concern, without physiological abnormality.
- Clinical escalation is provided in an equitable manner to all ED patients.
- The algorithms will empower nurses and other clinicians of any grade and experience to escalate their concerns about a patient to the Nurse-in-Charge and through them to the Senior Doctor in the ED.
- The algorithms provide a standardised approach to clinical escalation that will be implementable in all EDs, thus reducing unnecessary variation in clinical practice across the country.
- The Clinical Escalation guidance, as outlined in the algorithms, requires that repeat review without an escalating level of care mandates senior review. This avoids the risk of repeat review by a relatively inexperienced doctor who may fail to recognise the severity of the patient's condition or institute appropriate therapy and clinical management.

Practical guidance for implementation

- An urgent response pathway should be agreed under the guidance of the local EMEWS governance committee, taking into account availability and suitability of local resources. Team members should be appropriately trained and maintain their competency in the management of the acutely ill patient.

Requirements for implementation

- Training of all ED clinical staff, particularly medical staff
- Appropriate Senior Nursing and Medical staff in ED to respond to clinical escalation in a timely manner
- Resources to support further testing, refinement and development
- Development of a learning community with regard to patient monitoring and clinical escalation so that learning is shared during the implementation phase
- On-going ownership of the change in practice by ED nurses, Health Care Assistants (HCAs) and medical staff
- A communication programme to engage doctors from other specialties who assess patients in the ED setting
- Information for hospital and HSE risk managers regarding the new EMEWS
- Understanding within the ED and broader health system that this is a work in progress and that further adaptation and refinement of the approach will be required
- An open-minded approach to the further development of the Clinical Escalation guidance and possible adaptation of new research, service developments and ideas from international emergency care practice
- Further research into appropriate escalation parameters, the impact on staff of EMEWS and, most importantly, patient outcomes
- Monitoring of the number and impact of clinical escalations on ED activity and resources.

Communication

The use of structured communication tools has been shown to improve communication during handover and in stressful situations. ISBAR is the structured communication tool recommended by the NCEC NCG No. 5 Communication (Clinical Handover) in Maternity Services, NCEC NCG No. 11 Communication (Clinical Handover) in Acute and Children's Services as the standardised structure for communication between care providers.

ISBAR has been shown to be of benefit when used for inter-hospital transfers with staff reporting increased confidence in giving and receiving clinical handover and audits of medical charts indicating that the quality of information improved.

ISBAR should be used by ED nurses and doctors when discussing clinical escalation of a patient in response to physiological monitoring. It is also recommended for use when referring and handing-over patients for admission. ISBAR can also be used by EM doctors when discussing Patient-Specific Monitoring Plans with nursing colleagues.

ISBAR Communication Tool Testing Feedback

The use of ISBAR as a communication tool was positively evaluated by the pilot sites for communication within the ED and with the wider hospital. There was variation in EM doctor uptake of the ISBAR tool and it is anticipated that focussed training for doctors will be required to support adoption of the tool.

Recommendation 10

The ISBAR and ISBAR₃ communication tools should be used when communicating clinical concern.

Quality of evidence: **High**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice point

- The use of a universal tool ensures that all clinicians are speaking the same language, thus reducing the risk of misunderstanding and misinterpretation with associated risk to patients.

Practical guidance for implementation

- Training on how to use the ISBAR and ISBAR₃ tool will be included in the training for the EMEWS that all clinical staff will undertake.
- Consultant ownership of the ISBAR initiative will be necessary to support implementation and sustainability of the use of ISBAR.

Patient-Specific Monitoring Plan overview

The Patient-Specific Monitoring Plan is an individualised plan developed for the patient following review by a Treating Clinician. The Plan will be developed in consultation with the nurse assigned to the patient's essential nursing care. It will describe what vital signs should be monitored as part of the patient's on-going care, how often these vital signs should be recorded and what clinical escalation triggers apply.

Factors that will influence a patient's monitoring plan will include, *inter alia*:

- Their physiological status at triage, during subsequent nursing reviews and when assessed by the treating clinician.
- The working diagnosis based on their presenting complaint and subsequent assessment
- Co-morbidities.
- Pain management requirements.
- Evidence-based guidelines e.g. NICE Head Injury Guidelines.
- Local guidelines and clinical pathways e.g. post-sedation care guidelines.
- Clinical guidance provided by the Senior EM Doctor and/or the Nurse-in-Charge.

Whereas it may be possible to provide general guidance on minimum monitoring requirements for common conditions, patient-specific adaptation of general, best practice guidance and evidence based guidelines is often required, given the unique combination of co-morbidities and other patient related factors, e.g. cognitive impairment, psychological or behavioural issues. Senior EM doctor input should always be sought if there is uncertainty regarding the most appropriate monitoring plan for a patient.

A patient's monitoring plan may be changed at any time in response to a change in their condition. The plan may be changed by a senior EM doctor or by a senior decision-maker from the admitting on-call team responsible for the patient's further care. In the latter situation, it is anticipated that admitting clinicians will recommend monitoring plans based on NEWS. All monitoring plan changes must be communicated to the patient's assigned nurse and all monitoring plan revisions must be documented, signed, dated and timed. A template Patient-Specific Monitoring Plan and Event log has been designed to record all such changes (Appendix 5).

Patient-Specific Monitoring Plan testing feedback

During the pilot testing of EMEWS, sites reported difficulties in the development of Patient-Specific Monitoring Plans. The main problem identified was that traditionally ED nurses had decided on monitoring modalities and frequencies for most patients for whom they were caring, without routine consultation with the EM doctors responsible for the patient. The exception to this would usually be critically ill patients for whom senior EM doctors usually defined monitoring plans in consultation with ED nurses. For most patients ED nurses determined patient monitoring requirements based on their

clinical experience, judgement and usual practice in the ED. They informed medical staff whenever they became concerned about a patient's status. The standardisation of practice in all EDs with the implementation of EMEWS which includes the determination of Patient-Specific Monitoring Plans represents a major change in clinical practice in EM. Patient specific planning requires the Treating Clinician to prescribe the modality, frequency and acceptable parameter range for each patient in consultation with the nurse assigned to the patient. Many of the NCHDs involved in the pilots had no experience or knowledge of how to set appropriate parameter ranges and triggers for escalation for individual patients according to their presenting complaints and co-morbidities.

Training clinicians to provide Patient-Specific Monitoring Plans

Training for NCHDs in Emergency Medicine will initially require incorporation into ED training schedules until it is incorporated into the core curriculum for specialist training. The risk to the patient is that they could be receiving treatment from a junior nurse and doctor who, through lack of knowledge, clinical experience, judgement or training may prescribe inappropriate modalities, parameter ranges or frequencies. The risks of poor practice with regard to physiological monitoring may be exacerbated by the use of locum doctors in EDs and training in this area will need to be available to locum doctors as well as ED medical staff who are either permanent or on training schemes. Nurse training in patient specific monitoring planning will also be required so that ED nurses, NCHDs and Consultants in EM can work effectively as a team to provide the most appropriate monitoring plans and clinical escalation for ED patients.

Advanced nursing practice and Patient-Specific Monitoring Plans

No patients who were reviewed by an Advanced Nurse Practitioner (ANP) during the pilot testing required the development of a Patient-Specific Monitoring Plan so it was not possible to identify any potential issues that might arise. It is anticipated that ANPs will undertake the same training recommended by the Irish Committee for Emergency Medicine Training (ICEMT) to ensure a consistent approach to ED monitoring planning by Treating Clinicians in the ED.

Anticipated impact on current practice

This is a major change in clinical practice in EDs. Practice that was previously driven by local guidance, aspects of which may have been taken for granted, will now be formalised through EMEWS. Decision-making with regard to clinical observation will now be documented in a standardised manner. This more structured and transparent approach is intended to improve the quality and safety of care, reduce variation in practice and optimise the use of medical and nursing resources. When EMEWS is fully implemented it will undoubtedly define a new standard of expected practice for patient monitoring in EDs. This will have significant implications for ED clinicians, as decision-making for patient monitoring will be overt to a greater degree than has been the case previously and is likely to be closely examined in medico-legal cases relating to patients who experience adverse clinical outcomes. This likely scenario should be a driver for more focus on this element of emergency care and safer, better quality patient monitoring and clinical escalation in the ED setting. Alternative options, e.g. not attempting to guide and improve practice in patient monitoring, implementing blanket recommendations that do not allow for the natural variation in patient presentations and care needs in EDs or not requiring documentation of decision-making are not acceptable from a patient safety perspective. Despite the challenges in implementing patient specific monitoring, it is important that this should progress with due regard for the scale of change involved.

Future development of Patient-Specific Monitoring Plans

The Patient-Specific Monitoring Plans must be considered to be a practice change that is in the early stages of development and further work will undoubtedly be needed to refine this tool and optimise its effectiveness. As new clinical evidence emerges the tool may require further amendment. It would be beneficial if health technologies and patient information systems could support the capture of

monitoring data, include it in patient care records and support documentation and review of patient monitoring plans.

Recommendation 11

Following review by a treating clinician a clinical management plan must be put in place and clearly documented as part of the EMEWS response.

Quality of evidence: **High**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice points

- The risk of undetected deterioration is reduced by defining physiological and other trigger points for clinical escalation.
- Clinicians should consider the patient’s co-morbidities and individual risk factors in defining their monitoring plan.
- A national approach for documenting management plans reduces the variation in practice between EDs.
- If used appropriately, the individualisation of monitoring plans should reduce any unnecessary workload for nurses and health care assistants. Depending on the clinical scenario not all vital signs may need to be repeated on an on-going basis. Only those observations that are relevant to the patient’s care should be performed frequently. Refer to the Patient-Specific Monitoring Plan template in Appendix 5.
- A minimum frequency of 4-hourly observation applies to all patients in the ED, irrespective of their specific monitoring plans. This is a clinical safety-net to ensure that patient’s vital signs are assessed within this time frame as a minimum standard of care.
- Clinicians should be aware of the HSE Standards and Recommended Practices for Healthcare Records Management (2011) available at: http://www.hse.ie/eng/about/Who/qualityandpatientsafety/resourcesintelligence/Quality_and_Patient_Safety_Documents/v3.pdf.

Practical guidance for implementation

- EMEWS is a very complex intervention requiring careful introduction into clinical practice, ongoing evaluation and an appropriate degree of adaptation to local contexts.
- Standardised training for all ED clinical staff is required.
- A communication strategy to involve all ED clinicians and other stakeholders in the implementation process will need to be developed.
- Ensure ongoing ownership of the change in practice by ED nurses, HCAs and medical staff.
- Arrange for the printing of new documentation.
- Regularly review implementation progress with adaptation and refinement of the approach, as required.

Clinical question 7

What are the appropriate amendments (variances) that can be made to a patient's EMEWS parameters or escalation response?

PICO c

To describe the development and validation of such systems.

The existing clinical guidelines examined in the EMEWS systematic literature review (Wuytack et al, 2016), the testing undertaken to date and the expert consensus group addressed this question.

Summary of evidence for variances

There is currently a paucity of existing literature to support the practice of permitted variance in early warning system guidelines. Any decision to vary from the guideline should be documented in the Patient-Specific Monitoring Plan, including the reason for variance and the subsequent action taken. The rationale for allowing variance is to allow for individual patients whose physiological parameters can be expected to lie outside the normal range due to their underlying condition so that they do not automatically trigger an escalated response. The NHS NEWS report (RCP, 2012) recommends that, in circumstances in which the healthcare professional feels the trigger may be overestimating the severity of a patient's clinical condition, a more senior decision-maker within the clinical team should be consulted to determine whether further escalation of care is warranted.

Evidence statement for variances

Permitted variance is an important factor in EMEWS. It firmly supports the judgement of the clinician and considers the individual circumstances of each patient. Variances allow for the patient whose baseline is different to the expected range and whose clinical presentation is as expected for their illness; however it is also the part of the system which poses a risk as the triggers or escalation safety net is altered. Definitive on-going education is required to mitigate any risk and monitoring of the use of variances is essential to ensure adherence to safety measures.

Recommendation 12a

Any amendment to the Post-Triage Monitoring Plan, such as frequency of vital sign measurement or trigger point, for a given patient with a pre-existing condition that affects their baseline physiological status, e.g. Chronic Obstructive Pulmonary Disease should only be decided by a doctor of Registrar grade or above.

Quality of evidence: **Very Low/Expert Opinion**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 12b

In a situation where an unwell but stable adult would normally have triggered escalation using EMEWS, a Medical Escalation Agreement may be made by a doctor of Registrar grade or above for a maximum period of four hours.

Quality of evidence: **Very Low/Expert Opinion**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Practice points

- Parameter amendments are not permitted for acute conditions.
- Medical Escalation Agreements should be reviewed as appropriate to the patient's condition. The maximum interval for a Medical Escalation Agreement is 4 hours.
- The patient and/or their family should be informed of any decision regarding a parameter amendment or escalation suspension, where practical.
- All variances, including clinical rationale and planned review, must be clearly documented in the patient's healthcare record.

Key points for amending parameters:

- A Medical Escalation Agreement is intended for adults who are currently unwell, who have vital signs that deviate from expected normal limits and who are triggering EMEWS. Some of these adults may be stable and the parameter reflects the expected status of their known illness. Following assessment they are considered unlikely to deteriorate if they remain stable in this new range. A Medical Escalation Agreement must recognise stability in parameters that are triggering but continue to monitor for triggering in other parameters. It is important to be aware that deterioration is always possible. Amendments to acceptable parameters should only be made by a doctor at Registrar grade or above.
- Parameter amendment is only to be used for adults with pre-existing conditions affecting their baseline physiological parameters. It should not be used for adults whose current illness may be causing the variation from their expected baseline ranges.
- Deviation outside of the amended range should prompt the appropriate clinical response.

Key points for medical escalation agreements:

- Medical Escalation Agreements can only be decided by a doctor at Registrar grade or above.
- Patient is recognised as being 'sick but stable'.
- Despite extensive resuscitative treatment, some patients will continuously trigger an escalation response. These patients require discussion with senior clinicians to identify which triggers should remain active and which simply require monitoring.
- Escalation to senior nurse/nurse in charge always applies.
- Medical Escalation Agreements must be reviewed frequently and may be cancelled at any time if the patient's condition becomes concerning.
- Patients who require "end-of-life" care may have some or all of the parameters suspended if they will not impact on palliative treatment.
- A Medical Escalation Agreement is applicable for no more than 4 hours for patients under the care of a Consultant in Emergency Medicine.

Recommendation 12c

Any amendment to the Post-Triage Monitoring Plan or Medical Escalation Agreement must be clearly communicated and documented in the patient's ED chart.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Practical guidance for implementation

- EMEWS includes a template for a “Patient-Specific Monitoring Plan” to facilitate the clear prescribing of monitoring frequency based on the patient’s current physiology and a documentation of the escalation of care and actions to be taken in the event of deterioration.
- Management plans should include actions for all members of the team and timeframes in which interventions must occur. Medical staff must always document their impression which is their provisional diagnosis. When this is done each member of the team has a clear idea of their roles and responsibilities. A management plan may include directions as to the required frequency of observation until certain measurable improvements are achieved or criteria for escalation of care occur. It may also give guidance as to when to be concerned in relation to the management of the deteriorating patient, changes in patient drug therapy or interventions and planned further investigations.

4: Adult Sepsis

Clinical question 8

What additional investigations should be performed for adults with suspected sepsis?

PICO c

To describe the development and validation of such systems.

“Sepsis is a life threatening condition that arises when the body’s response to an infection injures its own tissues and organs. Sepsis leads to shock, multiple organ failure and death especially if not recognised early and treated promptly. Sepsis remains the primary cause of death from infection despite advances in modern medicine, including vaccines, antibiotics and acute care. Millions of people die of sepsis every year worldwide.”

Merinoff Symposium 2010: Sepsis

Sepsis presentations to the ED:

Sepsis guidelines, associated forms and algorithms are updated regularly to reflect new scientific and quality improvement data. The latest iteration of the forms is available on the Sepsis Programme’s website www.hse.ie/sepsis. The NCEC National Clinical Guideline No. 6: Sepsis Management is updated every three years. Changes are communicated to EDs via the Group Sepsis Assistant Directors of Nursing (ADoNs) and Hospital Sepsis Committees.

It is recommended that patients presenting to the ED with a history suggestive of infection have sepsis screening (using the ED Sepsis form) at the earliest opportunity, ideally immediately after triage. The full Sepsis Management Guideline is available at <http://health.gov.ie/wp-content/uploads/2014/11/National-Clinical-Guideline-No.-6- Sepsis-Management-Nov20141.pdf>.

Recommendation 13

In patients with a clinical suspicion of sepsis adherence to the NCEC National Clinical Guideline No. 6 Sepsis Management is strongly recommended.

Quality of evidence: **High**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice point

- The timely recognition of sepsis is a challenge for all clinical staff. Good clinical history and physical examination is vital to diagnose infection and to assess the host response to that infection.
- The only proven strategy to decrease mortality from sepsis is early recognition and treatment.
- Depending on presentation and clinical course patients may require more frequent assessment and earlier critical care review. Exercise clinical judgment.

Practical guidance for implementation

The EMEWS vital sign chart contains a graph for temperature and some clinical prompts for consideration of adult sepsis. These are not substitutes for clinical education and training in the management of an adult with known or suspected infection/sepsis. Patients with sepsis may present without pyrexia or indeed a systemic inflammatory response, particularly in the older or frail patient, so a careful assessment looking for new onset organ dysfunction is required in order not to miss cases. Management of the adult patient with sepsis should follow the current NCEC National Clinical Guideline No. 6 – Sepsis Management.

5: Governance

The task of implementing EMEWS is as important and challenging as operating the system itself. Implementation requires strong foundations including governance, leadership, patient and staff engagement, education and capability in improvement methodology. These supports generate the planning, motivation and culture change necessary to embed new and complex practices. It is well documented in the literature that despite good intentions by authors of guidelines, implementation remains problematic (Cabana et al, 1999; Pronovost, 2013; Hands et al, 2013). The Australian Commission on Safety and Quality in Healthcare identified in a survey that 72% of hospitals had a committee that oversaw the operation of the early warning systems (2011a).

Governance at individual hospital level should reside with the hospital's "Management of the Deteriorating Patient" committee or its equivalent. The hospital's committee should liaise closely with its equivalent at Hospital Group level and the National "Deteriorating Patient Quality Improvement Programme" established by the HSE in 2017.

The implementation of EMEWS will be a very complex intervention, involving over 1,500 nursing staff, 500 doctors, as well as HSCP staff across the country. Appropriate planning and resources at hospital and ED level will be required to optimise training and manage the introduction, dissemination and audit of this change in clinical practice.

Recommendation 14a

The Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN) of each hospital or hospital group are accountable for the operation of the EMEWS. A formal governance structure, such as a "Management of the Deteriorating Patient" governance committee, should oversee and support the local resourcing, implementation, operation, monitoring and assurance of EMEWS.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

Hospitals should employ quality improvement methods to enhance stakeholder engagement and support local implementation through the use of testing, measurement and feedback of key interventions. The GDG has made several recommendations that expressly support EMEWS implementation from an organisational to clinical level. The introduction of EMEWS generates new work insofar as it formally introduces the structured monitoring of patients in the waiting area. It is a separate role to that of triage. It is anticipated that for most sites there will be an impact on resources resulting from implementation of these recommendations and this is dealt with further in the budget impact analysis (Appendix 8). There is a requirement for the creation of additional post(s) to support implementation and sustainability of EMEWS, although some hospitals may have the capacity to allocate appropriately skilled resources to support the implementation of EMEWS from within existing structures therefore minimising additional costs.

Recommendation 14b

The “Management of the Deteriorating Patient” governance committee should identify a named individual(s) to coordinate local EMEWS implementation, e.g. a clinical facilitator.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

Practical guidance for implementation

- EMEWS nursing and medical implementation leads for each site should be identified.
- The local EMEWS coordinator may not be a new role but should include protected time for EMEWS implementation and audit.
- The selection of trainers is important as successful implementation depends on the quality of education provided.
- EMEWS champions should be identified to facilitate dealing with ad hoc questions/queries from colleagues or families and promote compliance with completion of vital sign charts and the necessary actions expected under EMEWS.
- Aids to EMEWS implementation may include use of:
 - o Briefing
 - o Safety Pause
 - o Huddles
 - o Team briefing
 - o Other quality improvement methodologies.

Information gained from the pilot testing indicates that the introduction of EMEWS requires a dedicated, experienced and trained emergency nurse to ensure appropriate and timely assessment and escalation and intervention when required.

Recommendation 15a

An appropriately experienced and trained nursing resource is required 24 hours a day for post-triage assessment as this is new work distinct from triage and other current emergency nursing roles. The use of the latest technological developments in patient monitoring should be explored.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Recommendation 15b

An appropriately trained senior Emergency Medicine doctor should be available 24 hours a day to support junior medical and nursing staff in the ED.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Practice points

- The use of latest technological developments in patient monitoring should be explored.
- Clinical escalation is to the senior doctor on-site in the absence of a Consultant in Emergency Medicine.

Practical guidance for implementation

- The governance for EMEWS implementation may be incorporated into existing “Management of the Deteriorating Patient” governance structures, and should:
 - o Include service users, clinicians and managers
 - o Have appropriate responsibilities delegated and be accountable for its decisions and actions
 - o Monitor the effectiveness of interventions and education
 - o Have a role in reviewing performance data and audits
 - o Provide advice about the allocation of resources.

6: Education

Summary of evidence for education and training prior to implementation of EMEWS

Training for the implementation of the EMEWS will be delivered through a train-the-trainer model. Although the systematic review identified no studies relating to education programmes for early warning systems, train-the-trainer models had been successfully used to implement a number of the NCEC NCGs in Ireland. Each ED will be asked to identify nurses who have the skills required to be trainers. EDs which have Clinical Facilitators should include them among the staff identified to be trainers. It is recommended that each hospital should have one or more members of staff who are trainers for all the tools for the early recognition of the deteriorating patient – NEWS, IMEWS, PEWS and EMEWS, these trainers will understand how the tools relate to each other and help front-line ED staff gain competence in their combined use for ED patient cohorts. Resuscitation Training Officers may be able to fulfil this important role.

Ideally the on-site training should be multidisciplinary to facilitate broad discussion although this may be difficult to achieve. To accommodate sites who are unable to deliver multidisciplinary training an additional training pack has been developed for Consultants in Emergency Medicine to deliver at a Non-Consultant Hospital Doctor training and education session. The Irish Association for Emergency Medicine Academic Committee is developing an education module for doctors relating to the prescribing of physiological parameters for emergency presentations.

The standard training module will include:

- Why we need to monitor patients
- Overview of EMEWS
- Overview of the Chart
- Patient-Specific Monitoring Plan
- Clinical Escalation in the Emergency Department
- Using the Event log
- Communication and using ISBAR
- Audit
- Case scenarios.

Each trainer will be given an electronic copy of all the resources required and should link with their local Centre for Nurse Education for resource support for the delivery of the training module. It will take a maximum of 3 hours to deliver the training module. If staff have previously undertaken Compass training, the time required will be reduced. EDs will require a minimum of 75% of staff trained in EMEWS or component of EMEWS prior to going live to ensure that there is a sufficient number of staff trained in the use of EMEWS on each shift. A refresher education module of one hour is recommended to be undertaken every 2 years by staff using EMEWS.

An e-learning platform has potential to facilitate access to training; however it should ideally be accompanied by simulated case scenarios. The costing's for the development of such an e-learning programme is included in the BIA (Appendix 8).

The National Deteriorating Patient Quality Improvement Programme is currently reviewing the most appropriate education modalities for the delivery of early warning system education.

Nursing staff in one pilot site had undertaken the “Deteriorating patient” module prior to EMEWS training and found this module to be a useful adjunct as it focuses on the physiology of vital signs in the context of the deteriorating patient.

Feedback from the pilot sites indicated that staff preferred scenario-based training where they were divided into small groups and given different clinical scenarios to discuss using EMEWS.

Recommendation 16

The Hospital Chief Executive Officer (CEO)/General Manager (GM) and Director of Nursing (DoN) in each hospital must ensure that EMEWS education is provided to all clinicians who work in the ED.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

Practice points

- Hospitals and “Management of the Deteriorating Patient” governance committees should ensure that all frontline clinicians involved in the assessment of undifferentiated, undiagnosed patients of varying acuity in EDs should have access to educational resources and complete relevant professional development so that they are confident and competent to recognise the deteriorating adult patient.
- Refresher education on EMEWS is recommended every 2 years in addition to informal ED-based reinforcement of learning. This update programme is yet to be developed but it is anticipated that it will be one hour in duration.

Practical guidance for implementation

- An EMEWS Implementation Guide for Hospitals is available that contains information on the education programme.
- All clinicians should be able to:
 - o Systematically assess an adult.
 - o Understand and interpret abnormal physiological parameters and other abnormal vital signs.
 - o Understand and follow the EMEWS guideline for escalation of care.
 - o Initiate appropriate early interventions for patients who are deteriorating.
 - o Respond with life-sustaining measures in the event of severe or rapid deterioration pending the arrival of emergency assistance.
 - o Communicate information about clinical deterioration in a structured and effective way to the primary medical practitioner or team, to clinicians providing emergency assistance and to patients, families and carers.
 - o Undertake tasks required to properly care for patients who are deteriorating such as developing a clinical management plan, writing plans and actions in the healthcare record and organising appropriate follow up.
 - o The EMEWS education programme is designed to complement existing cardiac and trauma life support courses. All clinicians should attend mandatory training in Cardiopulmonary Resuscitation (CPR)/Basic Life Support (BLS) as well as EMEWS education.

7: Supporting Practices

EMEWS is designed to meet the HIQA 2012 requirement for a 'system of physiological and triggered responses' in EDs. It is intended to assist ED clinical staff in establishing appropriate and effective monitoring and clinical escalation procedures for adult ED patients to protect and optimise the quality and safety of their care. A key aim of the EMP is that patients should experience the same standard of care in an ED regardless of when or where in the country they present for treatment. This type of standardisation model was also used for many of the studies identified in the systematic review. All adult patients should be considered for EMEWS which has been designed to be applicable to the care of adult ED patients from the moment of their arrival in an ED to their discharge from the ED or decision to admit.

Recommendation 17

Hospitals should implement safety practices that enhance EMEWS and lead to greater situational awareness among clinicians and multidisciplinary teams.

Quality of evidence: **Moderate**

Strength of Recommendation: **Conditional**

Responsible person/s for implementation: **Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN)**

Practice point

- The use of huddles/safety pauses may assist with managing an environment where multiple patients can be escalated simultaneously.

8: Evaluation and Audit

Evaluation and audit are an important part of the implementation of this initiative. The systematic review did not identify a standard set of criteria for audit, though there were commonalities such as core vital signs, identification of deterioration and appropriate escalation. It is recommended that the audit process is coordinated locally in each acute hospital by the local “Management of the Deteriorating Patient” governance committee or equivalent. The audit process should ideally be undertaken from a multidisciplinary perspective. In planning the frequency of audits to be undertaken, it is suggested that these should be initially at four weeks and twelve weeks following introduction to identify progress and areas for improvement and six monthly, as part of on-going departmental audit programme when EMEWS has been embedded into clinical practice. New recommendations in relation to audit practices may arise from work currently being undertaken by the National Deteriorating Patient Quality Improvement Programme.

For process audits the recommended standard required is 100% compliance. Where compliance is less than 80% local action plans should be put in place to address issues including increasing the frequency of audits and identification of problem areas. The recommended sample size for the audit is one third of patients’ charts in the ED.

Measuring outcomes is particularly important to demonstrate the effectiveness or otherwise of the intervention for patients.

The audit results and reports should be discussed at the “Management of the Deteriorating Patient” governance committee initially, thereafter linking into appropriate hospital fora as required. The clinical audit cycle should inform the audit plan as part of the continuous quality improvement process.

Recommendation 18a

Clinical audit should be used to aid implementation and quality assure EMEWS.

Quality of evidence: **High**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice points

- Data regarding clinical outcomes should be collated nationally. Until a structure for national data collection and reporting exists, hospitals should use local data to inform improvement practices.
- The outcome of the audit should be included in routine governance and quality assurance activities within the ED and hospital.
- The information acquired through audit will provide evidence to support the hospital’s self-assessment for the implementation of Standard 2.2 of the National Standard for Safer Better Healthcare, Health Information and Quality Authority (2012).

Practical guidance for implementation

- A process of on-going audit is vital to ensure embedding of the process and continued quality assurance. The minimum recommended frequency for on-going audit is six monthly. This should be supported and resourced by the local “Management of the Deteriorating Patient” governance structures and hospital management.
- All five components of EMEWS should undergo individual audit.
- Audit should be undertaken, at a minimum, at four weeks and 12 weeks following introduction of EMEWS to identify progress and areas for improvement.
- National audit tools should be used to assess:
 - Compliance with chart completion, recognition, referral and response processes and documentation.
 - Use of variances, associated documentation and clinical outcomes.
- Hospitals should engage in data collection regarding outcomes for patients including a minimum data set of:
 - Frequency of emergency calls.
 - Unplanned admissions to critical care areas.

Recommendation 18b

EMEWS should be supported through the application of quality improvement methods, such as engagement strategies, testing and measurement to ensure successful implementation, sustainability and future progress.

Quality of evidence: **Moderate**

Strength of recommendation: **Conditional**

Responsible person/s for implementation: **Clinical staff**

Practice point

- Shared learning and a need for quality improvement capability will be required by the multi-disciplinary ED teams.

9: Electronic Monitoring Technology

The evolving role of electronic monitoring technology

The introduction of track and trigger systems (TTS) and Early Warning Systems has led to the development of electronic monitoring technology systems to aid the recording of vital signs, at the appropriate frequency and escalation through alerts as required. Hands et al (2013) identified there was only partial adherence to vital signs monitoring protocols on a district general hospital ward. Sicker patients appear more likely to have vital signs measured overnight but even their observations were often not followed by timely repeat assessments. The observed pattern of monitoring may reflect the impact of competing clinical priorities. Edwards et al (2010) also reports inaccurate summation or inaccurate assignment of score in the use of the manually recorded Modified Early Warning Score.

The addition of electronic monitoring technology to assist staff reduces the risks related to accuracy of recording and the frequency of recordings. For escalation through alerts to be applied effectively individual parameter ranges may be required. Jones et al (2011) identified that electronic recording of patient observation linked to a computer system that calculates patient risk and then issues automatic graded alerts can improve clinical attendance to unstable general medical ward patients. There is a growing body of evidence relating to the use of electronic systems in the ward environment but there is a paucity of research relating to the ED environment. Wilson et al (2013) have completed a 500-patient trial of the use of the TTS in the ED of the John Radcliffe Hospital, Oxford, UK. They reviewed the paper track-and-trigger charts completed for these patients by the nursing staff and analysed the continuous vital sign data generated by the bedside monitors to which the patients were connected. Only 27% of physiological escalations were associated with a documented TTS score above the triggering threshold (Wilson et al, 2013). This has led to a re-think of how patient deterioration may optimally be identified in this setting.

In practice the use of electronic monitoring technology in the waiting room of EDs is not without its challenges; the volume of patients to be monitored and ensuring that patient do not leave while still wearing the monitoring equipment are two obvious ones.

The introduction of electronic monitoring technology is not without its risks from issues such as alarm fatigue and extra “noise” in the system from false alarms (Curry and Jungquist, 2014; Schmidt et al, 2015). The financial cost of introducing electronic monitoring technology will potentially be offset by the partial reduction in nursing resources required to undertake monitoring and more importantly assist in reducing the risk of undetected patient deterioration. Both the systematic review and the BIA identified the role for health technologies in patient care and implementation of EMEWS, however to date there have been no economic evaluations or studies undertaken to examine the cost-effectiveness of health technologies in this environment.

Electronic monitoring technology should be utilised to assist in triggering escalation from pulse rate, respiratory rate, oxygen saturation, systolic blood pressure and temperature (if possible). These systems currently cannot trigger as a result of altered level of consciousness. Family and staff concern as a trigger will always require face-to-face interaction.

Recommendation 19

Electronic monitoring technology should be utilised where possible to record physiological parameters therefore facilitating more efficient use of nursing resources.

Quality of evidence: **Moderate**

Strength of Recommendation: **Strong**

Responsible person/s for implementation: **Clinical staff**

Practice points

- The use of electronic monitoring technology assists nursing staff in adhering to monitoring frequency and in alerting them to escalation trigger points. Technology cannot replace nursing staff.
- Wearable technologies cannot replace the therapeutic interaction or clinical decision making of face-to-face contact with the patient.
- Electronic monitoring technology should meet compliance with EU legislation (CE criteria).
- Where possible temperature measurement should be recordable using electronic monitoring technology.

Appendix 2: GDG Terms of Reference



EMERGENCY
MEDICINE

Guideline Development Group for the
Emergency Medicine Early Warning System for adult patients
(EMEWS)

Terms of Reference
February 2016

Table of Contents

Glossary of terms

Abbreviations

Section 1

- 1.1 Background
- 1.2 Vision

Section 2

- 2.1 The Role of the GDG
- 2.2 Project Plan & Timelines
- 2.3 National & International Review
- 2.4 Patient and Public Involvement
- 2.5 Governance

Section 3

- 3.1 Membership of the GDG
 - 3.1.1 Working Group Membership
 - 3.1.2 Advisory Group Membership

Section 4

- 4.1 Process for Meetings
 - 4.1.1 Attendance
 - 4.1.2 Apologies
 - 4.1.3 Frequency of Meetings
 - 4.1.4 Venue
 - 4.1.5 Meeting Documentation
 - 4.1.6 Meeting Inputs
 - 4.1.7 Administrative Support
 - 4.1.8 Conflict of Interest

References

Glossary of Terms

Guideline Development Group (GDG) is the Emergency Medicine Early Warning System for adult patients Guideline Development Group.

HIQA Tallaght Report – Report of the investigation into the quality, safety and governance of the care provided by the Adelaide and Meath Hospital incorporating the National Children’s Hospital (AMNCH) for patients who require acute admission, Health Information and Quality Authority May 2012.

Treating Clinician – An Emergency Department doctor or an Advanced Nurse Practitioner (ANP).

Abbreviations

HIQA	Health Information & Quality Authority
HSE	Health Service Executive
ISBAR	Communication Tool – Identify, Situation, Background, Assessment, Recommendation
ED	Emergency Department
EMEWS	Emergency Medicine Early Warning System for Adult Patients
EMP	National Emergency Medicine Programme
HRN	Healthcare Record Number
NEWS	National Early Warning Score (NEWS)
NCEC	National Clinical Effectiveness Committee
QID	Quality Improvement Division

Section 1

1.1 Background

The Emergency Medicine Early Warning System (EMEWS) has been developed in response to staff concerns that ED patients are at risk of clinical deterioration between the time they have been triaged and the time they are assessed by a Treating Clinician and that there may be a delay in recognising this deterioration if the patient is not appropriately monitored. It is also a specific recommendation in the Tallaght HIQA Report. These patients have undifferentiated presentations, with the potential for rapid change in their physiological status and have only been assessed once in the ED i.e. at triage. Crowded and under-resourced EDs will have relatively larger numbers of such patients waiting for longer periods of time, thus increasing the clinical risk. The international literature reports examples of ED patients who have deteriorated and died in ED waiting rooms whilst awaiting assessment by a Treating Clinician.

Analysis of 576 deaths (throughout hospitals, not just in the ED) reported to the UK’s National Patient Safety Agency’s (NPSA) National Reporting and Learning System (NRLS) over a one-year period (2005) identified that 11 percent were as a result of deterioration not recognised or not acted upon. There were a number of points in the care process where failures were identified, including: not taking observations; not recognising early signs of deterioration; not communicating observations causing concern and not responding to these appropriately (NPSA Reports 2007 cited in Patient Safety First, 2008).

EMEWS is intended to address the risk of a patient’s clinical deterioration going unnoticed in the ED setting. It cannot address the root cause of this risk which requires appropriate demand-capacity

management and resourcing of EDs. The tool has been designed to interface seamlessly with the Manchester Triage System which is the nationally recommended ED triage approach for adult patients.

Prior to the HIQA Tallaght Report (2012) the development of an ED-specific system of physiological monitoring had already been identified by the National Emergency Medicine Programme (EMP) as an important area for development. This development was intended to facilitate standardisation of clinical care; improvement in clinical practice and be part of a suite of clinical tools for emergency care in Ireland. A new EMP work-stream was commenced to focus on this new development area. EMEWS has been developed as a tool through extensive consultation with ED nurses, doctors in Emergency Medicine and administrative staff. It has been designed to be compatible with the National Early Warning Score and has undergone extensive testing and piloting across a number of rural and urban Emergency Departments. The current version of the tool has been tested on over 2,200 patient episodes. Wide consultation took place on the development of the tool itself as well as the Implementation Guidance. The next phase is to build on the work undertaken to date to develop a national clinical guideline on Emergency Medicine Early Warning System for Adult Patients and submit this to the NCEC for quality assurance endorsement and publication. The systematic evidence review incorporated in the NCEC National Clinical Guideline approach will allow the incorporation of any relevant findings from this review into further development of the EMEWS tool.

Through NCEC endorsement of EMEWS, there will be a complete suite of tools for use in hospitals for the detection of deteriorating patients, from their presentation in the ED through to discharge from hospital. EMEWS has been designed to align closely with the other systems for detection of deterioration in adult patients within the context of the undifferentiated, undiagnosed nature of presentations to an ED. Adult patients move onto the National Early Warning Score (NEWS) following the decision to admit. Women who are deemed to require post-triage monitoring with confirmed pregnancy or who are up to 42 days post-partum will be commenced on the Irish Maternity Early Warning System (IMEWS) protocol (although the Glasgow Coma Score of EMEWS may also be required depending on the presenting complaint). Children are monitored using the post-triage monitoring guidance incorporated in the Irish Children's Triage System (ICTS) and move onto the Paediatric Early Warning Score (PEWS) following the decision to admit.

1.2 Vision

The intention is to produce a patient-centred, evidence-based monitoring and clinical escalation protocol as a National Clinical Guideline that, when implemented and utilised nationally, will support safe, effective and efficient monitoring and clinical escalation for ED patients.

The National Clinical Guideline will include:

- All adult patients (age 16 years and over) attending EDs

The National Clinical Guideline will exclude:

- Paediatric patients (i.e. those aged < 16 years)
- Patients cared for in clinical environments other than the ED

Section 2

2.1 The Role of the GDG

The role of the GDG is, by the end of 2016, to address the HIQA recommendation that "ED specific system of physiological monitoring and triggered responses comparable to the National Early Warning Score (NEWS) should be implemented", (HIQA 2012).

The GDG will:

1. Develop a project plan with defined timelines.
2. Define the scope of the project.
3. Develop a National Clinical Guideline to assist healthcare professionals' and service users' decision-making about the process of monitoring and clinical escalation for adult patients in EDs.
4. Liaise with clinical staff including doctors, nurses, midwives and health and social care professionals at different stages of the project.
5. Develop, agree and recommend audit tools for healthcare professionals.

2.2 Project Plan and Timelines

A detailed project plan will be prepared by the GDG.

The GDG will provide a completed guideline by the end of 2016. Monthly progress reports will be provided to the National Emergency Medicine Programme.

2.3. National and International Review

The GDG will consult with national and international experts to review the proposed recommendations and materials.

2.4. Patient and Public Involvement

The advice of patients and members of the public will be sought throughout the project. There is patient representation on the group.

2.5. Governance

The GDG will report to the National Emergency Medicine Programme.

The GDG is responsible for making recommendations to the National Emergency Medicine Programme, addressing the HIQA recommendation that "ED specific system of physiological monitoring and triggered responses comparable to the National Early Warning Score (NEWS) should be implemented", (HIQA 2012).

Section 3

3.1 Membership of the GDG

Membership nominations were sought from a wide range of experts so as to be as representative of all key stakeholders within the health care arena. The GDG may, from time to time, co-opt expertise from relevant sources as required.

3.1.1 Working Group Membership

The purpose of the Guideline Development Working Group is to oversee the project including; adherence to NCEC criteria, communication with the NCEC and HSE, managing timelines, documentation of the decision making process, review evidence from systematic review and agree recommendations generated by the Advisory Group based on the systematic and economic reviews. See page 3 for membership of the Guideline Development Working and Advisory Groups.

3.1.2 Advisory Group Membership

The purpose of the Guideline Advisory Group is to advise the Guideline Development Working Group on the views of the constituency they represent on various aspects of EMEWS, review evidence generated by the systematic review and suggest recommendation based on the evidence. See page 6 for membership.

Section 4

4.1 Process for Meetings

This section outlines how the GDG will conduct or undertake the work involved and make decisions.

4.1.1 Attendance

The project administrator will maintain a record of attendance, apologies and non-responders. Teleconference facilities will be provided for each meeting.

4.1.2 Apologies

Apologies should be sent to the project administrator (emp@rcsi.ie) in advance of the meeting. If a GDG member fails to send apologies or does not attend more than three consecutive meetings, either in person or by teleconference, a GDG co-chair will contact him/her to establish if they are still interested in being part of the group or if they would suggest a replacement.

4.1.3 Frequency of Meetings

A schedule of meetings will be agreed by the GDG. The GDG Working Group will meet at least monthly, supplemented by teleconferences as required. The GDG Advisory Group will meet three times;

- commencement of the guideline development;
- at the mid-point;
- at the final stage of development.

4.1.4 Venue

The venue for each meeting, in as far as possible, will be in the Royal College of Surgeons, 123 St Stephens Green Dublin 2 (to be arranged by the EMP co-ordinator) or, if unavailable, an alternative suitable venue will be sourced and advised to the members accordingly.

4.1.5 Meeting Documentation

The chairperson or project administrator will forward relevant documentation to the GDG at least 1 week in advance of the meeting, including:

- Meeting notes of previous meeting
- Agenda
- Other relevant supporting documentation

4.1.6 Meeting Inputs

Where GDG members are unable to attend a meeting, in person or by teleconference, they may submit comments to emp@rcsi.ie by 17.00hrs on the day prior to the meeting. The chairperson will bring forward comments received for consideration by the GDG members in attendance.

4.1.7 Administrative Support

The project administrator will coordinate meetings and note taking etc. Materials will be prepared by the chairperson and sent to group members 1 week in advance of the meetings.

4.1.8 Conflict of Interest

Each participant on the group will be asked to sign the relevant form in relation to conflict of interest.

References

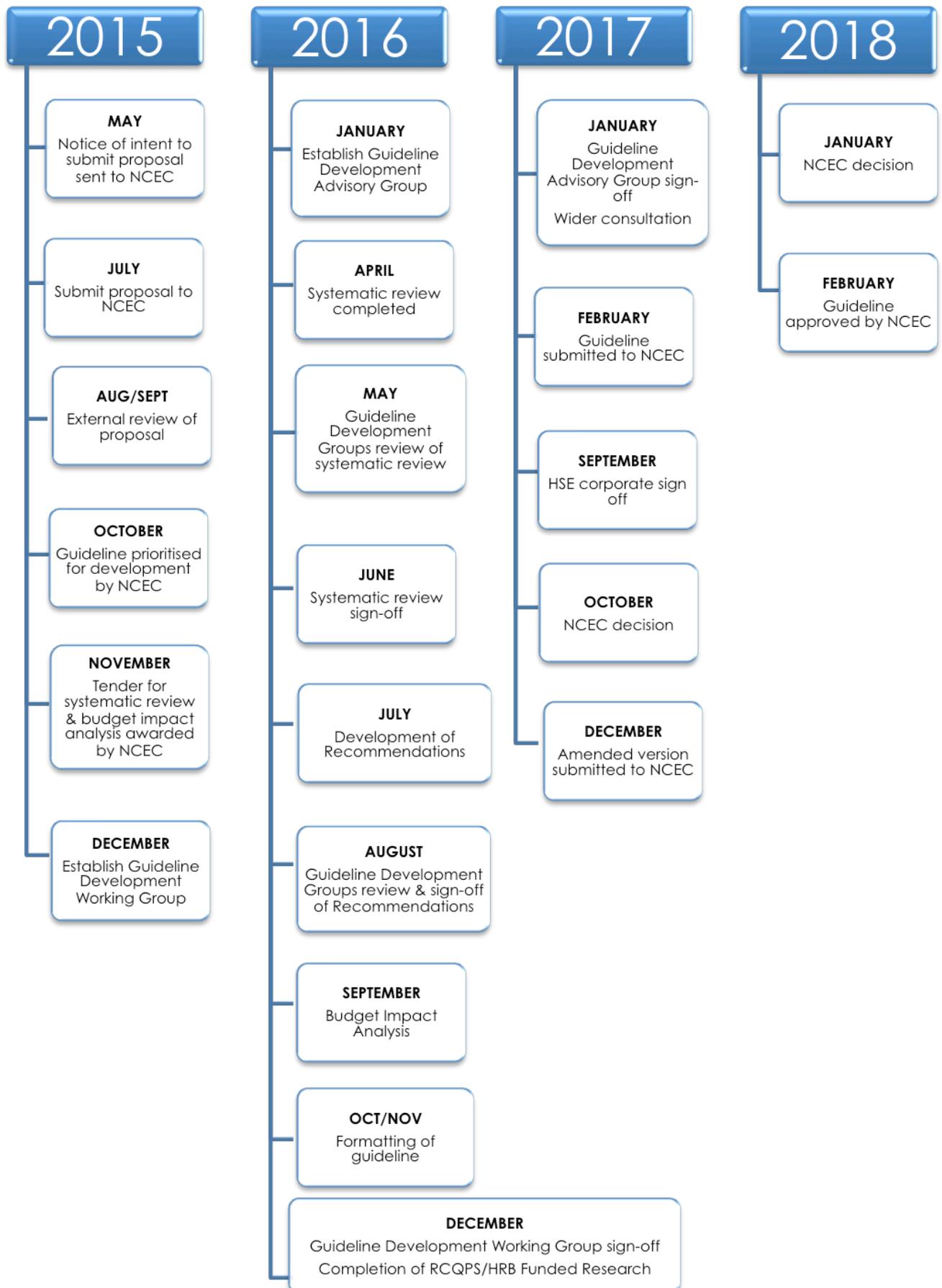
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National Emergency Medicine Programme, *Infection Control Algorithm for Adult Patients' developed in conjunction with the Healthcare Associated Infection Programme*. Available on request from: emp@rcsi.ie

Appendix 3: Guideline development timeline



Appendix 4: Report of Consultation process

Wider Consultation 13th January to 30th January 2017

Patient Groups

Patient Focus
Irish Patient's Association

Department of Health

Office of the Chief Nurse

HSE Divisions

Patient Advocacy Unit
Quality Improvement Division
National Quality Assurance and Verification Division
Quality and Patient Safety, Acute Hospitals Division
Office of the Nursing and Midwifery Services Directorate
National Clinical Advisor and Group Lead for Acute Hospitals
HSE National Director of Acute Hospitals
HSE Deputy National Director of Acute Hospitals
Hospital Group Directors of Nursing
Hospital Group Chief Executive Officers
Hospital Group Clinical Directors
Hospital Directors of Nursing, Acute Division
Hospital Chief Executive Officers and General Managers, Acute Division
Hospital Clinical Directors, Acute Division
National Director for Clinical Strategy and Programmes Division
Nurse Leads, Clinical Strategy and Programmes Division
Clinical Leads, Clinical Strategy and Programmes Division
Programme Managers, Clinical Strategy and Programmes Division
National Emergency Medicine Programme Working Group
Emergency Nursing Interest Group

Regulatory bodies

Medical Council of Ireland
Nursing and Midwifery Board of Ireland
Pre-Hospital Emergency Care Council

Academic bodies

Royal College of Emergency Medicine, UK
Royal College of Physicians in Ireland
Royal College of Surgeons in Ireland
Irish College of General Practitioners

Professional bodies

Irish Association for Emergency Medicine
Irish Association of Directors of Nursing and Midwifery
Irish Hospital Consultants Association
Irish Nurses and Midwifery Organisation (INMO)
Services, Industrial, Professional, Technical Union (SIPTU)
IMPACT

External Reviewers

Prof Julie Considine
Prof Peter Cameron
Dr Taj Hassan

Consultation feedback received from

Name	Representing
Ms Ann Calvert	Midland Regional Hospital, Tullamore
Ms Ruth Greene	Mater Misericordiae University Hospital
Mr Brian Power	Pre-Hospital Emergency Care Council
Ms Karen Holden Davis	Naas General Hospital
Dr Carol Blackburn	Our Lady's Childrens Hospital, Crumlin
Dr Dorothy Breen	Cork University Hospital
Ms Eileen Kelly Ms Siobhan Scanlon Ms Norma O'Sullivan Mr Diarmuid Nolan Ms Elaine O'Farrell	Cork University Hospital
Mr Michael Power	National Clinical Lead, Critical Care Programme
Ms Ligimol Varghese	Connolly Hospital Blanchardstown
Mr Frank Keane	National Clinical Lead, Surgery Programme
Ms Deirdre Carey	Quality Patient Safety, Acute Hospitals Division, HSE
Ms Geraldine O'Connor	Letterkenny University Hospital
Mr Gerry Lane	Letterkenny University Hospital
Ms Helen O'Shea	Sligo University Hospital
Ms Helena Hanrahan Ms Marie Burns	University Hospital, Galway
Mr Ashraf Butt	Irish Association for Emergency Medicine
Mr Kevin Clarkson	Saolta Group Peri-operative Clinical Director (CD) for Surgery, Anaesthesia and Critical Care
Mr Ken Figgis	SIPTU
Prof Liam Plant	National Clinical Director (CD), National Renal Office
Ms Mairead Twohig	State Claims Agency
Ms Marie Tighe	Assisted Decision Making (Capacity) Act 2015 Project Manager, Quality Improvement Division, HSE
Dr Martin Boyd	University Hospital Kerry
Ms Deirdre Lang	Director of Nursing (DoN), National Clinical Programme for Older People
Ms Mary Bedding	Sepsis ADON, Royal College of Surgeons in Ireland Hospital Group
Ms Áine Lynch	Nursing and Midwifery Planning and Development Unit Palmerstown
Ms Rosie Quinn	Therapies Lead, National Emergency Medicine Programme
Ms Breda Naddy	Programme Manager, National Emergency Medicine Programme

Ms Bridget Hoctor Ms Sarah Watkins	University Hospital Limerick
Ms Sinead Lardner	Office of the Chief Nursing, Department of Health
Mr Paul Gallagher	St James's Hospital
Consultants in Emergency Medicine	St Vincent's University Hospital
Emergency Department Nursing staff	St Vincent's University Hospital
Dr Vida Hamilton	National Clinical Lead, Sepsis Programme
Dr Karen Power	National Clinical Programme for Obstetrics and Gynaecology
Dr Colm Henry	National Clinical Advisor and Group Lead Acute Hospitals Division, HSE
Prof Julie Considine	Deakin University, Australia
Prof Peter Cameron	Academic Director of the Emergency and Trauma Centre, The Alfred Hospital, Australia
Dr Taj Hassan	Consultant in Emergency Medicine, Leeds, UK, President of the Royal College of Emergency Medicine
Dr Frances Drummond	Health Systems Researcher
Dr John Fitzsimons Ms Rachel MacDonell	National Paediatric Early Warning System
Ms Brid Boyce	National Lead for Policies, Procedures, Protocols and Guidelines, HSE

Themes from wider consultation feedback

The feedback received was generally positive and acknowledged the considerable work that had gone into creation of the EMEWS tool. Inevitably, concerns were expressed about the likely impact of EMEWS on already overstretched EDs and the fear of clinical staff that there might be an expectation that EMEWS could be implemented without adequate resources to do so.

The Guidelines Development Group reviewed all feedback received which was discussed and considered under the following themes:

Concerns about staffing and workload

- Number and skill mix of nursing staff
- Capacity to monitor the waiting room with current staffing
- Arduous nature of the post-triage monitoring schedule
- Concerns about insufficient medical staff to respond to escalations
- Current vacancy rate
- High nursing and medical staff turn-over
- Variable provision of Clinical Facilitators.

The GDG took the view that the final document addressed all these issues and had made it clear the resources that were required to introduce and use EMEWS.

ED Crowding

- Persistent ED crowding currently hampers provision of adequate and timely care
- Insufficient staff to manage current caseload
- Difficulties compounded by lack of patient flow to in-patient areas.

The GDG was unanimously of the view that ED crowding needed to be addressed more aggressively than it had been to date. It was accepted that EMEWS was not and should not be seen as a legitimisation of ED crowding and these points were further emphasised in the final version of the document.

Implementation

- Clarity required around who was responsible (e.g. EMP/HSE/Local Hospital management) for implementation of EMEWS
- While the GDG felt that this was clear in the draft document it decided to make certain statements even more explicit.

Infrastructure & Resources

- No space for the nurse undertaking post-triage monitoring on patients in the waiting area
- Training – need for resources and release of staff
- Not all hospitals have Practice Development Units or links with Centres for Nursing & Midwifery Education on site
- Lack of resources for audit
- Health technology – need for equipment and software to replace paper-based systems.

The GDG accepted that many EDs had infrastructure that was deficient and this needed to be addressed as part of infrastructural improvement works or by full-scale redevelopments of EDs. It was felt that the document clearly itemised the resources that were required.

Alignment with other tools

While concerns were raised that this represented yet another tool to be used in an ED setting the GDG were unanimously of the view that the ED was a unique clinical environment with a specific cohort of patients. It had been agreed at the outset that an ED-specific tool was required and the GDG had tried to ensure the greatest possible alignment between EMEWS and the other tools that were required for patients at different stages of their transit through the hospital system.

Risk

- Under-triaging to reduce recording of vital signs burden was raised as a risk
- Will nurse who reduces vital sign frequency be held responsible if patient subsequently deteriorates?

The GDG was of the view that the education programme intended to support the introduction of EMEWS would adequately address this risk. It was acknowledged that all clinical staff are obliged to meet professional obligations and that EMEWS decisions were no different than other clinical decisions such staff are accountable for.

Other issues

A number of miscellaneous issues were raised that the GDG felt to either be already addressed completely in the document or were not relevant to the EMEWS development process.

NCEC/HIQA National Quality Assurance Criteria for Clinical Guidelines Version 2 (2015) Questions for external reviewers to consider

1. Has the appropriate evidence been identified and reviewed in line with the scope and clinical questions posed by this guideline? **Yes**
2. Are there specific links between decisions and the available scientific evidence? **Yes**
3. Have the risks and potential harms of recommendations been fully considered in the context of clinical practice? **Yes**
4. Is the guideline clearly written, user friendly and allow for individual clinician decisions? **Yes**
5. Is the guideline suitable for routine use as intended (in so far as you are able to comment on the Irish situation)? **Yes**
6. Are there relevant international or well referenced guidelines (recommendations) on the same topic that these guidelines are in conflict with, and if yes are the reasons for this justified in the guidelines? **No**

Appendix 5: Tools to assist implementation and FAQs

Dartmouth Clinical Microsystem Academy ED Quality Improvement Methods and Tools

- ED Quality Improvement Coached Groups may develop improvement projects that support use of the Protocol e.g. improving communication within the ED team;
- Clinical Microsystem Improvement Tools:
- Fishbone Diagrams to analyse local barriers and solutions
- PDSA small tests of change
- Process mapping
- Simple surveys of patient and staff experience
- 5-S Lean approach to sorting work areas
- SDSA – creating protocols (playbooks) for standardised practice
- Safety Huddles.

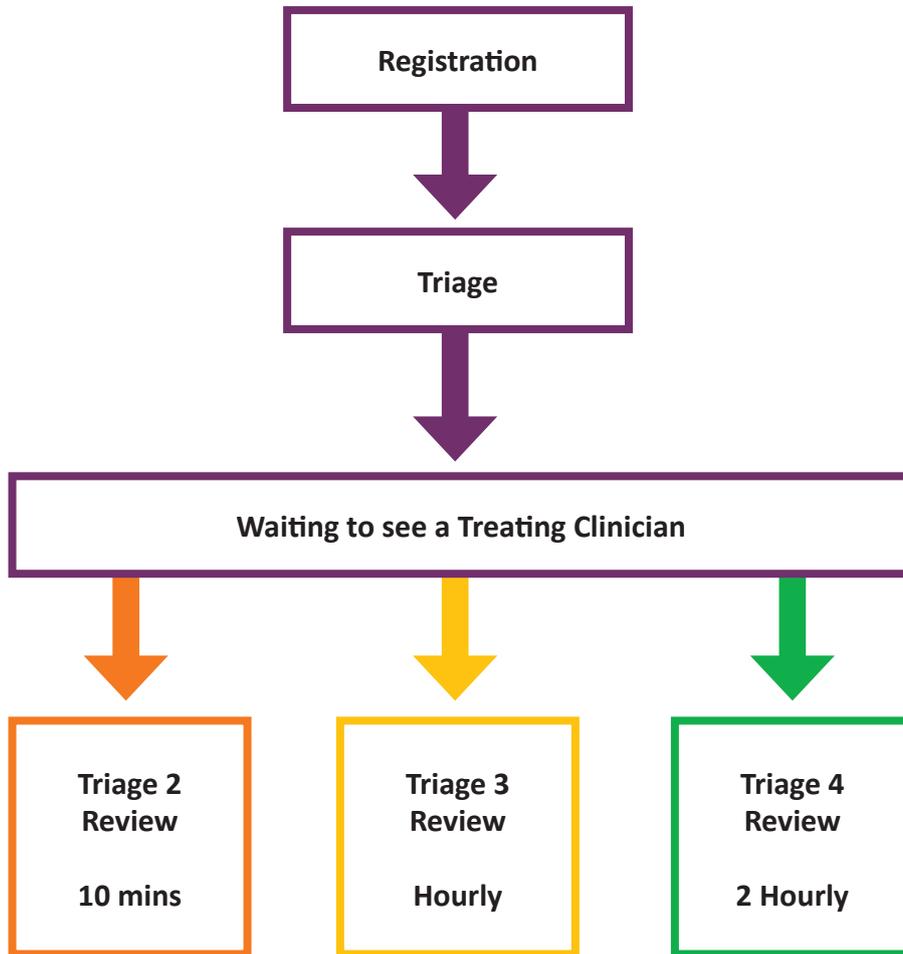
Additional resources can be found on www.emnow.ie

Key questions to consider when planning for implementation of EMEWS

1. Who is leading implementation of EMEWS in the hospital and what are their responsibilities?
2. Who are the leaders within the ED team – nursing, medical, administration?
3. What are the local aims for implementation?
4. Who will develop an initial plan?
5. What local infrastructure and other factors can be used to facilitate the implementation?
6. How will decisions regarding implementation be made?
7. What are the implications of EMEWS on staffing resources and deployment in the ED?
8. What additional infrastructure and equipment resources may be required?
9. What training resources are required to support its implementation?
10. How will communication regarding implementation of EMEWS be managed within the ED and within the hospital?
11. How will EMEWS be embedded in the daily work of the ED?
12. How will use of EMEWS be aligned with other systems including IMEWS, PEWS, NEWS and Pre-hospital systems (when developed)?
13. How will use of EMEWS be measured?
14. How will any unanticipated events associated with implementation of EMEWS be captured, reported and managed?
15. How will knowledge and information relating to EMEWS (e.g. local policies) be stored and shared to support EMEWS?
16. How will the ED keep informed on further national development and improvements with regard to the EMEWS?

Adapted from Massoud MR, Nielsen GA, Nolan K, Nolan T, Schull MW, Sevin C. A Framework for Spread: From Local Improvements to System-Wide Change. IHI Innovation Series white paper. Cambridge, Massachusetts: Institute for Healthcare Improvement; 2006.

Emergency Nursing Reviews Frequency Poster



The frequency of Emergency Nursing Reviews can be reduced following the recording of a minimum of 2 sets of vital signs in the Emergency Department.

All adjustments must be discussed with the Nurse-in-Charge

Frequently Asked Questions for Emergency Department Staff

Why do we need EMEWS?

- A key aim of EMP is that patients should experience the same standard of care in an ED regardless of where in the country they access that care. EMEWS standardises the monitoring and clinical escalation in EDs so that all ED patients in the country benefit from the same approach to monitoring and escalation.
- EMEWS is designed to meet the HIQA Tallaght Report (2012) requirement for a 'system of physiological and triggered responses' across all EDs.
- EMEWS assists ED clinical staff in establishing appropriate and effective monitoring and escalation schedules for ED patients to optimise the quality and safety of their care.
- EMEWS offers a structured approach for vital sign monitoring that will increase safety for both patients and staff, especially junior staff.

Why do we need a different chart for ED?

- Patients attending EDs have undifferentiated and undiagnosed conditions and are more likely than ward patients to be seriously ill and injured. This means that lower thresholds for escalation and more rapid responses are needed to ensure care is as safe as possible for ED patients.
- Recording of a GCS is required for a significant number of ED patients.
- The parameter ranges for respiratory rate, heart rate and temperature needed to be broadened to reflect the greater ranges of physiological abnormality seen in ED patients.
- Having a chart that aligns with core ED practice, such as the Manchester Triage System (MTS), makes it more usable and safer in the ED setting.
- It was considered important to include core-hospital physiological monitoring.

Which patients does EMEWS apply to?

- All patients attending the ED aged 16yrs and over assigned triage category 2, 3 or 4 including those assigned to the waiting area unless they meet the exclusion criteria. Patients to whom the EMEWS does not apply include:
 - Patients assigned MTS Triage category 1 as they require resuscitation
 - Patients assigned MTS Triage category 3 or 4 presenting with non-life or limb threatening injuries/illness who require no or at most "over the counter" analgesia. These patients will be commenced on EMEWS if they subsequently require additional analgesia.
 - Patients assigned triage MTS Triage 5 priority as they have no pain and their complaint has been present for more than 1 week.

Does the Triage Nurse undertake the Post-Triage Monitoring Nursing Reviews on patients in the waiting area?

- No, the Triage nurse is assigned to the assessment and prioritisation of new patients presenting and has a set timeframe in which to complete the assessment. Other nurses should undertake patient monitoring after triage.
- The monitoring of the patients in the waiting room places a new focus on the safety of patients in this clinical area. This is the first time that monitoring ED waiting room patients has been standardised. In many sites re-allocated or additional resources will be required to manage this workload. The tools for developing a business plan are included in the Emergency Nursing Workforce Planning Framework (2016).

Do all Post-Triage Emergency Nursing Reviews include vital signs?

- No, for some patients the review is used to check if the patient requires analgesia, assistance with going to the bathroom or needs pressure area care.

Why are the first and last sets of pre-hospital vital signs transcribed?

- The pre-hospital vital signs show the patient's status on first contact with a healthcare provider and the last set show any response to treatment while in transit to the hospital. They also show the trend in a patient's physiological status that may assist with the early identification of the deteriorating patient. Preferably, the PHECC registered practitioner should transcribe the vital signs.

Do I need to continue with the frequency of emergency nursing reviews as defined by the triage priority?

- Following the 2nd (i.e. review at Triage and one other) Emergency Nursing Review the frequency of the reviews can be reduced if the patient is considered to be "stable" and at relatively low clinical risk for deterioration.
- It is recommended that the reduction in frequency should be discussed with the nurse in charge of the area - especially if you are a junior nurse.

What is the most frequent level of monitoring?

- MTS Triage 2 patients initially require monitoring at 10 minute intervals, which may appear difficult to achieve but patients who are assigned Priority 2 are at significant risk and should be assessed by a doctor within 10 minutes. Some patients in Triage Priority 2 require the prescription of analgesia or time-critical treatment such as a nebuliser, so following initial review by a doctor and the administration of the required medication they may be suitable to have the frequency of their reviews reduced to 30 mins or 1 hour, as per a Patient-Specific Monitoring Plan determined by the treating doctor and nurse responsible for their care.

How do I decide at what frequency the nursing reviews should be reduced to?

- The guideline is that you reduce to the next frequency, i.e. 10mins to 30 mins (max hourly); hourly to 2 hourly; 2 hourly to 4 hourly.

What is the longest time allowed between nursing reviews?

- 4 hours. This is because patients have acute undifferentiated, undiagnosed conditions and require review at minimum every 4 hours.

How do I escalate care prior to review by Treating Clinician?

- Manage the patient's condition according to your scope of practice and competencies and inform senior staff as per the clinical escalation algorithms included in EMEWS. If in any doubt about a patient's condition escalate immediately to the most senior Nurse and/or Doctor in the ED.

How do I escalate care following review by Treating Clinician?

- Inform the treating clinician and/or the Nurse in Charge and Doctor in the ED, as per EMEWS.

Can we amend the chart locally?

- The free text sections on Pages 1 and 4 and the "other documents in use for this patient" can be customised to include local documentation but the essential components of the chart must be preserved. The chart can be printed in A4 or A3 format.

How should I transfer patient monitoring to a NEWS chart?

- If a patient is being admitted a NEWS chart should be commenced with the final 2 sets of ED vital signs recorded onto the new chart.

When do I use an IMEWS chart?

- For all pregnant women presenting to ED regardless of their presenting complaint.
- The recommended way to manage this is to clip the IMEWS observation chart over Page 2.
- The IMEWS does not include GCS scoring which your patient might require.

What percentage of staff should be trained prior to “go live”?

- It is recommended that a minimum of 75% of clinical staff have been trained prior to “go live”.

Who are the trainers?

- Trainers will be Emergency Nursing Clinical Facilitators, ED staff nurses and clinical nurse managers and Resuscitation Training Officers who have undertaken the train-the-trainer Programme. There will be several trainers in each ED.
- It is advisable that one trainer is also a “Compass” trainer.

Is on-going training required?

- Regular updates are recommended during the first few months followed by annual updates.

Should staff undertake the “Compass” training programme?

- Not essential for using the EMEWS, but it is a useful refresher for staff.

Is there an audit tool?

- Yes, there is an audit tool to assist sites with assessing compliance and identifying areas that require additional training which will be available to ED teams.

Appendix 6: Audit tool and guidance



Guidance for using the EMEWS Audit Tool

Frequency of audits

Following initial roll-out of EMEWS an audit at four weeks and twelve weeks is recommended, if compliance issues materialise then further charts should be reviewed. When EMEWS has become embedded into clinical practice the frequency of the audit can be reduced to a minimum of biannually.

Number of charts to be reviewed

The recommended sample size is one-third of ED patient charts. One approach that could be taken during roll-out would be to review one-third of charts on all shifts, discussing any issues that arose with the staff at the shift change/huddle or with individual members of staff. When EMEWS is established a minimum of one-third of EMEWS charts should be reviewed twice a year. Patient charts from triage categories 2, 3 & 4 should be included in all audits.

Compliance

100% in all aspects of the audit.

Non-compliance

If the non-compliance is with the same aspects of EMEWS or a pattern appears over successive audits an action plan should be formulated to address the deficits.

Suspending the Post-Triage Emergency Nursing Review process in ED

If Post-Triage Emergency Nursing Review process is suspended in a particular ED (i.e. due to staff shortages) a National Incident Reporting Form (NIRF) should be completed. It is the policy of the Health Service Executive (HSE) that all safety incidents are identified, reported and investigated. Safety Incidents include serious reportable events (SRE). Incidents should be disclosed in accordance with the guidance provided in the HSE/State Claims Agency (SCA) Open Disclosure Guideline.

All incidents should be monitored at departmental level and reviewed at the ED Clinical Operational group meetings and action plans formulated when the suspension stems from recurrent themes, i.e. inadequate staffing levels, competing needs of emergency patients and in-patients.

All incidents/near misses should be entered onto the National Incident Management System (NIMS).

Appendix 7: Systematic Review – Abstract

Background

Changes to physiological parameters precede deterioration of ill patients. Early warning and track and trigger systems (TTS) use routine physiological measurements with pre-specified thresholds to identify deteriorating patients and trigger appropriate and timely escalation of care. Patients presenting to the ED are undiagnosed, undifferentiated and of varying acuity, yet the effectiveness and cost-effectiveness of using early warning systems and TTS in this setting is unclear.

Aim

To provide a rapid systematic review of the evidence of the clinical and cost-effectiveness of physiologically based early warning systems and TTS for the detection of deterioration (post-triage) in adult patients presenting to ED.

Search methods

A comprehensive search of published and unpublished literature, including scientific databases and grey literature resources was carried out. No time filter was used but a filter to include adult patients was applied. No language filter was used but only information available in English was included. The literature searches were completed in March 2016.

Selection criteria

Participants were ED adult patients, post-triage. Only early warning systems and TTS that included routine physiological parameters were included. Studies were classified as: (1) Descriptive studies – type and extent of use; (2) Descriptive studies – educational programmes; (3) Guidelines; (4) Effectiveness studies; (5) Development and/or validation studies; and (6) Health economics studies.

Data collection, analysis and quality assessment

Two reviewers independently screened search results by title/abstract and full-text. Data extraction was done by one reviewer with independent verification checks of 50% of records by a second reviewer. Two reviewers conducted quality assessment independently. Data are presented in evidence tables.

Main results

A total of 6397 citations were identified, of which 47 studies, 3 guidelines and 1 clinical trial registration form were included. Although early warning systems are increasingly used in ED, compliance varies. One effectiveness study provided very low quality evidence (assessed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE)) that the use of an early warning system in the ED may lead to a change in patient management but does not reduce the number of adverse events; however this is uncertain, considering the quality of evidence. A total of 27 different early warning systems were developed/validated in 35 studies. There is relatively good evidence on the predictive ability of certain early warning systems on mortality and ICU/hospital admission. No health economic studies of health economic data in clinical studies were identified.

Conclusion

Early warning systems seem to be able to predict adverse outcomes in adult patients of varying acuity presenting to the ED but there is a lack of high quality comparative studies to examine the effect of using early warning systems on patient outcomes. A health economics assessment is also required. Strategies for ensuring compliance should be developed and tested.

Appendix 8: Budget impact analysis

This section of the report was completed by Paddy Gillespie and Adam Raymakers at the Health Economics and Policy Analysis Centre (HEPAC), NUI Galway. The budget impact analysis was conducted in a manner consistent with the guidelines issued by Health Information and Quality Authority (HIQA) in Ireland (HIQA, 2014).

Key Message

This budget impact analysis is founded on the clinical guideline recommendations. It should be reiterated that the use of EWS or TTS in hospital Emergency Departments (EDs) would be rendered unnecessary if the current difficulties obtaining timely access to ED care and subsequent access to a hospital bed were satisfactorily addressed.

1. Economic literature review results

Alongside the clinical literature review, a systematic search for evidence of economic evaluation (cost-effectiveness analysis, cost-utility analysis and cost-benefit analysis), cost impact and resource impact studies of EWS or TTS in hospital EDs was conducted. The search of published and unpublished economic literature, including scientific databases and numerous grey literature resources, did not identify any studies for inclusion in this review. Notably, there were no formal economic evaluations that examine the cost effectiveness of EWS in hospital Emergency Departments. That said, implementing EWS or TTS does require a healthcare resource investment. However, the degree to which such systems may or may not result in cost savings elsewhere in the healthcare system remains unclear. As described earlier in this report, there is a limited evidence base suggesting that EWS are effective in, for example, identifying deteriorating patients, reducing cardiac arrests and reducing intensive care unit admissions. Such effects, should they exist, provide the potential for healthcare cost savings which could go to fund, at least to some degree, the implementation costs of EWS in ED clinical practice. While this theory is open to question, it does go to highlight the need for primary research studies to be conducted to directly evaluate the cost effectiveness of EWS. Such studies should focus on the monitoring of resource use, costs and patient outcomes in order to determine whether early warning systems are likely to deliver a return on investment.

2. Budget Impact of National Clinical Guideline

The budget implications of the implementation of the guideline are explored in the context of the following categories: *Education & Training; Human Resources & Staffing; Equipment, Health Technologies, Materials & Consumables; Evaluation & Audit; Healthcare Savings*. The main cost of implementing the guideline will be the additional staffing requirements in EDs to facilitate the implementation of the *Emergency Medicine Early Warning System* for adults programme. This is followed in terms of resource impact by the electric monitoring health technology requirements, the education and training programme requirements for existing staff in EDs and that relating to on-going evaluation and audit. These components of resource use and costs are considered in more detail below. In completing the budget impact analysis, and given the uncertainty surrounding the resource requirements in some cases, particularly relating to the need for additional nursing staff, the estimates reported represent upper bound estimates for the budget implications of implementing the guideline. To inform the costing process, an opportunity cost approach is adopted with respect to the identification, measurement and valuation of costs. To account for the main sources of uncertainty, alternative estimates are provided in sensitivity analysis.

2.1 Education and Training

The implementation of *Emergency Medicine Early Warning System* will require investment for education and training purposes. This will consist primarily of the cost of staff time and the cost of developing and hosting a new *Emergency Medicine Early Warning System* e-learning module. For the budget impact analysis, we adopt an opportunity cost approach, in that the value of the time input of staff that is dedicated to education and training is estimated. That is, this resource requirement will involve diverting staff from their usual activities in EDs and this time input is explicitly costed. To cost the staff time input for education and training purposes, salary estimates (HSE, 2016) were generated following HIQA guidance (HIQA, 2014) and applied accordingly for each staff category: staff nurses, Clinical Nurse Managers, Assistant Directors of Nursing, non-consultant hospital doctors and Consultants in Emergency Medicine. To this end, midpoint salary scales, adjusted to include overheads and employer PRSI and pensions contributions, were estimated (HIQA, 2014). The specific costing process for each element of the education and training programme is detailed below.

A 'train the trainer' model will be adopted for the implementation of the *Emergency Medicine Early Warning System* education programme in EDs. A training module will be designed and developed by an *Emergency Medicine Early Warning System* team which will include 2 Clinical Nurse Managers and 1 Consultant in Emergency Medicine, each of whom will dedicate 6 hours to this process, at an overall cost of €1294. This preparatory work will inform the development of an e-learning module by an external information technology firm. While the content of the *Emergency Medicine Early Warning System* e-learning module will be developed by clinical staff, the e-learning module itself will be developed and hosted by the information technology firm at a cost of approximately €50,000 (HSE procurement estimate, 2016). This is an upper bound estimate of the cost of an e-learning module based on past HSE experience in this space. The *Emergency Medicine Early Warning System* team will undertake the training of trainers in each ED. To this end, 2 Clinical Nurse Managers and 1 Clinical Facilitator in each ED will perform the role of trainers and will receive 3 hours of training from the *Emergency Medicine Early Warning System* team. Applying the appropriate salary estimates to cost the time input of the relevant staff, the cost for training of trainers for *Emergency Medicine Early Warning System* in all 26 adult and mixed EDs nationally is estimated at €25,844.

The trainers in each ED will have the responsibility for the delivery of education and training for all existing staff in their respective EDs on the implementation of *Emergency Medicine Early Warning System*. This process is to be conducted initially and repeated at 2 years. It is explicitly recognised in the budget impact analysis that there will be a time input cost associated with this education and training process. There are 1543 WTE staff (1293 nurses, 250 doctors) working in the 26 EDs that require education and training for the *Emergency Medicine Early Warning System*. It is assumed all nursing staff will be required to dedicate 3 hours and all medical staff will be required to dedicate 1 hour for the completion of education and training at each time point. Applying the appropriate salary estimates to cost the time input of the relevant staff across the relevant EDs nationally, the estimated cost of education and training for existing ED staff is €286,228. This analysis assumes that each staff member will dedicate their time input to the e-learning module which will be facilitated, when required, by the trainers at each ED. The latter cost of facilitation is not costed, given that it is likely to be realised through efficiencies and flexibility in rostering and may not require direct staff replacement. This assumption will need to be reassessed and reconsidered over time.

It is also likely that there will be resource requirements with respect to materials and consumables for the purposes of the delivery of education and training. Based on the e-learning module model of delivery, we assume for the budget impact analysis that this cost will be negligible as they are likely to be covered by existing resources. These potential resource requirements will need to be reassessed and reconsidered over time.

For the budget impact analysis, the total cost of education and training is estimated at €363,366.

2.3 Human Resources and Staffing

The budget impact of the additional staffing requirements for the implementation of *Emergency Medicine Early Warning System* in EDs will be significant. That said, there is uncertainty over the precise nature of the staffing resource requirements within each individual ED. In the budget impact analysis, we present the upper bound estimate of the resource implications of implementing the guidelines and provide alternative estimates for consideration. In particular, we assume for the budget impact analysis that the implementation of *Emergency Medicine Early Warning System* will require additional nursing resources in each ED nationally. In practical terms, each ED will need to use the EMP Emergency Department Nursing Workforce Planning Framework (2016) tools to identify their local staff nurse requirement for the implementation of the *Emergency Medicine Early Warning System* programme. With respect to the implications for the budget impact analysis, the assumptions adopted will bias the cost estimates upwards, if one or more EDs can facilitate the implementation of *Emergency Medicine Early Warning System* from within their existing resource base. While this is unlikely, these impacts will need to be assessed within each ED nationally and the resource requirements overall will need to be reassessed and reconsidered over time if and when reliable data emerges.

The guideline recommends the requirement of the *Emergency Medicine Early Warning System* programme for a consultant in emergency medicine (middle grade or above) to be available to respond in a timely manner to escalations in the ED, when necessary. In the budget impact analysis, given the lack of available evidence to inform this specific resource requirement, we assume that it will be covered by existing staffing resources within EDs. This resource requirement will need to be reassessed and reconsidered over time.

The guideline also recommends a specific nursing resource requirement within each ED for the implementation of the *Emergency Medicine Early Warning System* programme. In the budget impact analysis, we assume that each ED will require an additional staff nurse to facilitate the implementation of the *Emergency Medicine Early Warning System* programme. In the budget impact analysis, given the lack of available baseline evidence to inform this specific nursing resource requirement for EDs individually and nationally, we present a number of alternative estimates for consideration. In all cases below, we present estimates on the basis of the whole time equivalent (WTE) staff nurse requirement, based on the HSE costing model, to facilitate the delivery of the *Emergency Medicine Early Warning System* programme.

- *Option 1:* Each ED will require an additional staff nurse resource to implement the *Emergency Medicine Early Warning System* programme over a period of 24 hours per day, 7 days per week and 52 weeks per year. This additional resource will require an investment in 6 new WTEs per ED. This estimate is explicitly based on costing cover for holiday, sick, maternity, parental and other forms of leave. The total cost of this resource is €7,878,143, estimated by hiring 6 staff nurses at a rate of €50,501 in each of the relevant 26 EDs nationally.
- *Option 2:* Each ED will require an additional staff nurse resource to implement the *Emergency Medicine Early Warning System* programme over a period of 16 hours per day, 7 days per week and 52 weeks per year. This estimate is based on the additional nursing resource only being required between 10.00 to 02.00 hours each day. This additional resource will require an investment in 3 new WTEs per ED. The total cost of this resource is €3,939,072, estimated by hiring 3 staff nurses at a rate of €50,501 in each of the 26 EDs nationally
- *Option 3:* Each ED will require an additional staff nurse resource to implement the *Emergency Medicine Early Warning System* programme. This estimate is based on the assumption that each ED employs 1 WTE staff nurse to facilitate the implementation of the *Emergency Medicine Early Warning System* programme. The assumption being that the additional workload would be shared between this new staff nurse resource and existing staffing resources. The total cost of this resource is €1,313,024, estimated by hiring 1 staff nurse at a rate of €50,501 in each of the 26 EDs nationally.

For the budget impact analysis, we present the upper bound cost estimate nationally by selecting *Option 1* for presentation purposes. As described above, this resource requirement will need to be reassessed and reconsidered within each ED.

For the budget impact analysis, the total cost of human resources and staffing is estimated at €7,878,143.

2.3 Equipment, Health Technologies, Materials & Consumables

The implementation of the *Emergency Medicine Early Warning System* programme will have resource implications for the existing usage of equipment, health technologies, materials and consumables within EDs. With respect to equipment requirements, these will include, for example, a desk, an office chair, a patient chair, a patient trolley and a computer with access to the ED information system.

In terms of health technologies, there will be a role for and a need to invest in electronic monitoring systems. For the purposes of the analysis, we assume that *Emergency Medicine Early Warning System* will require the installation of a new electronic monitoring system or an update to the existing monitoring system in each ED. To estimate the total budget impact across all EDs nationally, each of which will have their own specific technological requirements, we assumed that each ED will require some form of system investment. To this end, we classified all EDs into 'hub' (larger) or 'spoke' (smaller) sites, each of which are assumed to have particular electronic monitoring systems requirements. Based on quotation estimates provided from current HSE suppliers, we estimate the total budget impact of this investment in health technologies to be €4,557,710 (HSE procurement estimate, 2016).

Other resources may include a non-invasive physiological monitor, fully equipped phlebotomy and an IV cannulation trolley. In terms of consumables, *Emergency Medicine Early Warning System* will have implications for *Emergency Medicine Early Warning System* chart patient specific management plans, event logs, audit sheets, staff information sheets and patient information sheets. While these resource requirements will arise, we assume for the budget impact analysis that these costs will be covered by existing resources. These resource requirements will need to be reassessed and reconsidered over time.

For the budget impact analysis, the total cost of equipment, health technologies, materials and consumables is estimated at €4,557,710.

2.4 Evaluation & Audit

The *Emergency Medicine Early Warning System* programme will be audited and evaluated four weeks and twelve weeks after implementation. In the budget impact analysis, we assume that this process will be conducted by a Clinical Nurse Manager in each ED. We assume that new and existing nurse resources will be responsible for the recording of data relating to *Emergency Medicine Early Warning System* programme. We assume that the Clinical Nurse Manager will dedicate 6 hours per week for the conduct the audit at 4 weeks and 12 weeks. To cost the staff time input resource requirement across all 26 EDs, the appropriate salary estimate for the Clinical Nurse Manager was applied.

For the budget impact analysis, the total cost of evaluation and audit is estimated at €12,586.

2.5 Healthcare Savings

As stated previously, no economic evaluation, cost impact or resource impact studies of EWS or TTS were identified in the literature review. Therefore, the degree to which the *Emergency Medicine Early Warning System* programme may or may not result in cost savings to the healthcare system, or in

improved patient outcomes, remains unclear. That said, there is some limited evidence suggestive of the effect of EWS and TTS in identifying deteriorating patients, reducing cardiac arrests and reducing intensive care unit admissions. These data suggest the potential for healthcare cost savings from the implementation of *Emergency Medicine Early Warning System*. Studies are required to explore these questions however and future guidelines may incorporate this evidence if and when it is published.

For the budget impact analysis, the total healthcare saving is estimated at €0.

2.6 Total Cost Estimate for the Budget Impact of the National Guideline

The total cost of implementing the National Guideline for the *Emergency Medicine Early Warning System* programme in EDs nationally is estimated by adding the individual total cost estimates for *Education & Training, Human Resources & Staffing, Equipment, Health Technologies, Materials & Consumables, Evaluation & Audit* and subtracting the total cost estimate for *Healthcare Savings*.

The results are presented in Table 1. For the budget impact analysis, the total cost is estimated at **€12,811,806**.

As detailed in Table 2, this represents the upper bound estimate of the national budget impact. Depending on the assumptions adopted with respect to national nursing resource requirements, this varies from the lower bound estimates of **€6,246,686** and **€8,872,734**. Alternative estimates will also exist should EDs require differing staffing requirements to those included above.

Table 1: Emergency Medicine Early Warning System Programme - Budget Impact Analysis

Resource Category		Description & Issues	Assumptions	Cost Estimate (€)
A	Education & Training	A 'train-the-trainer' model of education and training employed for ED staff in all EDs across the country and facilitated through an 'e-learning' module. Training at implementation phase and at 2 years.	<p>Developers: 2 Clinical Nurse Managers, 1 Consultant in Emergency Medicine, information technology firm.</p> <p>Trainers: 2 Clinical Nurse Managers and 1 Clinical Facilitator in each ED.</p> <p>Training: 3 hours per nurse, 1 hour per doctor</p>	€363,366
B	Human Resources & Staffing	Each ED requires additional staff nurse resourcing to administer the programme.	Each ED requires 6 WTE staff nurses to implement EMEWS 24 hours per day, 7 days per week, 52 weeks per year.	€7,878,143
C	Equipment, Health Technologies, Materials & Consumables	The programme will have implications for equipment, health technologies, materials and consumables resources within EDs.	<p>The health technology investment requires the implementation of electric monitoring systems in each ED.</p> <p>Other resources will be covered by existing resources within EDs.</p>	€4,557,710
D	Evaluation & Audit	The programme will be evaluated and audited at 4 and 12 weeks.	Auditor: A Clinical Nurse Manager will allocate 6 hours to conduct analysis at 4 weeks and 12 weeks.	€12,586
E	Potential Healthcare Savings	The programme will potentially lead to cost savings in the healthcare system.	No evidence at present to support the inclusion of cost savings.	€0
Total Cost		A + B + C + D - E		€12,811,806

Table 2: Emergency Medicine Early Warning System Programme - Budget Impact Sensitivity Analysis

Analysis	Assumptions	Cost Estimate (€)
1	Staffing: Option 1: Each ED requires 3 WTE staff nurses to implement the programme 24 hours per day, 7 days per week, 52 weeks per year.	€8,872,734
2	Staffing: Option 2: Each ED requires 1 WTE staff nurse to implement the programme 24 hours per day, 7 days per week, 52 weeks per year.	€6,246,686

References

Health Information and Quality Authority, (2014). *Guidelines for the Budget Impact Analysis of Health Technologies in Ireland*. Dublin: Health Information and Quality Authority. Available at: https://www.hiqa.ie/sites/default/files/2017-01/Revised_BIA_Guidelines_posted_100714.pdf

Health Service Executive, (2016). *HSE January 2016 Revised Consolidated Payscale*. Available at: <https://www.hse.ie/eng/staff/benefitservices/pay/>

Appendix 9: Summary tables

To ensure clarity when assessing the quality of the recommendations the Scottish Intercollegiate Guidelines Network (SIGN) adopted the GRADE methodology. Further information is available at <http://sign.ac.uk>. The EMEWS GDG adopted these principals in its work.



Applying the GRADE methodology to SIGN guidelines: core principles

In 2009, SIGN took the decision to implement the GRADE approach within its guideline development methodology. This work is currently in process. There is, however, scope for variation in what people mean when they say they are “applying the GRADE system”. For clarity, this statement sets out the principles that SIGN will be applying when implementing GRADE.

We believe these principles are in line with the criteria set out by the GRADE Working Group, as they stood in June 2010.

1. All guideline recommendations will be based on a systematic review of the available evidence, and an assessment of the quality of that evidence. **Quality of evidence*** is defined as the extent to which confidence in an estimate of the effect is adequate to support recommendations.
2. Assessment of quality of evidence will be carried out in the context of its relevance to the NHS in Scotland. Criteria for establishing the overall quality of evidence will include all factors for increasing or decreasing the quality of evidence identified by the GRADE Working Group.
3. Evidence identified in a systematic review will be summarised in an evidence table listing key characteristics of individual studies. Each table will in turn be summarised in relation to the overall quality of evidence for each critical or important outcome identified by the guideline development group (GDG). These summaries will form the basis for all decisions regarding the **quality of evidence*** or **strength of recommendations**. Summaries will be produced either using Gradepro software or by recording decisions made by the GDG relating to each quality factor in a considered judgement form specific to this stage of the process.
4. Quality of evidence will be rated in one of four categories (ranging from low to high) as defined by the GRADE working group.
5. **Strength of recommendation** will be established on the basis of explicit consideration of each of the criteria established by the GRADE Working Group, and recorded in a considered judgement form specific to this stage of the process.
6. **Recommendations** will either be **unconditional** (strong evidence, no important drawbacks) or **conditional** (weaker evidence, serious potential drawbacks).

* Quality of evidence – Expert consensus is defined as detailed consideration by the GDG

1: Overarching recommendations

Clinical question 1: In what circumstances should EMEWS be activated?

EMEWS is recommended for use in EDs when patients are waiting longer for review by a Treating Clinician than is recommended based on their Manchester Triage System (MTS) Category. Based on international experience, if patient flow into and through the hospital were more optimal, there would be little need to introduce a new schedule of on-going monitoring. It is the responsibility of the Hospital Chief Executive Officer (CEO)/General Manager (GM) to optimise patient flow and to ensure timely and appropriate action is taken to eliminate/minimise ED crowding.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<u>Benefit</u> Expert opinion considers the introduction of EMEWS to be a pragmatic solution to a situation not within their control <u>Harm</u> Undetected patient deterioration
<i>Quality of evidence</i>	Expert opinion <u>GRADE Criteria for ACTIVATING EMEWS:</u> Quality of evidence: High
<i>Values and preferences</i>	Pilot test, focus group and GDG values the implementation of a clinical tool that is designed to meet the needs of the undiagnosed, undifferentiated patient with varying acuity
<i>Resource use</i>	Trained and experienced nursing and medical resource who know how and when to activate EMEWS
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

Patients should be assigned to the track and trigger system appropriate to their age, condition and stage of their journey through the health care system.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<u>Benefit</u> Patient is assigned to the correct track and trigger system <u>Harm</u> Undetected patient deterioration
<i>Quality of evidence</i>	Expert opinion <u>GRADE Criteria for ACTIVATING EMEWS:</u> Quality of evidence: Expert Opinion
<i>Values and preferences</i>	Pilot test, focus group and GDG values the implementation of a clinical tool that is designed to meet the needs of the undiagnosed, undifferentiated patient with varying acuity
<i>Resource use</i>	Trained and experienced nursing and medical resource who know how and when to activate EMEWS
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

2: Measurement and Documentation of Vital Signs	
Clinical question 2: Should EMEWS be used for all adults in Emergency Department setting for early identification of, and response to, clinical deterioration?	
Monitoring using EMEWS should be considered for all adult patients (≥16 years) in any Emergency Department (ED) setting following prioritisation using the Manchester Triage System	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Standardisation, quality of care, safety is enhanced</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>No concrete evidence to state what system is the most beneficial or conclusive, measurable improvement in outcomes but definite positive directional trends in outcomes and clinician support</p> <p><u>GRADE Criteria for EMEWS</u>: Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	Early detection universally supported
<i>Resource use</i>	<ul style="list-style-type: none"> • Time required to introduce and train adequately to inform the system, not just a new chart • The EMEWS training course is only part of the complex intervention • Additional costs will be incurred by Healthcare Institutions where they must provide additional training in Early Recognition of the Seriously Ill child • There may be a resource required to oversee the process – long-term project to ensure success • There will be a cost involved in printing the national charts but this may be balanced by the cost of the charts that are being replaced • There will be an audit implication • All costs are balanced by likelihood that standardisation will lead to improved patient safety and outcome
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

<p>To reduce risk in the ED environment the internationally recognised “heat” colour scheme should be used on the vital sign chart to denote parameter ranges.</p>	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Consistent approach with same colours used in other prioritisation systems used in ED</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>System used is the internationally recognised “heat” colour scheme</p> <p><u>GRADE Criteria for COLOUR SCHEME FOR PARAMETER RANGES:</u> Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	Use of the internationally recognised “heat” colour scheme supported
<i>Resource use</i>	Updating of current documentation
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

Clinical question 3: If an adult does not trigger escalation but a clinician is concerned about the patient’s clinical status, does EMEWS replace clinical judgement?

EMEWS should complement care not replace clinical judgement. Any concern about an individual adult patient warrants escalation, irrespective of the presence or absence of a trigger. The level of escalation should reflect the degree of clinical concern.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Continuation of good practice. Clinical concern, judgement and impression remain the standard for practice with EMEWS to assist good practice and standardise</p> <p><u>Harm</u> Allowing EMEWS to falsely reassure. Not taking into account the full clinical picture.</p> <p>Offset with robust training within a recognised competency framework.</p>

<i>Quality of evidence</i>	<p><u>Consistency</u>: All present regard the education around clinician clinical judgment, concern, impression to be of the utmost importance in maintaining patient safety and this was reflected in the literature</p> <p><u>Generalisability</u>: No tool can replace the human factors involved with situation awareness</p> <p><u>Applicability</u>: All clinicians should be aware that EMEWS should never override clinical concern or provide false reassurance.</p> <p>Expert opinion absolutely unanimous – concern/judgement should be emphasised.</p> <p><u>Impact</u>: Must be a national standard</p> <p><u>GRADE Criteria for CLINICAL JUDGEMENT</u>: High quality: Further research is very unlikely to change our confidence in the estimate of effect:</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	Universally strongly expressed by group
<i>Resource use</i>	Nil
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

Clinical question 4: What physiological parameters should be included in an assessment to generate a valid EMEWS assessment? How and when should, these vital signs be performed?	
<p>The core EMEWS physiological parameters must be recorded as a baseline at triage. These are: Respiratory Rate (RR), Oxygen Saturation (SpO₂), Fraction of inspired Oxygen (FiO₂), Heart Rate (HR), Systolic Blood Pressure (SBP), Temperature (T) and Level of Consciousness (ACVPU: Alert/Confused/Respond to Voice/Respond to Pain/Unresponsive). The subsequent frequency of observations is initially determined by their triage category and presenting complaint until a Patient-Specific Monitoring Plan is in place.</p>	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Holistic view of the adult</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>Evidence still emerging. Parameter ranges aligned with NEWS.</p> <p><u>GRADE Criteria for CORE EMEWS PHYSIOLOGICAL PARAMETERS</u>: further research is likely to have an important impact on the estimated effect of recording all parameters</p> <p>Quality of evidence: Moderate</p>

<i>Values and preferences</i>	Requires a cultural shift to perform complete assessment therefore a perception of increased workload by nursing staff
<i>Resource use</i>	May require some minutes additionally at the bedside but this is seen as a benefit overall
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

The technique of recording, measuring and monitoring of vital signs should be undertaken in line with recognised, evidence-based practice.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Evidence-based standards of care, quality improvement. Ensures standardisation of clinical guidelines and practices across all EDs in Ireland</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>Correct application of equipment and recording of measurements as per The Royal Marsden Hospital Manual of Clinical Nursing Procedures (9th Ed, 2015)</p> <p><u>GRADE Criteria for STANDARDS FOR VITAL SIGNS: High.</u></p> <p>Further research is very unlikely to change our confidence in the estimate of effect</p> <p>Quality of evidence: High</p>
<i>Values and preferences</i>	Unlikely to indicate preference for variation in vital sign standards
<i>Resource use</i>	Possible equipment costs if changes are required to achieve standardisation required across ED but this is negligible and benefits of enhanced patient safety more than outweigh any cost
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

Clinical question 5: Should staff/family concern be included as a core parameter in the EMEWS tool for the identification of clinical deterioration of adults in Emergency Department settings?	
Staff concern is an important indicator of the level of illness/clinical status of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Enhanced staff/patient relationship, enhanced multi-disciplinary relationship. Promotes situation awareness and clinical judgement.</p> <p>The level of escalation and response required is judged by the attending member of staff.</p> <p><u>Harm</u> Could arise from misunderstanding on the part of the staff as to the concept of concern or at the expression of concern – address with education and resources to actively engage with the patient and promote shared understanding</p>
<i>Quality of evidence</i>	<p><u>GRADE Criteria for STAFF CONCERN</u>: Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	The presence of any level of concern on behalf of any member of staff
<i>Resource use</i>	Requires inclusion in EMEWS training
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

Family concern is an important indicator of the level of illness of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Enhanced staff/family relationship, enhanced multi-disciplinary relationship. Promotes situation awareness and clinical judgement</p> <p>The level of escalation and response required is judged by the attending member of staff.</p> <p><u>Harm</u> Could arise from misunderstanding on the part of the family or clinician as to the concept of concern or at the expression of concern – address with education and resources to actively engage with the family and promote shared understanding</p>

<i>Quality of evidence</i>	<p><u>GRADE Criteria for FAMILY CONCERN</u>: Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	The presence of any level of concern on behalf of any member of staff
<i>Resource use</i>	Requires inclusion in EMEWS training
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

3: Escalation of Care and Clinical Communication

Clinical question 6: What mechanism and communication tool should be used for the escalation of clinical care?

The EMEWS escalation protocol identifies the clinical escalation steps that should be taken in the event of any parameter/s being triggered.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Increased patient safety, team work, communication, common understanding. Greater situation awareness for ED multidisciplinary team to facilitate prioritisation of care, delegation of duties.</p> <p>Timely response to deterioration with the aim of prevention.</p> <p>Benefits of standardised communication are well established. Clear communication, record keeping adhering to mandatory standards</p> <p><u>Harm</u> Allowing guide to influence clinical judgement in revising actions down based on a lower than expected score and therefore delaying escalation</p> <p>Unnecessary escalations</p>
<i>Quality of evidence</i>	<p>Difficult to compare due to variances at all stages: detection systems, activation criteria, activation process, team composition and availability, response measures/outcomes etc. but EMEWS has an escalation algorithm or care recommendations following a trigger</p> <p><u>GRADE Criteria for CLINICAL ESCALATION:</u> Increasing body of evidence for response and detection systems</p> <p>High quality: Further research is very unlikely to change our confidence in the estimate of effect</p> <p>Quality of evidence: Moderate High</p>
<i>Values and preferences</i>	<p>Some clinicians were concerned that EMEWS would result in unnecessary increased workload</p>
<i>Resource use</i>	<p>Additional senior medical and nursing personnel on duty may be required</p>
<i>Strength of recommendation</i>	<p>Strong</p>
<i>GDG consensus</i>	<p>Agreed by Guideline Development Group</p>

The ISBAR and ISBAR₃ communication tools should be used when communicating clinical concern.	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Benefits of standardised communication are well established</p> <p><u>Harm</u> Nil</p>
<i>Quality of evidence</i>	<p><u>GRADE Criteria for ISBAR:</u></p> <p>High quality: Further research is very unlikely to change our confidence in the estimate of effect</p> <p>Quality of evidence: High</p>
<i>Values and preferences</i>	<p>Standardised communication is universally supported.</p> <p>ISBAR is the NCEC recommended tool Communication (Clinical Handover) in Maternity Services NCEC NCG No. 5 and Communication (Clinical Handover) in Acute and Children’s Services NCEC NCG No. 11.</p>
<i>Resource use</i>	<p>ISBAR is the NCEC recommended tool Communication (Clinical Handover) in Maternity Services NCEC NCG No. 5 and Communication (Clinical Handover) in Acute and Children’s Services NCEC NCG No. 11. Many hospitals have already put the tool in place. Others will have to comply. For those hospitals there may be costs associated with training, education, culture – bedrock, buy in from all stakeholders and resource support from the top; leadership. All sites will require on-going attention to monitor, evaluate and sustain implementation</p>
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

Following review by a treating clinician a clinical management plan must be put in place and clearly documented as part of the EMEWS response.	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Clear communication, record keeping adhering to mandatory standards</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>Health Service Executive: Standards and Recommended Practices for Healthcare Records Management QPSD-D-006-3 V3.0 May 2011</p> <p>Nursing and Midwifery Board of Ireland: Recording Clinical Practice. Professional guidance. 2015.</p> <p>Quality of evidence: High</p>

<i>Values and preferences</i>	
<i>Resource use</i>	Documentation: mandatory standards – should be current practice though refresher training may be implemented locally
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

Clinical question 7: What are the appropriate amendments (variances) that can be made to a patient's EMEWS parameters or escalation response?

Any amendment to the Post-Triage Monitoring Plan, such as frequency of vital sign measurement or trigger point, for a given patient with a pre-existing condition that affects their baseline physiological status, e.g. Chronic Obstructive Pulmonary Disease should only be decided by a doctor of Registrar grade or above.

In a situation where an unwell but stable adult would normally have triggered escalation using EMEWS, a Medical Escalation Agreement may be made by a doctor of Registrar grade or above for a maximum period of four hours.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Reducing inappropriate calls. Enhances communication with patient and their family.</p> <p>Increases specificity. Individualised, patient focused</p> <p><u>Harm</u> Inappropriate amendments - resolved through education and audit</p>
<i>Quality of evidence</i>	<p>There was strong feeling at Guideline Development Group that the permitted variances are an important factor in EMEWS. Allowing variance is the aspect which firmly embeds the judgement of the clinician and the individual circumstances of each patient as paramount. Variances allow for the adult patient whose baseline is different to the expected range and/or whose clinical presentation, as expected though their illness is causing physiological triggers. It is also the aspect of the EMEWS which poses a risk as the triggers or escalation safety net is altered. Clear and on-going education is required to ensure that parameter amendments are used appropriately.</p> <p><u>GRADE Criteria for PARAMETER AMENDMENTS</u>: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate</p> <p>Quality of evidence: Very Low/Expert Opinion</p>
<i>Values and preferences</i>	During the test phase concern was raised that parameter amendments may be used inappropriately

<i>Resource use</i>	<p>Education required pre implementation and focused audit required to monitor and embed</p> <p>On-going attention to monitor and evaluate and sustain appropriate amendment changes</p> <p>Audit/monitoring essential to embedding system post implementation. Champions/medical support/medical case review</p>
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

Any amendment to the Post-Triage Monitoring Plan or Medical Escalation Agreement must be communicated and documented in the patient's ED chart.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Good clinical practice ensures more effective use of resources Increases specificity. Individualised, patient focused</p> <p><u>Harm</u> Inappropriate amendments - resolved through education and audit</p>
<i>Quality of evidence</i>	<p>Recording medical and nursing practice as per professional guidance</p> <p>Recording Clinical Practice, Nursing and Midwifery Board of Ireland (2015) and Guide to Professional Conduct and Ethics for Registered Medical Practitioners (8th Ed, 2016) Medical Council.</p> <p><u>GRADE Criteria for AMENDMENT or SUSPENSION</u>: Further research will assist in identifying the appropriate duration of suspensions</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	Pilot test and focus group raised the need for an appropriately trained and experienced clinician
<i>Resource use</i>	Nil
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

4: Adult Sepsis

Clinical question 8: What additional investigations should be performed for adults with suspected sepsis?

In patients with a clinical suspicion of infection and a high mortality risk from sepsis i.e.:

1. On chemotherapy/radiotherapy with risk of neutropenia
2. Clinically or biochemically apparent new organ dysfunction
3. ≥ 2 of the modified SIRS criteria and the presence of ≥ 1 co-morbidity associated with increased mortality with infection

it is recommended that the Adult Sepsis Pathway is commenced within one hour of diagnosis or two hours from triage or deterioration alert “Time Zero”. When the results of the tests and investigations are assessed, the diagnosis and treatment plan should be reviewed and amended accordingly.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> The burden of sepsis has been well established. The benefit of early detection and timely effective management of sepsis has been well established.</p> <p><u>Harm</u> Undetected sepsis and/or complications</p>
<i>Quality of evidence</i>	<p>NCEC National Clinical Guideline for Sepsis Management (No. 6)</p> <p><u>GRADE Criteria for ADULT SEPSIS</u>: Further research is very unlikely to change our confidence in the estimate of effect</p> <p>Quality of evidence: High</p>
<i>Values and preferences</i>	
<i>Resource use</i>	Cost of training outweighed by clinical benefit to patients, and likely reduction in ICU admissions, reduction of level of illness and length of stay, reduced long term sequelae, reduced mortality
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

5: Governance	
<p>The Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN) of each hospital or hospital group are accountable for the operation of the EMEWS. A formal governance structure, such as a “Management of the Deteriorating Patient” governance committee, should oversee and support the local resourcing, implementation, operation, monitoring and assurance of the EMEWS.</p>	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Oversight, leadership, cultural transformation, sustaining and embedding change into practice. Ensuring standards and quality</p> <p><u>Harm</u> Nil</p>
<i>Quality of evidence</i>	<p>For consistency apply same approach as other related track and trigger National Clinical Guidelines;</p> <ul style="list-style-type: none"> • National Early Warning Score (NCEC NCG No. 1) • Irish Maternity Early Warning System (NCEC NCG No. 4) • Paediatric Early Warning System (NCEC NCG No. 12) <p><u>GRADE Criteria for GOVERNANCE</u>: Further research is unlikely to change our confidence in the estimate of effect</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	Strong governance committee with decision making abilities to implement at local level required to implement and sustain complex change
<i>Resource use</i>	The “Management of the Deteriorating Patient” governance committee should be formed to oversee planning and implementation of EMEWS locally (time cost)
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

The “Management of the Deteriorating Patient” governance committee should identify a named individual(s) to coordinate local EMEWS implementation for example a clinical facilitator.	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Ensuring consistency and quality in the training of staff</p> <p><u>Harm</u> Nil</p>
<i>Quality of evidence</i>	<p>For consistency apply same approach as other related track and trigger National Clinical Guidelines;</p> <ul style="list-style-type: none"> • National Early Warning Score (NCEC NCG No. 1) • Irish Maternity Early Warning System (NCEC NCG No. 4) • Paediatric Early Warning System (NCEC NCG No. 12) <p><u>GRADE Criteria for IMPLEMENTATION</u>: Further research is unlikely to change our confidence in the estimate of effect</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	Identifiable lead in ED essential
<i>Resource use</i>	Assignment of dedicated clinical facilitator hours to training and implementation of EMEWS
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

An appropriately experienced and trained nursing resource is required 24 hours a day for post-triage assessment as this is new work distinct from triage and other current emergency nursing roles. Consideration of the use of the latest technological developments in patient monitoring should be explored.	
An appropriately trained senior Emergency Medicine doctor should be available 24 hours a day to support junior medical and nursing staff in the ED.	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Appropriate and timely application of the guideline</p> <p>Appropriate and timely escalation as required</p> <p><u>Harm</u> Delay in application of the guideline</p> <p>Potentially missed patient deterioration and therefore escalation</p>

<i>Quality of evidence</i>	<p>Implementation of the guideline involves new work which requires appropriate resourcing.</p> <p><u>GRADE Criteria for NURSING and MEDICAL RESOURCE</u>: Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	Unanimous voicing during pilot phase, focus group and GDG to ensure appropriate application and where necessary escalation of care
<i>Resource use</i>	Availability of appropriately trained nurse and doctor 24hrs a day 7 days a week
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

6: Education

The Hospital Chief Executive Officer (CEO)/General Manager (GM) and Director of Nursing (DoN) in each hospital must ensure that EMEWS education is provided to all clinicians who work in the ED.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Quality assurance, more effective implementation, enhanced understanding of the system and therefore compliance</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>Known barriers to implementation include lack of formalised education</p> <p><u>GRADE Criteria for EDUCATION</u> : Moderate quality: further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	
<i>Resource use</i>	Time for nursing and medical staff to be released for training
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

7: Supporting Practices

Hospitals should implement safety practices that enhance the EMEWS and lead to greater situational awareness among clinicians and multidisciplinary teams.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Enhanced patient safety through greater situational awareness. Shared situational awareness through briefings/huddles/safety pause to prompt and promote safety concerns</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>Increasing evidence on the impact of human factors in healthcare systems. Increasing body of work around situational awareness and patient safety/quality of care</p> <p><u>GRADE Criteria for QUALITY IMPROVEMENT:</u> Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the effect</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	
<i>Resource use</i>	Time for education and embedding in processes
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

8: Evaluation and Audit

Clinical Audit should be used to aid implementation and quality-assure EMEWS.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Audit will provide real data and assess progress. It will allow identification of areas for improvement using targeted educational strategies</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>During the pilot tests and in discussion at the guideline development group it was suggested that auditing of the baseline performance and facilitated, targeted ED training would assist in promoting good practice</p> <p>Quality of evidence: High</p>
<i>Values and preferences</i>	None predicted
<i>Resource use</i>	Initial audit process time consuming
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

EMEWS should be supported through the application of quality improvement methods, such as engagement strategies, testing and measurement to ensure successful implementation, sustainability and future progress.

Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Quality improvement methods can assist in the implementation of change</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>The use of quality improvement methods have been shown to assist with the embedding of change in clinical practice</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	None predicted
<i>Resource use</i>	Initial audit process time consuming
<i>Strength of recommendation</i>	Conditional
<i>GDG consensus</i>	Agreed by Guideline Development Group

9: Electronic Monitoring Technology	
Electronic monitoring technology should be utilised where possible to record physiological parameters therefore facilitating more efficient use of nursing resources.	
Factor	Comment
<i>The balance of desirable and undesirable effects</i>	<p><u>Benefit</u> Accurate recording of vital signs</p> <p>Ability to set alarms to alert staff if pre-determined parameters are exceeded</p> <p><u>Harm</u> None foreseen</p>
<i>Quality of evidence</i>	<p>Increasing body of evidence demonstrating improved accuracy of recording and adherence to trigger criteria</p> <p>Quality of evidence: Moderate</p>
<i>Values and preferences</i>	None predicted
<i>Resource use</i>	Investment in appropriate non-invasive physiological monitoring system
<i>Strength of recommendation</i>	Strong
<i>GDG consensus</i>	Agreed by Guideline Development Group

Appendix 10: Resource implications of implementing EMEWS

The following table identifies the areas where there are potential resource implications involved with implementing the EMEWS recommendations.

1: Overarching Recommendations	Change in resources
<p>Recommendation 1 EMEWS is recommended for use in EDs when patients are waiting longer for review by a Treating Clinician than is recommended based on their Manchester Triage System (MTS) Category. Based on international experience, if patient flow into and through the hospital were more optimal, there would be little need to introduce a new schedule of on-going monitoring. It is the responsibility of the Hospital Chief Executive Officer (CEO)/General Manager (GM) to optimise patient flow and to ensure timely and appropriate action is taken to eliminate/minimise ED crowding.</p> <p>Quality of Evidence: High Strength of recommendation: Strong Responsible person/s for implementation: Hospital Chief Executive Officer (CEO)/General Manager (GM)</p> <p>Recommendation 2 Patients should be assigned to the track and trigger system appropriate to their age, condition and stage of their journey through the health system.</p> <p>Quality of Evidence: Expert Opinion Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p>	<p>Potential for implementation costs to be reduced if patient egress from the ED into the hospital is improved.</p> <p>Resource implication for initial changeover to new charts</p>
2: Measurement and Documentation of Vital Signs	
<p>Recommendation 3 Monitoring using EMEWS should be considered for all adult patients (≥16 years) in any ED setting following prioritisation using the Manchester Triage System.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>No resource implications</p>

<p>Recommendation 4 To reduce risk in the ED environment the internationally recognised “heat” colour scheme should be used on the vital sign chart to denote parameter ranges.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>Resource implication for initial changeover to new charts</p>
<p>Recommendation 5 EMEWS should complement care, not replace clinical judgement. Any concern about an individual adult patient warrants escalation, irrespective of the presence or absence of a trigger. The level of escalation should reflect the degree of clinical concern.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>No resource implication</p>
<p>Recommendation 6 The core EMEWS physiological parameters must be recorded as a baseline at triage. These are: Respiratory Rate (RR), Oxygen Saturation (SpO₂), Fraction of inspired Oxygen (FiO₂), Heart Rate (HR), Systolic Blood Pressure (SBP), Temperature (T) and Level of Consciousness (ACVPU: Alert/Confused/Respond to Voice/Respond to Pain/Unresponsive). The subsequent frequency of observations is initially determined by their triage category and presenting complaint until a Patient-Specific Monitoring Plan is in place.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>No resource implication</p>
<p>Recommendation 7 The technique of recording, measuring and monitoring of vital signs should be undertaken in line with recognised, evidence-based practice.</p> <p>Quality of Evidence: High Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p>	<p>No resource implication</p>
<p>Recommendation 8a Staff concern is an important indicator of the level of illness/ clinical status of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p>	<p>No resource implication</p>

<p>Recommendation 8b Family concern is an important indicator of the level of illness of an adult which may prompt a greater level of escalation and response than that indicated by the EMEWS alone.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p>	<p>No resource implication</p>
<p>3: Escalation of Care and Clinical Communication</p>	
<p>Recommendation 9 The EMEWS escalation protocol identifies the clinical escalation steps that should to be taken in the event of any parameter/s being triggered.</p> <p>Quality of Evidence: High Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p> <p>Recommendation 10 The ISBAR and ISBAR₃ communication tools should be used when communicating clinical concern.</p> <p>Quality of Evidence: High Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p> <p>Recommendation 11 Following review by a treating clinician, a clinical management plan must be put in place and clearly documented as part of the EMEWS response.</p> <p>Quality of Evidence: High Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p> <p>Recommendation 12a Any amendment to the Post-Triage Monitoring Plan, such as frequency of vital sign measurement or trigger point for a given patient with a pre-existing condition that affects their baseline physiological status, e.g. Chronic Obstructive Pulmonary Disease should only be decided by a doctor of Registrar grade or above.</p> <p>Quality of Evidence: Very Low / Expert Opinion Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>Sufficient senior decision makers available on-site to respond to clinical escalations</p> <p>No resource implications, already introduced in hospitals</p> <p>No resource implications, already part of clinical practice</p> <p>Resource required for training and development of monitoring plans and balancing of risks</p>

<p>Recommendation 12b In a situation where an unwell but stable adult would normally have triggered escalation using EMEWS, a Medical Escalation Agreement may be made by a doctor of Registrar grade or above for a maximum period of four hours.</p> <p>Quality of Evidence: Very Low / Expert Opinion Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p> <p>Recommendation 12c Any amendment to the Post-Triage Monitoring Plan or Medical Escalation Agreement must be clearly communicated and documented in the patient’s ED chart.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>Resource required for training in Medical Escalation Agreement development</p> <p>No resource implications</p>
<p>4: Adult Sepsis</p>	
<p>Recommendation 13 In patients with a clinical suspicion of sepsis adherence to the NCEC National Clinical Guideline No. 6 Sepsis Management is strongly recommended.</p> <p>Quality of Evidence: High Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p>	<p>Potential additional resources required to meet guideline but this does not arise as a direct result of the introduction of EMEWS</p>
<p>5: Governance</p>	
<p>Recommendation 14a The Hospital Chief Executive Officer (CEO)/General Manager (GM), Clinical Director (CD) and Director of Nursing (DoN) of each hospital or hospital group are accountable for the operation of the EMEWS. A formal governance structure, such as a “Management of the Deteriorating Patient” governance committee, should oversee and support the local resourcing, implementation, operation, monitoring and assurance of the EMEWS.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Hospital Chief Executive Officer (CEO)/General Manager (GM)</p>	<p>No resource implication if “Management of the Deteriorating Patient” governance committee already exists in hospital</p>

<p>Recommendation 14b The “Management of the Deteriorating Patient” governance committee should identify a named individual(s) to coordinate local EMEWS implementation e.g. a clinical facilitator.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Hospital Chief Executive Officer (CEO)/General Manager (GM)</p> <p>Recommendation 15a An appropriately experienced and trained nursing resource is required 24 hours a day for post-triage assessment as this is new work distinct from triage and other current emergency nursing roles. The use of the latest technological developments in patient monitoring should be explored.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p> <p>Recommendation 15b An appropriately trained senior Emergency Medicine doctor should be available 24 hours a day to support junior medical and nursing staff in the ED.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>Resource required if not already in post</p> <p>Resource required</p> <p>Resource may be required in some sites</p>
<p>6: Education</p>	
<p>Recommendation 16 The Hospital Chief Executive Officer (CEO)/General Manager (GM) and Director of Nursing (DoN) in each hospital must ensure that EMEWS education is provided to all clinicians who work in the ED.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Hospital Chief Executive Officer (CEO)/General Manager (GM)</p>	<p>Resources required to release staff for training as well as training materials and venue</p>

7: Supporting Practices	
<p>Recommendation 17 Hospitals should implement safety practices that enhance EMEWS and lead to greater situational awareness among clinicians and multidisciplinary teams.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Hospital Chief Executive Officer (CEO)/General Manager (GM)</p>	<p>No resource implications. Majority of sites have already implemented safety huddles / pauses</p>
8: Audit	
<p>Recommendation 18a Clinical audit should be used to aid implementation and quality-assure EMEWS.</p> <p>Quality of Evidence: High Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p> <p>Recommendation 18b EMEWS should be supported through the application of quality improvement methods, such as engagement strategies, testing and measurement to ensure successful implementation, sustainability and future progress.</p> <p>Quality of evidence: Moderate Strength of recommendation: Conditional Responsible person/s for implementation: Clinical staff</p>	<p>Resources required to undertake clinical audit and develop improvement plans if required</p> <p>Resource implications for quality improvement training, if not already in place</p>
9: Electronic Monitoring Technology	
<p>Recommendation 19 Electronic monitoring technology should be utilised, where possible, to record physiological parameters.</p> <p>Quality of Evidence: Moderate Strength of recommendation: Strong Responsible person/s for implementation: Clinical staff</p>	<p>Resources required to purchase additional non-invasive physiological equipment on some sites</p>

Appendix 11: Glossary of terms and abbreviations

Glossary of Terms

Adult Only Emergency Department (ED)

An ED that treats patients aged 16 years and over

Paediatric Emergency Department (PED)

An ED which treats patients under the age of 16 years

Clinical Escalation

Describes a process whereby a change in the patient's physiological status or a clinical concern that need not be specified prompts a team response such that a clinician with appropriate competencies and diagnostic skills attends the patient in an appropriate time-frame (usually immediately in the ED setting) and manages the physiological problem or clinical cause for concern

HIQA Tallaght Report

Report of the investigation into the Quality, Safety and Governance of the care provided by the Adelaide and Meath Hospital, Dublin incorporating the National Children's Hospital (AMNCH) for patients who require Acute Admission, Health Information and Quality Authority, May 2012

Mixed Emergency Department (ED)

An ED that treats both Adults and Children

Nurse-in-Charge

The Nurse-in-Charge can be managing an area/zone of the Emergency Department or the entire department depending on its size and/or foot-print

Patient-Specific Monitoring Plan

On-going monitoring plan developed following review by a Treating Clinician

Post-Triage Emergency Nursing Reviews

Review undertaken during the period from triage to time seen by a Treating Clinician

Senior Decision Maker

A medical professional of registrar grade or higher

Senior Nurse

A nurse who may be a Senior Staff Nurse, Shift Leader, CNM or ADON/DNM for example

Treating Clinician

An Emergency Medicine doctor or an Advanced Nurse Practitioner (ANP)

Abbreviations

ADON	Assistant Director of Nursing (DoN)
BIA	Budget Impact Analysis
DON	Director of Nursing
ED	Emergency Department
EM	Emergency Medicine
EMEWS	Emergency Medicine Early Warning System for Adult Patients
EMP	National Emergency Medicine Programme
ENIG	Emergency Nursing Interest Group
GCS	Glasgow Coma Scale
GDAG	Guideline Development Advisory Group
GDG	Guideline Development Group
GDWG	Guideline Development Working Group
HIQA	Health Information & Quality Authority
HSE	Health Service Executive
HSCP	Health and Social Care Professionals
IAEM	Irish Association for Emergency Medicine
ICEMT	Irish Committee for Emergency Medicine Training
IMEWS	Irish Maternity Early Warning System
ISBAR	Communication Tool – Identify, Situation, Background, Assessment, Recommendation
ISBAR₃	Communication Tool – Identify, Situation, Background, Assessment, Recommendation, Read-Back, Risk
MTS	Manchester Trauma System
NCEC	National Clinical Effectiveness Committee
NEWS	National Early Warning Score (NEWS)
ONMSD	the Office of the Nursing and Midwifery Services Director
PEWS	Paediatric Early Warning System
PHECC	Pre-Hospital Emergency Care Council
QID	Quality Improvement Division
RCEM	Royal College of Emergency Medicine
SIGN	Scottish Intercollegiate Guidelines Network
TTS	Track and trigger systems

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