An Roinn Sláinte
Department of Health

# Irish Maternity Early Warning System (IMEWS) V2

National Clinical Guideline No. 4

## Annex 2: Budget impact analysis

National Patient Safety Office
Oifig Náisiúnta um Shábháilteacht Othar

National Clinical Effectiveness Committee

HRB Health Research Board

CICER Collaboration in Ireland for Clinical Effectiveness Reviews

CICER
Collaboration in Ireland for Clinical Effectiveness Reviews

# Irish Maternity Early Warning System: budget impact analysis

National Clinical Guideline No. 4

August 2018

Health Information and Quality Authority
An tÚdarás Um Fhaisnéis agus Cáilíocht Sláinte

HRB Health Research Board

NATIONAL CLINICAL EFFECTIVENESS COMMITTEE

RCSI

## About HRB-CICER

In 2016, the Department of Health requested the Health Research Board (HRB) to fund a dedicated multidisciplinary research group to support the activities of the Ministerial appointed National Clinical Effectiveness Committee (NCEC). Called HRB-CICER (Collaboration in Ireland for Clinical Effectiveness Reviews), a five-year contract (2017 to 2022) was awarded following a competitive process to the Health Information and Quality Authority (HIQA). The HRB-CICER team comprises a dedicated multidisciplinary research team (including expertise in health economics, qualitative and quantitative research methods and epidemiology) supported by staff from the Health Technology Assessment (HTA) team in HIQA and the HRB Centre for Primary Care Research at the Royal College of Surgeons in Ireland (RCSI), as well as national and international clinical and methodological experts.

Guideline development groups submit clinical guidelines for appraisal and endorsement by the NCEC as National Clinical Guidelines. HRB-CICER provides independent scientific support to guideline development groups tailored according to their specific needs. The main role of the HRB-CICER team is to undertake systematic reviews of the clinical effectiveness and cost-effectiveness of interventions included in the guidelines and to estimate the budget impact of implementing the guidelines. Additional support can be provided by HRB-CICER to guideline development groups including; providing tailored training sessions and working closely with the guideline development groups to develop clinical questions and search strategies; performing systematic reviews of international clinical guidelines; supporting the assessment of their suitability for adaption to Ireland and assisting in the development of evidence-based recommendations.

## Membership of the evaluation team

The members of the HRB-CICER and HIQA Evaluation Team were Dr Barbara Clyne, Michelle O'Neill, Paul Carty, Dr Pat Moran, Professor Susan Smith and Dr Máirín Ryan.

# Table of Contents

# List of Tables

## List of abbreviations

| | |
|---|---|
| **BIA** | budget impact analysis |
| **CEO** | chief executive officer |
| **CGDG** | childbirth guideline development group |
| **CI** | confidence interval |
| **HIQA** | Health Information and Quality Authority |
| **HRB-CICER** | Health Research Board-Collaboration in Ireland for Clinical Effectiveness Reviews |
| **HSPC** | Health Service Personnel Census |
| **HSE** | Health Service Executive |
| **HSE NWIHP** | HSE National Women and Infants Health Programme |
| **HTA** | health technology assessment |
| **IMEWS** | Irish Maternity Early Warning System |
| **ISBAR** | identify, situation, background, assessment and recommendation |
| **MEWT** | Maternal Early Warning Trigger |
| **MN-CMS** | Maternal & Newborn Clinical Management System |
| **NCHD** | non-consultant hospital doctor |
| **PRSI** | Pay-Related Social Insurance |
| **QALY** | quality-adjusted life year |
| **RCSI** | Royal College of Surgeons in Ireland |
| **WTE** | whole time equivalent |

# 1 Introduction

## 1.1 Scope of work

The completion of a budget impact analysis (BIA) is a required step in the development of National Clinical Guidelines in Ireland.[1] A BIA addresses the expected changes in the expenditure of a healthcare system after the adoption of a new intervention. In the context of guideline development, the purpose of the BIA is to quantify the resource implications of the recommendations. That is, to synthesise the available knowledge in order to estimate the likely resource or financial consequences for the healthcare system.[2] This BIA has been developed to support the work of the Childbirth Guideline Development Group (CGDG) to update the Irish Maternity Early Warning System (IMEWS) National Clinical Guideline (No. 4).[3]

## 1.2 Burden of disease: maternal death and morbidity

Although most women progress through pregnancy, labour and delivery with few complications, maternal death and severe morbidity remain important public health concerns.[4] The *Confidential Maternal Deaths Enquiry in Ireland* published in 2017 confirmed that Ireland continues to have a low maternal mortality ratio (6.5 per 100,000 maternities, 95% confidence interval [CI] 3.5-11.2) by international standards.[5] However, severe maternal morbidity is more common, with figures from the UK indicating that for every maternal death, nine mothers develop severe obstetric complications.[6] In a study of severe maternal morbidity for 2004 to 2005 in the three Dublin maternity hospitals, which account for 37% of the total births nationally, the rate of severe maternal morbidity* was 3.2 per 1,000 maternities.[7] The most common causes of maternal morbidity were haemorrhage, cerebral dysfunction and coagulation dysfunction. Many cases of major maternal morbidity and mortality may be preventable; therefore, early recognition of

* The UK figure is as a ratio per death while the Irish figure is per maternity, therefore the figures for maternal severe morbidity not comparable

clinically deteriorating pregnant women remains a priority for improving maternity services.[8]

### 1.3 Economic impact of maternal early warning systems

As part of the update of the IMEWS National Clinical Guideline (No. 4), a systematic literature review was conducted to update the available clinical effectiveness and cost-effectiveness literature. A comprehensive search of databases, including PubMed, EMBASE, Database of Abstracts of Reviews of Effects, NHS Economic Evaluation Database and National Institute for Health Research Health Technology Assessment Database, was conducted from April 2014 to October 2017. Using this search, one health economic study was identified. As this was published in abstract form only it was not possible to assess the transferability of the findings to the Irish context. The study assessed the cost-effectiveness of a Maternal Early Warning Trigger (MEWT) in the reduction of severe maternal morbidity and maternal mortality during delivery hospitalisations using a decision-analytic model. In a theoretical cohort of four million women, the MEWT tool led to a 14.6% reduction in maternal mortality, a 20% reduction in overall rates of severe maternal morbidity, a 33% reduction in hysterectomy, and an 80% reduction in eclampsia. Improvement in these outcomes translated to an additional 40,000 maternal quality-adjusted life years (QALYs) and cost savings of nearly $US 330 million for the cohort of four million women.[9]

## 2 Study purpose

A BIA addresses the expected changes in the expenditure of a healthcare system when introducing a new intervention. In the case of clinical guideline development, the intervention is any recommendation that will lead to a change in the treatment pathway. In this context, the BIA aims to quantify the resource implications of all recommendations identified as representing a change to standard clinical practice. The purpose of this analysis is to estimate the likely ongoing financial consequences for the Irish healthcare system of the clinical recommendations outlined in the IMEWS National Clinical Guideline (No. 4)

update.[3] The BIA was conducted in accordance with HIQA guidelines for budget impact analysis and economic evaluation in Ireland.[10, 11]

# 3 Methods

## 3.1 Study perspective

In line with national guidelines, the BIA was conducted from the perspective of the publicly-funded health and social care system, the Health Service Executive (HSE).[10, 11] Only those costs and resource requirements relevant to the HSE were included. Indirect costs, such as decreased productivity associated with morbidity, treatment or death, and out-of pocket expenses incurred by patients were excluded from the analysis.

## 3.2 Time horizon

The time horizon represents the timeframe over which resource use is planned. In accordance with national guidelines, the BIA was estimated on a yearly basis over a five year time horizon.[11]

## 3.3 Rationale for included and excluded interventions

The IMEWS National Clinical Guideline (No. 4) was introduced in 2014 and is considered the current standard of care.[3, 12] Whether or not a new or updated recommendation represented a change to current clinical practice was identified by discussion with the Guideline Development Group (CGDG), evidence from the existing IMEWS National Clinical Guideline (No. 4),[3] and evidence from a national clinical audit of compliance with the IMEWS National Clinical Guideline in selected Irish maternity hospitals/units (May–November 2014).[12] The rationale for inclusion and exclusion of each individual recommendation is summarised in Appendix 1.

The key changes that will result from implementing the clinical recommendations contained in the guideline update are:

1. The creation of six new posts (recommendation 17)
2. Moving from the current face-to-face training model to an e-learning model (recommendation 15).

No changes to standard practice arising from the guideline recommendations were identified for any of the following categories:

- measurement and documentation of observations (recommendations 1–6)
- clinical communication and escalation of care (recommendations 7–10)
- governance (recommendations 11–14).

In relation to audit (recommendations 16 and 18), changes to the existing audit tool are currently being made to the nursing and midwifery quality care-metrics online system to include the audit on chart completion and will not result in any additional costs or resources. The number of questions has increased from 9 to 23. Audit of escalation and response (12 questions) is to be completed separately as it includes questions outside the scope of nursing and midwifery and should be resourced locally. This change is not anticipated to result in any additional costs or resources. It is noted that hospitals and units using the electronic Maternal & Newborn Clinical Management System (MN-CMS) may require more time to complete audits due to functionality issues with the retrieval of certain information, and this should be considered locally through MN-CMS governance structures.

A number of recommendations relate to a change in the layout/structure of the IMEWS chart. These are:

- noting patient Body Mass Index
- noting the cuff size to use on the chart (recommendation 6)
- allowing for variances to IMEWS parameters or the escalation guidelines to be made by senior medical personnel with caution in certain permitted circumstances (recommendation 10)

Changes to the paper IMEWS chart are being made currently and will not result in any further design costs. Furthermore, as the number of pages remains the same, there will be no additional print costs. Changes to the MN-CMS will be required; however, it has been

confirmed (personal communication with CGDG) that this will not result in any additional costs.

## 3.4 Description of new posts

The CGDG recommends the creation of six new posts (recommendation 17), one per hospital group (excluding the Children's Hospital Group). The staff in these whole time equivalent (WTE) posts will be responsible for providing education (that is, education apart from the e-learning module) and training on IMEWS to staff members in the maternity and acute hospitals within their hospital group. These staff will also oversee regular local audits of IMEWS.

### 3.4.1 Costs

The proposed six new posts were estimated on the clinical midwife/nurse manager pay scale, within which there are three grades. The base case analysis assumed all six posts will be appointed at grade 2. Sensitivity analysis were conducted, with appointments all made at grade 1 and grade 3. Salary costs were calculated using consolidated salary scales available from the Department of Health.[13] As per HIQA guidelines,[10, 11] midpoint salaries scales were used and were inflated to account for PRSI, superannuation, overheads and pension costs.

## 3.5 Description of training

The previous guideline recommended that all clinical staff receive education and training in IMEWS, relevant to their position. A train the trainer model was recommended and the on-going educational costs were estimated at €49,086 annually.[3] Currently, the IMEWS train the trainer model of education delivery and refresher training is not standard practice across all hospitals, with training most commonly provided through clinically based skills sessions. The guideline update recommends a change from the train the trainer approach to an e-learning format. The proposed training will involve an e-learning module which will take approximately 1 hour (pre-reading is also recommended, but it is not included in this analysis). The e-learning module will supplement the induction training staff currently receive at the commencement of their employment in their respective hospitals (the

content of this training varies across the hospitals). It is also proposed that a refresher one hour e-learning module should be undertaken every 3 years, in line with the guideline update timelines. The first refresher training is assumed to occur for all staff in the first year of the budget impact analysis, that is, in the year following the publication of this guideline update, a further refresher training is assumed to occur in year 4 (following the expected guideline update). The cost of the initial induction training has not been included in this BIA as it is not anticipated that this will lead to any additional opportunity costs.

Local clinically based skills sessions will be recommended to complement the e-learning session. Within most hospitals, there are current local training processes in place such as skills and drills sessions and toolbox sessions. The content and method of delivery varies from site to site. It is recommended that IMEWS content should be incorporated into these current training processes. This does not represent a change in current local practice so will not be included in the BIA.

The six new posts outlined in recommendation 17 will assume responsibilities for providing education and training on IMEWS to staff members in the maternity and acute hospitals within their hospital groups.

### 3.5.1 Target population

There are a number of approaches that can be adopted with regard to staff training in IMEWS, ranging from educating all clinical staff involved in providing maternity care only, to educating all clinical staff across all hospitals. Consultation with representatives across the six hospital groups (excluding the Children's Hospital Group) indicates that there is variation in how training in IMEWS is currently provided. Within two hospital groups, all clinical staff across maternity and acute sector hospitals receive training. In other hospital groups, only staff in the maternity hospitals receive training. The most appropriate approach has not been identified; therefore, a range of scenarios which reflect the models of current practice are presented here:

1. Education for all clinical staff in maternity hospitals and those involved in delivering maternity care in maternity units within general hospitals

2. Education for all clinical staff in maternity hospitals and general hospitals with maternity units
3. Education for all clinical staff across all maternity and all general hospitals.

In all scenarios the following clinical staff should receive education and training in IMEWS (recommendation 15):

- nurses
- midwives
- doctors, including obstetricians and anaesthetists.

Allied health professionals and healthcare assistants are not included in the population for education.

**SCENARIO 1: Education for all clinical staff in maternity hospitals and those involved in delivering maternity care in maternity units within general hospitals**

There are 19 maternity hospitals/units in total, five of which are maternity hospitals. The remaining 14 are general hospitals with a maternity unit. The aggregate numbers of staff employed at each level was requested by the CGDG from HIQA. As part of HIQA's monitoring programme against the National Standards for Safer Better Maternity services, with a focus on obstetric emergencies,[14] all maternity hospitals were asked to complete a self-assessment tool. As part of this assessment, hospitals provided self-assessed WTE numbers of clinicians and midwives working within their maternity units. In order to estimate the headcount within maternity units, the observed ratio of WTE to headcount within each staff grade in HSE Human Resources data was used to provide an inflation factor for each staff grade. The headcount was estimated by inflating the WTE data by these factors. The base case analysis applied the average inflation factor by staff grade across hospitals. To estimate the uncertainty surrounding these numbers, a range was created using the observed minimum and maximum inflation factor across hospitals. Based on this data, there is an estimated 3,067 WTE staff, equating to a headcount of 3,427 (range 3,315 to 3,662) medical and nursing staff employed across all 19 maternity hospitals and maternity units within general hospitals (Table 1).

**SCENARIO 2: Education for all clinical staff in maternity hospitals and in general hospitals with maternity units**

Numbers of staff employed nationally at each level were provided by HSE Human Resources to the CGDG. Based on this data for April 2018, there is 14,384 WTE, with a headcount of 16,145 medical and nursing staff employed across all 19 maternity hospitals and hospitals with maternity units (Table 1).

**SCENARIO 3: Education for all staff across all maternity and general hospitals**

This proposal is that all clinical staff across all maternity and general hospitals (excluding the Children's Hospital Group) should be educated and trained. The Employment Monitoring Reports/Health Service Personnel Census (HSPC)[15] was used to obtain the WTE clinical staff employed across the general hospitals. In order to estimate headcount data from WTE the same methodology as outlined in scenario 1 was applied. Based on HSPC data for May 2018,[15] there is an estimated 14,441 WTE medical and nursing staff employed across the acute (non-maternity hospitals). Applying the inflation factor of the WTE to headcount ratio obtained from data used in scenario 2, there is an estimated headcount of 16,320 staff (15,388 to 18,085). Including the staff in the maternity hospital, this would result in an estimated 32,072 (31,533 to 34,230) medical and nursing staff requiring education and training (Table 1).

**Table 1. Estimated numbers of WTE and headcount staff**

| Scenario | Number of WTE | Headcount (estimate range) |
|---|---|---|
| Scenario 1: Maternity hospitals and staff delivering care maternity units only | 3,067 | 3,427[±] (3,315 – 3,662) |
| Scenario 2: All maternity hospitals and acute hospitals with maternity units | 14,384 | 16,145[^] |
| Scenario 3: All maternity and acute hospitals | 28,825 | 32,072* (31,533 – 34,230) |

[±] Estimated values based on inflation of values from HIQA data by HSE Human Resources headcount data

[^] Figures from HSE Human Resources data

*Estimated values based on inflation of WTE values from HSPC data by HSE Human Resources headcount data

### 3.5.2 Training Costs

#### 3.5.2.1 Labour costs

As described in section 3.4.1, midpoint salaries scales, adjusted to include overheads and employer PRSI and pensions contributions, were used to estimate staff costs. Training is estimated to take 3 hours per participant — 1 hour e-learning module with a recommended (estimated) 2 hours of pre-reading. Only the 1 hour e-learning module was included within the BIA. For the BIA, an opportunity cost approach was adopted, in that the staff time that is dedicated to education and training is estimated. This resource requirement will involve diverting staff from their usual activities, and this time input is explicitly costed. To cost the staff time for education, an average salary for each of the staff groups was assumed as follows: midwives and nurses are a mix of nurse managers, nurse specialist, staff nurses and student midwives/nurses while doctors are a mix of consultants and non-consultant hospital doctors (NCHDs). For scenario 1, where midwife/nurse numbers were not available by grade, the national proportions in these grades were applied to provide an estimated breakdown by grade. It should be noted that HSE hospital consultant contracts can vary significantly. Therefore, the cost of a consultant is based on the average HSE contract cost estimated in a previous health technology assessment.[16] This may not represent the true cost of the consultant's time, but it is assumed to be broadly representative of the average cost to the system of a consultant's time.

Delivery of any additional training in the maternity and acute hospitals will form part of the responsibilities of the new posts as described in section 3.4.

#### 3.5.2.2 Material costs

Development of the e-learning module cost €26,775 (personal communication with CGDG). There are no additional costs such as licence fee, hosting fees or annual maintenance fees.

# 4 Results

## 4.1 Costs of new staff

The costs for the recruitment of additional staff are presented in Table 2. The appointment of six WTE clinical midwife/nurse managers at grade 2 (midpoint) would cost €439,315 annually.

**Table 2. Costs of new staff**

| Description | Details | Annual cost (€) | Annual cost of 6 posts (€) |
|---|---|---|---|
| Clinical midwife/nurse manager | Grade 2 | 73,219* | 439,315 |
| ***Sensitivity analysis*** | | | |
| Clinical midwife/nurse manager | Grade 1 | 66,915* | 401,491 |
| Clinical midwife/nurse manager | Grade 3 | 83,558* | 501,348 |

* Salaries based on mid-point of scale adjusted for pension, PRSI and overheads

## 4.2 Costs of training: e-learning

The cost of the development of the e-learning module was €26,775. The opportunity costs of staff undertaking the 1 hour e-learning module are presented based on the scenarios outlined in section 3.5.1. In scenario 1, all staff in maternity hospitals and those involved in delivering maternity care in maternity units within general hospitals will be trained. This equates to an estimated headcount of 3,427 (3,315 to 3,662). The opportunity cost for staff undertaking the 1 hour e-learning module in this scenario is estimated at €171,535, range (€165,062 to €186,684) (Table 3).

**Table 3. Cost of 1 hour training by grade for scenario 1 (all clinical staff in maternity hospitals and those involved in delivering maternity care in maternity units within general hospitals)**

| Staff grade | Hourly cost (€) | Number of staff (base case) | Overall cost (€) | Number of staff (min) | Overall cost (€) (min) | Number of staff (max) | Overall cost (€) (max) |
|---|---|---|---|---|---|---|---|
| **Consultants*** | 129.48 | 337 | 43,640 | 315 | 40,794 | 396 | 51,277 |
| **NCHDs~** | 56.32 | 896 | 50,483 | 876 | 49,333 | 958 | 53,967 |
| **Midwife/nurse ±** | 35.28 | 2,194 | 77,411 | 2,124 | 74,935 | 2,308 | 81,440 |
| **Total** | | **3,427** | **171,535** | **3,315** | **165,062** | **3,662** | **186,684** |

* Based on the average HSE contract cost estimated in a previous health technology assessment[16]
~ Weighted average across NCHD grades
± Weighted average across midwife/nurse grades

In scenario 2, all clinical staff in maternity hospitals and in general hospitals with maternity units will be trained. Across these 19 hospitals, this equates to a headcount of 16,145. The opportunity costs for staff undertaking the 1 hour e-learning module in this scenario is estimated at €741,300 (Table 4).

**Table 4. Cost of 1 hour training by grade for scenario 2 (all clinical staff in maternity hospitals and general hospitals with maternity units)**

| Staff grade | Hourly cost (€) | Number of staff | Overall cost (€) |
|---|---|---|---|
| **Consultants*** | 129.48 | 1,211 | 156,799 |
| **NCHDs~** | 56.32 | 2,680 | 150,928 |
| **Midwife/nurse manager±** | 46.82 | 1,966 | 92,054 |
| **Nurse specialist** | 46.82 | 969 | 45,371 |
| **Midwife/staff nurse** | 32.19 | 8,718 | 280,660 |
| **Midwifery/nursing student** | 18.27 | 482 | 8,805 |
| **Midwifery/nursing (other)** | 56.15 | 119 | 6,682 |
| **Total** | | **16,145** | **741,300** |

Note: The headcount is known precisely from the data provided to the CGDG from the HSE Human Resources
* Based on the average HSE contract cost estimated in a previous health technology assessment[16]
~ Weighted average across NCHD grades
± Clinical midwife/nurse manager grade 2

In scenario 3, all clinical staff across all maternity and general hospitals should be educated. Across all these hospitals, there is an estimated headcount of 32,072 (31,533 to 34,230). The

opportunity costs of staff undertaking the 1 hour e-learning module in this scenario is estimated at €1,478,521 (€1,455,020 to €1,582,759) (Table 5).

**Table 5. Cost of 1 hour training by grade for scenario 3 (all clinical staff in all maternity and acute sector hospitals)**

| Staff grade | Hourly cost (€) | Number of staff (base case) | Overall cost (€) | Number of staff (min) | Overall cost (€) (min) | Number of staff (max) | Overall cost (€) (max) |
|---|---|---|---|---|---|---|---|
| **Consultants*** | 129.48 | 2,524 | 326,756 | 2,438 | 315,671 | 2,753 | 356,498 |
| **NCHDs~** | 56.32 | 5,199 | 292,789 | 5,199 | 292,789 | 5,436 | 306,113 |
| **Midwife/nurse manager±** | 46.82 | 4,142 | 193,940 | 4,289 | 200,825 | 4,494 | 210,406 |
| **Nurse specialist** | 46.82 | 1,515 | 70,937 | 1,537 | 71,985 | 1,836 | 85,951 |
| **Midwife/staff nurse** | 32.19 | 17,423 | 560,895 | 16,852 | 542,522 | 18,072 | 581,790 |
| **Midwifery/nursing student** | 18.27 | 1,005 | 18,365 | 981 | 17,920 | 1,323 | 24,158 |
| **Midwifery/nursing (other)** | 56.15 | 264 | 14,839 | 237 | 13,308 | 318 | 17,843 |
| **Total** | | **32,072** | **1,478,521** | **31,533** | **1,455,020** | **34,230** | **1,582,759** |

* Based on the average HSE contract cost estimated in a previous health technology assessment[16]

~ Weighted average across NCHD grades

± Clinical midwife/nurse manager grade 2

## 4.3 Total costs

Overall, the cost of implementing the guideline recommendations was estimated at €2.6 million for scenario 1 (training only staff delivering maternity care), €3.7 million for scenario 2 (educating staff in maternity hospitals and hospitals with maternity units) and €5.2 million for scenario 3 (educating all clinical staff in maternity hospitals and acute hospitals) over five years. These estimates include the costs of hiring six additional staff and introducing e-learning (Table 6).

**Table 6. Summary of annual costs for the principal cost categories per year**

| Cost (€) | Year 1 | Year 2 | Year 3 | Year 4* | Year 5 | Total |
|---|---|---|---|---|---|---|
| **Scenario 1** | | | | | | |
| **Staff recruitment/ salaries** | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 2,196,577 (2,007,453-2,506,738) |
| **E-learning module development** | 26,775 | - | - | - | - | 26,775 |
| **Training costs** | 171,535 (165,062-186, 684) | - | - | 171,535 (165,062-186, 684) | - | 343,070 (330,125-373,367) |
| **Total costs for 5 years** | | | | | | **2,566,421 (2,364,353–2,906,880)** |
| **Scenario 2** | | | | | | |
| **Staff recruitment/ salaries** | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 2,196,577 (2,007,453-2,506,738) |
| **E-learning module development** | 26,775 | - | - | - | - | 26,775 |
| **Training costs** | 741,300 | - | - | 741,300 | - | 1,482,600 |
| **Total costs for 5 years** | | | | | | **3,705,951 (3,516,827–4,016,112)** |
| **Scenario 3** | | | | | | |
| **Staff recruitment/ salaries** | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 439,315 (401,491-501,348) | 2,196,577 (2,007,453-2,506,738) |
| **E-learning module development** | 26,775 | - | - | - | - | 26,775 |
| **Training costs** | 1,478,521 (1,455,020-1,582,759) | - | - | 1,478,521 (1,455,020-1,582,759) | - | 2,957,042 (2,910,039-3,165,517) |
| **Total costs over 5 years** | | | | | | **5,180,394 (4,944,267–5,699,030)** |

* Refresher one hour e-learning module undertaken every 3 years, in line with the anticipated guideline update timelines

# 5 Discussion

Based on the update and implementation of the IMEWS National Clinical Guideline, this budget impact analysis identified the following changes:

- the creation of six new posts (recommendation 17)
- moving from the current face-to-face training model to an e-learning model (recommendation 15).

The cost of employing six additional staff and changing to an e-learning model is estimated to lead to a BIA of between €2.6million and €5.2million over a five-year time horizon, depending on the scenario chosen for staff education.

The main cost driver in this BIA is the opportunity costs of undertaking a 1 hour e-learning module. Consultation with representatives across the six hospital groups (excluding the Children's Hospital Group) indicated that there is variation in how training in IMEWS is currently provided; therefore, a range of scenarios which reflect the models of current practice have been presented here. Previously, it was highlighted as a risk that in Midland Regional Hospital Portlaoise (a general hospital with a maternity unit), the IMEWS chart was not in use for pregnant and postnatal women outside the Maternity Department; instead, the National Early Warning Score was being used.[17] Given this potential risk, the approaches outlined in scenario 2 (education for all clinical staff in maternity hospitals and in general hospitals with maternity units) and scenario 3 (educate all clinical staff across all maternity and all acute sector hospitals) would seem most appropriate.

Although the resources for undertaking education are significant, these are opportunity costs, that is, diverting staff members from their usual activities to complete the training. This is not an actual cash cost to the HSE. This cost may be realised through efficiencies and flexibility in rostering, and direct staff replacement may not be required. Therefore, the opportunity costs presented here can be considered a maximum.

Our previous systematic review highlighted that there is a dearth of studies on the effectiveness of introducing maternal early warning systems on processes of care and patient outcomes. A national clinical audit of compliance with the IMEWS Clinical Practice Guideline in selected Irish maternity hospitals/units found reasonable evidence that the use of IMEWS triggered the escalation of care in the cases of maternal septicaemia.[12] While it is reasonable to assume that IMEWS will lead to improved patient care, there is currently no evidence available to estimate how this would translate into cost savings.

## 5.1 Limitations

The main cost driver in this BIA is the opportunity costs of undertaking a 1 hour e-learning module. The headcounts used in scenario 1 and 3 are estimated based on an inflation factor derived from available WTE to headcount data ratio, as described in section 3.5.1. Although sensitivity analysis was conducted around the inflation factor, these figures are still estimates and not exact headcounts as these data were not available. Furthermore, the data on WTE used in scenario 1 was obtained from self-assessed WTE numbers for clinicians and midwives working within maternity units.

## 5.2 Future research

There is a lack of economic evaluations to establish the cost-effectiveness and resource implications related to the implementation of maternal early warning systems. This may reflect that economic evaluation literature tends to be published after clinical effectiveness studies have been conducted, and HRB-CICER's previous systematic review has highlighted that few such studies have been published. Future planned effectiveness studies should incorporate economic evaluations. Furthermore, the potential for using economic modelling in future studies should be explored in order to provide robust data.

## 5.3 Conclusions

Over a five-year time horizon, the budget impact of the guideline recommendations is estimated to be between €2.6 million and €5.2 million.

# Appendix 1 — Summary of Guideline recommendations and BIA implications

| Recommendation | Current practice | BIA implications |
|---|---|---|
| 1. The IMEWS should be used for the hospital care of a woman with a confirmed clinical pregnancy and for up to 42 days in the postnatal period irrespective of age or reason for presentation to hospital. Exclusions include women in labour, high dependency, recovery and critical care settings. | This is current practice and was introduced as part of IMEWS National Clinical Guideline (No. 4).[3] A national clinical audit of compliance with the IMEWS Clinical Practice Guideline in selected Irish maternity hospitals/units found that six out of seven hospitals sampled were using the IMEWS at the time of the audit (May – November 2014).[12] The CGDG confirmed this is current practice in all maternity and acute care hospitals. | None identified |
| 2. IMEWS should be used to complement clinical care and it is not designed to replace clinical judgment. Clinical concern about an individual woman warrants an escalation to medical staff irrespective of the presence or absence of IMEWS triggers. The level and speed of escalation should reflect the degree of clinical concern. | This is current practice and was introduced as part of IMEWS National Clinical Guideline (No. 4). (3) A national clinical audit of compliance with the IMEWS Clinical Practice Guideline in selected Irish maternity hospitals/units found that six out of seven hospitals sampled were using the IMEWS at the time of the audit (May – November 2014).[12] The CGDG confirmed this is current practice in all maternity | None identified |
| 3. If a woman or a visitor expresses concern about her wellbeing, this should be listened to carefully as it may reflect the early onset of a critical illness. The woman should have her vital signs checked and be escalated as appropriate and as per the escalation guide. | Although this is a new recommendation, it is likely current practice. There is no evidence on its current practice, variation in application or likely impact it would have (that is, increase/decrease) on escalation of care. | None identified |
| 4. The standard IMEWS vital signs must be recorded as a baseline on admission. These are: respiratory rate, temperature, maternal heart rate, systolic blood pressure, diastolic blood pressure and neurological response. The subsequent | This is current practice and introduced as part of IMEWS National Clinical Guideline (No. 4).[3] A national clinical audit of compliance with the IMEWS Clinical Practice Guideline in selected Irish maternity hospitals/units, found that vital signs were appropriately | None identified |

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| | frequency of observations should be determined by the baseline recordings and the woman's individual clinical circumstances. | recorded on the IMEWS observation chart by nursing/midwifery staff.[12] | |
| 5. | The standard IMEWS vital signs must be completed contemporaneously and recorded for every set of vital signs unless otherwise clinically indicated (See Recommendation 10). | This is current practice and was introduced as part of IMEWS National Clinical Guideline (No. 4).[3]A national clinical audit of compliance with the IMEWS Clinical Practice Guideline in selected Irish maternity hospitals/units found there was variation in compliance.[12] The national clinical audit recommended education and training in areas of poor compliance or variation.[12] Training is outlined in recommendation 15. | None identified |
| 6. | The technique of measuring, recording and monitoring of vital signs should be undertaken in line with recognised, evidence-based practice. | This is current practice. It was highlighted by participants at the IMEWS implementation day that some equipment may not always be available on the wards, for example, larger cuff sizes for BP monitoring in overweight/obese patients. There may be a need for hospitals to purchase such equipment; however, the CGDG highlight this will come under the resources already allocated to the hospitals.<br><br>The cuff size is noted on the new version paper chart, and it has been confirmed by MN-CMS (personal communication with CGDG) that there would be no cost impact for changes to MN-CMS. | None identified |
| 7. | The ISBAR (patient deterioration) and ISBAR3 (clinical handover) communication tools should be used when communicating clinical information. When a situation is deemed to be critical, this must be clearly stated at the outset of the conversation. | This is current practice and was introduced as part of the Clinical Handover in Maternity Services National Clinical Guideline (No. 5).[18] | None identified |
| 8. | Following clinical review, | This is current practice and was | None identified |

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| | plans must be put in place and clearly documented as part of the IMEWS response. | introduced as part of IMEWS National Clinical Guideline (No. 4).[3] A national clinical audit of compliance with the IMEWS Clinical Practice Guideline in selected Irish maternity hospitals/units found there was variation in compliance.[12] The national clinical audit recommended education and training in areas of poor compliance or variation.[12] Training is outlined in recommendation 15. | |
| 9. | The IMEWS escalation guide should identify the clinical escalation steps that should be taken in the event of any IMEWS triggers. | Although this is a new recommendation, the CGDG confirmed this is current practice. | None identified |
| 10. | Variances to IMEWS parameters or the escalation guideline may be made by senior medical personnel and should be based on clinical assessment. Parameter changes should be recorded and re-evaluated at a minimum 24hrs and at each admission. | Although this is a new recommendation, the CGDG confirmed this is current practice. There is no evidence on its current practice, variation in application or likely impact it would have on the escalation of care.<br><br>Confirmed by MN-CMS (personal communication with CGDG) that there would be no cost impact in relation to changes from in the system | None identified |
| 11. | The Master or CEO, Clinical Director and Director of Midwifery of each hospital and the Chief Executive Officer of the hospital groups are accountable for the local operation of the Irish Maternity Early Warning System (IMEWS). The HSE NWIHP should ensure that there is a governance structure in place nationally for the implementation and, if necessary, the revision of IMEWS. | This is a new recommendation. Introduction of new staff (described in detail in recommendation 17) will be required. | See recommendation 17 |
| 12. | A local governance group should oversee the implementation and ongoing review of IMEWS | Governance structures and multidisciplinary groups in a governance capacity for all units are currently unknown. | None identified |

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| | recognition and response systems locally. | CGDG have advised that this is up to individual hospitals to review in line with their use of other early warning systems. | |
| 13. | A local governance group should identify and support named individuals to oversee local IMEWS implementation. | The CGDG advised that maternity units have these in place; however, this is unknown in acute settings.<br><br>CGDG have advised that this is up to individual hospitals to review in line with their use of other early warning systems. | None identified |
| 14. | A local governance group should support additional safety practices (e.g. incorporating briefings, safety pause and huddles) and implementation of relevant guidelines (e.g. National Clinical Guideline No. 5: Clinical Handover in Maternity Services) to enhance the IMEWS and lead to greater situation awareness among clinicians and multidisciplinary teams. | This is current practice. Although this is a new recommendation, it is consistent with the Clinical Handover in Maternity Services National Clinical Guideline (No. 5).[18] | None identified |
| 15. | Clinical staff in both maternity and general hospitals should receive education and training in IMEWS. They should know how to call for emergency assistance if they have any concerns about a woman, and know who they should call under these circumstances. This information should be provided at the start of employment and as part of regular refresher education and training. | This is current practice. However, the form of training is to change from face-to-face to e-learning. | Yes – cost of e-learning and training time |
| 16. | Audit data should be collected and reviewed locally and overseen nationally regarding the implementation and effectiveness of IMEWS. | This is current practice and was introduced as part of IMEWS National Clinical Guideline (No. 4).[3] A national clinical audit of compliance with the IMEWS Clinical Practice Guideline in selected Irish maternity hospitals/units found there was | None identified |

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| | | variation in compliance.[12]<br>Audit would be part of the remit of new staff, as outlined in recommendation 17. | |
| 17. | A dedicated midwife/nurse with the appropriate clinical knowledge should be designated in each of the six hospital groups to provide education and training on IMEWS to staff members in the maternity and acute hospitals within their hospital network. This individual should also oversee regular local audits of IMEWS. | This is a new recommendation. | Yes – creation of 6 new WTE posts |
| 18. | IMEWS 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. | This is current practice. Although this is a new recommendation, it is consistent with other national guidelines.[18]<br><br>This would be part of the remit of new staff, as outlined in recommendation 17. | None identified |

**Key: CEO — chief executive officer; CGDG — childbirth guideline development group; HSE NWIHP — HSE National Women and Infants Health Programme; ISBAR — identify, situation, background, assessment and recommendation.**

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HRB Collaboration in Ireland for Clinical Effectiveness Reviews (HRB-CICER),
Health Information and Quality Authority (HIQA),
Dublin Regional Office
George's Court
George's Lane
Smithfield
Dublin 7

Phone: +353 (0) 1 814 7400
URL: www.hiqa.ie



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