

# NATIONAL AUDIT OF HOSPITAL MORTALITY REPORT

*December 2016*



## PREPARED BY (WITH ASSISTANCE FROM MEMBERS OF THE NAHM GOVERNANCE COMMITTEE)

### Dr Brian Creedon

Chair, NAHM Governance Committee  
Royal College of Physicians in Ireland

### Prof Simon Jones

International Expert

### Dr Declan McKeown

HSE Health Intelligence Unit

### Dr Gerardine Sayers

HSE Health Intelligence Unit

### Marina Cronin

National Office of Clinical Audit

### Dr Jennifer Martin

Chair, NAHM Steering Committee  
HSE Quality Improvement Division

### Grainne Cosgrove

HSE Quality Improvement Division

### Dr Howard Johnson

HSE Health Intelligence Unit

### Deirdre Murphy

Healthcare Pricing Office

### Deirdre Burke

National Office of Clinical Audit

## NATIONAL OFFICE OF CLINICAL AUDIT (NOCA)

NOCA was established in 2012 to create sustainable clinical audit programmes at national level. NOCA is funded by the Health Service Executive Quality Improvement Division and operationally supported by the Royal College of Surgeons in Ireland.

The National Clinical Effectiveness Committee (NCEC 2015, p.2) define national clinical audit as “a cyclical process that aims to improve patient care and outcomes by systematic, structured review and evaluation of clinical care against explicit clinical standards on a national basis”.

NOCA supports hospitals to learn from their audit cycles.

### Citation for this report:

National Office of Clinical Audit, (2016)  
*National Audit of Hospital Mortality Report*.  
Dublin: National Office of Clinical Audit.

ISSN 2009-9657 (Print)  
ISSN 2009-9665 (Electronic)

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### Electronic copies of this report can be found at:

<https://www.noca.ie/publications>  
This report was published on 15th December 2016.

## ACKNOWLEDGMENTS



The NAHM Governance Committee want to acknowledge the HSE National Clinical Programmes for their guidance and support for preparation of this first report. In particular, we want to mention the following; Prof Kieran Daly, Dr Siobhan Jennings, Mr Brendan Cavanagh and colleagues from the National Clinical Programme for Acute Coronary Syndrome  
Prof Ken McDonald and Ms Regina Black from the National Clinical Programme for Heart Failure  
Prof Joseph Harbison and Ms Joan McCormack from the National Clinical Programme for Stroke  
Prof Tim McDonnell, Dr Máire O'Connor and Ms Linda Kearns from the National Clinical Programme for Chronic Obstructive Pulmonary Disease



The Health Intelligence Unit (HIU), Health and Wellbeing HSE, supports the quest for better health for patients, their families and the public by exploiting the quality assurance/improvement, health mapping and research potential of available data. The HIU leads the development of the National Quality Assurance Intelligence System (NQAIS) suite of tools in partnership with OpenApp, the Clinical Programmes and other stakeholders. NAHM focuses on in-hospital mortality patterns.



The Quality Improvement Division was established to support the development of a culture that ensures improvement of quality of care is at the heart of all services that the HSE delivers. HSE QID work in partnership with patients, families and all who work in the health system to innovate and improve the quality and safety of our care.



The Healthcare Pricing Office (HPO) manage the Hospital In-Patient Enquiry Scheme (HIPE) which collects information on hospital day cases and in-patients in Ireland. The HPO provides HIPE data to the Health Intelligence Unit, Health and Wellbeing, for the generation of mortality patterns in the NQAIS NAHM tool.

## ACKNOWLEDGING SIGNIFICANT CONTRIBUTIONS FROM THE FOLLOWING:



For more information  
about this report, contact:

National Office of Clinical Audit, 2nd Floor,  
Ardilaun House, 111 St Stephens Green, Dublin 2

Tel: + (353) 1 4028577  
Email: [nahm@nocai.ie](mailto:nahm@nocai.ie)

DESIGNED BY  
**SWERVE**

# **National Audit of Hospital Mortality Report**

*December 2016*



Dr Brian Creedon  
Chair  
National Audit of Hospital Mortality  
Governance Committee  
National Office of Clinical Audit  
2nd Floor, Ardilaun House  
111 St. Stephen's Green  
Dublin 2

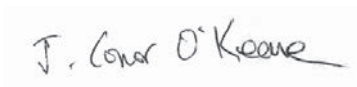
25th November 2016

Dear Dr Creedon,

Many thanks for your presentation of the National Audit of Hospital Mortality Report to the NOCA Governance Board on 24th November 2016. The work of the NAHM Governance Committee is to be commended. This report presents hospital mortality data in a clear and transparent manner which will be of interest to patients.

On behalf of the NOCA Governance Board, I wish to congratulate your own and your colleagues continued efforts in supporting this valuable quality improvement initiative. We strongly welcome the recommendations in this report. Please accept this as formal endorsement from the NOCA Governance Board of this first National Audit of Hospital Mortality Report.

Yours sincerely,



**Professor Conor O' Keane FFPATH FRCPI**  
**Chairman**  
**National Office of Clinical Audit Governance Board**

# FOREWORD

In 1858 Florence Nightingale published her analysis of hospital mortality (related to British soldiers injured in the Crimean War) showing wide variation, which could not be explained by differences in the health of individual patients. She predicted that uniform hospital statistics could be used to improve the understanding of hospital and disease related mortality. Patients die every day in hospitals despite modern medical treatments. It may be possible to prevent some hospital deaths if all the factors that contribute to them are better understood. As with all quality improvement efforts, a hospital whose aim is to prevent potentially avoidable deaths must begin with the collection and analysis of data.

Hospital mortality is one of many potential outcome measures which can be used as a quality indicator to improve care. This first report presents an analysis of mortality from the National Audit of Hospital Mortality between 2013 and 2015. There are 44 publicly funded acute hospitals contributing data to the audit.

This is the beginning of a journey of improvement. Experience from other countries demonstrates that the positive impact of broad-based quality improvement efforts is seen over years rather than months. The National Office of Clinical Audit remains committed to continuing to work with hospitals on this journey. We will continue to make this analysis of mortality available to hospitals, provide tools to support the use of this analysis and share learnings from hospitals, hospital groups and Boards using this data in different ways. We will also continue to work with hospitals and others to improve the quality of data, refine the methods used in this audit and develop national reports. This includes working with healthcare and public stakeholders to build a set of quality measures that will be useful for improving care provided in hospitals.

There are clear benefits for hospitals to measure and review health outcome indicators, such as standardised hospital mortality ratios (SMRs). Significant variance in SMRs may indicate a signal for issues of data quality and consistency, service resourcing, or quality of care provided. This National Audit of Hospital Mortality report is a significant step to further understanding and, most importantly, promoting the continuous improvement of the quality and safety of care provided in our acute hospitals. The public reporting of patient outcomes ensures patients, the public and hospitals can make improved health care decisions. This fosters openness and transparency while also being an important catalyst to quality improvement in health care.

This report would not have been possible without the collaboration of numerous stakeholders. We wish to acknowledge the many diverse contributions which were essential to facilitating this report.



**DR BRIAN CREEDON**



**DR PHILIP CROWLEY**

A handwritten signature in black ink, appearing to read 'Brian Creedon'.

**Dr Brian Creedon**

Chair  
NAHM Governance Committee

A handwritten signature in black ink, appearing to read 'Philip Crowley'.

**Dr Philip Crowley**

National Director  
Quality Improvement Division, HSE

## MESSAGE FROM BRIAN O'MAHONY, NAHM PUBLIC REPRESENTATIVE

Poor quality healthcare leads to an increased burden of avoidable morbidity and death in health systems around the world. The standardised mortality ratio (SMR) is a complex health care quality measure which can play an important role in the health and wellbeing of Irish patients. The SMR is the ratio between the observed number of patients who die in hospital and the number that would be expected to die in hospital on the basis of the overall national rate.



BRIAN O'MAHONY

This is an important measure which can be used to screen for safety and quality issues in hospitals. However, the quality of the Irish health service cannot be measured by one indicator alone. SMRs are most useful when used as part of a broader measurement strategy, including other indicators which are important to patients.

This is the first report from the National Audit of Hospital Mortality (NAHM) in the National Office of Clinical Audit (NOCA). It presents hospital mortality in a clear and transparent manner, which will be of interest to patients, the public at large and health care professionals. I welcome the commitment of our hospitals to understanding their data and implementing change to improve patient safety. This seems to demonstrate a culture of learning and improvement in hospitals.

It is important that the information in this report is used responsibly. Differences in hospital mortality may not necessarily suggest different standards or quality of care. A hospital may have a higher mortality rate than another as it is a specialist centre and therefore takes the sickest patients, rather than a reflection of inferior care. It may be due to variances in the way data is collected. However, where a hospital's SMR is unexpectedly high or low, further examination is warranted.

As a public representative member of the NAHM governance committee, I was able to contribute to a project that is focused on the importance of producing accurate data which will support improvements in the quality of care provided in Irish hospitals. NAHM is supporting the important issue of transparency by sharing this data publicly. This level of transparency will ultimately foster improved trust between patients and their hospitals.

Everyone will be a hospital patient at some stage during their lives and will expect to receive care of the highest quality. It is heartening to know that the ongoing work of NAHM should lead to better patient care and better outcomes for patients.

A handwritten signature in black ink that reads "Brian O Mahony". The signature is written in a cursive, slightly informal style.

**Brian O'Mahony**  
Public Representative  
NAHM Governance Committee

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# EXECUTIVE SUMMARY

Measuring quality of care is one of the essential components to improving the quality of modern healthcare. Clinical audits are key to this process. The purpose of clinical audit is to identify learning opportunities to inform quality assurance and improvement initiatives to further enhance the structure, process and outcome of care. Through the governance structures established by the National Office of Clinical Audit (NOCA), the National Audit of Hospital Mortality (NAHM) was deployed to 44 publicly funded acute hospitals in Ireland.

Over the last two decades, in-hospital mortality patterns have been used internationally as one indicator of the quality of care. A number of broadly similar methods have evolved, and the standardised mortality ratio (SMR) is the most commonly used approach for exploring hospital mortality patterns within a country. The SMR is a metric that compares the observed number of deaths to the expected number of deaths within diagnostic groups within the hospital setting.

The SMR is based on the principal diagnosis (the primary reason a patient is admitted to hospital). To ensure that “like is compared with like” across the diversity of hospitals, potentially confounding factors (factors that may directly influence the outcome) are adjusted for in the analysis, for example, patient age and the presence of other serious illnesses. The SMR used in NAHM includes the analysis of patients coded for palliative care which differs from some international models, where patients who are coded for palliative care are excluded from analysis. The inclusion of palliative care coded patients ensures completeness of data and recognises that palliative care coding does not equivocate to end of life care.

The SMR should be considered as a (statistical) screening test and must be interpreted in the context of other sources of information on quality, such as, patient experience, staff feedback and safety incident reporting. In addition, it should be understood that SMRs, because of their statistical properties, can only be used to examine mortality patterns within a hospital and not to compare hospitals with each other. Furthermore, SMRs cannot be used to generate a league table of hospital mortality (e.g. attempting to rank highest to lowest).

The National Quality Assurance Intelligence System for Hospital Mortality, known as NQAIS NAHM, was developed to analyse and visualise the SMR in the Irish context. In Ireland, clinical and administrative data on patient discharges is routinely collected by all publicly funded acute hospitals and is included in the Hospital In-Patient Enquiry (HIPE) system. This is overseen by the HSE Healthcare Pricing Office (HPO) and the data undergoes rigorous quality assurance processes so that it can support the management of hospital services.

NQAIS NAHM displays individual in-hospital mortality patterns in a national context. By highlighting unusual patterns, this information can be used to identify potential areas of concern, a review can be instigated and potential learning opportunities identified. The strength of NAHM lies in its potential to help hospitals understand the relationship between the quality of data recorded in the patient chart, the accuracy of its transcription to HIPE and how it can be used in conjunction with other quality indicators to pinpoint potential areas of concern. NAHM provides clinicians, clinical directors, hospital

managers and their Boards with an evidence base to support their ongoing pursuit of excellence in healthcare delivery.

The purpose of this report is to provide patients, families, the public and the wider health system with an account of NAHM and its findings across an initial number of key diagnoses/medical conditions. This report outlines how the audit is used by hospitals and presents information across five key diagnoses, namely acute myocardial infarction (heart attack), heart failure, ischaemic stroke, haemorrhagic stroke, chronic obstructive pulmonary disease and bronchiectasis (chronic lung disease). These diagnoses were chosen based on clinical and methodological selection criteria, to ensure a focus on quality, safety and improvement in acute hospital care.

## KEY FINDINGS

- **Acute myocardial infarction (AMI):** Between 2005 and 2015, national in-hospital mortality rate following admission with AMI showed a significant (46%) reduction. In 2015, all hospitals had an SMR which was within the expected range for AMI.
- **Heart failure:** Between 2005 and 2015, national in-hospital mortality rate following admission with heart failure showed a small but significant reduction. In 2015, all hospitals had an SMR which was within the expected range for heart failure.
- **Ischaemic stroke:** Between 2005 and 2015, national in-hospital mortality rate following admission with ischaemic stroke showed a small but significant reduction. In 2015, all hospitals had an SMR which was within the expected range for ischaemic stroke.
- **Haemorrhagic stroke:** Between 2005 and 2015, national in-hospital mortality rate following admission with haemorrhagic stroke did not show a significant reduction. Between 2013 and 2015, all hospitals had an SMR which was within the expected range for haemorrhagic stroke.
- **Chronic obstructive pulmonary disease (COPD) and Bronchiectasis:** Between 2005 and 2015, national in-hospital mortality rate following admission with COPD and bronchiectasis did not show a significant reduction. In 2015, the SMR for COPD and bronchiectasis was found to be outside the expected range in one hospital, and this pattern is currently under review by the hospital.
- In preparing this report some inter- and intra-hospital variations in the documentation and/or coding of hospital data have emerged. This includes documentation of principle diagnosis, the correct identification of emergency/ elective admissions and the practice of completing a discharge summary for all in-hospital mortality.

## KEY RECOMMENDATIONS

- Continued and increased collaboration between clinicians and clinical coders (the administrative staff who extract information from the medical records) will improve the quality of medical records and the recording and coding of hospital data.
- A patient discharge summary should be completed for every in-hospital mortality, which will further improve the accuracy of HIPE data.
- NAHM should be used by clinicians, hospital managers and their Boards as a quality improvement tool for the targeted review of hospital mortality patterns. This should be done in the wider context of quality tools, such as patient experience and complaints, staff feedback and safety incident reporting.
- To ensure that the learning from the use of NAHM is shared both within and between hospitals/hospital groups, NAHM should be integrated within the hospital and hospital group governance structures as an agenda item on the Executive and Board Quality and Safety Committees. This should also involve clinical teams which will maximise the benefits from the process and enable prompt action to be taken, if required, to improve the quality of care.
- NAHM should evolve in response to feedback from hospitals, HSE National Clinical Programmes and international developments, including the re-classification of diseases (such as COPD and stroke).
- Future NAHM reports should be expanded to include other less common disease categories, where sufficient volume of data is present to support the statistical result.
- It is envisaged that hospitals will use NQAIS NAHM on a prospective basis so that the earliest indication of potential areas of concern can be identified and if necessary, a review undertaken.

A photograph of a doctor's hands holding a patient's arm, overlaid with a blue gradient. The doctor's hands are visible in the upper left, with a stethoscope around their neck. The patient's arm is in the lower right. The text 'INTRODUCTION' is written in blue capital letters on the right side of the image.

## INTRODUCTION

# INTRODUCTION

## WELCOME TO THE FIRST NATIONAL AUDIT OF HOSPITAL MORTALITY (NAHM) REPORT

Most deaths that occur in hospital are inevitable because of the patient's clinical condition on admission. However, there is increased awareness that some deaths may be prevented by improving care and treatment or by avoiding harm. This has led to an increasing interest in hospital mortality as a signal of broader issues in relation to the safety and quality of care. Hospital mortality ratios are now used in a number of countries including the United Kingdom, United States of America, Canada, Netherlands and Australia. In December 2014, the National Office of Clinical Audit (NOCA) was asked by HSE Quality Improvement Division (QID) to support implementation and provide a governance framework for NAHM.

NAHM analyses and displays mortality patterns across all Irish publicly funded acute hospitals. It does so by extracting key data from the Hospital In-Patient Enquiry system (HIPE). The data is analysed and adjusted to take account of some of the factors known to affect the underlying risk of death in hospital. This analysis can identify statistically unusual patterns of mortality in hospitals.

Healthcare quality has many dimensions. NAHM provides very valuable information, but should always be used in conjunction with other hospital quality indicators and listening to staff and patients in order to identify potential learning opportunities to improve clinical care.

## AIMS OF NAHM

The aims of NAHM are to:

- Understand and improve the quality of hospital based mortality data,
- Promote reflection on the quality of overall patient care,
- Identify areas for improvement.

## PURPOSE OF THIS REPORT

Hospitals receive quarterly NAHM updates that they use on an on-going basis to monitor their expected mortality ranges and to trigger prompt investigation regarding areas of concern. This report presents an analysis of hospital mortality across five key diagnoses;

- acute myocardial infarction (AMI)
- heart failure
- ischaemic stroke
- haemorrhagic stroke
- chronic obstructive pulmonary disease (COPD) and bronchiectasis

This analysis of hospital mortality is calculated using each patient's unique profile that takes into account the following variables;

- age
- gender
- pre-existing illness
- previous emergency admissions in last 12 months
- indicator of deprivation
- in-hospital palliative care treatment
- source of admission (eg. home, nursing home)
- type of admission (e.g. elective, emergency)

**The purpose of this report is to assure patients, families, the public and the wider health system that hospital mortality is continuously monitored and that structures exist to investigate areas of concern and implement improvements as required.**

If a hospital's actual mortality level for a diagnosis is within the expected range, it means that the number of patients who died was within the expected range based on the patient profile. If a hospital's actual mortality level for a diagnosis is outside the expected range, it means that more patients died than was expected and a review should take place.

**This is an appropriate way of looking at mortality data as it reflects that each patient is unique. For example patients conditions can vary, while patients may also respond differently to treatment e.g. surgery, medications.**

## WHAT THIS REPORT CANNOT DO

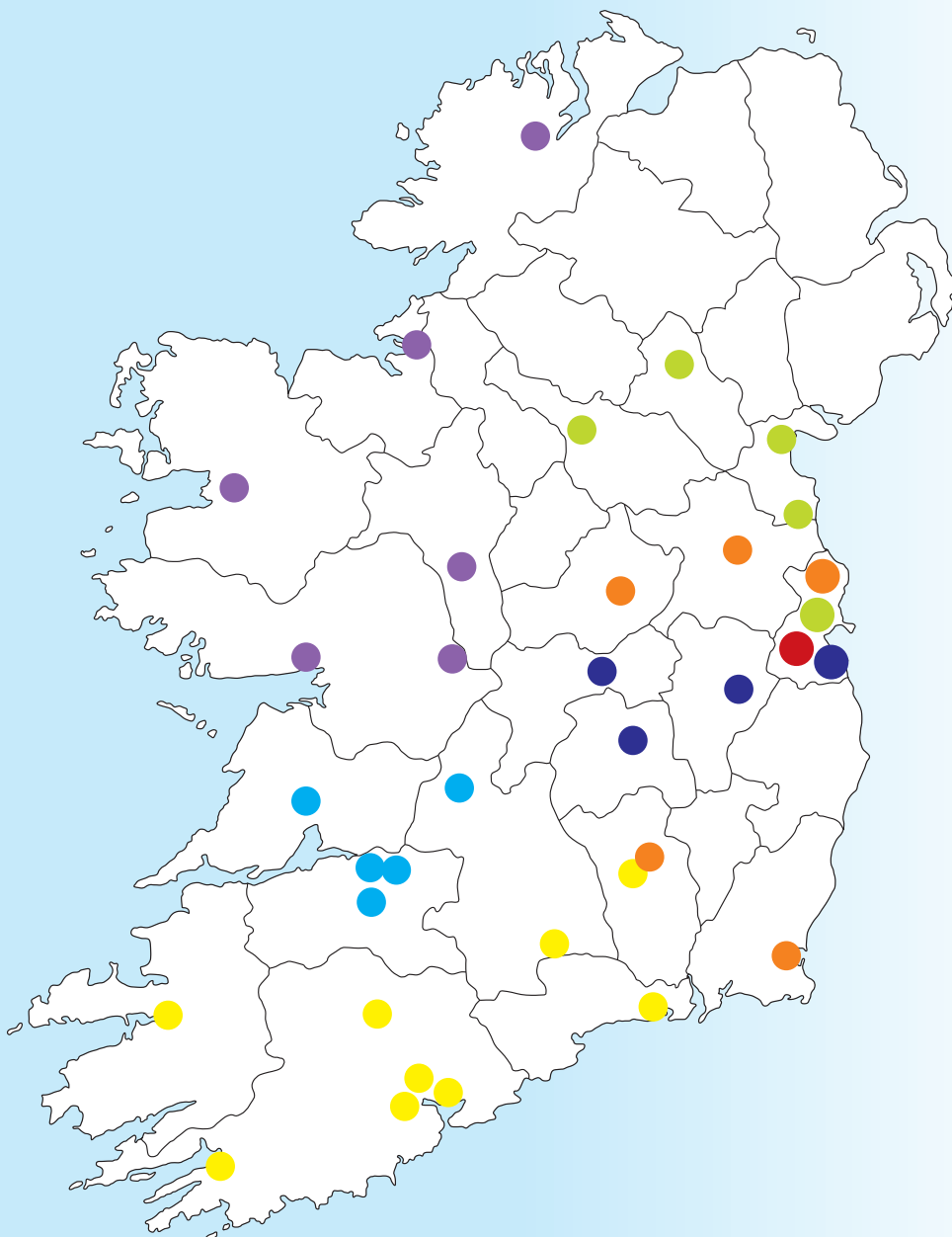
No two hospitals will have the same patient profile. Some hospitals will have greater numbers of patients with severe conditions e.g. hospitals such as specialist referral centres may only admit patients with more complicated conditions.

**This report cannot be used to compare hospitals.**

## NAHM IN ACUTE HOSPITALS

Through the governance structures established by NOCA, NAHM is now deployed to 44 publicly funded acute hospitals in Ireland (Figure 1). Standalone maternity hospitals are not included. NAHM does not currently extend to private hospitals in Ireland as they do not use the HIPE system. Considerable commitment from hospitals is required to ensure sustainability of NAHM; NOCA has found engagement and willingness to participate extremely positive, due to the combined leadership of clinicians and hospital executives. Recruitment of hospitals to NAHM occurred throughout 2015 and was completed in 2016. Development and implementation of NAHM to the acute hospital system involved cooperation of multiple stakeholders, along with the hospitals, such as the HSE Health Intelligence Unit (HIU), Healthcare Pricing Office (HPO), QID, along with NOCA. These are outlined in Appendix 1.

**FIGURE 1: IMPLEMENTATION OF NAHM TO ACUTE HOSPITALS**



NOTE: Dublin Hospitals have been displayed collectively by hospital group.

## Saolta University Healthcare Group

Galway University Hospitals  
Letterkenny University Hospital  
Mayo University Hospital  
Portlincula University Hospital  
Roscommon University Hospital  
Sligo University Hospital

## RCSI Hospital Group

Beaumont Hospital  
Cavan General Hospital  
Connolly Hospital  
Louth County Hospital, Dundalk  
Monaghan Hospital  
Our Lady of Lourdes Hospital, Drogheda

## Dublin Midlands Hospital Group

Midland Regional Hospital Portlaoise  
Midland Regional Hospital Tullamore  
Naas General Hospital  
St James's Hospital, Dublin  
Tallaght Hospital (Adult)

## Ireland East Hospital Group

Cappagh National Orthopaedic Hospital, Dublin  
Mater Misericordiae University Hospital  
Midland Regional Hospital Mullingar  
Our Lady's Hospital, Navan  
Royal Victoria Eye and Ear Hospital, Dublin  
St. Columcille's Hospital, Loughlinstown  
St. Luke's General Hospital, Kilkenny  
St. Michael's Hospital, Dun Laoghaire  
St. Vincent's University Hospital  
Wexford General Hospital

## National Children's Hospital Group

Our Lady's Children's Hospital Crumlin  
Tallaght Hospital (Paediatrics)  
Temple Street, Children's University Hospital

## UL Hospital Group

Croom Hospital  
Ennis Hospital  
Nenagh Hospital  
St John's Hospital, Limerick  
University Hospital Limerick

## South / South West Hospital Group

Bantry General Hospital  
Cork University Hospital  
Kilcreene Regional Orthopaedic Hospital  
Mercy University Hospital  
Mallow General Hospital  
South Infirmary Victoria University Hospital  
South Tipperary General Hospital  
University Hospital Kerry  
University Hospital Waterford



The background image is a light blue-tinted photograph showing a close-up of a doctor's hands. The doctor, wearing a white coat and a stethoscope, is gently holding a patient's arm. The patient's arm is hairy, suggesting a male. The doctor's hands are positioned to support the patient's arm, with fingers interlaced. The overall tone is professional and caring.

# **NAHM METHODOLOGY**

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## NAHM METHODOLOGY

### METHODOLOGY FOR MEASURING IN-HOSPITAL MORTALITY

In-hospital mortality (death) rates measure the number of deaths as a proportion of the number of hospital admissions. Differences in mortality findings between hospitals can be due to:

- Expected variation; due to the nature of data there will always be some fluctuation in the precise measure between one reporting period and the next,
- Differences in patient factors (including age, gender and co-morbidities),
- Differences in the data collection (i.e. how a medical chart is completed, recorded and coded),
- Differences in the quality of care.

There are a number of approaches to measuring mortality rates. Each varies; they are calculated in different ways and used for different purposes. Three main approaches are:

- Crude in-hospital mortality rate,
- Directly standardised in-hospital mortality rate,
- Indirectly standardised in-hospital mortality ratio.

### Crude in-hospital mortality rate

The crude in-hospital mortality rate is a measure of the number of deaths per 100 cases. It does not attempt to adjust for differences in patient populations. It is usually presented with reference to a specific disease, for example stroke or AMI. It is typically expressed as the number of deaths per 100 of the population per year.

$$\text{CRUDE IN-HOSPITAL MORTALITY RATE} = \frac{\text{NO. OF DEATHS}^*}{\text{TOTAL ADMISSIONS}^*} \times 100 \text{ PER YEAR}$$

\*From a given diagnosis

The crude in-hospital mortality rate gives an overview of the extent to which a given condition adds to the overall burden from death in a hospital. It is not a standardised measure because it does not take into consideration confounding factors such as age, type of admission, previous admissions or existing background illness (case mix and co-morbidity) in a population of patients. This method is useful for hospitals to look at their in-hospital deaths, provided there has been no significant change in case mix in the time period in question. However, comparison of crude in-hospital death rates between hospitals is not appropriate because it does not take into consideration other important factors affecting mortality. Crude in-hospital mortality is used in this report to show the national trend.

### Directly standardised mortality rate

The direct method adjusts for population differences. This method produces standardised mortality rates that these populations would have if they had the same population attributes as the standard population. Direct methods are more powerful when numbers are larger. This approach is best used for a single or otherwise homogeneous group of diagnoses and can only be standardised for a number of factors with this method.

The Organisation for Economic Cooperation and Development (OECD) uses the direct standardised death rate as the basis for its methodological approach (OECD 2015b). The reference population is based on the age and gender profile of the OECD 2010 population admitted to hospital with selected conditions. This allows direct comparison between OECD member states and is of greatest value when it is comparing practice across international boundaries. This is the approach used by the Department of Health (DoH) for the National Healthcare Quality Reporting System (DoH 2016) for selected diagnoses: AMI, haemorrhagic and ischaemic stroke.

### Indirectly standardised mortality ratio

The standardised mortality ratio (SMR) is another method that adjusts for population differences. It is a measure of mortality which allows individual hospitals to compare their observed death rate against the death rate that would be expected in that hospital if other variables affecting mortality could be taken into consideration. SMRs are analysed based on the principal diagnosis of the patient recorded in HIPE; the diagnosis which was established after investigation and found to be responsible for the episode of admitted patient care, as represented by a code (National Casemix and Classification Centre, Australian Health Services Research Institute, University of Wollongong 2013). It does not follow that the principal reason for their hospitalisation is always the reason for their death.

$$\text{SMR} = \frac{\text{OBSERVED DEATHS}}{\text{EXPECTED DEATHS}} \times 100 \text{ PER YEAR}$$

The “expected” deaths are calculated from national data using statistical techniques to account for differences in patient factors. These factors include: age, deprivation, whether patients were in receipt of palliative care treatment in hospital, number of previous admissions in the past year, source and type of admission (for example, from home or nursing home or an emergency transfer from another acute hospital) and the Charlson Index (Charlson et al. 1987), which is a measure of co-morbidity. The Charlson Index assigns a weighting to the degree to which the patient is debilitated by a number of background illnesses and conditions.

SMR is an appropriate way to measure in-hospital mortality in Ireland as;

- there are a large number of hospitals, some of which are very much smaller than others and
- it takes account of a larger number of variables, which impact on in-hospital mortality.

SMRs can be presented by individual hospital and by diagnosis group such as AMI or stroke. They do not allow hospitals to compare outcomes against one another, but they allow comparison against a national average, which is set at 100.

### METHODOLOGY TO ACCOUNT FOR THE EXPECTED VARIATION IN THE DATA - CONTROL LIMITS

While the national average is set at 100, it is unlikely that any SMR is exactly 100. It is to be expected that SMRs will be slightly above or below 100 due to the normal variation that happens month on month. For this reason control limits are calculated – these are statistical calculations based on the number of admissions and deaths within each hospital which show the variation that is expected and normal to occur in that hospital's data. The control limits are set at 99.8%, meaning there is a 1 in 500 chance of a hospital being outside these limits by chance alone. This means that an SMR which is above or below the 99.8% control limits is unlikely to have occurred by chance and may indicate greater or fewer deaths than would otherwise be expected.

### NATIONAL QUALITY ASSURANCE INTELLIGENCE SYSTEM

#### Development of NQAIS NAHM

Internationally a number of broadly similar and evolving methods such as the SMR, are used to explore hospital mortality patterns and support the process of health improvement. Following an analysis by the Department of Health in 2014 and their publication of hospital mortality in 2015, (DoH 2015a), NQAIS NAHM, which was developed to provide a systematic approach to enable hospitals to review their mortality patterns in detail, was deployed to hospitals.

NQAIS NAHM was developed by a partnership of the HIU, Health and Wellbeing, HSE and OpenApp, with support from Professor Simon Jones (Professor in Population Health, New York University), with the assistance of the specialist registrars attached to the HIU (Fitzpatrick 2014) and (Robinson 2016), QID and NOCA. The purpose of NQAIS NAHM is to display individual hospital mortality patterns in a national context and to identify potential learning opportunities to support clinicians, clinical directors and hospital managers with an evidence base in their ongoing pursuit of excellence in health care delivery.

Hospital mortality patterns are generated internationally by the use of routinely collected clinical and administrative data on patients discharged from hospital. In Ireland, this data is collected by HIPE which is overseen by the HPO on behalf of the HSE.

NQAIS NAHM focuses on the principal/admission diagnosis (the primary reason the patient is admitted to hospital). The diagnosis is categorised into approximately 260 clinically meaningful groups based on the Clinical Classification System (CCS), developed by the Agency for Healthcare Research and Quality (AHRQ). To ensure that like is compared with like across the diversity of hospitals, potentially confounding factors are adjusted for in the model including: patient age; the presence of certain co-morbidities based on the Charlson Index (e.g. diabetes, dementia, COPD), emergency or non-emergency admission, emergency admissions within the preceding 12 months, admission source (home, nursing home or other hospital), receipt of palliative care, and an indicator of deprivation (medical card).

NQAIS NAHM provides hospitals with a dynamic view of their in-hospital mortality patterns. The primary focus is the most recent rolling 12-month period. Results are displayed by diagnosis in numerical and graphical format. Unusual patterns (signals) are symbolised and colour-coded for ease of recognition. In the rolling 12 month period records can be identified and selected to explain the pattern of interest. Hospitals are provided with a simple two-page template, developed by HIU, to guide the process of signal reviews and the sharing of learning points nationally.

However, as emphasised elsewhere in this report, mortality patterns should be interpreted with caution as they may be due to a number of factors not adjusted for in the methodology, including: random (statistical) variation beyond the control limits set for the model, differences in patient characteristics not fully accounted for, the accuracy of the principal/admission diagnosis, the depth of diagnostic coding which impacts on the determination of co-morbidities and difference in the overall quality of care. Clearly, the overall quality of the available data is dependent upon the accuracy and clarity of the clinical recording in the patients' charts and its subsequent coding into HIPE.

Hospital mortality analysis is a (statistical) screening tool for reviewing quality of care in hospitals. Results should be interpreted together with other sources of information on quality, including: critical event reporting, mortality and morbidity review processes, patient/staff satisfaction and quality and risk management processes. Furthermore, it should be noted that SMRs can only be used to examine mortality patterns within a hospital, and not to compare hospitals with each other, or to provide a league table of hospital mortality.

### Hospital In-Patient Enquiry - HIPE: data source for NQAIS NAHM

Hospital mortality patterns are generated internationally by the use of routinely collected clinical and administrative data on patients discharged from hospital. In Ireland, this data is collected from publicly funded acute hospitals by the HIPE system which is managed by the HPO on behalf of the HSE. Hospital HIPE data is comprised of data extracted from hospital patient administration systems and the patient medical record. HIPE clinical coders extract, code and enter the data from the patient medical record (including discharge summary) into the standardised HIPE Portal data entry system. The HPO supports the use of HIPE in hospitals. The HPO provides anonymised HIPE data to NQAIS NAHM, where it is analysed to provide NAHM outputs, such as the SMR.

**TABLE 1: NATIONAL HIPE DATA COVERAGE**

YEAR	COVERAGE (%)
2013	99.1%
2014	97%
2015	99.8%

Data can be considered of good quality when the correct reliable data is available in a timely manner. Hospitals return encrypted and secure HIPE exports to the HPO on a monthly basis and a new national file is created each month to include these updates. In 2015, data on 99.8% of all in-patient discharges was returned to the HPO (Table 1).

Each hospital uses the same HIPE data entry system so all data is subject to the same data entry and edit checks. HIPE data quality activities occur before, during and after HIPE data entry. Data entry edits and checks ensure a high standard of data before being exported to the HPO. Many hospitals, with the support of HPO, perform regular checks on HIPE data to ensure their own high standards of accuracy. The key to ensuring accurate HIPE data is that there is a complete and accurate medical record, including discharge summary, which is then completely and accurately coded. A patient discharge summary should be completed for every in-hospital mortality (this is currently not routinely the case), which will further improve the accuracy of HIPE data (HIQA 2013). The HPO works to ensure this through a continuous improvement cycle involving: clinical coder training and support, audit and review, data validation and HIPE Software systems. The HPO commissioned an independent review of HIPE in 2015 which acknowledged the overall quality of the HIPE data, but noted a need to develop a national data quality improvement agenda that reduces variations in coding practice between the hospitals (Pavilion Health Australia, 2016).

Both clinicians and clinical coders in hospitals and the HPO work to ensure that the data is accurate to reflect both the reason for and process of in-patient care. Constant collaboration and cooperation with clinical staff within hospitals and nationally is essential to ensure that information in clinical documentation is suitable for the purpose of collecting timely and accurate HIPE data on patients' episodes of care. This recommendation is reiterated in the recent review of national HIPE data (Pavilion Health Australia 2016).

## Analysing and displaying the SMR in NQAIS NAHM

NQAIS NAHM provides hospitals with a dynamic view of their in-hospital mortality patterns particularly the SMR. This is a secure web-enabled interface which provides hospitals with an ongoing view of their mortality data. Although the tool displays the most recent full year for which complete data is available, the primary focus for hospitals is the most recent rolling 12 month period.

Key data from the HIPE system is extracted to generate mortality data including SMRs for hospitals. The ICD-10-AM (8th Edition) (National Casemix and Classification Centre 2013) classification contains approximately 16,800 codes for diagnostic conditions. Such a large number can be challenging to manage, hence SMRs are displayed by diagnostic groups. These are called CCS groups which were developed by the AHRQ. So, for example, the CCS group "acute myocardial infarction" will include conditions such as acute transmural MI, acute sub endocardial MI, MI of anterior wall or MI of inferior wall. It makes clinical sense to group together these conditions which require similar treatment approaches.

The SMR used in NQAIS NAHM includes the analysis of patients coded for palliative care which differs from some international models, where patients who are coded for palliative care are excluded from analysis. The inclusion of palliative care coded patients ensures that potential "gaming" (where there is a referral to palliative care which

excludes cases from review for SMR purposes) cannot take place and also recognises that palliative care coding does not equivocate to end of life care (Chong et al. 2012). Hospital mortality data is presented in numerical and graphical format for selected time periods, usually one year. NAHM only publishes data using the 99.8 per cent control limit statistical test. NQAIS NAHM also presents a 'more liberal' 95 per cent confidence interval banding. This is to give clinicians and managers the ability to closely monitor the mortality pattern for an early warning of potential areas of concern.

Where an SMR is outside the expected range, hospitals should examine their records to understand their SMR pattern. Determining the SMR is an important step, but this should be followed by a local analysis of what this means and what has contributed to this value. Within NQAIS NAHM, there is the capability to identify records which can focus a review of mortality patterns. Hospitals are provided with a template to guide the review process and to facilitate sharing of the learning points.







# **HOSPITAL ENGAGEMENT WITH NAHM**

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### HOSPITAL ENGAGEMENT WITH NAHM

It is important to remember that the SMR is only one of a suite of indicators used for measuring hospital quality and should always be used in conjunction with other indicators of the quality of care. Other indicators which may be considered include: incident reporting, patient and staff satisfaction surveys, local and national clinical audit as well as internal and external quality reviews.

Hospitals, Hospital Boards and Hospital Groups are now using their NAHM outputs to monitor hospital mortality and identify opportunities for improving patient care. Exemplars of use of NAHM are presented here.

#### TALLAGHT HOSPITAL

*“The introduction of Ireland’s National Audit of Hospital Mortality database has presented many positive opportunities for Tallaght Hospital to develop its systems and processes for mortality review. In line with our clinical governance, safety and quality assurance processes, we have recently formed a hospital mortality committee which provides strategic oversight and surveillance of the Hospitals’ mortality data. Specifically, the committee agree and quality assure a process whereby statistics of hospital deaths are collated, recorded and reviewed. This enables the Hospital to learn lessons from any potentially preventable deaths or deaths where the care provided could have been improved. A key component of this is having easy access to NOCA’s comparable standardised mortality data which provides an excellent facility to quickly identify deaths which require further scrutiny. As the committee develops we aim to introduce a more structured process for individual case reviews and the development of morbidity and mortality methodology.”*

#### **Dr Daragh Fahey**

Director Quality, Safety and Risk Management,  
Tallaght Hospital

#### UL HOSPITALS GROUP BOARD

*“NAHM data is used to analyse the trend in hospital mortality in all our model 2 and 4 hospitals over the last 15 years. The strength and validity of the data makes it easy to use in the Board setting, and provided reassurance to the Board that our developing hospital structure is working effectively for the wellbeing and health of our patients in the UL Hospitals Group.”*

#### **Mr Paul Burke**

Chief Clinical Director,  
UL Hospitals

**MATER MISERICORDIAE UNIVERSITY HOSPITAL**

As part of the 'Mater Board on Board' project in partnership with HSE QID, the Board identified in-hospital mortality as an important outcome measure for the Board Quality Dashboard (Mater Misericordiae University Hospital and Health Service Executive, Quality Improvement Division, 2015). Clinicians also use NAHM to identify potential learning by examining mortality patterns.

In 2016, the executive Clinical Director and the Clinical Director for Quality and Patient Safety, in conjunction with hospital clinicians, undertook an internal review of mortality related to COPD and bronchiectasis.

*"The review has not provided a definitive explanation, neither has it raised any immediate concerns. The review has raised questions for further consideration (outlined in detail in COPD and Bronchiectasis findings). The noted standardised mortality ratio is significant for 2015 only; it cannot be viewed in isolation and will continue to be closely monitored in 2016. We value the engagement we have had with NOCA on this audit. We appreciate this is still a learning curve for both organisations and we are committed to continuing in this learning process and to using the data to identify potential areas for improvement."*

**Mr Gordon Dunne**

CEO,  
Mater Misericordiae University Hospital

Hospitals are encouraged to continuously review their NAHM data, being aware of how it may change over time and using this information to contribute to wider efforts to improve patient care. This can provide an early indication of potential areas of concern. Where the SMR is outside the expected range, this should be investigated further and understood. This would include an investigation of both the quality of the medical record and the clinical coding in tandem with a review of clinical care factors. The overall quality of the available data is dependent upon the accuracy and clarity of the clinical recording in the patients' charts and its subsequent coding into HIPE. NOCA is available to support hospitals in the interpretation of this data.

To ensure that the learning from the use of NAHM is shared within and between hospitals/hospital groups, NAHM should be integrated within the hospital and hospital group governance structures and include the involvement of clinical teams. This will maximise the benefits from the process and enable prompt action to be taken, if required, to improve the quality of care.





# **FRAMEWORK FOR THE NAHM REPORT**

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## FRAMEWORK FOR THE NAHM REPORT

The NAHM Governance Committee sought to ensure that an account of NAHM is available to the wider health system, patients, families and the public. This report focuses on in-hospital mortality in the publicly funded acute hospitals. A process was undertaken to select the key diagnoses for reporting. The selection process took into account that NAHM will continue to evolve over time. The NAHM Governance Committee applied the following criteria to select a cohort of key diagnoses:

**TABLE 2: CRITERIA FOR SELECTION OF KEY DIAGNOSES**

	CRITERIA	COMMENT	RATIONALE
CLINICAL	<b>Alignment to Clinical Care Programme</b>	Is there an associated HSE Clinical Care Programme?	HSE Clinical Care Programmes provide national leadership for Improvement.
	<b>Burden of the Clinical Topic</b>	Is the 'key diagnosis' considered of high volume?	Priority in this report is given to disease associated with the greatest burden to public health and the health system.
	<b>Significant clinical risk</b>	Is the 'key diagnosis' considered of significant clinical risk e.g. high mortality?	
METHODOLOGICAL	<b>Definition</b>	Is the 'key diagnosis' clearly clinically defined?	Only key diagnoses which are explicitly defined are selected for reporting.
	<b>No. of hospitals with defined number of admissions and expected events</b>	Volume of expected deaths $\geq 5$ ? Volume of admissions $> 100$ over the reporting period for the individual diagnosis?	The model is more statistically reliable when these criteria are met.
	<b>Statistical validity of the model</b>	ROC statistic $> 0.7$ ?	This measure calculates the performance of the model in predicting death. A result of 0.7 is considered a satisfactory predictor.

Applying these criteria, the following key diagnoses are reported on;

- acute myocardial infarction
- heart failure
- ischaemic stroke
- haemorrhagic stroke
- COPD and bronchiectasis

This report was prepared following consultation with relevant HSE National Clinical Care Programmes. The communication tool ISBAR (identify, situation, background, assessment and recommendation) provides a methodology to structure, analyse and finally present each key diagnosis.

## PRESENTATION OF MORTALITY DATA IN THIS REPORT

NAHM data was analysed across the key diagnoses as follows:

- Crude national in-hospital mortality rate from 2005 to 2015. This is presented in a line / trend chart.
- National in-hospital SMR for 2015, with the exception of haemorrhagic stroke, which is presented over a three year time period, 2013-2015. This is presented in a funnel plot.
- Hospital SMR is presented in appendices in a control chart.

### SMR Funnel plot

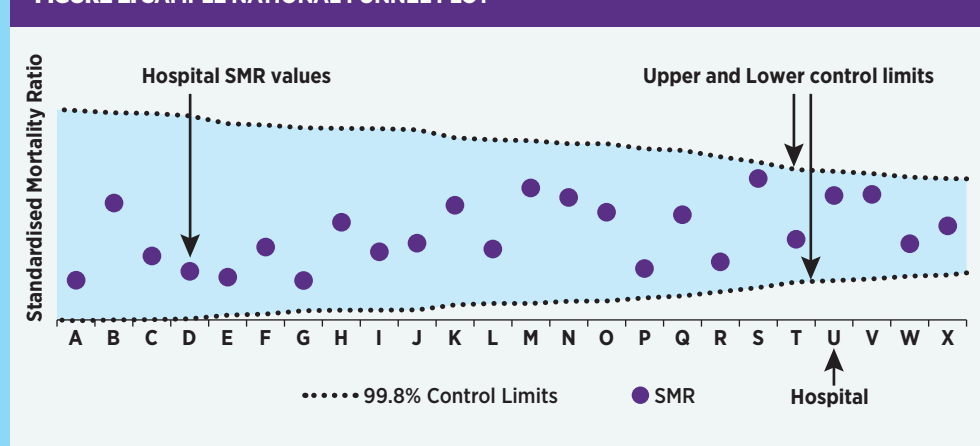


For this report, SMR funnel plots are scatterplots of individual hospital's SMR. The upper and lower borders of the funnel are represented by the 99.8% control limits. These borders represent the upper and lower limits of what is referred to as "expected variation". The control limits are affected by the number of cases with an individual diagnosis in hospitals. Hospitals with smaller numbers of cases have wider control limits and appear to the left of the SMR funnel plots, while hospitals with larger number of cases have narrower control limits and appear to the right of the funnel plot.

An SMR is expected to appear within the 99.8% control limits 998 times out of 1000. Statistically, 1 in 500 observations can be expected to appear outside these control limits by chance alone. In other words, if an SMR appears outside these limits, it is very unlikely that it is there due to chance. These observations represent variation worthy of further review.

Funnel plots make it very easy to identify these observations worthy of further review. The Association of Public Health Observatories (2008) recommend funnel plots as a graphical aid for institutional monitoring. A hospital's SMR should only be compared to its own control limits. There is no basis for ranking of institutions into 'league tables' (Spiegelhalter 2005), therefore it is not valid to directly compare SMRs between hospitals.

**FIGURE 2: SAMPLE NATIONAL FUNNEL PLOT**







The image is a full-page background photograph with a light blue overlay. It depicts a medical professional, likely a doctor, wearing a white coat and a stethoscope. The doctor's hands are gently holding a patient's arm, which is resting on a surface. The patient's arm is hairy, suggesting a male patient. The overall tone is professional and caring.

# **ACUTE MYOCARDIAL INFARCTION**

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## ACUTE MYOCARDIAL INFARCTION

### Identify: Acute myocardial infarction

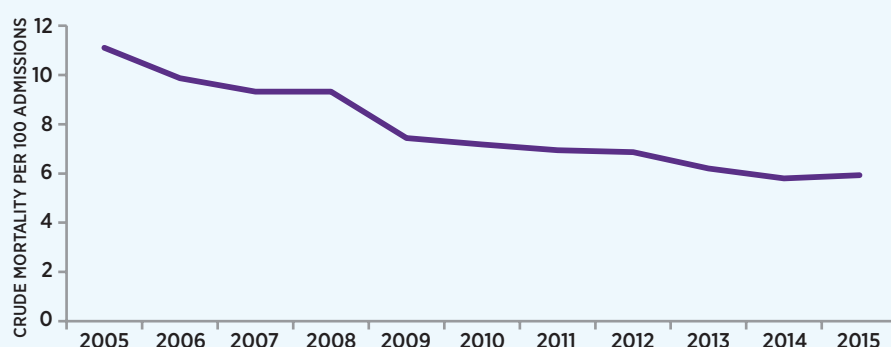
A heart attack is a serious medical emergency in which the supply of blood to the heart is suddenly blocked, usually by a blood clot, causing serious damage to the heart muscle if not treated quickly (HSE, RCPI, 2015). This is called an AMI. Such an interruption of blood flow to the heart muscle will weaken or permanently damage its ability to function. While there are important clinical differences between subtypes of myocardial infarction (ST elevation myocardial infarction (STEMI) and Non ST elevation myocardial infarction (NSTEMI)) (HSE, RCPI, 2015), for the purposes of this report these entities are grouped together.

Care of patients having AMI is aimed at stabilising the blood flow to the heart muscle as soon as possible. Ultimately where there are improvements in reperfusion of the heart muscle through interventions such as percutaneous coronary intervention (PCI), thrombolysis along with early treatment with aspirin and beta- blockers, this will lead to improvement in survival. The measure presented here is the SMR for AMI and this is fully defined in Appendix 2.

### Situation: In-hospital mortality following admission with a principal diagnosis of acute myocardial infarction

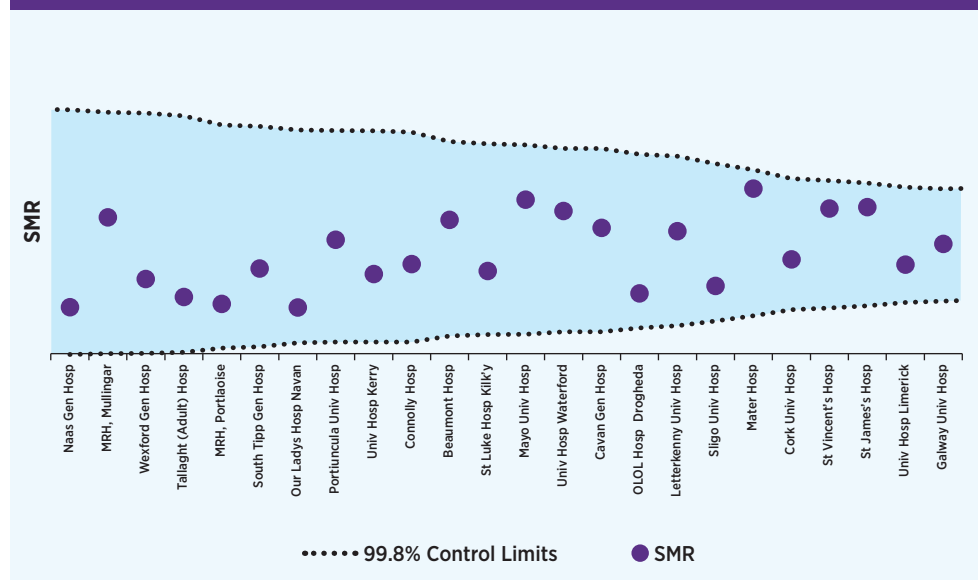
From HIPE data, a crude in-hospital mortality rate for AMI from 2005 to 2015 is presented in Figure 3. This data has not been adjusted for differences in age profile or comorbidities over time, but it provides background information to current hospital presentations. This illustrates a significant (46%) reduction during this time period (from 11.1 deaths per 100 admissions in 2005 to 5.9 deaths per 100 admissions in 2015).

**FIGURE 3: NATIONAL IN-HOSPITAL MORTALITY FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF AMI, 2005-2015**



- Twenty four hospitals had over 100 patients admitted with a principal diagnosis of AMI in 2015, ranging from 104 to 645 admissions. Figure 4 presents the SMR for these hospitals in a funnel plot. The control limits are set at 99.8%, meaning there is only a 1 in 500 chance of a hospital being outside these limits by chance alone. Control limits are calculated based on the number of admissions and the number of actual deaths in each hospital.
- All hospitals had an SMR within the control limits, indicating that all hospitals SMR were within the expected range.
- Twenty hospitals are not included in this analysis, as they did not meet the selection criterion relating to defined number of admissions and expected events (Table 2).

**FIGURE 4: NATIONAL IN-HOSPITAL SMR FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF AMI, 2015**



Findings in relation to hospital SMR for AMI for 2011-2015 are presented in Appendix 2. These are presented by hospital with confidence intervals calculated based on the numbers in each hospital.

## Background: Acute myocardial infarction, the HSE Acute Coronary Syndrome Programme

The National Clinical Programme for Acute Coronary Syndrome (ACS) was set up in Ireland in 2010 with the aim of saving lives by standardising the care of patients across the country. The programme prioritised development of a national Optimal Reperfusion Service (ORS) protocol and treatment pathway for patients with a particular type of heart attack [ST-elevation myocardial infarction (STEMI)]. This has been successful in that 92% of patients had this treatment in 2013-2014 (HSE, RCPI, 2015). In 2010, a national data collection add-on to the HIPE portal, known as Heartbeat, was established to collect and report ACS data.

### Assessment: NAHM in relation to acute myocardial infarction

NAHM presents SMR data for all hospitals where patients are admitted with all types of AMI. The SMR for AMI is presented across different types and models of hospitals (Model 2, 3 and 4). Some of these hospitals will provide more specialist treatment than others (HSE 2010). Any interpretation of these findings should consider this.

### Recommendation:

- Findings coming from NAHM are contingent on data in clinical records. Continued and increased collaboration between clinicians and clinical coders at both hospital and national levels can improve the quality of clinical records and the recording and understanding of mortality data.
- To promote reflection on quality of patient care and identify areas for improvement, hospitals and hospital groups at both Executive and at Board level should monitor and engage with this data.

The image is a full-page background photograph with a light blue overlay. It depicts a medical professional, likely a doctor, wearing a white coat and a stethoscope. The doctor's hands are gently holding a patient's arm, which is resting on a surface. The patient's arm has some hair on it. The overall tone is professional and caring.

## HEART FAILURE

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## HEART FAILURE

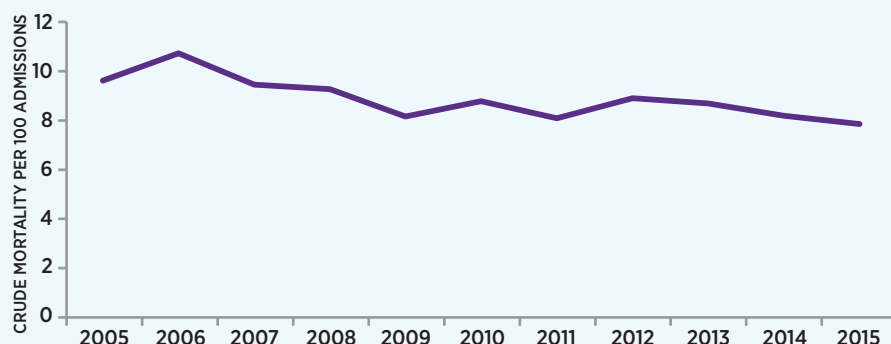
### Identify: Heart failure

Heart failure is an abnormality of cardiac function and structure. It is caused by a progressive weakening of the heart muscle, resulting in its inability to pump adequate amounts of blood needed to perfuse organs and other tissues. Heart failure can be classified as an acute or chronic disease process, with worsening disease resulting in admission to hospital. There are several classifications within heart failure such as acute or chronic. The measure presented here is the SMR for heart failure and this is fully defined in Appendix 3.

### Situation: In-hospital mortality following admission with a principal diagnosis of heart failure

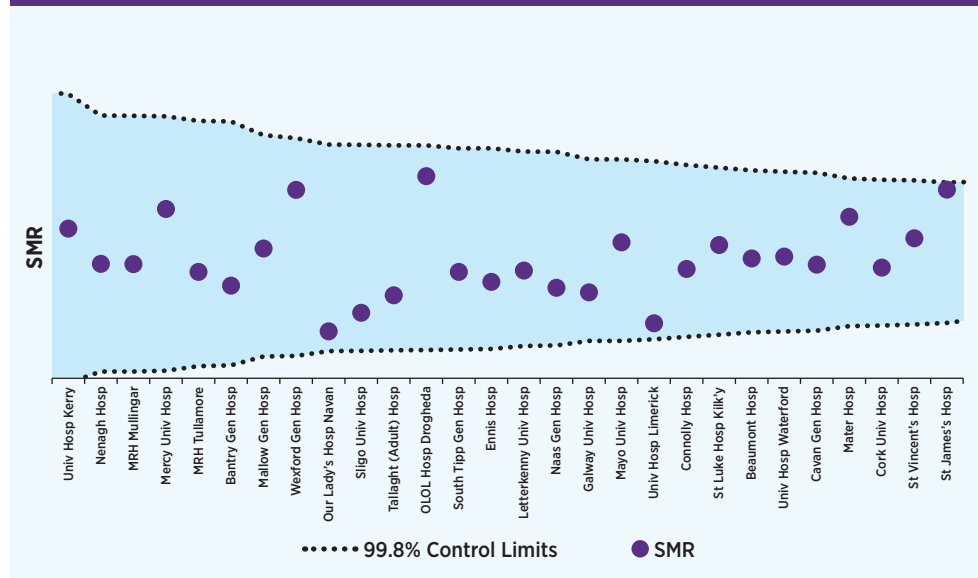
From HIPE data, a crude in-hospital mortality rate for heart failure from 2005 to 2015, is presented in Figure 5. This data has not been adjusted for differences in age profile or comorbidities over time, but it provides background information to current hospital presentations. This shows a small but significant reduction in in-hospital mortality over that time period (from 9.6 deaths per 100 admissions in 2005 to 7.9 deaths per 100 admissions in 2015).

**FIGURE 5: NATIONAL IN-HOSPITAL MORTALITY FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF HEART FAILURE, 2005-2015**



- Twenty eight hospitals had over 100 patients with a principal diagnosis of heart failure on admission to hospital in 2015. The number of admissions in these hospitals ranged from 105 to 382. Figure 6 presents the SMR for these hospitals in a funnel plot, with 99.8% control limits.
- All hospitals had an SMR within the control limits, indicating that all hospitals SMRs were within the expected range.
- Sixteen hospitals are not included in this analysis, as they did not meet the selection criterion relating to defined number of admissions and expected events (Table 2).

**FIGURE 6: NATIONAL IN-HOSPITAL SMR FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF HEART FAILURE, 2015**



Findings in relation to hospital SMR for heart failure for 2011-2015 are presented in Appendix 3. These are presented by hospital with confidence intervals calculated based on the numbers in each hospital.

### Background: Heart failure, the HSE National Clinical Programme for Heart Failure

Heart failure is a major public health problem affecting more than 120,000 Irish people. A recently published review attributed 537 deaths to heart failure in Ireland in 2012, equating to 3,683 of potential life years lost, and 46 full lifetimes lost per annum (HSE National Heart Failure Clinical Care Programme, Irish Heart Foundation 2015). This report also suggests that approximately 4% of all in-patient hospital admissions and 7.3% of all HSE bed days in 2012 can be attributed to heart failure. The HSE National Clinical Programme for Heart Failure aims to reorganise the way heart failure patients are managed across the health service, both in acute hospital and community setting.

### Assessment: NAHM in relation to heart failure

The crude in- hospital mortality rate was estimated at 7.9% in 2015. All 28 hospitals included in the analysis were within the expected range.

### Recommendation:

- Findings coming from NAHM are contingent on data in clinical records. Continued and increased collaboration between clinicians and clinical coders at both hospital and national levels can improve the quality of clinical records and the recording and understanding of mortality data.
- To promote reflection on quality of patient care and identify areas for improvement, hospitals and hospital groups at both Executive and at Board level should monitor and engage with this data.



The image is a full-page background photograph with a light blue overlay. It depicts a medical professional, likely a doctor, wearing a white coat and a stethoscope. The doctor's hands are gently holding a patient's arm, which is resting on a surface. The patient's arm has some hair on it. The overall tone is professional and caring.

## **STROKE**

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## STROKE

A stroke is a serious, life-threatening medical condition that occurs when the blood supply to part of the brain is interrupted and even cut off. Like all organs, the brain needs oxygen and nutrients provided by blood to function properly. If the supply of blood becomes interrupted or cut off, brain cells begin to die. When the affected brain cells die, the part of the body controlled by these cells stops working. Depending on the location and size of the affected area, a stroke can lead to brain injury, disability and possibly even death.

A recent consensus document on stroke definition from the American Heart Association and the American Stroke Association (Sacco et al. 2013), incorporated both tissue and clinical criteria:

- central nervous system (CNS) infarction attributable to ischemia (brain cell death)
- clinical evidence of injury in a part of the body controlled by the affected brain cells after 24 hours.

There are two main causes of strokes:

- ischaemic – where the blood supply to the brain is stopped due to a blood clot, accounting for approximately 70-80% of all strokes.
- haemorrhagic – where a weakened blood vessel supplying the brain ruptures, causing bleeding into the brain. These account for the remaining number of strokes in Ireland (Stroke, available at [http://www.irishheart.ie/iopen24/heart-conditions-explained-t-7\\_19.html](http://www.irishheart.ie/iopen24/heart-conditions-explained-t-7_19.html) Accessed on: 29.08.2016).

## ISCHAEMIC STROKE

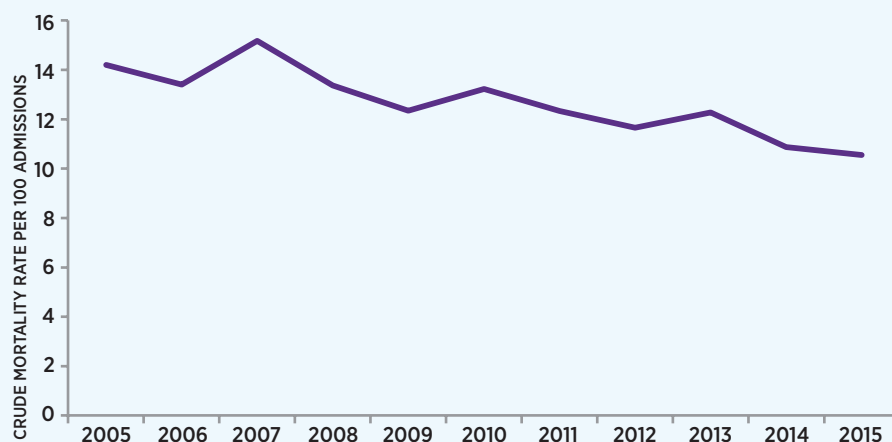
### Identify: Ischaemic stroke

Cerebral thrombosis (a clot or fatty deposit) and cerebral embolism (a wandering clot, usually from the heart) cause ischaemic stroke, when these clots occlude blood flow to brain tissue. This is the most common type of stroke. There are several classifications within ischaemic stroke. The measure presented here is the SMR for ischaemic stroke and this is fully defined in Appendix 4.

### Situation: In-hospital mortality following admission with a principal diagnosis of ischaemic stroke

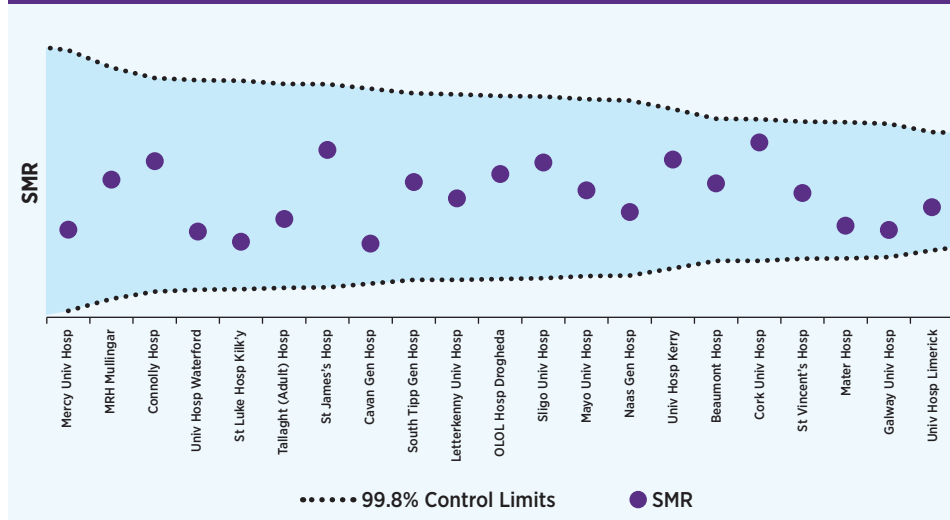
From HIPE data, a crude in-hospital mortality rate for ischaemic stroke between 2005 - 2015, is presented in Figure 7. This data has not been adjusted for differences in age profile or comorbidities over time, but it provides background information to current hospital presentations. This shows a small but significant reduction in in-hospital mortality over that time period (from 14.2 deaths per 100 admissions in 2005 to 10.5 deaths per 100 admissions in 2015).

**FIGURE 7: NATIONAL IN-HOSPITAL MORTALITY FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF ISCHAEMIC STROKE, 2005-2015**



- Twenty one hospitals had over 100 patients with a principal diagnosis of ischaemic stroke on admission to hospital during 2015. The number of admissions ranged from 102 to 367 in that year. Figure 8 presents the SMR for these hospitals in a funnel plot, with control limits at 99.8%.
- All hospitals had an SMR within the control limits, indicating that all hospitals SMRs were within the expected range.
- Twenty three hospitals are not included in this analysis, as they did not meet the selection criterion relating to defined number of admissions and expected events (Table 2).

**FIGURE 8: NATIONAL IN-HOSPITAL SMR FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF ISCHAEMIC STROKE, 2015**



Findings in relation to hospital SMR for ischaemic stroke for 2011-2015 are presented in Appendix 4. These are presented by hospital with confidence intervals calculated based on the numbers in each hospital.

## HAEMORRHAGIC STROKE

### Identify: Haemorrhagic stroke

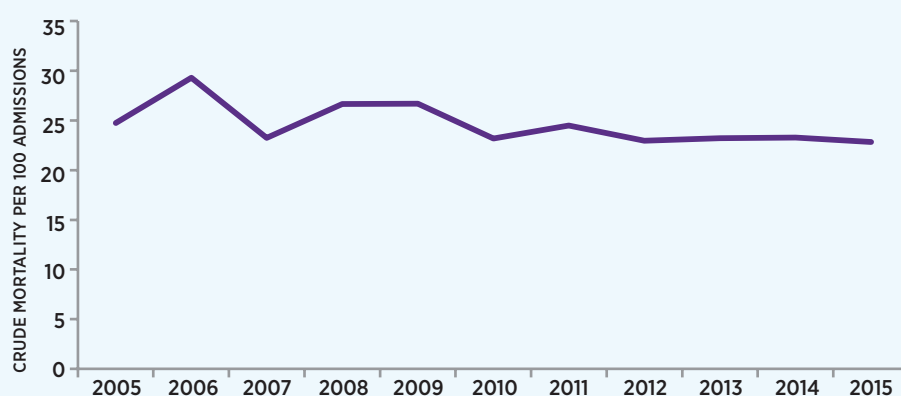
Intracerebral and sub-arachnoid haemorrhages, caused by ruptured blood vessels leading to bleeding in the brain causes stroke (Irish Heart Foundation). Brain haemorrhages should only be classified as stroke if they are non-traumatic, caused by a vascular event and result in injury or ischemia to the central nervous system / brain (Sacco et al. 2013). Haemorrhagic stroke occurs less frequently than ischaemic stroke, but can have much higher associated mortality and morbidity (Sacco et al. 2013).

The measure presented here is the SMR for patients who were admitted to hospital with haemorrhagic stroke. Due to the low incidence of haemorrhagic stroke, a three year period 2013-2015 was selected (Appendix 5). This CCS group includes non-traumatic subdural haemorrhage, and data should be interpreted with this in mind. This current classification of haemorrhagic stroke is broad and reflects what is used in current CCS groupings internationally.

### Situation: In-hospital mortality following admission with a principal diagnosis of haemorrhagic stroke

From HIPE data, a crude in-hospital mortality rate for haemorrhagic stroke from 2005 to 2015 is presented in Figure 9. This data has not been adjusted for differences in age profile or comorbidities over time, but it provides background information to current hospital presentations. This shows that the rate of in-hospital mortality did not show a significant reduction over that time period.

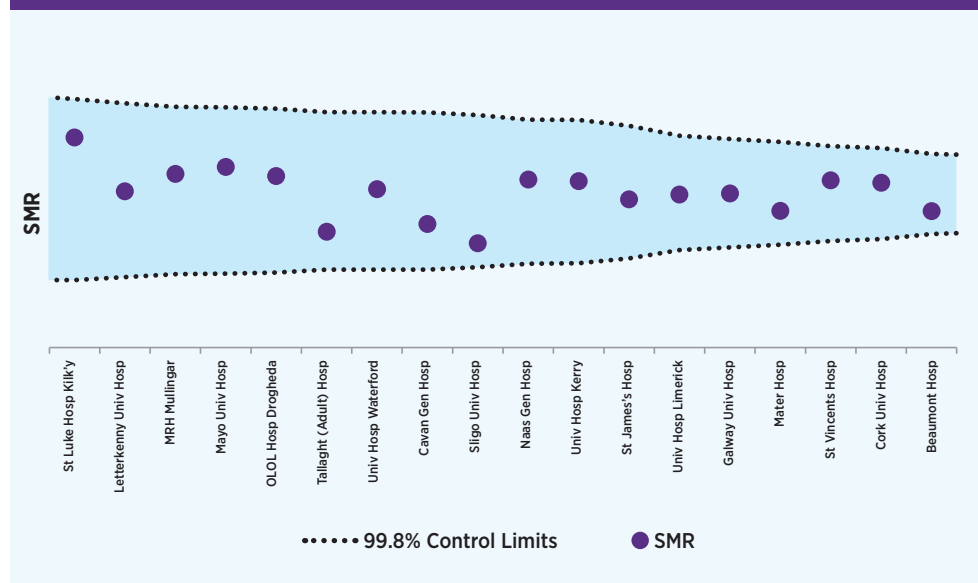
**FIGURE 9: NATIONAL IN-HOSPITAL MORTALITY FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF HAEMORRHAGIC STROKE, 2005-2015**



- Eighteen hospitals had over 100 patients with a principal diagnosis of haemorrhagic stroke following admission between 2013 and 2015. Over this time period, the number of admissions ranged from 100 to 1242. Figure 10 presents the SMR for these hospitals in a funnel plot, with control limits of 99.8%.

- All hospitals had an SMR within the control limits, indicating that all hospitals SMRs were within the expected range.
- Twenty six hospitals are not included in this analysis, as they did not meet the selection criterion relating to defined number of admissions and expected events (Table 2).

**FIGURE 10: NATIONAL IN-HOSPITAL SMR FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF HAEMORRHAGIC STROKE, 2013 - 2015**



Findings in relation to hospital SMR for haemorrhagic stroke for 2011-2015 are presented in Appendix 5. These are presented by hospital with confidence intervals calculated based on the numbers in each hospital.

### Background: ischaemic and haemorrhagic stroke, the HSE Stroke Clinical Care Programme

Stroke is recognised as a leading cause of mortality and disability. Over 7,000 patients are admitted to hospital following stroke in Ireland each year. The HSE, National Stroke Programme, since its implementation in 2010, prioritised improving outcomes for stroke patients. Key objectives include prevention of stroke, access to quality stroke service and reduction of death and disability (McElwaine et al. 2015). The recent Irish Heart Foundation, HSE National Stroke Audit showed:

- 21 Irish hospitals have stroke units
- A thrombolysis rate of 11%, fluctuated across sites but compared favourably internationally

A reduction of the in-hospital mortality rate was noted (McElwaine et al. 2015). This audit measured in-hospital mortality both for patients admitted with stroke and those who developed a stroke while in hospital.

## Assessment: NAHM in relation to ischaemic and haemorrhagic stroke

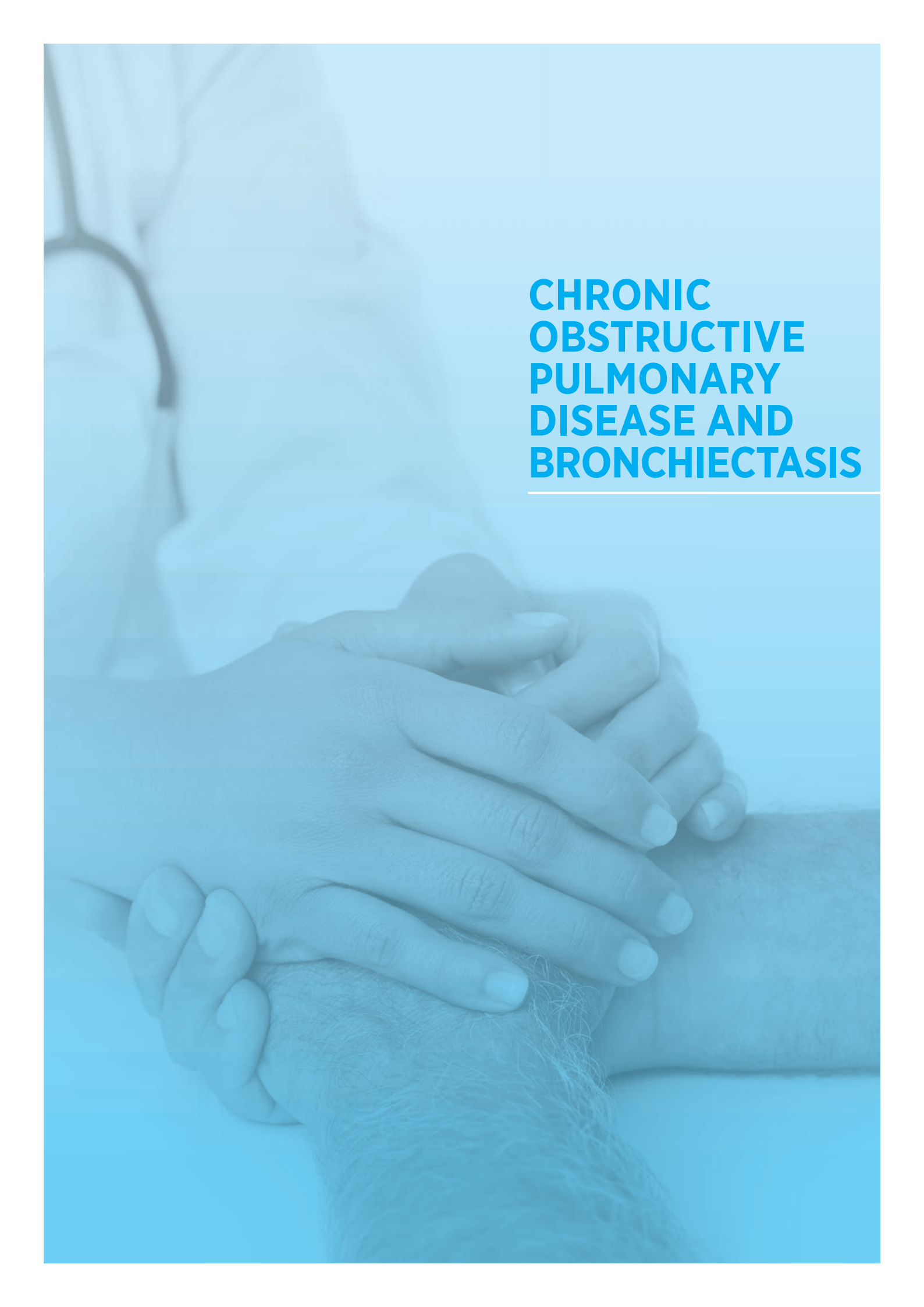
Ischaemic stroke is the more common stroke experienced by patients and this is presented for one year - 2015. As for all of the key diagnosis in this report, this focuses only on patients who were admitted to hospital following an ischaemic stroke. There was a significant reduction in in-hospital mortality between 2005-2015 and all hospitals had an SMR within their control limits. This is aligned with ongoing improvements in stroke care reported by McElwaine et al. (2015). As haemorrhagic stroke accounts for just over 20% of all strokes, the numbers are very much smaller and therefore it is presented over a three year period.

What is included here is the definition of haemorrhagic stroke as used by OECD (OECD 2015a). This classification of haemorrhagic stroke is broad and includes non-traumatic subdural and extradural haemorrhage. These are not now considered strokes in any current classification (Sacco et al. 2013). There is no direct brain injury due to the bleeding or 'vascular cause' in cases of subdural and extradural haemorrhage, as it never makes direct contact with the brain. The risk factors for subdural and extradural haemorrhage are completely different to haemorrhagic stroke. For example, subdural and extradural haemorrhage are predominantly of a venous, not arterial aetiology, and therefore are not classified as a cardiovascular disease. Neither subdural nor extradural haemorrhage have ever been included in any clinical trial of stroke and do not form part of clinical guidelines on management of stroke. Clinical management of subdural and extradural haemorrhage is a collaboration with neurosurgical services. As a result of this, these are not included in the remit of the HSE, National Stroke Programme.

This is challenging for reporting as these disease process have been grouped together for this purpose. A review of HIPE data between 2013 and 2015 showed that between 20% and 24% of patients whose admission is grouped under the haemorrhagic stroke classification were admitted with subdural and extradural haemorrhage (HIPE Statistics Reporter, Available at: <http://www.hpo.ie/>. Accessed on 14/09/2016). To address this, the NAHM Governance Committee will consider development of future reporting on a cohort of appropriate haemorrhagic stroke diseases.

## Recommendation:

- Findings coming from NAHM are contingent on data in clinical records. Continued and increased collaboration between clinicians and clinical coders at both hospital and national levels can improve the quality of clinical records and the recording and understanding of mortality data.
- To promote reflection on quality of patient care and identify areas for improvement, Hospitals and hospital groups at both Executive and at Board level should monitor and engage with this data.
- Future reporting on a more appropriate haemorrhagic stroke diagnosis should be considered, to promote a more comprehensive reflection of quality of care of these patients.

The background image is a light blue-tinted photograph. It shows a close-up of a doctor's hands, wearing a white lab coat, gently holding a patient's arm. A stethoscope is visible around the doctor's neck. The overall tone is professional and caring.

# **CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND BRONCHIECTASIS**

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# CHRONIC OBSTRUCTIVE PULMONARY DISEASE AND BRONCHIECTASIS

## Identify: chronic obstructive pulmonary disease & bronchiectasis

COPD is a common progressive lung disease and is the most prevalent respiratory disease in adults. It is characterised by a persistent and progressive airflow limitation, associated with an enhanced chronic inflammatory response in the airways and the lung. It is complicated by exacerbations and individual comorbidities contributing to overall illness severity (Global Initiative for Chronic Obstructive Lung Disease (GOLD 2016)). This progressive airflow limitation characteristic of COPD is caused by a mixture of small airways disease (obstructive bronchiolitis) and parenchymal destruction (emphysema), the relative contributions of which vary from person to person (GOLD 2016). This definition has been adopted by the HSE National Clinical Programme for COPD (2016).

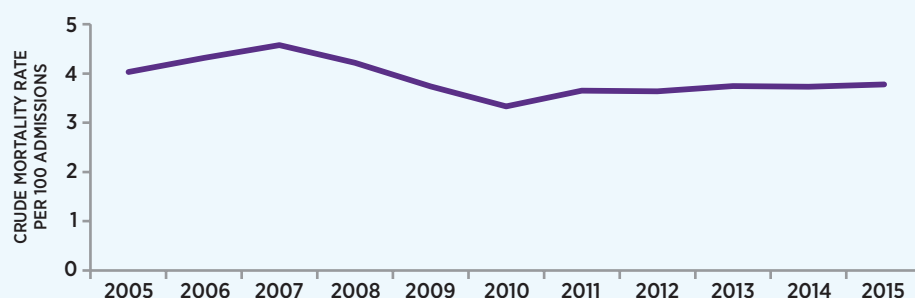
Bronchiectasis is a progressive inflammatory condition of the larger airways. Because of the inflammation, the airways are less able to clear secretions, and can cause a chronic cough and production of excessive amounts of sputum. (What is bronchiectasis? Available at: <https://www.nhlbi.nih.gov/health/health-topics/topics/brn> Accessed on 3/10/2016). There is currently no cure for bronchiectasis and the damage to the respiratory airways is usually permanent (Bronchiectasis, Available at: <http://www.hse.ie/eng/health/az/B/Bronchiectasis/Causes-of-bronchiectasis.html> Accessed on 14/09/2016).

This combined analysis of COPD and bronchiectasis is presented as the principles of treatment are broadly similar. Secondly, these definitions are combined for OECD reporting, (OECD 2015a). The measure presented here is the SMR for COPD and bronchiectasis and is fully defined in Appendix 6.

## Situation: In-hospital mortality following admission with a principal diagnosis of COPD and bronchiectasis

From HIPE data, a crude in-hospital mortality rate for COPD and bronchiectasis from 2005 to 2015 is presented in Figure 11. This data has not been adjusted for differences in age profile or comorbidities over time, but it provides background information to current hospital presentations. This shows that the rate of in-hospital mortality did not show a significant reduction over that time period.

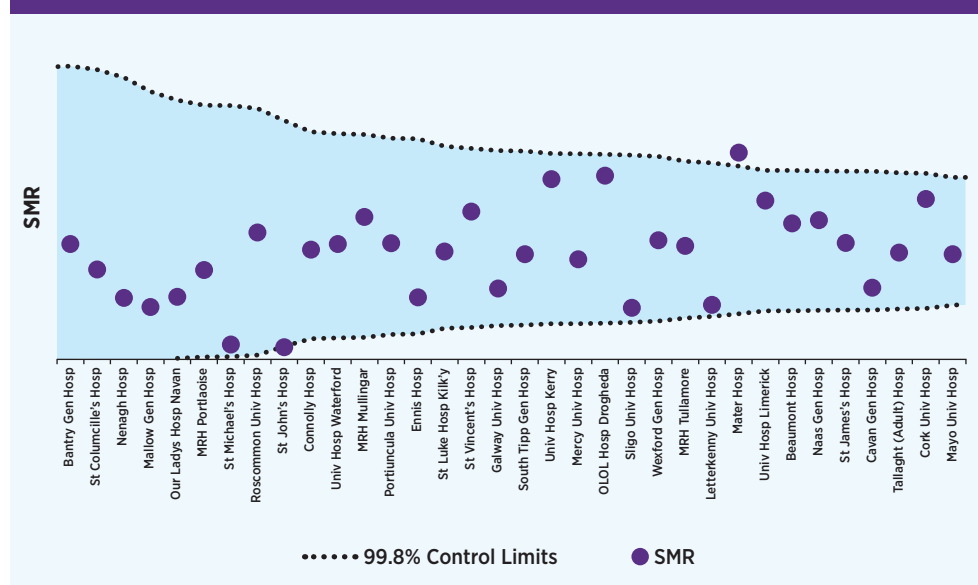
**FIGURE 11: NATIONAL IN-HOSPITAL MORTALITY FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF COPD AND BRONCHIECTASIS, 2005-2015**





- Thirty four hospitals had over 100 patients with a principal diagnosis of COPD and bronchiectasis following admission in 2015. The number of admissions ranged from 136 to 772. Figure 12 presents the SMR for these hospitals in a funnel plot, with 99.8% control limits.
- Thirty three hospitals had an SMR within the control limits of 99.8%, one hospital had an SMR outside that expected range.
- Ten hospitals are not included in this analysis, as they did not meet the selection criterion relating to defined number of admissions and expected events (Table 2).

**FIGURE 12: NATIONAL IN-HOSPITAL SMR FOLLOWING ADMISSION WITH PRINCIPAL DIAGNOSIS OF COPD AND BRONCHIECTASIS, 2015**



Findings in relation to hospital SMR for COPD and bronchiectasis for 2011-2015 are presented in Appendix 6. These are presented by hospital with confidence intervals calculated based on the numbers in each hospital.

### Background: COPD and bronchiectasis, the HSE Respiratory Clinical Care Programme

The HSE National Clinical Programme for COPD estimates the prevalence from 275,000 cases (clinical diagnosis) to 460,000 cases based on mortality, relatively high rate of hospitalisations for COPD in Ireland and international prevalence data (HSE National Clinical Programme for COPD 2016). COPD has considerable impact both on the quality and quantity of life of the patient, involving long term medical care, frequent hospital admissions for many and often resulting in premature death. There were 382 hospitalisations for COPD and bronchiectasis per 100,000 population in 2015 (DOH 2016).

Internationally, COPD is a very common cause of death. Currently in Ireland it is the 4th most common cause of death (DOH 2015b). It is projected that COPD is set to become the third leading cause of death worldwide by 2020. This increased mortality is driven

in part as a result of the epidemic of smoking, in addition to reduced mortality from other common causes of death (e.g. ischemic heart disease, infectious diseases), and ageing of the world population (GOLD 2016).

### Assessment: NAHM in relation to COPD and bronchiectasis

One hospital had an SMR above the upper control limit in 2015, meaning that this SMR was higher than could be explained by chance. The reasons for this could be differences in patient factors not fully accounted for in the model, differences in the medical record and coding into HIPE, or differences in the quality of care. This should, and did, prompt a thorough review of both the coding and the clinical care for those patients. A summary of the findings of that review are included below.

The Executive Clinical Director and Clinical Director for Quality and Patient Safety, together with clinicians in the Mater Misericordiae University Hospital undertook a review of COPD and bronchiectasis. The findings are summarised as follows:

*“An internal review of deaths ... has not provided a definitive explanation, neither has it raised any immediate concerns. It has however, raised questions for further consideration. In exploring the data, we have concluded in general that the inclusion of palliative care associated mortality has not significantly contributed to this change in mortality rate. However, a number of other considerations have arisen;*

- a) The interpretation of coding of the primary admitting diagnosis from the clinical notes is challenging due to the complexity of presenting symptoms and existing co-morbidities.*
- b) The accuracy of reflecting the number and complexity of co-morbidities associated with patients and the significance of these in contributing to their mortality.*
- c) Finally, in relation to COPD/ Bronchiectasis diagnosis, COPD is a ubiquitous term and inherently leads to a bias in coding deflecting from alternative diagnoses particularly pneumonia. The noted standardised mortality ratio is statistically significant for 2015 only; it cannot be viewed in isolation and will continue to be closely monitored in 2016.”*

**Mr Gordon Dunne,**  
CEO,  
Mater Misericordiae University Hospital

It is clear that COPD frequently occurs in combination with one or more comorbid respiratory conditions. Exacerbations of COPD can be caused by other factors including bacterial and/or viral infection (HSE National Clinical Programme for COPD 2016). In 2014, an analysis of all patients with a diagnosis of COPD and bronchiectasis, found 50% of patients were admitted with this diagnosis as the principal reason and the other half had this coded as a co-morbid condition (HIPE Statistics Reporter, Available at: <http://www.hpo.ie/>. Accessed on 14/09/2016).

Comorbidities, especially where respiratory disease is comorbid, can have a major impact on both quality of life and survival. It should be noted that where there is variation in documentation and /or coding between COPD and bronchiectasis and other respiratory diseases, this may impact on reported mortality. Very often, while treatment will not differ, it may be challenging to pin point what is a principal diagnosis; why a patient is admitted to hospital or a co-existing diagnoses – contributing to severity of reason for admission. To address this, the NAHM Governance Committee will consider development of future reporting on a broader cohort of appropriate respiratory diseases.

### Recommendation:

- Findings coming from NAHM are contingent on data in clinical records. Continued and increased collaboration between clinicians and clinical coders at both hospital and national levels can improve the quality of clinical records and the recording and understanding of mortality data.
- To promote reflection on quality of patient care and identify areas for improvement, Hospitals and hospital groups at both Executive and at Board level should monitor and engage with this data.
- Future reporting on a broader cohort of appropriate respiratory diseases should be investigated to test whether a more comprehensive reflection of quality of care for these patients is possible.



A blue-tinted photograph showing a doctor's hands holding a patient's arm. A stethoscope is visible around the doctor's neck in the background. The text 'EVALUATING NAHM' is overlaid on the right side of the image.

## **EVALUATING NAHM**

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## EVALUATING NAHM

Modern healthcare is a complex system that requires reliable measurement to understand the quality of care and help ensure that patients receive the best possible care that is safe and effective. At a time of implementation to all publicly funded acute hospitals and conclusion of the first report, it is important to evaluate the process and future of NAHM.

### **BENEFITS AND LIMITATIONS OF NAHM**

NAHM provides a measure of in-hospital mortality, which should be used in conjunction with other indicators in the assessment of the quality of care. Both the benefits and limitations should be acknowledged.

Concerns can sometimes be raised about use of an administrative data such as HIPE as the source for SMRs. NAHM takes data from HIPE, primarily an administration database. The recently commissioned review of HIPE acknowledged the overall quality of the HIPE data, but noted a need to develop a national data quality improvement agenda (Pavilion Health Australia 2016). Collaboration between hospital based and national clinicians and clinical coders can continue to improve the accuracy of the data in HIPE. HIPE data captures an entire in-hospital population, thereby ensuring a complete data set. Clinical audit often struggles to ensure complete population coverage. As data in NAHM is extracted from the HIPE system, an additional infrastructure for data collection at hospital level is not required.

Another often cited limitation is the possibility to alter data and therefore the SMR itself. SMRs endeavour to adjust for the patient factors that affect mortality, independently of the care they receive. One factor that is adjusted for in NAHM is palliative care. Patients who receive treatment under the care of the palliative care team are included in NAHM. A statistical adjustment is made for assignment of a palliative care code. While there always remains the possibility that this code may be added inappropriately, the risk of this can be reduced by monitoring and making the rates of palliative care coding transparent.

The most important aspects of care for patients are the quality of their experience and the outcome of their care. Very often, the focus of measures in healthcare is on structures and process and not on the patient experience and the outcome of their care. NAHM provides an outcome measure –namely mortality. While no one measure will fully capture quality of care, mortality is a key outcome and when used with other process measures, it can provide deeper understanding of quality of care.

Exemplars have been shared in this report of how hospitals, hospital groups and Boards are beginning to prospectively engage and understand their NAHM data. This is very encouraging and sharing these practice examples can support other hospitals in their NAHM journey. Further evaluation is required to identify learning from reviews, learning and challenges from the process and opportunities for quality improvement, which will ultimately lead to better patient outcomes.

## FUTURE DEVELOPMENTS IN NAHM REPORTING

This is the first NAHM report coming from NOCA. This was developed by the NAHM Steering Committee with oversight of the NAHM Governance Committee. This report has been approved by the Governance Board of NOCA. This report sets out the cohort of key diagnoses selected for national reporting. Over the coming years, NAHM will evolve in response to the feedback from hospital use, the expertise of clinicians and new developments internationally. The presentation of further key diagnoses and expansion of reporting time periods to meaningfully present data from smaller hospitals will be explored and developed.





A light blue-tinted photograph of a doctor's hands holding a patient's arm. The doctor's hands are positioned over the patient's forearm, with fingers gently gripping it. A stethoscope is visible in the background, draped over the doctor's shoulder. The overall image has a soft, clinical feel.

## REFERENCES

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## REFERENCES

Association of Public Health Observatories (2008) Technical Briefing 2: Statistical process control methods in public health intelligence. Available at: <http://www.apho.org.uk/resource/item.aspx?RID=39445> [Accessed on: 17.10.2016].

Charlson, M. Pompei, P. Ales, K. et al. (1987) A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *Journal of Chronic Diseases*.40(5):373–83.

Chong, C. Nguyen,G. , Wilcox M. (2012) Trends in Canadian hospital standardised mortality ratios and palliative care coding 2004–2010: a retrospective database analysis. *British Medical Journal*. Available at: <http://bmjopen.bmj.com/content/2/6/e001729.full>. [Accessed 27/10/2016].

Department of Health (2015a) National Healthcare Quality Reporting System, First Annual Report 2015. Available at: <http://health.gov.ie/wp-content/uploads/2015/03/NHQRS-Annual-Report-2014.pdf>. [Accessed on 13/10/2016].

Department of Health (2015b) Health in Ireland Key Trends 2015. Available at: <http://health.gov.ie/blog/publications/health-in-ireland-key-trends-2015/> [Accessed on: 19/09/2016].

Department of Health (2016) National Healthcare Quality Reporting System, Second Annual Report 2016. Available at: <http://health.gov.ie/blog/publications/national-healthcare-quality-reporting-system-nhqs-annual-report-2016/>. [Accessed on: 19/09/2016].

Fitzpatrick, G. (2014) *Irish Hospital Standardised Mortality Ratio*, Membership of the Faculty of Public Health Medicine, Royal College of Physicians of Ireland.

Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2016.Global Strategy for the Diagnosis, Management and Prevention of COPD. Available from: <http://goldcopd.org/> [Accessed on: 19/09/2016].

Health Information and Quality Authority (2013) National Standard for Patient Discharge Summary. Available at: [http:// www.hiqa.ie/publications/national-standard-patient-discharge-summary-information](http://www.hiqa.ie/publications/national-standard-patient-discharge-summary-information) [Accessed on 26/10/2016]

HSE (2010) Report of the National Acute Medicine Programme. Available at: <http://www.hse.ie/eng/services/Publications/Hospitals/AMP.pdf> [Accessed on: 19/09/2016].

HSE, Clinical Strategy & Programmes, RCPI (2015) Report of the national clinical programme for Acute Coronary Syndrome (ACS) on standardising treatment of patients with STEMI in 2014. Available at: <http://www.hse.ie/eng/about/Who/clinical/natclinprog/heartattackcare.pdf> [Accessed on: 19/09/2016].

HSE National Clinical Programme for COPD (2016) COPD Model of Care. (Personal communication)

HSE National Heart Failure Clinical Care Programme, Irish Heart Foundation (2015) The Cost of Heart Failure in Ireland, The social, economic and health implications of Heart Failure in Ireland. (Personal communication).

Mater Misericordiae University Hospital and Health Service Executive, Quality Improvement Division (2015) 'Board on Board with Quality of Clinical Care' Quality Improvement Project: Case Study Report. Available at: [http://www.hse.ie/eng/about/Who/qualityandpatientsafety/Clinical\\_Governance/boards/](http://www.hse.ie/eng/about/Who/qualityandpatientsafety/Clinical_Governance/boards/) [Accessed on: 29.09.2016].

McElwaine, P. McCormack, J. Harbison, J. on behalf of the National Stroke Programme Audit Steering Group, (2015) Irish Heart Foundation/HSE National Stroke Audit 2015. Available at: [http://www.stroke.ie/media/pub/strokereports/ihf\\_hse\\_national\\_stroke\\_audit\\_2015\\_\\_web\\_version.pdf](http://www.stroke.ie/media/pub/strokereports/ihf_hse_national_stroke_audit_2015__web_version.pdf) [Accessed on: 29.08.2016].

National Casemix and Classification Centre, Australian Health Services Research Institute, University of Wollongong (2013), Australian Coding Standard 0001 Principal Diagnosis, ICD-10-AM/ACHI 8th Edition.

National Clinical Effectiveness Committee (2015), Prioritisation and Quality Assurance for National Clinical Audit. Available at: <http://health.gov.ie/patient-safety/ncec/national-clinical-audit/> [Accessed 8 Aug. 2016].

OECD (2015a), Definitions for Health Care Quality Indicators 2014-2015 HCQI Data Collection, Available at: <http://stats.oecd.org/wbos/fileview2.aspx?IDFile=62f94ae6-180c-4e4b-9a22-b030ddadfd35> [Accessed 12.10.2016].

OECD (2015b), Health at a Glance, OECD Indicators. Available at: <http://www.oecd.org/health/health-systems/health-at-a-glance-19991312.htm> [Accessed 12.10.2016].

Pavilion Health Australia (2016), National Audit of Admitted Patient Information in Irish Acute Hospitals, National Level Report, Available at: [http://www.hpo.ie/latest\\_hipe\\_nprs\\_reports/Pavilion\\_Report\\_National\\_Audit\\_\\_Admitted\\_Patient\\_Info\\_Sept\\_2016.pdf](http://www.hpo.ie/latest_hipe_nprs_reports/Pavilion_Report_National_Audit__Admitted_Patient_Info_Sept_2016.pdf) [Accessed 17.10.2016].

Robinson, E. (2016) *Palliative Care: To Include or Exclude?* Membership of the Faculty of Public Health Medicine, Royal College of Physicians of Ireland.

Sacco RL, Kasner SE, Broderick JP, Caplan LR, Connors JJ, Culebras A, Elkind MS, George MG, Hamdan AD, Higashida RT, Hoh BL, Janis LS, Kase CS, Kleindorfer DO, Lee JM, Moseley ME, Peterson ED, Turan TN, Valderrama AL, Vinters HV; American Heart Association Stroke Council, Council on Cardiovascular Surgery and Anesthesia; Council on Cardiovascular Radiology and Intervention; Council on Cardiovascular and Stroke Nursing; Council on Epidemiology and Prevention; Council on Peripheral Vascular Disease; Council on Nutrition, Physical Activity and Metabolism (2013) An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 44(7), pp 2064-89.

Spiegelhalter, D. (2005) Funnel plots for comparing institutional performance. *Statistics in Medicine*. 24(8), 1185-1202.



A blue-tinted photograph showing a doctor's hands holding a patient's arm. A stethoscope is visible on the doctor's chest in the background. The word "APPENDICES" is written in bold blue capital letters on the right side of the image, underlined.

## APPENDICES

# APPENDIX 1: STAKEHOLDER INVOLVEMENT IN IMPLEMENTATION OF NAHM TO PUBLICLY FUNDED ACUTE HOSPITALS

Implementation of NAHM to publicly funded acute hospitals took place between 2015 and 2016. This occurred through collaboration of the following stakeholders.

## The HSE Health Intelligence Unit, Health and Wellbeing

The HSE HIU, Health and Wellbeing supports the quest for better health for patients, their families and the public by exploiting the quality assurance/improvement, health mapping and research potential of available data. The HIU leads the development of the National Quality Assurance Intelligence System (NQAIS) suite of tools in partnership with OpenApp, the HSE National Clinical Programmes and other stakeholders. NQAIS assists hospitals in identifying variation in the patterns of care, and in recognising potential learning opportunities to optimise clinical outcomes. NQAIS NAHM focuses on in-hospital mortality patterns.

## The HSE Quality Improvement Division

The HSE QID, supports the development of a culture that ensures that improvement of quality of care is at the heart of services that the HSE delivers and for this reason commissioned NOCA to implement NAHM across the publicly funded acute hospitals in Ireland.

## The HSE Healthcare Pricing Office

The HPO manage the HIPE system which collects information on hospital day cases and in-patients in Ireland for acute publicly funded hospitals. It provides training and support to clinical coders and other stakeholders across the system. They manage, develop and monitor the collection of these data through the HIPE portal. They provide expert advice on the clinical classifications in use. They work with hospitals to ensure data quality is constantly monitored and that collection of these data is complete and timely. The HPO provide HIPE data, used to generate mortality patterns in NQAIS NAHM.

## The National Office of Clinical Audit

NOCA was established in 2012 through a collaborative agreement between the HSE QID (previously called the Quality & Patient Safety Division) and the Royal College of Surgeons in Ireland. The primary purpose of NOCA is to establish sustainable clinical audit programmes at national level which will ultimately improve outcomes for patients in hospitals in Ireland. Current national audits in development or implementation phase include the

- National Audit of Hospital Mortality (NAHM)
- Major Trauma Audit (MTA)
- Irish National Orthopaedic Register (INOR)
- National Intensive Care Audit (ICU Audit)
- Irish Hip Fracture Database (IHFD)
- Irish Audit of Surgical Mortality (IASM) (This audit is currently on hold pending the implementation of the Patient Safety and Health Information legislation)

NOCA also provides governance to clinical audits coming from the National Perinatal Epidemiology Centre (NPEC).

## NAHM governance framework

NAHM is deployed under the governance framework of NOCA. NOCA has established a NAHM Steering Committee with an operational remit to support the co-ordinated implementation and ongoing monitoring of NAHM in each hospital group and hospital. Membership of the NAHM Steering Committee is as follows:

ROLE / REPRESENTING BODY	NAME
Chair NAHM Steering Committee - Quality Improvement Division Lead on Measurement for Improvement	Dr Jennifer Martin
HSE Quality Improvement Division	Grainne Cosgrove
HSE Health Intelligence Unit , Clinical Lead	Dr Howard Johnson
HSE Health Intelligence Unit	Dr Declan McKeown
NOCA Hospital Relations Manager	Marina Cronin
NOCA Audit Coordinator	Deirdre Burke
HSE Healthcare Pricing Office	Deirdre Murphy
OpenApp	Mel McIntyre
Chair NAHM Governance Committee (contribute as required)	Dr Brian Creedon

The NAHM Governance Committee provides governance to NAHM. This is comprised of multidisciplinary Governance Committee with clinical and executive leadership from the Irish hospitals and health service. The membership and attendance at governance committee meetings is outlined.

#### NAHM GOVERNANCE COMMITTEE MEMBERSHIP; ATTENDANCE AT GOVERNANCE COMMITTEE MEETINGS IN 2015

Name	Representing Body	11 March 2015	13 April 2015	9 Sept 2015
Dr Brian Creedon, Chair	Royal College of Physicians in Ireland	N/A	YES	YES
Margaret Brennan <sup>1, 5</sup>	HSE Acute Hospitals Division	N/A	N/A	N/A
Prof Paddy Broe <sup>3</sup>	Royal College of Surgeons in Ireland	NO	NO	NO
Thora Burgess	HSE Clinical Directors Programme	YES	NO	NO
Fiona Cahill <sup>4</sup>	NOCA	YES	YES	YES
Prof Richard Costello	Royal College of Physicians in Ireland	YES	YES	NO
Dr Rory Dwyer	Joint Faculty of Intensive Care Medicine in Ireland	YES	YES	YES
Ms. Bridget Egan	Royal College of Surgeons in Ireland	YES	YES	YES
Dr John Fitzsimons <sup>2</sup>	HSE Quality Improvement Division	YES	YES	NO
Eilish Hardiman	Hospital Group CEO Forum	YES	YES	YES
Dr Howard Johnson	HSE Health intelligence Unit	YES	YES	YES
Prof Simon Jones	International Expert	YES	NO	YES
Dr Niall Mahon	Royal College of Physicians in Ireland	YES	YES	YES
Dr Jennifer Martin <sup>2</sup>	HSE Quality Improvement Division	N/A	N/A	N/A
Dr Julie McCarthy <sup>6</sup>	HSE Clinical Directors Programme	N/A	N/A	N/A
Dr Kathleen McGarry	Royal College of Physicians in Ireland	YES	YES	YES
Deirdre Murphy	HSE Healthcare Pricing Office	YES	YES	YES
Deirdre O'Keeffe <sup>1</sup>	HSE Acute Hospitals Programme	NO	NO	YES
Brian O'Mahony	Public Representative	N/A	N/A	YES
Dr Orlaith O'Reilly <sup>5</sup>	HSE Clinical Strategy and Programmes	YES	NO	NO
Dr Ellen O'Sullivan	College of Anaesthetists in Ireland	NO	YES	NO
A/A Prof Geraldine Shaw	HSE Office of Nursing and Midwifery	YES	YES	NO
Dr Barry White	Royal College of Physicians in Ireland	YES	YES	YES
Deirdre Burke	In attendance: NOCA	YES	YES	YES
Marina Cronin	In attendance: NOCA	YES	YES	YES

1-2 Denotes change of representation to NAHM Governance Committee

3,4,5 Resignations from NAHM Governance Committee

6 Joined NAHM Governance Committee in 2016

N/A Representatives not yet appointed or resigned from Committee for meeting dates stated above

## APPENDICES

The layout of each Appendix 2 - 6 is as follows;

- Definition of key diagnosis
- Key diagnosis -Table of Hospital SMR with Confidence Intervals
- Key diagnosis - Hospital SMR Control Charts

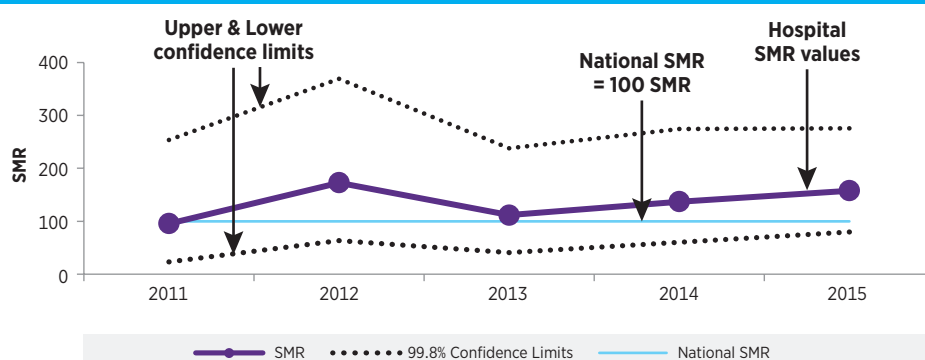
### SMR control charts



The SMR control charts for key diagnosis from 2011 to 2015 show three horizontal traces set against the national SMR of 100 (blue line). An SMR of 100 means that the number of observed and expected deaths are exactly the same. The middle, bold trace is the SMR trend, calculated year on year for that key diagnosis and for that hospital. The upper, dotted line represents the upper 99.8% confidence limit; the lower, dotted line represents the lower 99.8% confidence limit.

If the line SMR=100 appears above or below the dotted confidence limit lines; this means that the SMR in that hospital for that condition is significantly higher (or significantly lower) than expected. It is unusual for that to happen due to chance (probability of 1 in 500). These observations represent variation worthy of further review.

#### SAMPLE CONTROL CHART HOSPITAL SMR





## APPENDIX 2: ACUTE MYOCARDIAL INFARCTION

### DEFINITION OF AMI INDICATOR

Definition	Standardised mortality ratio with a principal diagnosis of AMI
Years covered	2011 - 2015
ICD-10-AM code	I21, I210, I211, I212, I213, I214, I219, I22, I220, I221, I228, I229
Methodology	<p><b>Numerator:</b> Number of actual deaths following admission to hospital with the following ICD-10-AM principal diagnoses</p> <p>'Acute myocardial infarction', 'Acute transmural MI of anterior wall', 'Acute transmural MI of inferior wall', 'Acute transmural MI of other sites', 'Acute transmural MI of unspecified site', 'Acute sub-endocardial MI', 'Acute myocardial infarction unspecified', 'Subsequent myocardial infarction', 'Subsequent MI of anterior wall', 'Subsequent MI of inferior wall', 'Subsequent MI of other sites', 'Subsequent MI of unspecified site'</p> <p><b>Denominator</b> Number of expected deaths for AMI. This is calculated using an indirect standardisation and logistic regression modelling of all discharges of AMI</p>

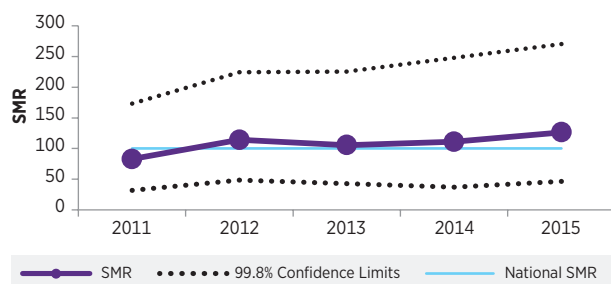
## AMI: TABULAR PRESENTATION FOR IN-HOSPITAL MORTALITY 2015

Hospital Group	Hospital Name	No. of Admissions for AMI, 2015	SMR (99.8% Confidence Interval)
RCSI Hospital Group	Beaumont Hospital	199	127 (47 – 270)
	Cavan General Hospital	131	119 (46 – 248)
	Connolly Hospital	151	85 (20 – 224)
	Our Lady of Lourdes Hospital (Drogheda)	230	57 (14 – 151)
Ireland East Hospital Group	Mater Misericordiae University Hospital	477	156 (83 – 264)
	Midland Regional Hospital Mullingar	106	129 (34 – 325)
	St. Luke's General Hospital, Kilkenny	229	78 (21 – 197)
	St. Vincent's University Hospital	329	137 (77 – 224)
	Wexford General Hospital	163	71 (10 – 233)
	Our Lady's Hospital Navan	147	44 (4 – 162)
Dublin Midlands Hospital Group	Tallaght Hospital (Adult)	206	54 (5 – 200)
	Midland Regional Hospital Portlaoise	104	47 (5 – 175)
	Naas General Hospital	108	44 (2 – 192)
	St James's Hospital (Dublin)	634	138 (80 – 222)
UL Hospitals Group	University Hospital Limerick	485	84 (43 – 147)
South / South West Hospital Group	Cork University Hospital	582	89 (41 – 165)
	University Hospital Kerry	127	75 (16 – 212)
	South Tipperary General Hospital	114	80 (17 – 226)
	University Hospital Waterford	216	135 (55 – 270)
Saolta University Healthcare Group	Letterkenny University Hospital	213	116 (48 – 232)
	Mayo University Hospital	236	145 (60 – 291)
	Sligo University Hospital	195	64 (20 – 149)
	Galway University Hospitals	645	104 (58 – 170)
	Portiuncula University Hospital	118	108 (31 – 260)

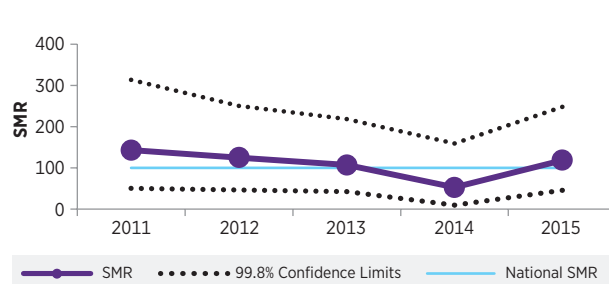
# AMI SMR TREND CHARTS

## RCSI Hospital Group

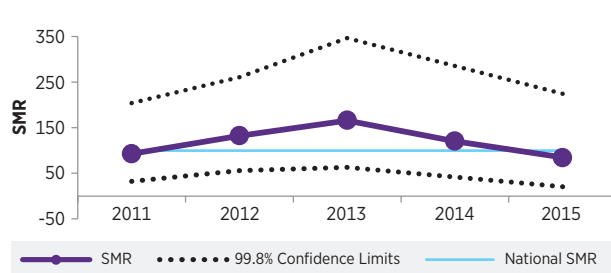
AMI: Beaumont Hospital



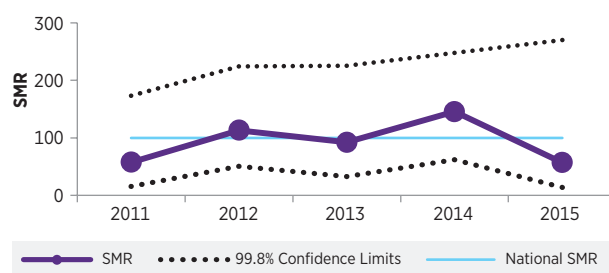
AMI: Cavan General Hospital



AMI: Connolly Hospital

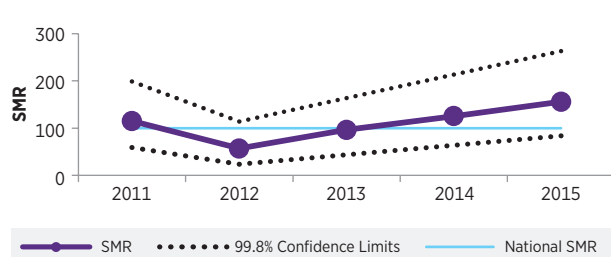


AMI: Our Lady of Lourdes Hospital, Drogheda

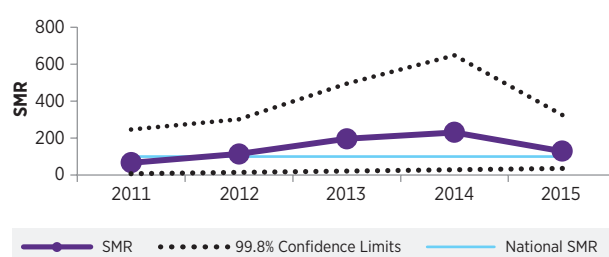


## Ireland East Hospital Group

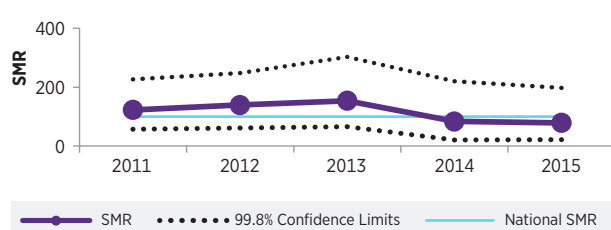
AMI: Mater Misericordiae University Hospital



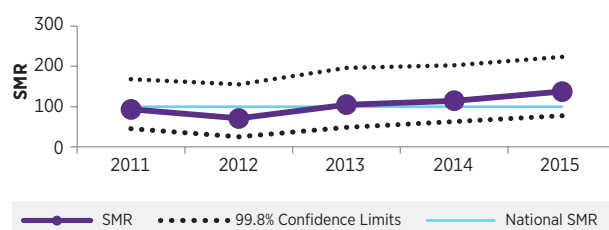
AMI: Midland Regional Hospital Mullingar



AMI: St Luke's Hospital Kilkenny

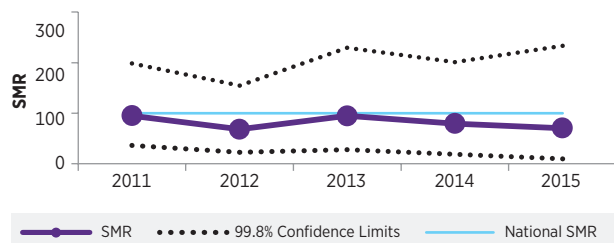


AMI: St Vincent's University Hospital

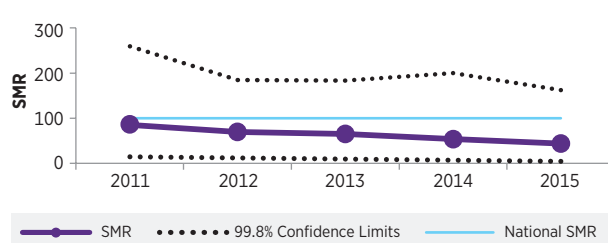


## Ireland East Hospital Group

**AMI: Wexford General Hospital**

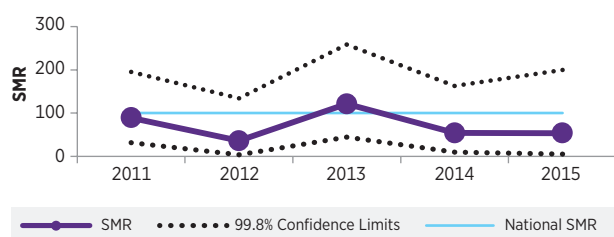


**AMI: Our Lady's Hospital Navan**

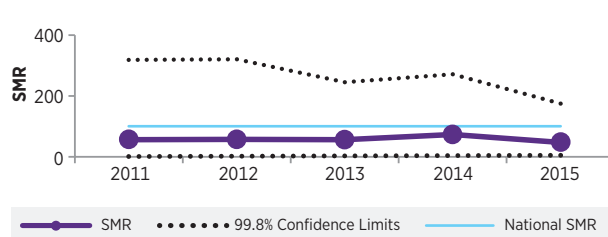


## Dublin Midlands Hospital Group

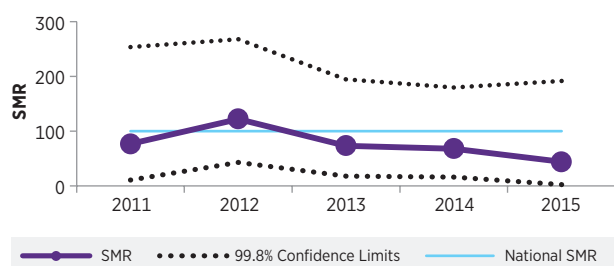
**AMI: Tallaght Hospital (Adult)**



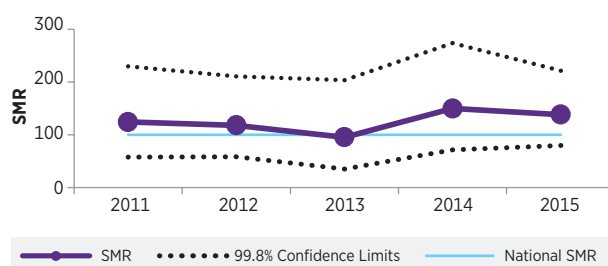
**AMI: Midland Regional Hospital Portlaoise**



**AMI: Naas General Hospital**

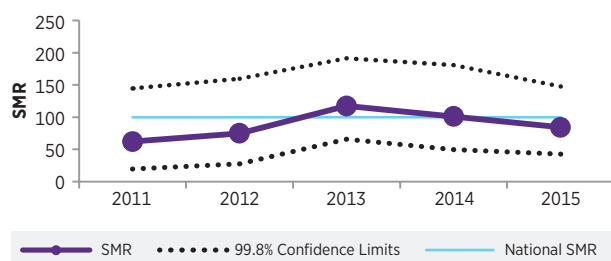


**AMI: St James's Hospital (Dublin)**



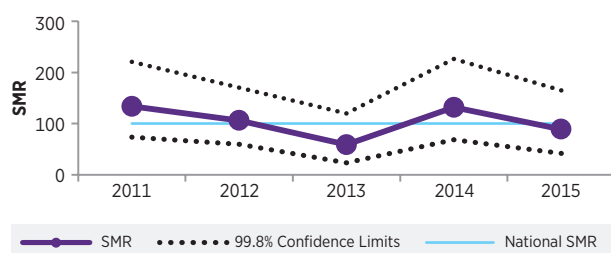
## University of Limerick Hospital Group

**AMI: University Hospital Limerick**

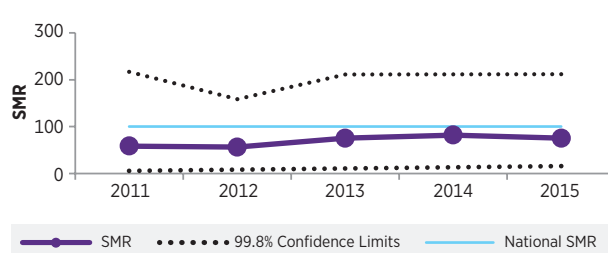


## South / South West Hospital Group

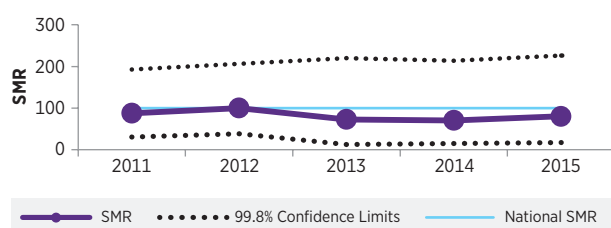
**AMI: Cork University Hospital**



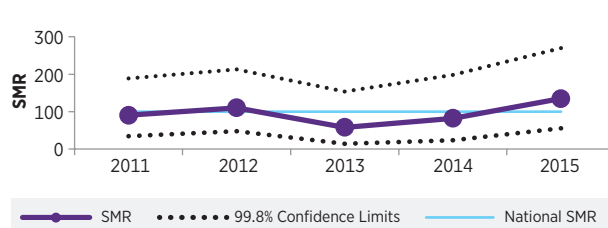
**AMI: University Hospital Kerry**



**AMI: South Tipperary General Hospital**

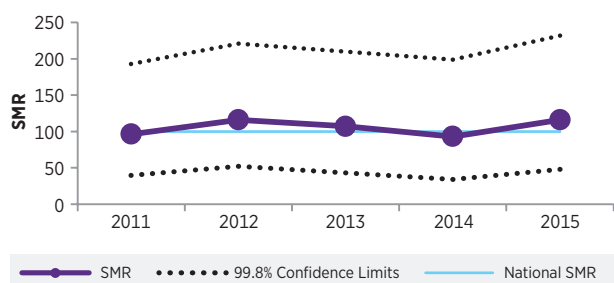


**AMI: University Hospital Waterford**

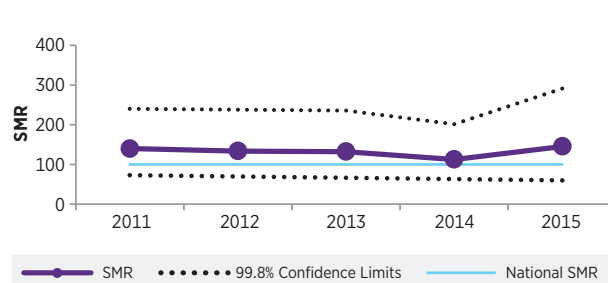


# Saolta University Healthcare Group

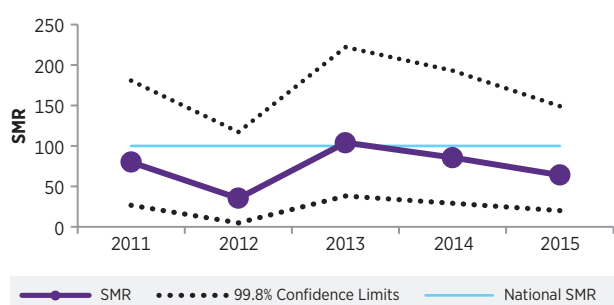
**AMI: Letterkenny University Hospital**



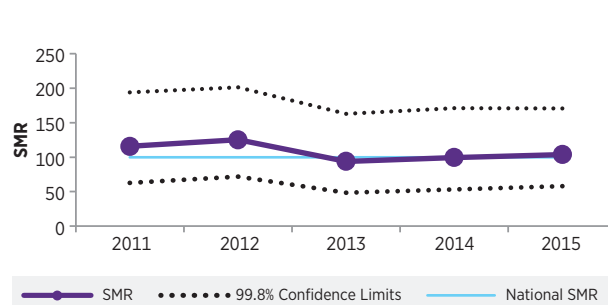
**AMI: Mayo University Hospital**



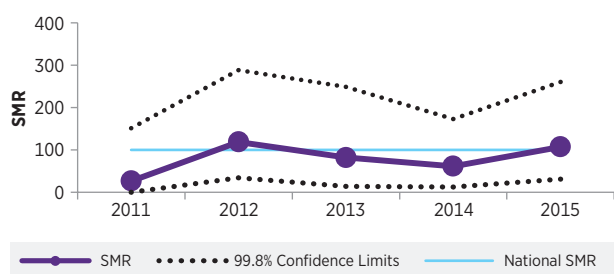
**AMI: Sligo University Hospital**



**AMI: Galway University Hospitals**



**AMI: Portlincula University Hospital**



## APPENDIX 3: HEART FAILURE

### HEART FAILURE INDICATOR

Definition	Standardised mortality ratio with a principal diagnosis of heart failure
Years covered	2011 - 2015
ICD-10-AM code	I50, I500, I501, I509
Methodology	<p><b>Numerator:</b> Number of actual deaths following admission to hospital with the following ICD -10-AM principal diagnoses</p> <p>'Heart failure', 'Congestive heart failure', 'Left ventricular failure', 'Heart failure unspecified</p> <p><b>Denominator</b> Number of expected deaths for heart failure. This is calculated using an indirect standardisation and logistic regression modelling of all discharges of heart failure</p>

## HEART FAILURE: TABULAR PRESENTATION FOR IN-HOSPITAL MORTALITY 2015

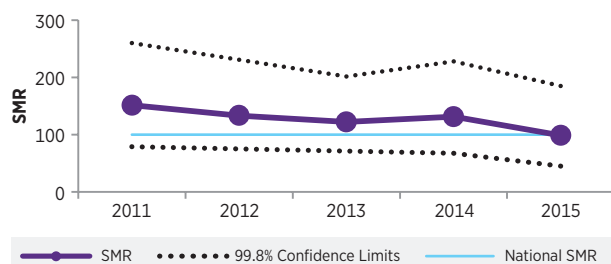
Hospital Group	Hospital Name	No. of Admissions for heart failure, 2015	SMR (99.8% Confidence Interval)
RCSI Hospital Group	Beaumont Hospital	269	99 (45 – 185)
	Cavan General Hospital	219	94 (43 – 176)
	Connolly Hospital	225	90 (37 – 180)
	Our Lady of Lourdes Hospital (Drogheda)	225	166 (78 – 308)
Ireland East Hospital Group	Mater Misericordiae University Hospital	286	133 (73 – 220)
	Midland Regional Hospital Mullingar	123	94 (23 – 249)
	St. Luke's General Hospital, Kilkenny	223	110 (51 – 203)
	St. Vincent's University Hospital	276	115 (62 – 195)
	Wexford General Hospital	245	155 (66 – 305)
	Our Lady's Hospital Navan	161	39 (5 – 128)
Dublin Midlands Hospital Group	Tallaght Hospital (Adult)	160	68 (18 – 173)
	Midland Regional Hospital Tullamore	121	88 (21 – 232)
	Naas General Hospital	161	74 (23 – 174)
	St James's Hospital (Dublin)	367	155 (93 – 242)
UL Hospitals Group	University Hospital Limerick	254	45 (11 – 120)
	Ennis Hospital	124	79 (25 – 185)
	Nenagh Hospital	105	94 (23 – 250)
South / South West Hospital Group	Cork University Hospital	382	91 (44 – 165)
	University Hospital Kerry	115	123 (30 – 327)
	Mercy University Hospital	137	139 (46 – 314)
	South Tipperary General Hospital	172	87 (29 – 197)
	University Hospital Waterford	253	100 (47 – 185)
	Bantry General Hospital	120	31 (16 – 214)
	Mallow General Hospital	137	107 (36 – 241)
Saolta University Healthcare Group	Letterkenny University Hospital	221	89 (31 – 194)
	Mayo University Hospital	245	112 (49 – 216)
	Sligo University Hospital	149	54 (11 – 152)
	Galway University Hospitals	232	71 (24 – 160)



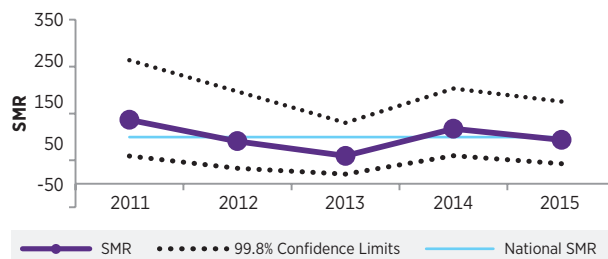
# HEART FAILURE SMR TREND CHARTS

## RCSI Hospital Group

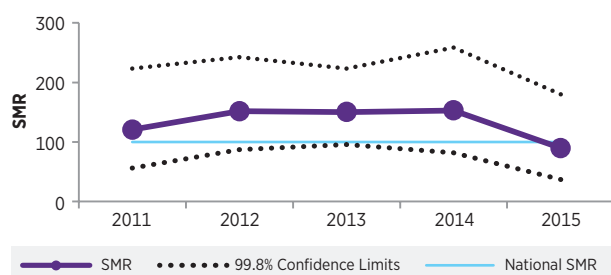
Heart Failure: Beaumont Hospital



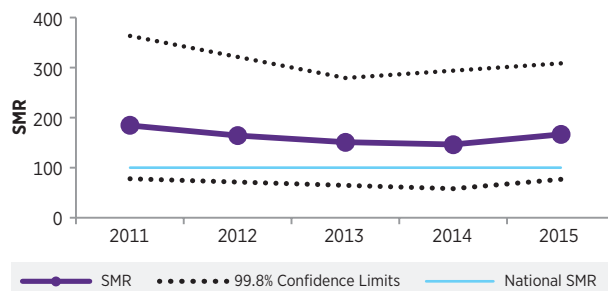
Heart Failure: Cavan General Hospital



Heart Failure: Connolly Hospital

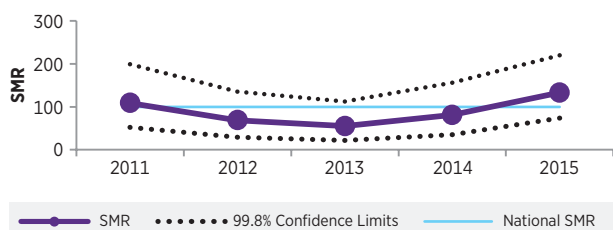


Heart Failure: Our Lady of Lourdes Hospital, Drogheda

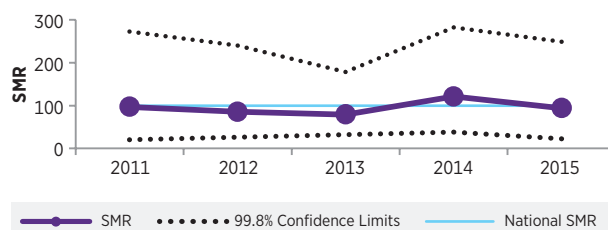


## Ireland East Hospital Group

Heart Failure: Mater Misericordiae University Hospital

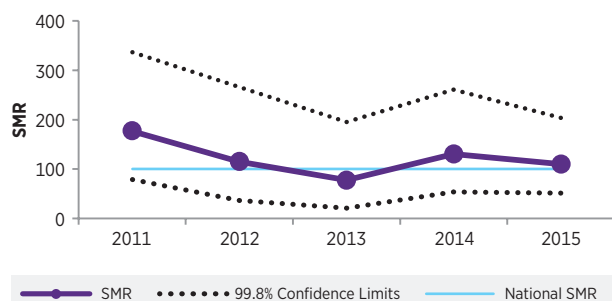


Heart Failure: Midland Regional Hospital Mullingar

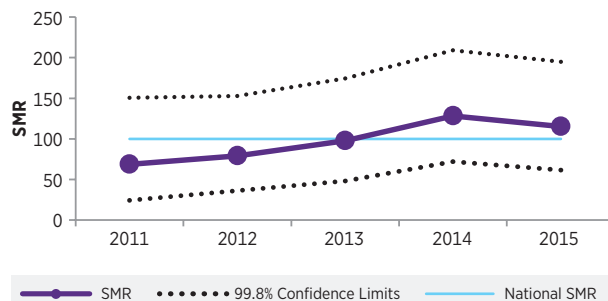


## Ireland East Hospital Group

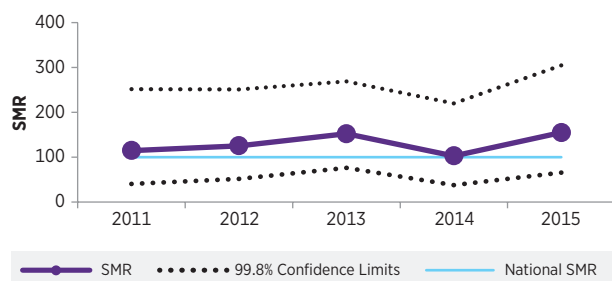
Heart Failure: St Luke's Hospital Kilkenny



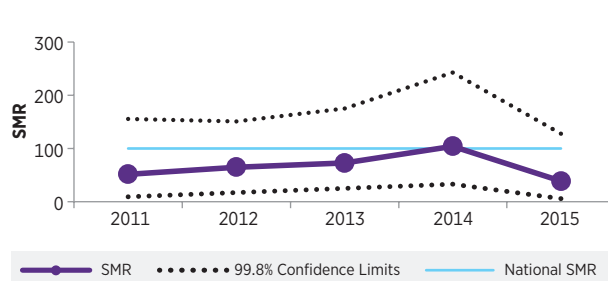
Heart Failure: St Vincent's University Hospital



Heart Failure: Wexford General Hospital

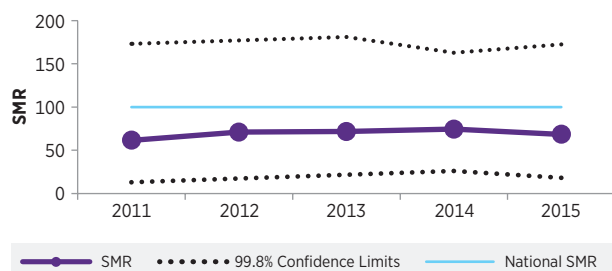


Heart Failure: Our Lady's Hospital Navan



## Dublin Midlands Hospital Group

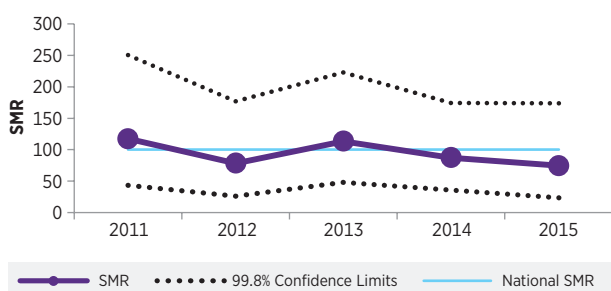
Heart Failure: Tallaght Hospital (Adult)



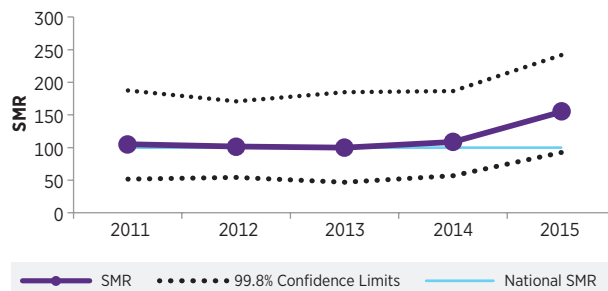
Heart Failure: Midland Regional Hospital Tullamore



Heart Failure: Naas General Hospital

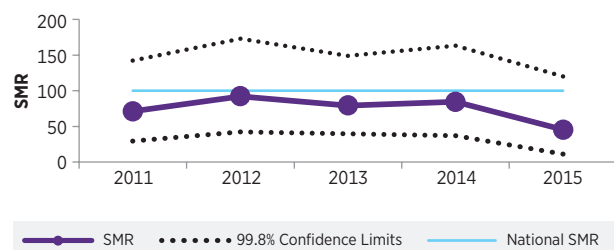


Heart Failure: St James's Hospital (Dublin)

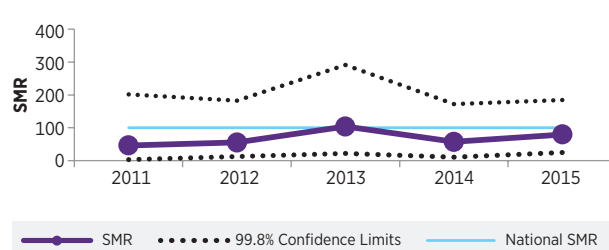


## University of Limerick Hospital Group

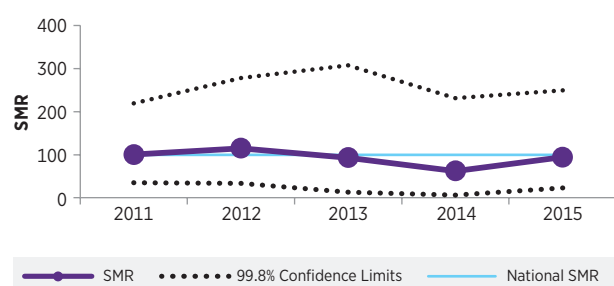
### Heart Failure: University Hospital Limerick



### Heart Failure: Ennis Hospital

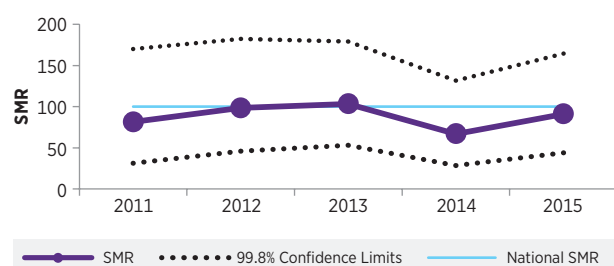


### Heart Failure: Nenagh Hospital

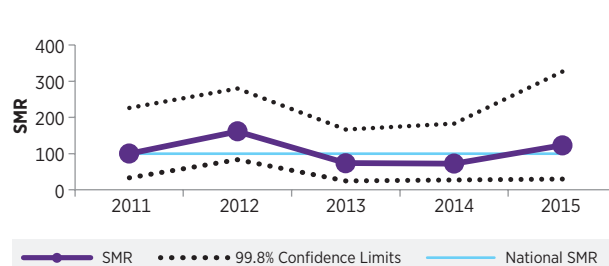


## South / South West Hospital Group

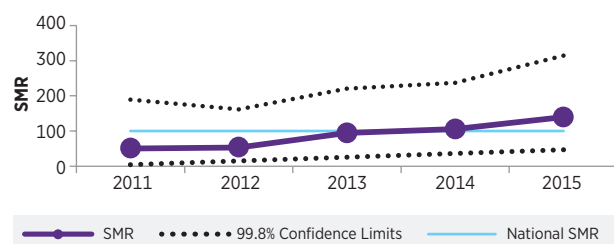
### Heart Failure: Cork University Hospital



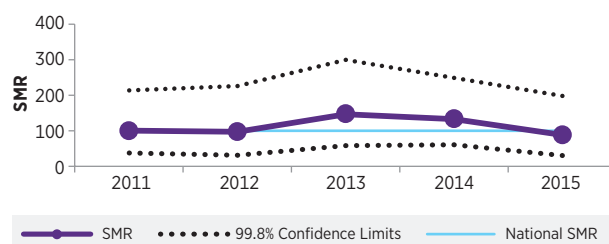
### Heart Failure: University Hospital Kerry



### Heart Failure: Mercy University Hospital

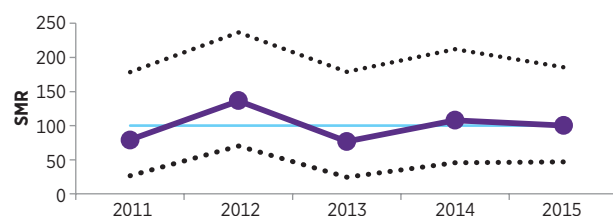


### Heart Failure: South Tipperary General Hospital

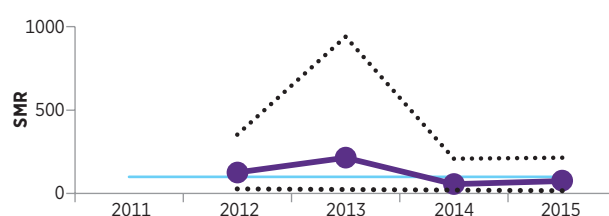


## South / South West Hospital Group

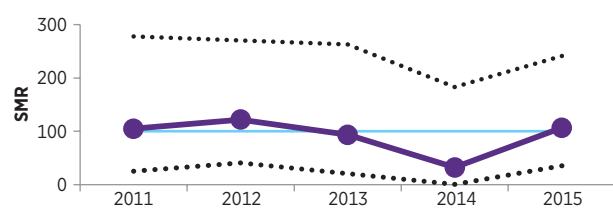
Heart Failure: University Hospital Waterford



Heart Failure: Bantry General Hospital

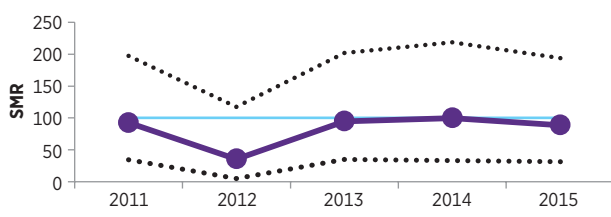


Heart Failure: Mallow General Hospital

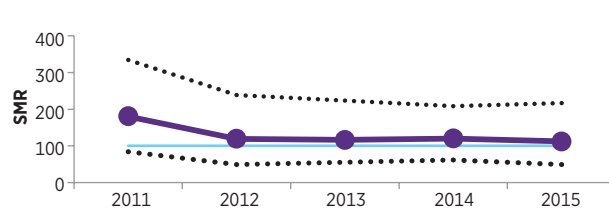


## Saolta University Healthcare Group

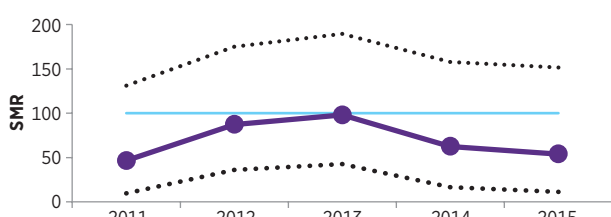
Heart Failure: Letterkenny University Hospital



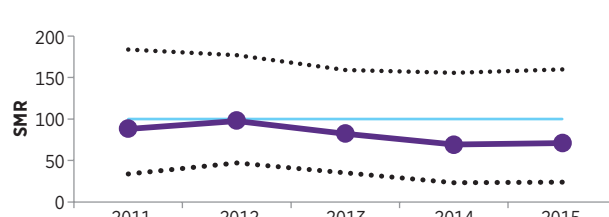
Heart Failure: Mayo University Hospital



Heart Failure: Sligo University Hospital



Heart Failure: Galway University Hospitals



## APPENDIX 4: ISCHAEMIC STROKE

### ISCHAEMIC STROKE INDICATOR

Definition	Standardised mortality ratio with a principal diagnosis of ischaemic stroke
Years covered	2011 - 2015
ICD-10-AM code	I63, I630, I631, I632, I633, I634, I635, I636, I638, I639
Methodology	<p><b>Numerator:</b> Number of actual deaths following admission to hospital with the following ICD -10-AM principal diagnoses 'Cerebral infarction', 'Cerebral infarction due to thrombosis of the pre-cerebral artery', 'Cerebral infarction due to embolism of pre-cerebral artery', 'Cerebral infarction due to unspecified occlusion of pre-cerebral artery', 'Cerebral infarction due to thrombosis of the cerebral artery', 'Cerebral infarction due to embolism of the cerebral artery', 'Cerebral infarction due to unspecified occlusion of the cerebral artery', 'Cerebral infarction due to central venous thrombosis non-pyogenic', 'Other cerebral infarction', 'Cerebral infarction unspecified'</p> <p><b>Denominator</b> Number of expected deaths for ischaemic stroke. This is calculated using an indirect standardisation and logistic regression modelling of all discharges of ischaemic stroke.</p>

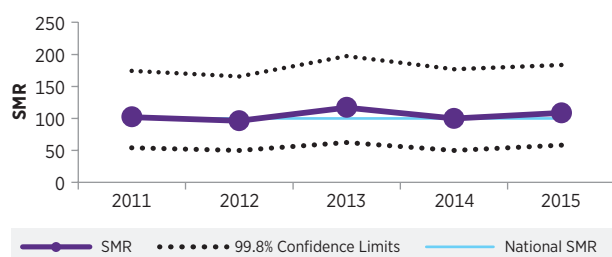
## ISCHAEMIC STROKE: TABULAR PRESENTATION FOR IN-HOSPITAL MORTALITY 2015

Hospital Group	Hospital Name	No. of Admissions for ischaemic stroke, 2015	SMR (99.8% Confidence Interval)
RCSI Hospital Group	Beaumont Hospital	366	109 (58 – 184)
	Cavan General Hospital	118	60 (16 – 151)
	Connolly Hospital	129	127 (50 – 258)
	Our Lady of Lourdes Hospital (Drogheda)	161	116 (52 – 221)
Ireland East Hospital Group	Mater Misericordiae University Hospital	301	74 (35 – 136)
	Midland Regional Hospital Mullingar	102	112 (37 – 252)
	St. Luke's General Hospital, Kilkenny	135	61 (15 – 163)
	St. Vincent's University Hospital	279	101 (54 – 170)
Dublin Midlands Hospital Group	Tallaght Hospital (Adult)	179	80 (25 – 186)
	Naas General Hospital	185	85 (34 – 174)
	St James's Hospital (Dublin)	182	136 (59 – 262)
UL Hospitals Group	University Hospital Limerick	322	89 (51 – 145)
South / South West Hospital Group	Cork University Hospital	367	142 (83 – 224)
	University Hospital Kerry	161	128 (67 – 220)
	Mercy University Hospital	113	71 (13 – 215)
	South Tipperary General Hospital	109	110 (46 – 216)
	University Hospital Waterford	128	69 (19 – 175)
Saolta University Healthcare Group	Letterkenny University Hospital	147	96 (38 – 197)
	Mayo University Hospital	157	103 (45 – 199)
	Sligo University Hospital	146	126 (59 – 233)
	Galway University Hospitals	240	71 (34 – 130)

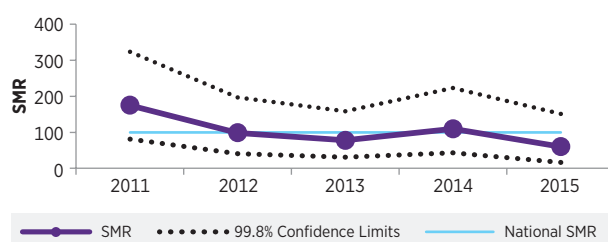
# ISCHAEMIC STROKE SMR TREND CHARTS

## RCSI Hospital Group

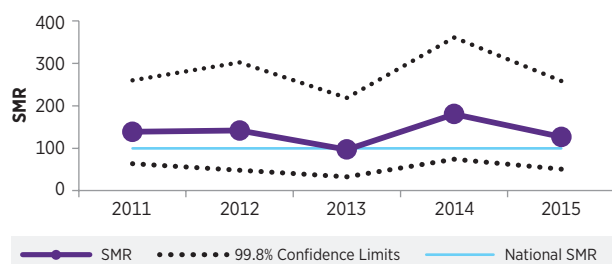
Ischaemic Stroke: Beaumont Hospital



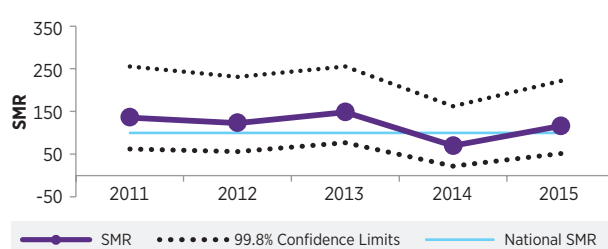
Ischaemic Stroke: Cavan General Hospital



Ischaemic Stroke: Connolly Hospital

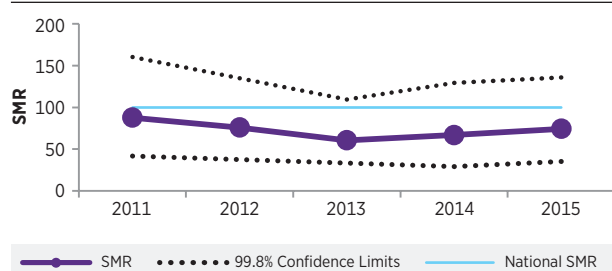


Ischaemic Stroke: Our Lady of Lourdes Hospital, Drogheda

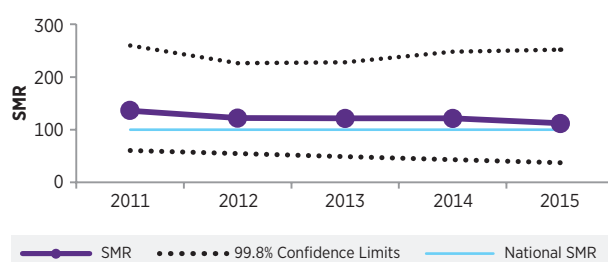


## Ireland East Hospital Group

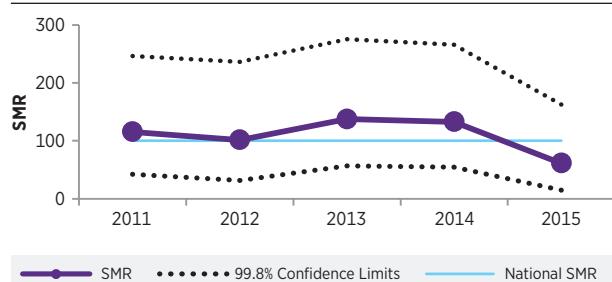
Ischaemic Stroke: Mater Misericordiae University Hospital



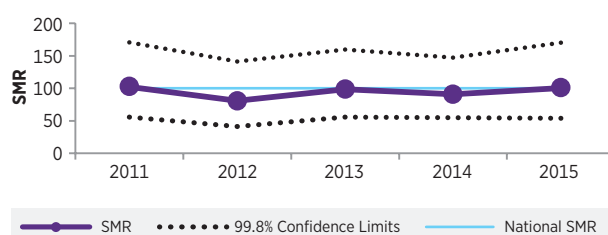
Ischaemic Stroke: Midland Regional Hospital Mullingar



Ischaemic Stroke: St Luke's Hospital Kilkenny

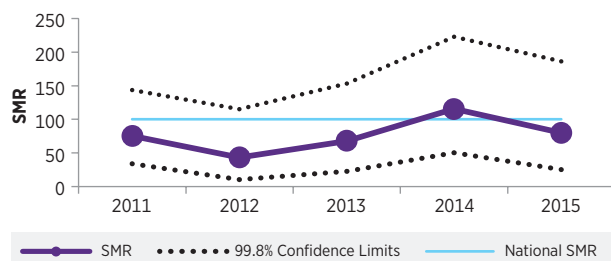


Ischaemic Stroke: St Vincent's University Hospital

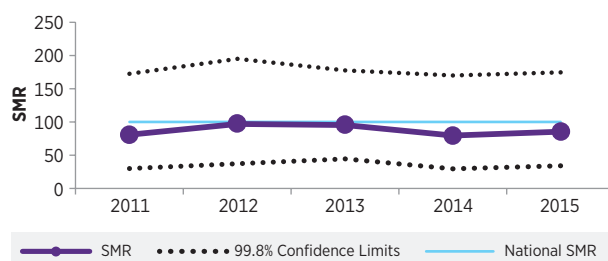


## Dublin Midlands Hospital Group

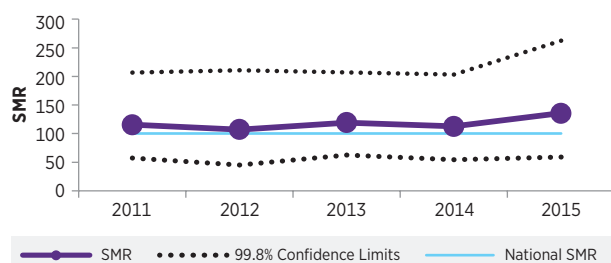
**Ischaemic Stroke: Tallaght Hospital (Adult)**



**Ischaemic Stroke: Naas General Hospital**

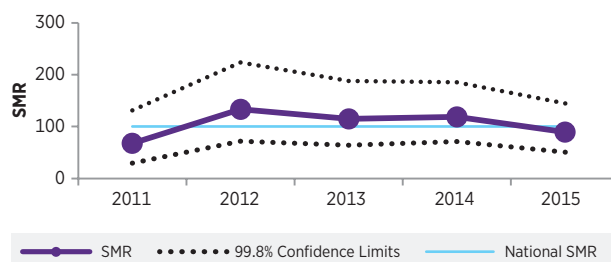


**Ischaemic Stroke: St James's Hospital (Dublin)**



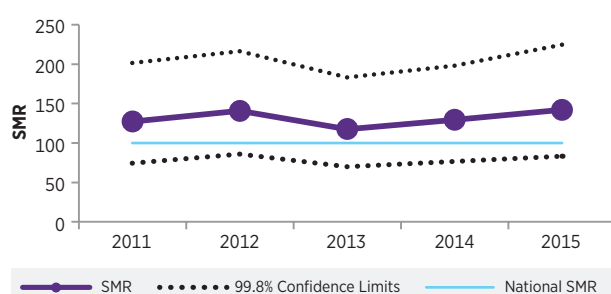
## University of Limerick Hospital Group

**Ischaemic Stroke: University Hospital Limerick**

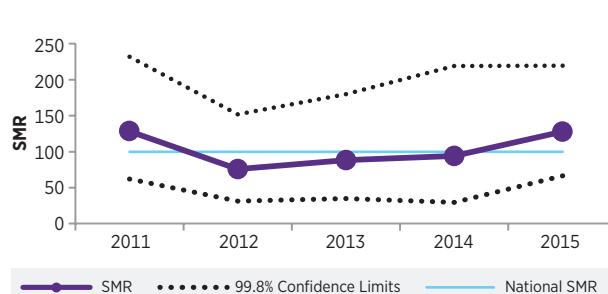


## South / South West Hospital Group

**Ischaemic Stroke: Cork University Hospital**



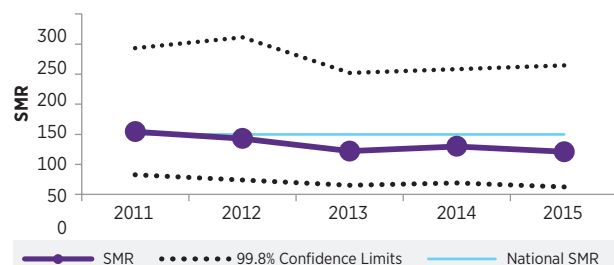
**Ischaemic Stroke: University Hospital Kerry**



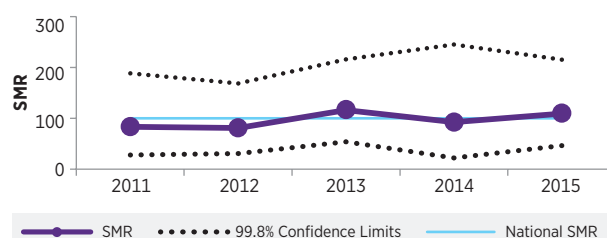


## South / South West Hospital Group

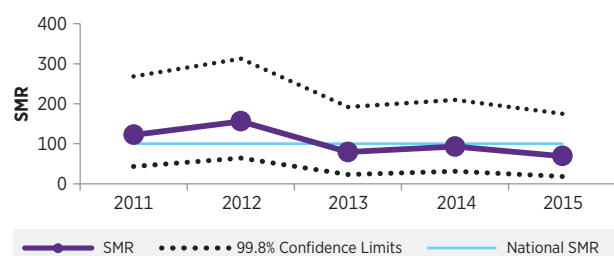
**Ischaemic Stroke: Mercy University Hospital**



**Ischaemic Stroke: South Tipperary General Hospital**

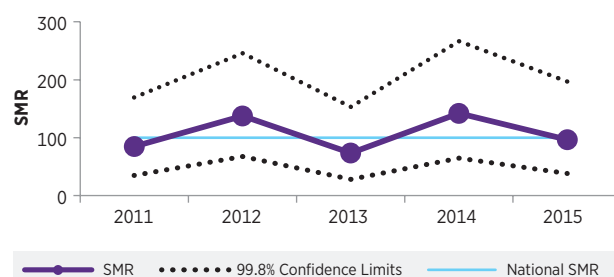


**Ischaemic Stroke: University Hospital Waterford**

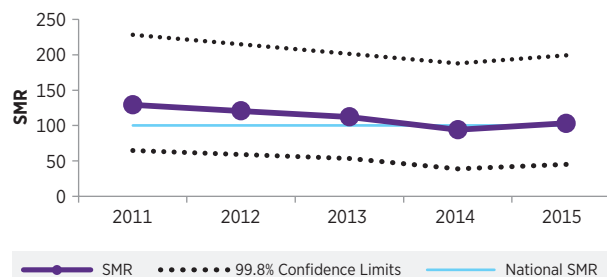


## Saolta University Healthcare Group

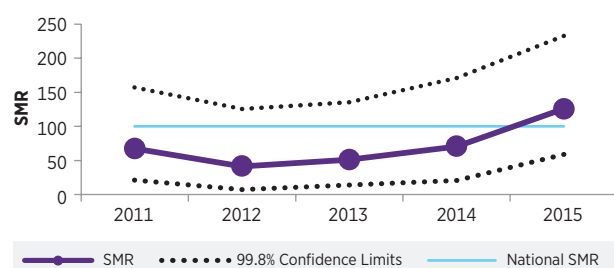
**Ischaemic Stroke: Letterkenny University Hospital**



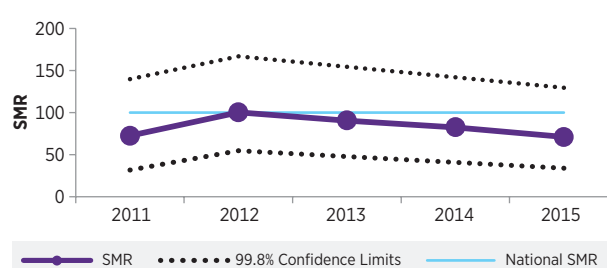
**Ischaemic Stroke: Mayo University Hospital**



**Ischaemic Stroke: Sligo University Hospital**



**Ischaemic Stroke: Galway University Hospitals**



## APPENDIX 5: HAEMORRHAGIC STROKE

### HAEMORRHAGIC STROKE INDICATOR

Definition	Standardised mortality ratio with a principal diagnosis of haemorrhagic stroke
Years covered	2011 - 2015
ICD-10-AM code	I60, I600, I601, I602, I603, I604, I605, I606, I607, I608, I609, I61, I610, I611, I612, I613, I614, I615, I616, I618, I619, I62, I620, I621, I629
Methodology	<p><b>Numerator:</b> Number of actual deaths following admission to hospital with the following ICD -10-AM principal diagnoses</p> <p>'Subarachnoid haemorrhage', 'Subarachnoid haemorrhage, carotid siphon and bifurcation;', 'Subarachnoid haemorrhage from middle cerebral artery, 'Subarachnoid haemorrhage from anterior communicating artery, 'Subarachnoid haemorrhage from posterior communicating artery, 'Subarachnoid haemorrhage from basilar artery', 'Subarachnoid haemorrhage from vertebral artery, 'Subarachnoid haemorrhage from other intracranial artery, 'Subarachnoid haemorrhage from intracranial artery unspecified., 'Other subarachnoid haemorrhage', 'Subarachnoid haemorrhage unspecified', 'Intracerebral haemorrhage', 'Intracerebral haemorrhage in hemisphere subcortical', 'Intracerebral haemorrhage in hemisphere cortical', 'Intracerebral haemorrhage in hemisphere unspecified', 'Intracerebral haemorrhage in brain stem', 'Intracerebral haemorrhage in cerebellum', 'Intracerebral haemorrhage intraventricular', 'Intracerebral haemorrhage multiple localised', 'Other intracerebral haemorrhage', 'Intracerebral haemorrhage unspecified', 'Other non-traumatic intracranial haemorrhage', 'Subdural haemorrhage (acute)(non-traumatic)', 'Non-traumatic extradural haemorrhage', 'Intracranial haemorrhage (non-traumatic) unspecified'</p> <p><b>Denominator</b> Number of expected deaths for haemorrhagic stroke. This is calculated using an indirect standardisation and logistic regression modelling of all discharges of haemorrhagic stroke.</p>

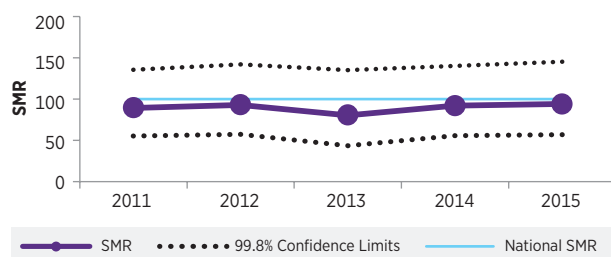
## HAEMORRHAGIC STROKE; TABULAR PRESENTATION FOR IN-HOSPITAL MORTALITY 2013 - 2015

Hospital Group	Hospital Name	No. of Admissions for haemorrhagic stroke, 2013-15	SMR (99.8% Confidence Interval)
RCSI Hospital Group	Beaumont Hospital	1242	89 (67 - 117)
	Cavan General Hospital	118	81 (42 - 139)
	Our Lady of Lourdes Hospital (Drogheda)	135	112 (64 - 182)
Ireland East Hospital Group	Mater Misericordiae University Hospital	269	90 (61 - 126)
	Midland Regional Hospital Mullingar	100	114 (64 - 186)
	St. Luke's General Hospital, Kilkenny	108	138 (78 - 223)
	St. Vincent's University Hospital	314	110 (80 - 146)
Dublin Midlands Hospital Group	Tallaght Hospital (Adult)	154	76 (39 - 133)
	Naas General Hospital	131	110 (67 - 169)
	St James's Hospital (Dublin)	198	97 (60 - 148)
UL Hospital Group	University Hospital Limerick	260	100 (67 - 144)
South / South West Hospital Group	Cork University Hospital	557	108 (80 - 143)
	University Hospital Kerry	143	109 (66 - 168)
	University Hospital Waterford	113	104 (59 - 168)
Saolta University Healthcare Group	Letterkenny University Hospital	119	102 (54 - 175)
	Mayo University Hospital	125	118 (68 - 191)
	Sligo University Hospital	124	68 (34 - 121)
	Galway University Hospitals	242	101 (69 - 142)

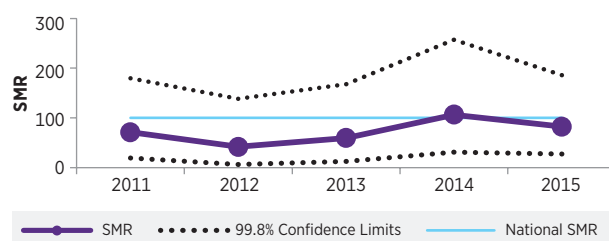
# HAEMORRHAGIC STROKE SMR TREND CHARTS

## RCSI Hospital Group

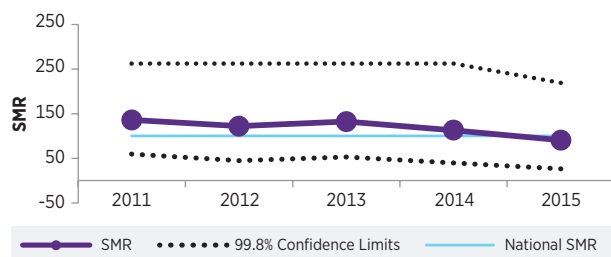
Haemorrhagic Stroke: Beaumont Hospital



Haemorrhagic Stroke: Cavan General Hospital

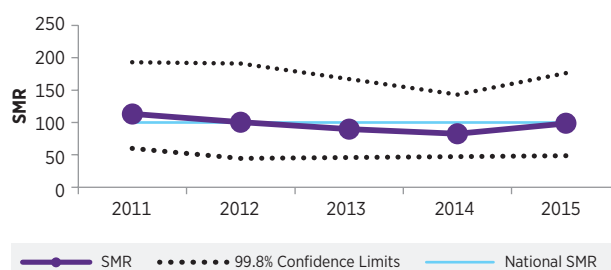


Haemorrhagic Stroke: Our Lady of Lourdes Hospital Drogheda

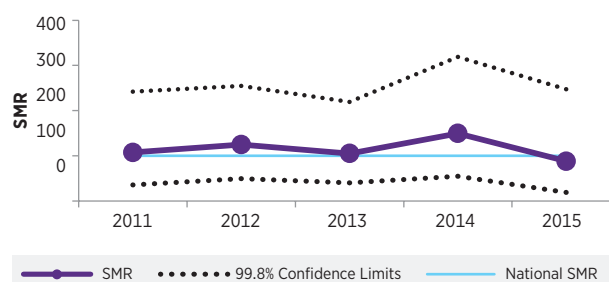


## Ireland East Hospital Group

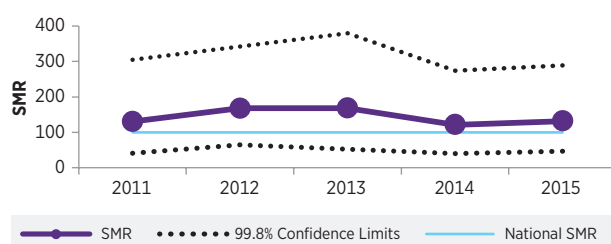
Haemorrhagic Stroke: Mater Misericordiae University Hospital



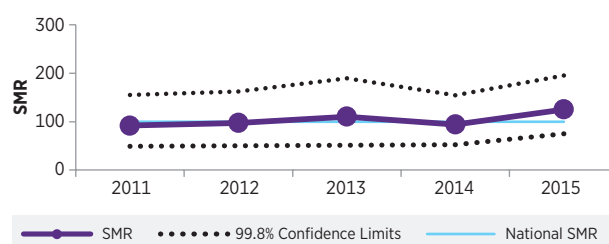
Haemorrhagic Stroke: Midland Regional Hospital Mullingar



Haemorrhagic Stroke: St Luke's General Hospital Kilkenny

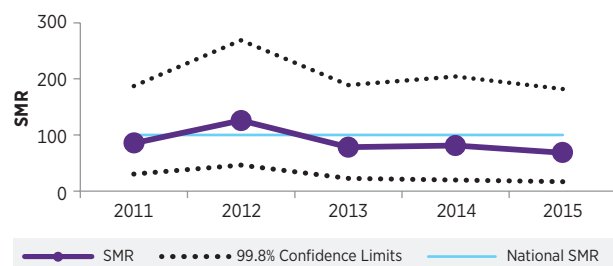


Haemorrhagic Stroke: St Vincent's University Hospital

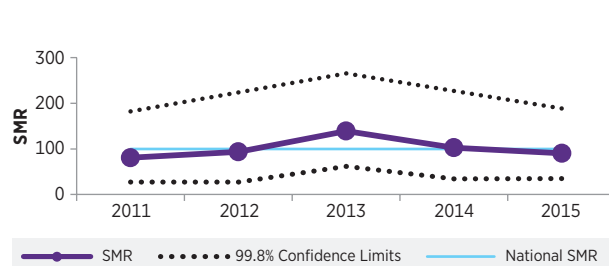


## Dublin Midlands Hospital Group

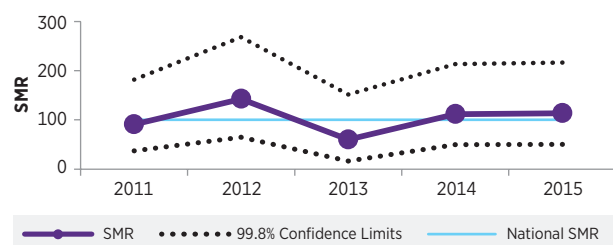
### Haemorrhagic Stroke: Tallaght Hospital (Adult)



### Haemorrhagic Stroke: Naas General Hospital

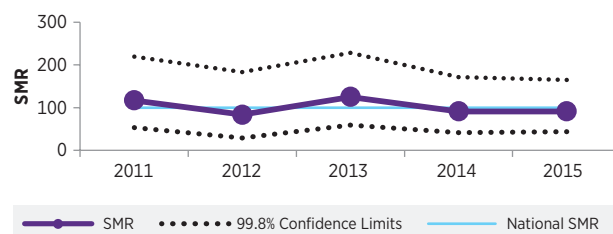


### Haemorrhagic Stroke: St James's Hospital (Dublin)



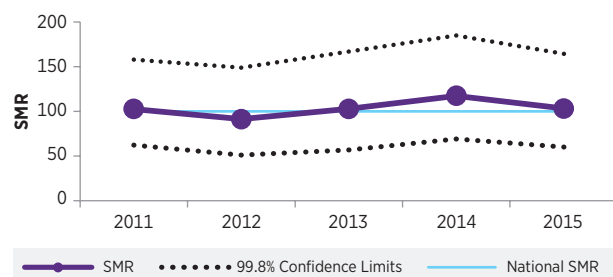
## University of Limerick Hospital Group

### Haemorrhagic Stroke: University Hospital Limerick

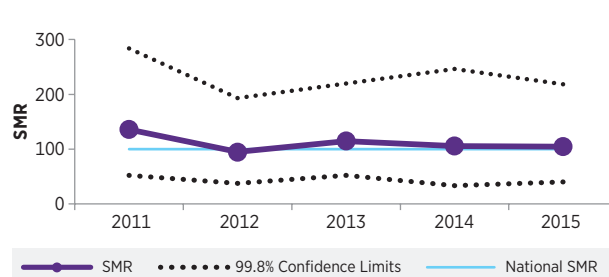


## South / South West Hospital Group

### Haemorrhagic Stroke: Cork University Hospital

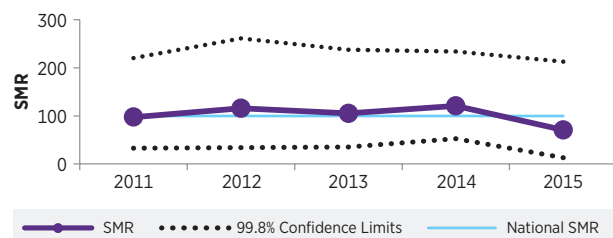


### Haemorrhagic Stroke: University Hospital Kerry



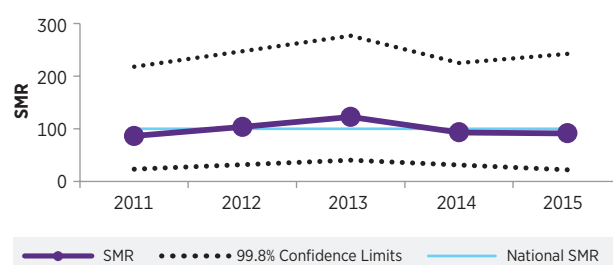
## South / South West Hospital Group

### Haemorrhagic Stroke: University Hospital Waterford

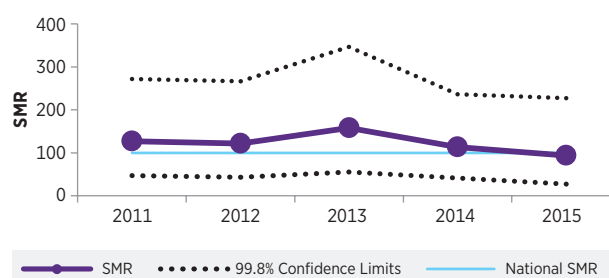


## Saolta University Healthcare Group

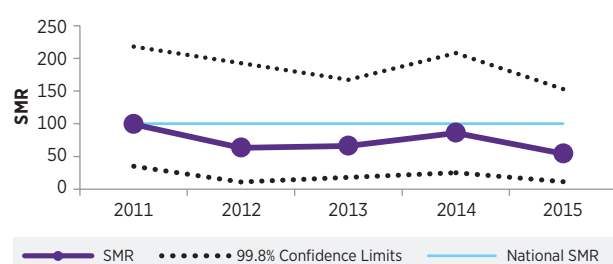
### Haemorrhagic Stroke: Letterkenny University Hospital



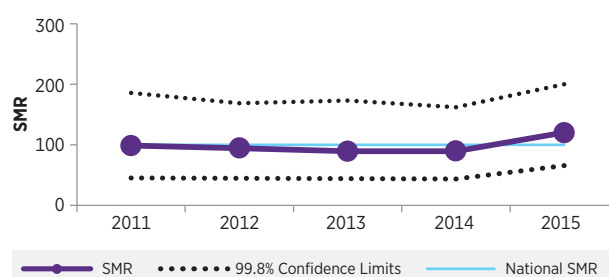
### Haemorrhagic Stroke: Mayo University Hospital



### Haemorrhagic Stroke: Sligo University Hospital



### Haemorrhagic Stroke: Galway University Hospitals



## APPENDIX 6: COPD AND BRONCHIECTASIS

### COPD AND BRONCHIECTASIS INDICATOR

Definition	Standardised mortality ratio with a principal diagnosis of COPD and bronchiectasis
Years covered	2011 - 2015
ICD-10-AM code	J40, J41, J410, J411, J418, J42, J43, J430, J431, J432, J438, J439, J44, J440, J441, J448, J449, J47
Methodology	<p><b>Numerator:</b> Number of actual deaths following admission to hospital with the following ICD -10-AM principal diagnoses 'Bronchitis not specified as acute or chronic', 'Simple &amp; mucopurulent chronic bronchitis', 'Simple chronic bronchitis', 'Mucopurulent chronic bronchitis', 'Mixed simple &amp; mucopurulent chronic bronchitis', 'Unspecified chronic bronchitis', 'Emphysema', 'MacLeod's syndrome', 'Pan-lobular emphysema', 'Centrilobular emphysema', 'Other emphysema', 'Emphysema unspecified', 'Other COPD', 'COPD with acute lower respiratory infection', 'COPD with acute exacerbation unspecified', 'Other specified COPD', 'COPD unspecified', 'Bronchiectasis'</p> <p><b>Denominator</b> Number of expected deaths for COPD and bronchiectasis. This is calculated using an indirect standardisation and logistic regression modelling of all discharges of COPD and bronchiectasis.</p>

## COPD AND BRONCHIECTASIS: TABULAR PRESENTATION FOR IN-HOSPITAL MORTALITY FOR 2015

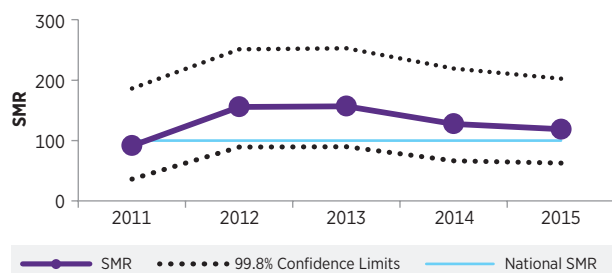
Hospital Group	Hospital Name	No. of Admissions for COPD and Bronchiectasis, 2015	SMR (99.8% Confidence Interval)
RCSI Hospital Group	Beaumont Hospital	706	119 (63 – 202)
	Cavan General Hospital	550	63 (25 – 128)
	Connolly Hospital	349	96 (30 – 223)
	Our Lady of Lourdes Hospital (Drogheda)	520	161 (83 – 278)
Ireland East Hospital Group	Mater Misericordiae University Hospital	772	181 (106 – 286)
	Midland Regional Hospital Mullingar	385	124 (48 – 259)
	St. Luke's General Hospital, Kilkenny	432	94 (35 – 201)
	St. Vincent's University Hospital	398	129 (58 – 246)
	St Michael's Hospital, Dun Laoghaire	152	13 (0 – 120)
	St Columcille's Hospital, Loughlinstown	218	79 (8 – 292)
	Wexford General Hospital	604	104 (45 – 201)
	Our Lady's Hospital Navan	242	55 (5 – 203)
Dublin Midlands Hospital Group	Dublin Midlands Hospital Group		
	Tallaght Hospital (Adult)	718	93 (46 – 167)
	Midland Regional Hospital Tullamore	485	99 (44 – 189)
	Midland Regional Hospital Portlaoise	237	78 (14 – 236)
	Naas General Hospital	438	122 (65 – 205)
	St James's Hospital (Dublin)	665	102 (51 – 180)
UL Hospitals Group	University Hospital Limerick	626	139 (77 – 228)
	Ennis Hospital	243	54 (11 – 153)
	Nenagh Hospital	136	54 (3 – 236)
	St John's Hospital	312	10 (0 – 98)
South / South West Hospital Group	Cork University Hospital	627	140 (80 – 226)
	University Hospital Kerry	354	157 (80 – 276)
	Mercy University Hospital	571	87 (33 – 182)
	South Tipperary General Hospital	437	92 (35 – 191)
	University Hospital Waterford	301	101 (34 – 227)
	Bantry General Hospital	138	101 (14 – 333)
	Mallow General Hospital	239	46 (2 – 201)
Saolta University Healthcare Group	Letterkenny University Hospital	675	48 (14 – 115)
	Mayo University Hospital	592	92 (47 – 159)
	Sligo University Hospital	425	45 (11 – 119)
	Galway University Hospitals	500	62 (18 – 150)
	Roscommon University Hospital	148	111 (30 – 280)
	Portiuncula University Hospital	342	102 (36 – 223)



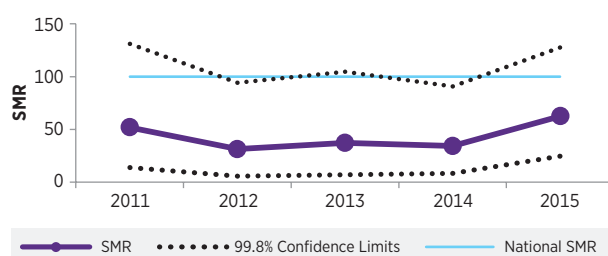
# COPD AND BRONCHIECTASIS SMR TREND CHARTS

## RCSI Hospital Group

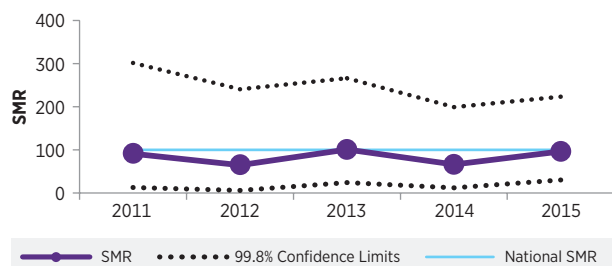
**COPD: Beaumont Hospital**



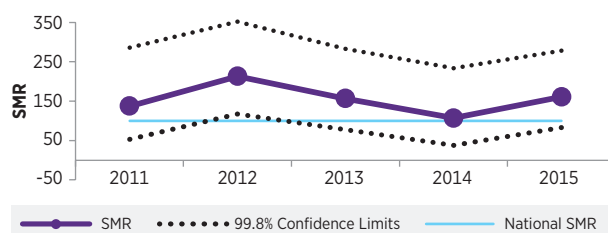
**COPD: Cavan General Hospital**



**COPD: Connolly Hospital**

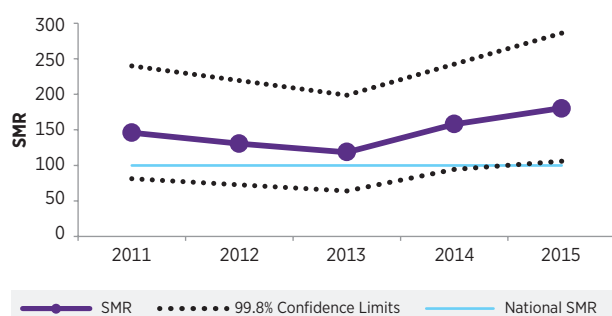


**COPD: Our Lady of Lourdes Hospital, Drogheda**

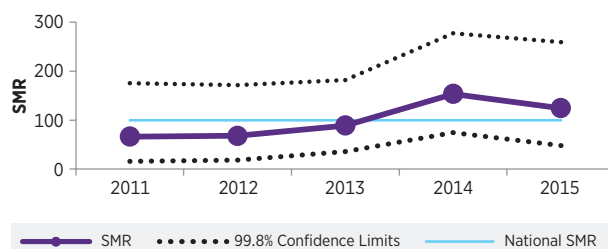


## Ireland East Hospital Group

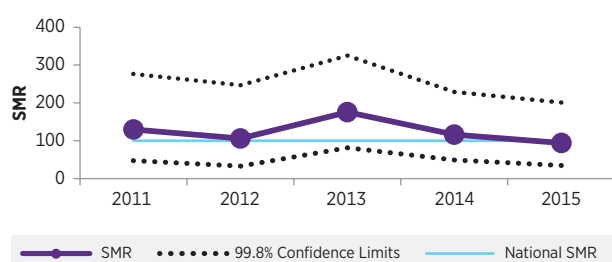
**COPD: Mater Misericordiae University Hospital**



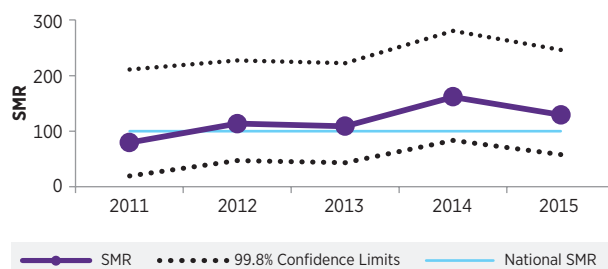
**COPD: Midland Regional Hospital Mullingar**



**COPD: St Luke's General Hospital Kilkenny**

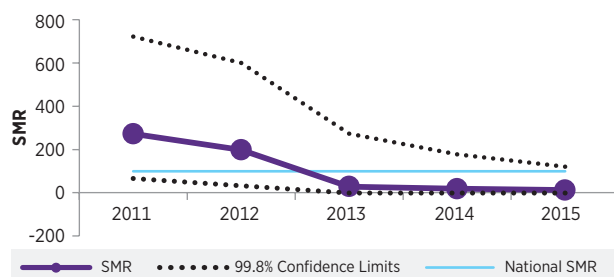


**COPD: St Vincent's University Hospital**

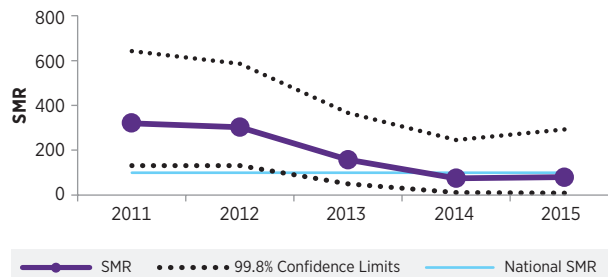


## Ireland East Hospital Group

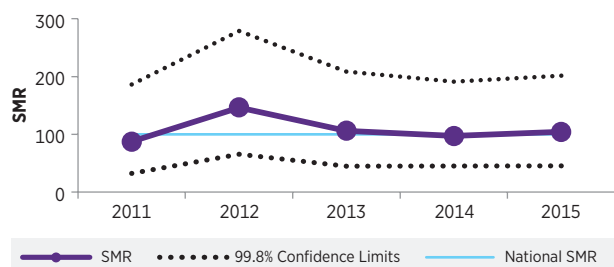
**COPD: St Michael's Hospital Dun Laoghaire**



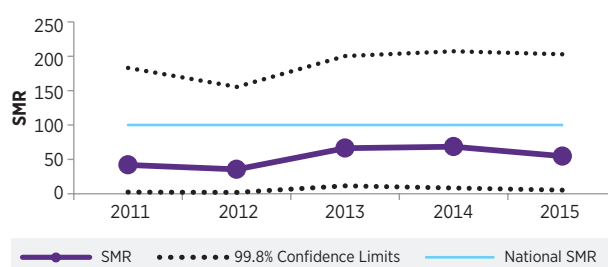
**COPD: St Columcille's Hospital**



**COPD: Wexford General Hospital**

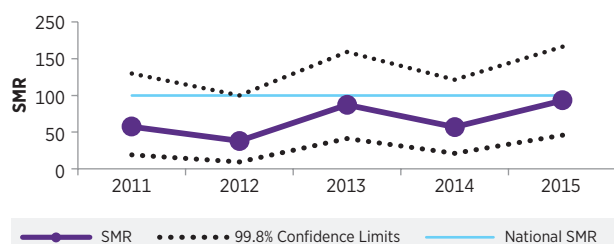


**COPD: Our Lady's Hospital Navan**

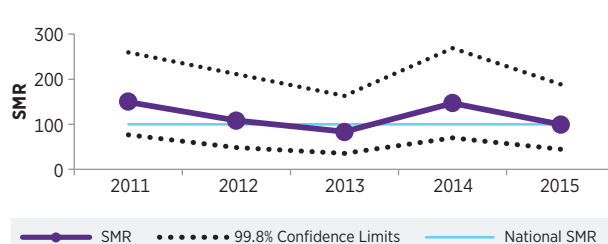


## Dublin Midlands Hospital Group

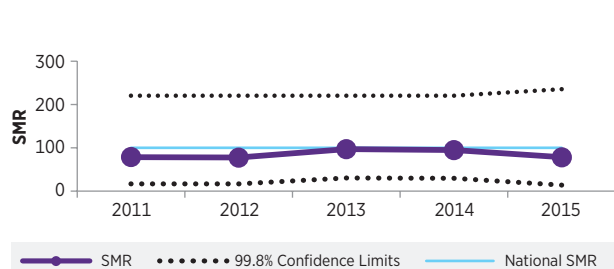
**COPD: Tallaght Hospital (Adult)**



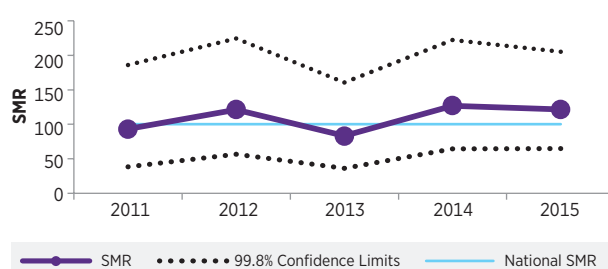
**COPD: Midland Regional Hospital Tullamore**



**COPD: Midland Regional Hospital Portlaoise**

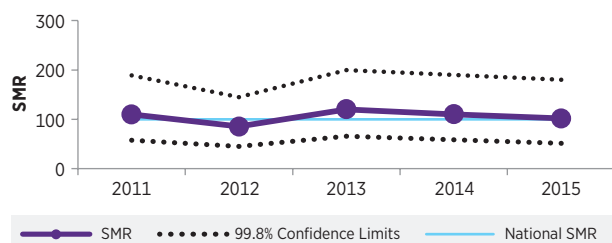


**COPD: Naas General Hospital**



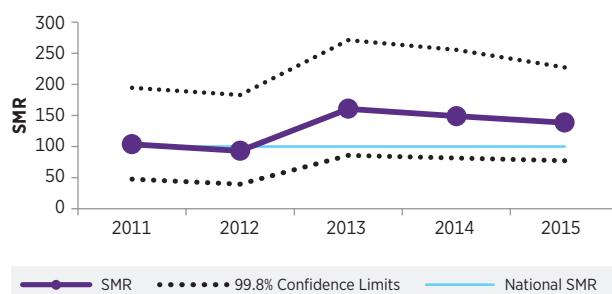
## Dublin Midlands Hospital Group

### COPD: St James's Hospital (Dublin)

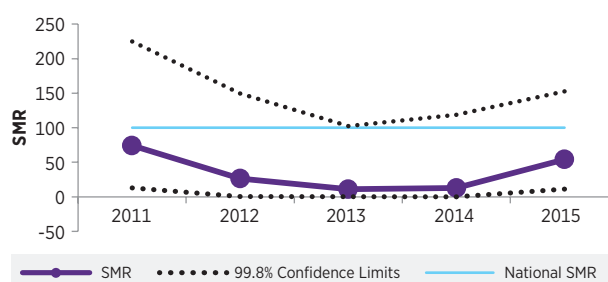


## University of Limerick Hospital Group

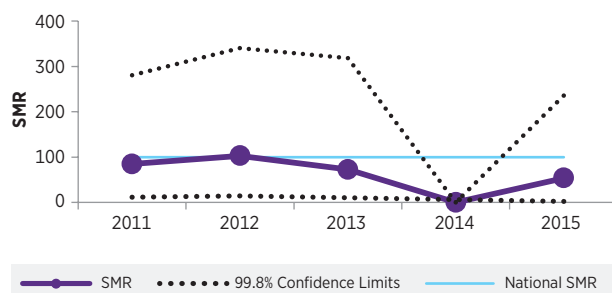
### COPD: University Hospital Limerick



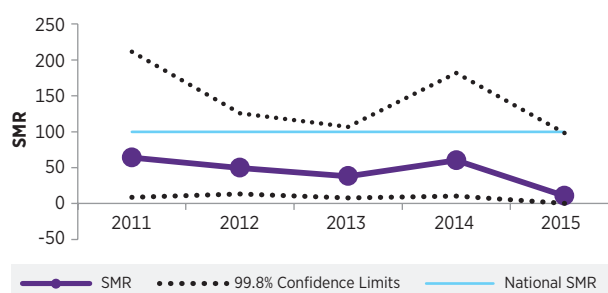
### COPD: Ennis Hospital



### COPD: Nenagh Hospital

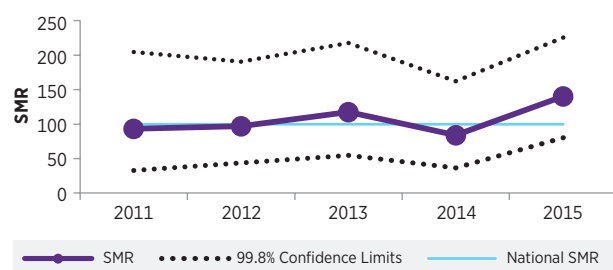


### COPD: St John's Hospital Limerick

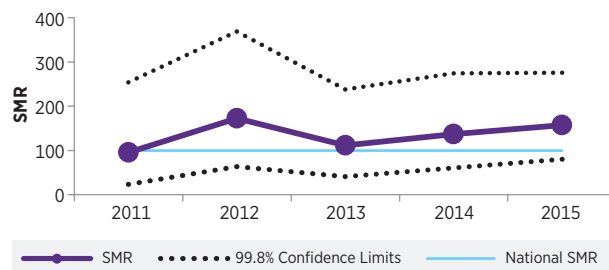


# South / South West Hospital Group

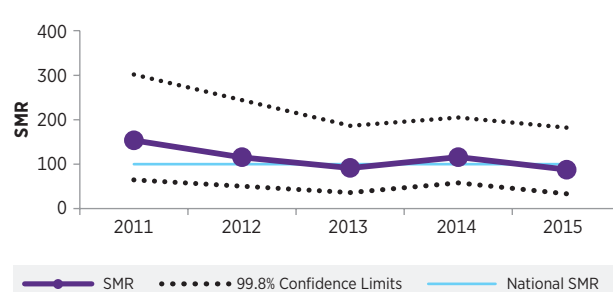
**COPD: Cork University Hospital**



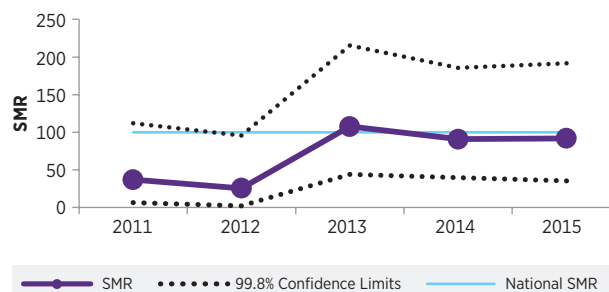
**COPD: University Hospital Kerry**



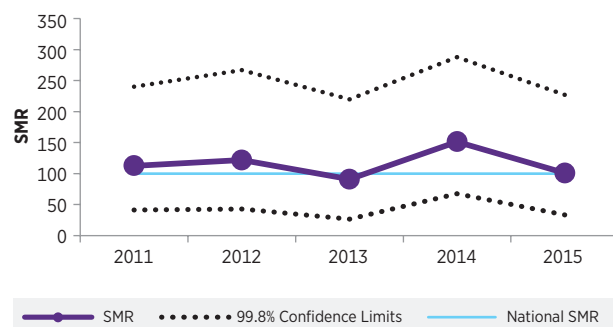
**COPD: Mercy University Hospital**



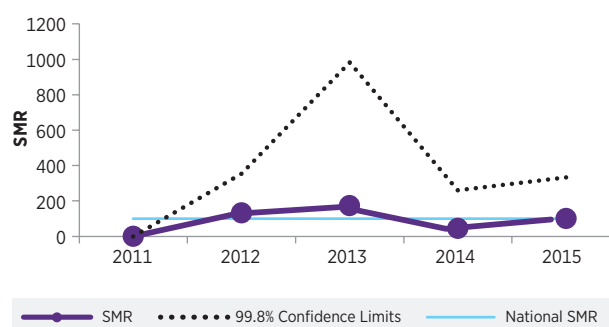
**COPD: South Tipperary General Hospital**



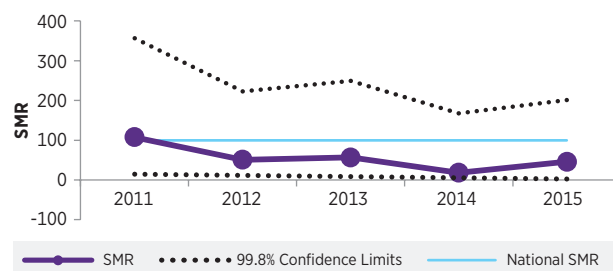
**COPD: University Hospital Waterford**



**COPD: Bantry General Hospital**

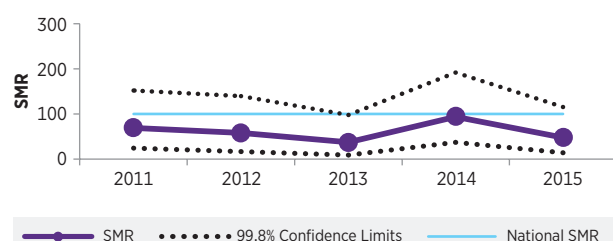


**COPD: Mallow General Hospital**

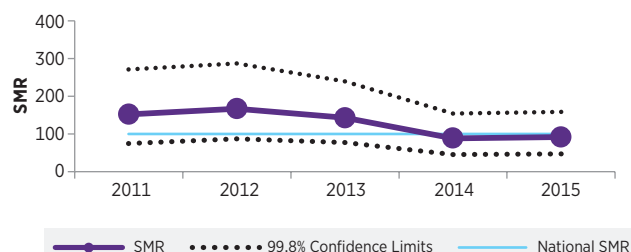


# Saolta University Healthcare Group

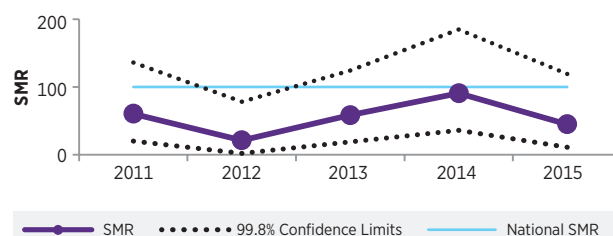
**COPD: Letterkenny University Hospital**



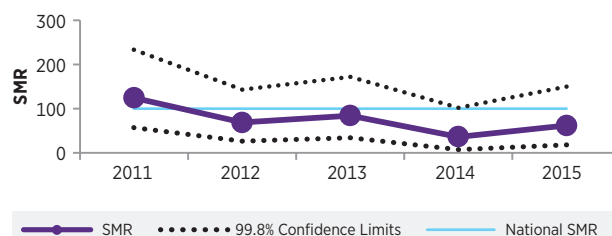
**COPD: Mayo University Hospital**



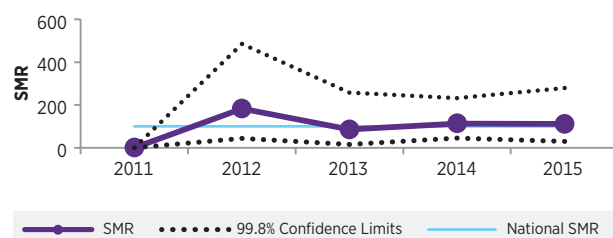
**COPD: Sligo University Hospital**



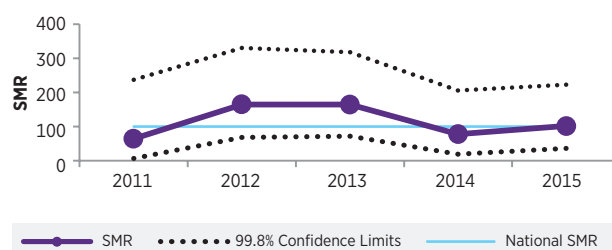
**COPD: Galway University Hospitals**



**COPD: Roscommon University Hospital**



**COPD: Portlincula University Hospital**



## APPENDIX 7: GLOSSARY

<b>ACS</b>	Acute Coronary Syndrome
<b>AHRQ</b>	Agency for Healthcare Research and Quality
<b>AMI</b>	Acute Myocardial Infarction (Heart Attack)
<b>CCS</b>	Clinical Classifications Software
<b>CNS</b>	Central Nervous System
<b>COPD</b>	Chronic Obstructive Pulmonary Disease
<b>GOLD</b>	Global Initiative for Chronic Obstructive Lung Disease
<b>HIPE</b>	Hospital In-Patient Enquiry system
<b>HIU</b>	Health Intelligence Unit
<b>HPO</b>	Healthcare Pricing Office
<b>ICD-10-AM</b>	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification
<b>ISBAR</b>	identify, situation, background, assessment and recommendation
<b>NAHM</b>	The National Audit of Hospital Mortality. A structured review and evaluation of care as part of clinical audit cycle
<b>NOCA</b>	National Office of Clinical Audit
<b>NQAIS</b>	National Quality Assurance Intelligence System. A suite of audit and performance monitoring tools developed by the Health Intelligence Unit, HSE
<b>NQAIS NAHM</b>	The National Quality Assurance Intelligence System for Hospital Mortality
<b>OECD</b>	Organisation for Economic Cooperation and Development
<b>ORS</b>	Optimal Reperfusion Service
<b>PCI</b>	Percutaneous coronary intervention
<b>PRINCIPAL DIAGNOSIS</b>	The diagnosis which was established after investigation and found to be responsible for the episode of admitted patient care, as represented by a code. National Casemix and Classification Centre, Australian Health Services Research Institute, University of Wollongong (2013)
<b>QID</b>	Quality Improvement Division, HSE



**NCCA** National Office of  
Clinical Audit



+353 1 4028577



nahm@noca.ie



@noca\_irl



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