An Roinn Sláinte
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Tús Áite do Shábháilteacht Othar
Patient Safety First

Health Care Quality Indicators in the Irish Health System

Examining the Potential of Hospital Discharge Data using the Hospital Inpatient Enquiry System

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Examining the Potential of Hospital Discharge Data using the Hospital Inpatient Enquiry System

Report prepared by the CMO Office,

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Special thanks are due to the hospitals who commented on their data to inform this study.

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Executive Summary

Purpose of report

A quality health service provides the range of services which meet the most important health needs of its population in a safe and effective way, without waste and within the regulatory framework.

Monitoring the performance of health services in meeting their objectives is important in supporting and strengthening accountability and in improving the quality and safety of the services. Information, including performance indicators, can be used to monitor and evaluate the effectiveness and safety of services, to identify areas of performance which may require further exploration and action and to inform decisions about the planning, design and delivery of services.

The purpose of this report is to propose and examine a number of key quality indicators derived from Hospital Inpatient Enquiry (HIPE) data in order to assess their feasibility in monitoring quality of care and measuring health service performance. The Economic and Social Research Institute (ESRI) manages the HIPE system on behalf of the Health Service Executive (HSE) and provides support and training to the hospitals and the coders in the hospitals.[1]

Background and methods

The monitoring of the quality and safety of healthcare is becoming increasingly important internationally and many countries use quality indicators to monitor the performance of their health services and to highlight issues that need further exploration in relation to quality and safety.

The Organisation for Economic Co-operation and Development (OECD) and other bodies internationally have begun to exploit the potential of routine hospital discharge data for the purpose of measuring indicators of quality. The OECD Health Care Quality Indicators (HCQI) project, which commenced in 2001, shows that high level indicators based on specific diagnoses and/or procedures are valuable as a first step in the comparison of performance (http://www.oecd.org/health/hcqi). Ireland as part of the OECD has been reporting into this project using HIPE data.

The Hospital Inpatient Enquiry (HIPE) system provides a rich source of data on discharges from all publicly funded acute hospitals in Ireland. Originally designed to record hospital activity, its functions have expanded over time and now it is a well-developed database used for a variety of purposes including case-mix based hospital funding. It is also proposed that HIPE will have a key role in future health reforms including “Money follows the Patient” and Universal Health Insurance.

In line with other countries it was decided that potential candidates for quality indicators should be identified and assessed as a precursor to the development of specific quality and safety indicators for the Irish health system. The study builds on the work of the OECD with many of the indicators examined based on the definitions and guidelines set out by the OECD as part of the HCQI project. A number of additional indicators were also developed based on further research and discussion between relevant experts and clinicians.

One of the key factors in assessing the feasibility of indicators is the availability of and access to a comprehensive quality information system. As HIPE is a publicly funded major source of information on acute hospital activity in Ireland this report assesses the feasibility of indicators derived from HIPE.

[1] During the process of compiling this report, the HIPE system was administered by the Health Research and Information Division in the ESRI. From 1st January 2014 responsibility has been transferred to the Healthcare Pricing Office within the Health Service Executive.

Other criteria considered in this analysis of feasibility of the selected indicators included:

- Are there agreed international definitions and guidelines for the indicator?
- Is there potential for international comparability?
- Are all of the necessary variables currently coded in HIPE?
- Are there sufficient numbers of cases (both numerator and denominator) with identified conditions to support the calculation of rates?
- Are there ICD-10-AM codes available for the conditions assessed?
- Are there sources apart from HIPE available that are more accessible and robust?
- Are the indicators representative of a range of process, structure and outcome indicators?

Since this was a preliminary scoping study the analysis was high level focusing on the principal diagnosis or procedures[2].

The preliminary focus of this study was to assess the feasibility of indicators derived from HIPE. As part of this study an analysis of the data for the selected indicators was undertaken with a process for referral to the HSE Quality and Patient Safety Directorate if issues were highlighted that required further exploration and possible action.

Summary of the indicators considered for selection

See Appendix 1 for detailed indicator specifications.

Selected indicators:

- **In-hospital mortality within 30 days after acute myocardial infarction (AMI)**
  This indicator is defined as the number of patients who die in hospital within 30 days of being admitted to hospital with an AMI as a proportion of the total number of patients admitted to that hospital with an AMI. Both crude mortality rates and age-standardised mortality ratios were calculated, aggregated over the period 2008-2010. This is an OECD indicator.

- **In-hospital mortality within 30 days after ischaemic stroke**
  This indicator is defined as the number of patients who die in hospital within 30 days of being admitted to hospital with ischaemic stroke as a proportion of the total number of patients admitted to that hospital with ischaemic stroke. Both crude mortality rates and age-standardised mortality ratios were calculated, aggregated over the period 2008-2010. This is an OECD indicator.

- **In-hospital mortality within 30 days after haemorrhagic stroke**
  This indicator is defined as the number of patients who die in hospital within 30 days of being admitted to hospital with haemorrhagic stroke as a proportion of the total number of patients admitted to that hospital with haemorrhagic stroke. Both crude mortality rates and age-standardised mortality ratios were calculated, aggregated over the period 2008-2010. This is an OECD indicator.

- **In-hospital mortality within 30 days following hip fracture surgery**
  This indicator is defined as the number of patients undergoing hip fracture surgery who die in hospital within 30 days of admission as a proportion of the total number of patients who underwent hip fracture surgery. Both crude rates and age-standardised mortality ratios were calculated, aggregated over the period 2006-2010. This is not an OECD indicator.

- **In-hospital mortality within 30 days after colectomy for emergency admissions**
  This indicator is defined as the number of patients undergoing colectomy surgery and admitted as an emergency who die in hospital within 30 days of admission as a proportion of the total number of emergency admissions who underwent a colectomy.

[2] See the HIPE Data Dictionary at www.hipe.ie for full definitions of principal diagnosis and procedures.

Both crude mortality rates and age-standardised mortality ratios were calculated, aggregated over the period 2006– 2010. This is not an OECD indicator.

- **Time to hip fracture surgery**
  This indicator is defined as the time from admission of a person aged 65 years or older with a principal diagnosis of fractured neck of femur to time of surgery for the fracture aggregated over the period 2008-2010. This is an OECD indicator.

- **Age at orchidopexy**
  This indicator is defined as age at which orchidopexy is undertaken for the treatment of undescended testes, aggregated over the period 2006-2010. This is not an OECD indicator.

Other indicators considered:

- Age at first hospital admission with developmental dysplasia of hip (DDH).
- Rate of pulmonary embolism (PE) or deep vein thrombosis (DVT) following surgery.
- Rate of catheter-related blood stream infections.
- Proportion of patients with ST elevation myocardial infarction (STEMI) who received thrombolysis or cardiac catheterisation within the following 24 hours.
- Number of falls in hospitals as a percentage of all inpatient discharges.
- Rate of ventilator associated pneumonia (VAP).

Many of the high level indicators presented in this report are based on definitions developed in the context of the OECD HCQI project. Where relevant, and in line with OECD guidelines, the indicators have been age-standardised to take account of differences in the age profiles of patients across hospitals. In-hospital mortality rates are considered by the OECD and other international agencies to be useful indicators of hospital care (AHRQ, 2013). These are high-level measures, the benefit of which is that they provide for a standard international approach, which allows for cross-country comparisons. However, there is an inevitable trade-off with the precision of the indicators, particularly the lack of inclusion of co-morbidities and other confounding factors.

The 30 day in-hospital mortality indicators after AMI, stroke, colectomy and hip fracture are calculated based on deaths in hospital after admission with the relevant principal diagnosis or procedure. The indicator does not attribute the mortality to that principal diagnosis or procedure. For example, it is likely that many deaths following hip fracture are due to medical complications rather than hip fracture surgery itself.

Findings

The study found that a number of the selected indicators derived from HIPE fulfilled most if not all of the criteria in order to be considered feasible. However it also found that some of the other indicators reviewed would require significant changes to the indicator definitions and methodology, and/or to the data in the HIPE system to be considered as fulfilling the feasibility criteria.

The indicators considered as feasible are set out below, although it is also recognised that for each of these indicators there were some issues of quality and robustness that should be explored and if possible addressed through further development.

The preliminary assessment of in-hospital mortality within 30 days after acute myocardial infarction (AMI) and ischaemic and haemorrhagic stroke provided the following findings:

- Preliminary assessment of the indicator for in-hospital mortality within 30 days after admission for AMI as derived from HIPE suggests that it meets the criteria for feasibility as a potentially useful indicator although limitations were also highlighted.

- The indicators on in-hospital mortality within 30 days following ischaemic and haemorrhagic stroke also show that it is feasible to use these indicators as derived from HIPE, although again there were a number of significant limitations.

Some of the limitations highlighted in relation to these three mortality indicators included that the indicators do not attribute the mortality to the principal diagnosis or procedure. Also this preliminary analysis did not assess and take into account patient factors including co-morbidities and medication use that may have an effect on the outcomes. It is suggested that a more developed analysis that takes into account these factors would lead to improvement in these measures.

Furthermore, 30-day in-hospital mortality rates are also influenced by factors occurring before or after treatment in hospital. This includes access and care prior to reaching hospital, within the emergency department or following discharge from hospital. In Ireland it is also not possible at present to track deaths which occur outside hospital within the 30-day period.

The development of systems to capture this data would improve the measure. However, in-hospital mortality rates, while they must be interpreted with caution, are useful in identifying variation that should be explored further.

For some in-hospital mortality indicators, the age-standardised mortality ratios were higher than expected in a small number of hospitals during the period of analysis.[3] The Quality and Patient Safety Directorate of the HSE and the individual hospitals were communicated with about these variations. As a result, a number of hospitals on reviewing their healthcare records and HIPE data found inconsistencies in the recording in medical records and/or in coding into the HIPE system. It is important to note that the issues of data quality referenced in the study relate to the small number of hospitals which reviewed their data.

Preliminary assessment of the indicator on in-hospital mortality following hip fracture surgery as derived from HIPE suggests that it offers good potential as an outcome measure. However, it must be noted that due to small numbers in the Irish system in some hospitals the likelihood of observation of statistically significant variation is reduced, even where that variation may be important clinically.

Also for this indicator patient factors including co-morbidities are likely to affect mortality rates. Therefore a more developed analysis that accounts for these issues could improve this measure. It is also important to note that mortality following hip fracture is generally due to a medical condition and therefore medical care and the provision of an ortho-geriatric service may affect variation in outcomes following hip fractures. As stated before 30-day mortality in-hospital rates are likely to be affected by factors that occur before or after treatment within the hospital.

Preliminary assessment of the indicator on the in-hospital mortality rate following emergency admission and colectomy surgery suggests that it offers good potential as a future outcome measure. Although the small numbers for this condition could present an issue leading to unstable and unreliable rates, this can be counterbalanced by the likelihood that for this indicator the recording of death and procedure are more likely to be accurate. Again, taking into account patient factors such as co-morbidities could improve this indicator.

The indicator on time to hip fracture surgery is used internationally as a measure of quality. In this study it was found that this indicator is useful as a high level indicator but has a significant limitation, in that time data was not captured in HIPE prior to 2011. It is proposed that to improve this indicator accurate time of admission and times of procedures should be recorded on HIPE. Since 2011 times of admission and discharge are being recorded on HIPE, although times of procedures are not at this point available.

Review and analysis of the indicator on age at orchidopexy showed that this indicator derived from HIPE is feasible and has potential as an outcome measure. However the analysis highlighted some issues with this indicator including information on whether a delay in admission for orchidopexy was due to lack of timely diagnosis or access issues. HIPE does not cover outpatients, community or primary care and therefore cannot provide information on the care provided in these settings including access to screening and appropriate referral.

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[3] See Appendix 3 for details of the methodology and interpretation of age-standardised mortality ratios.

However the study has shown that this indicator can be derived from HIPE due to the clear recording of a treatment specific procedure and age at admission for this procedure. It therefore highlights the need for further exploration to determine the reasons for variations in findings.

Other indicators reviewed included age at first hospital admission with developmental dysplasia of hip (DDH). The review indicated that it is not feasible to derive a robust indicator for management of DDH from HIPE for many reasons including small numbers and whether it is an accurate reflection of the diagnosis and management of DDH.

Other indicators were also reviewed but were not considered feasible for a number of reasons including lack of a specific ICD-10-AM code for the condition in HIPE or small numbers for specific conditions. These indicators are more fully discussed in the text of the report.

As previously stated initial analysis found that a small number of hospitals reported 30-day mortality rates higher than would be expected when compared with national rates. While it was known to be likely that inconsistencies in reporting and other factors could account for some of this variation, it signalled that further exploration and explanation was required particularly to rule out patient safety issues. Therefore, the HSE was advised where there was significant variation from the national average in a hospital or region and that these findings required further exploration and explanation. The Quality and Patient Safety Directorate of the HSE followed up by communicating with the individual hospitals and providing the relevant data to hospitals in order for them to comment on the quality of their data and to ensure that there were no patient safety issues.

In response these hospitals undertook a further review, the extent and method of which varied by hospital. The majority of hospitals which undertook a review examined the healthcare records and HIPE records of patients who died following admission with the principal diagnosis (primary reason for admission) under investigation. The hospitals identified a number of issues in relation to their data, including incorrect recording of the principal diagnosis in the healthcare record and, to a lesser extent, incorrect coding from the healthcare record into the HIPE system. Their reviews highlighted issues in relation to data quality. The learning from the hospitals' reviews of their data was very valuable and is therefore included in the text of this report. It is important to note that the purpose of this report was not to assess the overall quality of HIPE data, although the reviews carried out by some hospitals indicated data quality issues that should be further examined and addressed.

The further refinement and development of these indicators should include assessments of the quality of healthcare records and the associated HIPE data, including issues such as the application of coding guidelines, the depth of coding of comorbidities and other factors such as transfer status.

The HIPE files for the years 2005 to 2010 for all hospitals were reopened on a phased basis starting from the end of 2011. Some hospitals, including some of the hospitals which reviewed their data following the initial findings, made changes to their HIPE files. The revised HIPE files are now included in this report. The findings, analysis and discussion in this report are based on the initial data and the revised HIPE data resubmitted by hospitals. However it should be noted that not all hospitals resubmitted data following the reopening of the HIPE files. This can raise issues in relation to interpretation as some hospitals made changes to their HIPE data but not all hospitals did and some hospitals only focused on certain conditions and related deaths. Some of these issues could be addressed through a review of all healthcare records to check the accuracy of the principal diagnosis. However the primary focus of this study was to look at the feasibility of these indicators and to progress to robust indicators for the future rather than carrying out a review of historical data.

Conclusions

Internationally the use of quality indicators to measure health service performance is recognised as an important initiative in improving the quality, effectiveness and safety of healthcare. In line with this approach and building on the work of the OECD through the Health Care Quality Indicators (HCQI) initiative, the Department established this study as an important first step in assessing the feasibility of indicators derived from HIPE as potential indicators to be used by the Irish health system to measure health service performance in delivering quality healthcare.

The report highlights important issues in a number of areas including the importance of data quality in developing and implementing indicators. Its focus is on the value of HIPE, on the importance of data quality and on the benefit to the health system of good quality data. For this reason individual hospitals are not identified in this report.

This report confirms the value of the HIPE system as a resource for the development of indicators of quality of care in hospitals in Ireland. At the same time it draws attention to areas where HIPE may not be suitable and/or where additions and improvements to HIPE will be required prior to using these measures as reliable outcome indicators. The report also highlights the requirement for hospitals, with guidance from the HSE, to improve the quality and accuracy of the information that they record, both in the healthcare record and subsequently onto the HIPE system. It is also the case that in the context of the health reform programme the quality of HIPE data is becoming ever more important since the implementation of policies such as “Money follow the Patient” and Universal Health Insurance require the use of Diagnosis Related Groups (DRGs) which are based on HIPE.

The preliminary analysis undertaken as part of this study has highlighted factors that may have a confounding effect on the findings, particularly in relation to the in-hospital mortality indicators. One of the most significant risk factors that affects mortality is age, as the number and severity of co-morbidities usually increases with age. The in-hospital mortality indicators have been age-standardised as part of the methodology used in this study in order to adjust for varying age profiles of patients in different hospitals. However, other confounding factors such as co-morbidities, which may influence outcomes, need to be addressed through subsequent refinements of the methodology including the addition of further variables in the analysis.

The analysis of hospital level data has highlighted the limitation of small or very small numbers when developing and reporting indicators. Small numbers can result in unstable and unreliable rates and problems with confidentiality. There are ways to try and counteract this for example by aggregating years, by grouping hospitals, or combining clinical groups. This report has attempted to address some of these issues through the aggregation of several years of data and the inclusion of 95% confidence levels.

Analysis of the effect of the presence of co-morbidities and other confounding variables such as social deprivation would be an obvious next step in any further analysis of these indicators. However it would also be very beneficial if a further assessment and implementation of identified improvements to data quality was carried out in advance of this process. It should also be noted that the introduction of a unique patient identifier would greatly assist in developing accurate and robust indicators. Linking to other datasets, such as Central Statistics Office mortality data also has the potential to improve these indicators.

This study has shown that some of the data used in the calculation of these indicators was unreliable due to lack of consistency in the documentation in the healthcare record and subsequently the transfer onto the HIPE system. However this is data entered directly by the hospitals and therefore the quality of the healthcare record and the inputted data is the responsibility of the hospital. This data is an important source of information for the hospitals, for the health system and also for the public. Indicators derived from data entered by the hospital onto HIPE allow hospitals to monitor their own performance over time. This ability to compare outcomes over time and across services is an important function and it is essential for service providers to have high quality information available to them that allows them to do this.

The observed variations across hospitals found in this study may be due to a number of factors, including quality of care issues, data quality issues or issues in relation to the inclusion of confounding factors in the analysis. The small number of reviews carried out by hospitals identified issues in regard to the quality of the data, and in particular the medical record, which need to be addressed in order to support further analysis and more targeted interpretation of results. Nevertheless, the report has demonstrated the value of calculating quality indicators based on HIPE data and has identified areas requiring further exploration both in relation to data collection and clinical care.

It is accepted that indicators are alerts or flags to identify areas of performance that may require further exploration. In addition indicators can help to identify good practice which can then be disseminated throughout the system. However it must be noted that the international literature on performance indicators warns against using a specific measure as a generic indicator of an organisation's performance and safety and also highlights the limitations of the precise interpretation of the correlation between in-hospital mortality rates and hospital performance (Health Foundation, 2013). Indicators should be assessed within the context in which care is delivered and should not be reviewed in isolation.

It is important that a range of robust indicators are used to reflect quality of healthcare. The findings set out in this report should not be taken as making any inferences concerning quality of care in hospitals and certainly should not be interpreted as ranking hospitals with respect to the selected indicators.

Quality indicators should be used by clinical and management teams to monitor the quality of care delivered. Following further exploration, and if required, a quality improvement plan that can be monitored and evaluated over time should be put in place and systematically implemented.

This report provides a preliminary analysis of indicators derived from reported HIPE data, which serves principally to highlight the potential of the selected indicators but also raises important questions. This study will inform the future development of healthcare quality indicators for Ireland which, aligned with international evidence-based practice, should then be implemented and reported on at all levels of the Irish health system and internationally.

Developments following preliminary findings

The initial analysis was shared with a number of key agencies including the Quality and Patient Safety Directorate (QPS Directorate) of the Health Service Executive (HSE), the Health Research and Information Division of the Economic and Social Research Institute (ESRI) and the Health Information and Quality Authority (HIQA). All of these agencies provided comments on the draft document and these comments have been taken into account in the final report.

As stated previously the QPS Directorate of the HSE contacted and followed up with a small number of individual hospitals to further explore specific issues highlighted by the initial analysis including mortality rates higher than would be expected when compared with national rates.

The QPS Directorate in conjunction with the office of the Chief Medical Officer (CMO) also communicated in January 2012 with all HSE hospitals to state that each hospital should review the quality of their data with a particular focus on data for 2011. This communication also stated that the data for 2011 would be published in the future with individual hospitals identified.

The Health Intelligence Unit of the HSE in conjunction with the QPS Directorate commenced a project to further develop the identified indicators in this study specifically the 30 day in-hospital mortality rates. This further development of indicators included linking this information to data from other databases, for example the CSO mortality data.

The Health Research and Information Division in the ESRI have undertaken a number of quality initiatives including seminars with a focus on data quality tools.

HIQA has produced guidance in relation to performance indicators for healthcare: "Guidelines on developing Key Performance Indicators and Minimum Datasets to monitor healthcare quality" with an update published in February 2013.

As stated above these initiatives have addressed some of the initial findings from this analysis and have progressed the preliminary work undertaken in this study. These initiatives will support the development of robust indicators derived from HIPE that can be used by the health system, both internally by service providers and by external agencies e.g. regulators such as HIQA, to monitor the quality and safety of healthcare while supporting accountability and driving improvements in healthcare. Also importantly with public reporting of this information the public and policy makers can make informed decisions about their own care and future healthcare services. The dissemination of this information should be seen as an important driver of improvements in the quality and safety of healthcare in Ireland for the future.

Response to the report

The Hospital Inpatient Enquiry System (HIPE), within certain parameters, will be used by the Department of Health (DoH), the Health Service Executive (HSE) and other relevant health service providers, to derive performance indicators to measure the performance of health services in delivering quality and safe healthcare. These parameters include that the data in HIPE is validated, accurate high quality data.

Clear governance mechanisms at both a national, regional and local level for the quality of HIPE will be established including a national governance group and clear service level agreements with service providers. Those responsible for the quality of HIPE both at the national level, that is the HSE and at a local level, for example acute hospitals, should ensure continuous improvement in the quality of HIPE through implementation of quality improvement programmes. These quality improvement programmes should include regular audits along the data flow pathway and education and training programmes for clinical staff and administrative staff involved in HIPE. Under these governance arrangements and as part of the annual review process of HIPE variables, specific additions will be considered which would enhance the value of HIPE for measuring performance.

The Department of Health will develop a formal public national reporting system by the Minister for Health in relation to National Healthcare System Quality Performance Indicators for Ireland. These performance indicators and targets will be aligned with evidence-based international practice and linked to international norms, e.g. OECD Health Care Quality Indicators, wherever possible. The DoH in establishing the reporting mechanism for National Healthcare System Performance Quality Indicators will engage with all key stakeholders including the HSE and HIQA.

The indicators which were assessed to be feasible in this report will be further developed and evaluated by the DoH and the HSE in consultation with key stakeholders. The DoH, the HSE and the wider healthcare system will also continue to develop and report evidence-based quality of care and outcome indicators in line with each organisation's mandate.

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Aim and Objectives

The aim of this report is to propose and examine a number of key quality indicators using Hospital Inpatient Enquiry (HIPE) data in order to assess their feasibility in monitoring quality of care and measuring health service performance. This report is a preliminary study and it is envisaged that the findings will inform further exploration and development of indicators to measure the quality of care provided by Irish health services.

The objectives are:

- To identify selected indicators derived from HIPE data to measure and monitor the quality of patient care.
- To base these indicators, where feasible, on standard international indicators and, in particular, on quality of care measures developed by the OECD's Health Care Quality Indicators (HCQI) project.
- To calculate the indicator data by hospital or region.
- To examine the data in order to identify its potential and reliability in measuring patient outcomes.
- To examine the indicators and discuss their validity in measuring patient outcomes.
- To make recommendations in relation to the future potential and methods of improving the robustness of indicators derived from HIPE.

Background

A quality health service provides the range of services which meet the most important health needs of the population (including preventative services) in a safe and effective way, without waste and within the regulatory framework.

To be able to sustainably deliver quality care, health services need to monitor the quality of the care they deliver, the outcomes for their patients and to implement continuous improvements. Improvement in the quality of patient care requires a comprehensive, multifaceted approach to identifying and disseminating the learning from good quality care and from identifying and managing poor quality care in individual services and finding broad long-term solutions for the system as a whole.

A major element of programmes to improve the quality of patient care is the capacity to capture comprehensive information including performance measures. Performance measurement enables informed decision making by monitoring, analysing, and communicating the degree to which key organisational goals are met. Performance measures, such as indicators, can also be used to identify areas of performance which may require further exploration and sometimes immediate action. However, it is internationally recognised that it is important that when measuring performance a balance of measurements is used and that there is no single measure that provides assurance of an organisation's safety or quality of performance. Therefore it is important that a range of indicators are used that reflect structure, process and outcomes.

Performance measurement contributes to improving quality in a number of ways. Firstly, it drives improvement by enabling service users to make choices based on quality measures, which in turn creates an incentive for providers to improve performance so as to attract more service users. Secondly, professionals have an intrinsic desire to improve performance when they are made aware, through performance measurement, that there is potential for improvement. Thirdly, performance measurement drives improvement through comparing the performance of individuals, teams or organisations resulting in a desire to improve or maintain performance relative to others and the reliability of the quality and safety of services that they provide.

In choosing key quality indicators it is important that

- they can be measured
- measurement can be realistically achieved within available resources
- they are important to patient safety and patient care
- they are valid indicators of performance
- they contribute to service improvement and cost efficiencies
- they are actionable
- they have intelligent targets.

Indicators should also be chosen that enable international performance comparisons, where possible. They should take cognisance of the important factors for key performance indicators as outlined in the Health Information and Quality Authority's (HIQA), *Guidelines on Developing of Key Performance Indicators and Minimum Data Sets to Monitor Healthcare Quality (available at http://www.hiqa.ie/resource-centre/professionals/kpi-data-sets).*

Performance measurement is a continuous process that involves collecting data to determine if a service is meeting desired standards or targets. It is dependent on good quality information on health and social care which can only be achieved by having a systematic process to ensure that data are collected consistently, both within, and across organisations. Development of de novo systems to measure quality outcomes would likely ensure the most robust indicators but would be very costly and resource intensive. Utilisation of existing data sources, therefore, may provide a useful alternative. There are a number of data systems within the Irish health and social care system that may be fit for this purpose including the Hospital In-Patient Enquiry (HIPE) system.

This study examines the feasibility of developing and measuring a number of quality of care indicators based on data from the HIPE system. HIPE is a computer-based system designed to collect patient demographic, clinical and administrative data on discharges and deaths from acute hospitals nationally. All acute public hospitals participate in HIPE reporting on over 1.4 million discharges in 2010. The Economic and Social Research Institute (ESRI) manages the HIPE system on behalf of the Health Service Executive (HSE) and provides support and training to the hospitals and the coders in the hospitals.[4]

While HIPE was originally designed to measure hospital activity rather than to assess hospital performance, it provides a rich source of data with the potential to shed light on issues of quality of care.

Doctors, nurses, and other healthcare professionals input information into the healthcare record. The HIPE coding team in the hospital is then responsible for accurately transferring information from the healthcare record to the HIPE system. This information is then exported to the ESRI, where additional validation checks are carried out prior to the data being used for reporting and analysis. It should be noted that validation at this point cannot identify cases where the information may be inaccurate but, nevertheless, coded appropriately.

The ESRI, HSE and Department of Health (DoH) utilise the national HIPE database to monitor many aspects of the health service. To date, most of this monitoring has been on types and levels of activity and on costing through the application of case-mix modelling to the HIPE data. However many bodies including the HSE through the Health Intelligence Unit and the clinical programmes have begun to recognise and exploit the potential of HIPE and other administrative data sets in supporting and enabling measurement of quality of care.

For the purposes of this study, a number of indicators have been selected to assess the potential of deriving quality of care indicators from HIPE. The study mainly focuses on the feasibility of deriving these indicators from HIPE, rather than on other possible selection criteria. However it should be noted that most of the selected indicators are based on indicators used internationally to measure quality of care. In fact where available, these indicators are based on the rigorous developmental work carried out by the OECD as part of its Health Care Quality Indicators (HCQI) project. This project continues to demonstrate clear value in the use of routine hospital discharge data for the purposes of

[4] During the process of compiling this report, the HIPE system was administered by the Health Research and Information Division in the ESRI. From 1st January 2014 responsibility has been transferred to the Healthcare Pricing Office within the Health Service Executive.

performance measurement and for cross-country comparisons. Ireland is involved in the OECD HCQI project and Irish data is being published as part of the OECD reports. There are four OECD indicators that have been selected for this study.

A number of other indicators were selected for assessment based on consideration by relevant experts and clinicians of their feasibility, validity and balance (structure, process and outcome). Two of these indicators are based on mortality following surgery. The international literature suggests that mortality following surgery varies with individual surgeons, teams, hospitals and services and that this variation is influenced by a number of factors including procedure volume and access to effective multidisciplinary care (Birkmeyer, JD and Dimick, JB, 2009).

The HIPE system does not cover community or primary care and in the absence of this it was proposed that indicators would be selected for assessment that may reflect some aspects of community and primary care. Therefore two indicators were chosen to review: age at which orchidopexy is undertaken for the treatment of undescended testes and age at first admission to hospital with a principal diagnosis of developmental dysplasia of hip (DDH).

The suite of indicators presented does not purport to provide a comprehensive or representative view of areas where measurement of the quality of care is indicated, but rather aims to assess the feasibility of these selected indicators as derived from HIPE.

The main criteria considered in this analysis of the feasibility of these selected indicators derived from HIPE included whether:

- There are agreed international definitions and guidelines for the indicator, for example OECD indicators for in-hospital mortality rates for AMI, ischaemic stroke, haemorrhagic stroke.
- There is potential for international comparability, for example if there are international definitions can these be applied to HIPE data and whether the coding system facilitates cross-country comparisons i.e. use of ICD-10-AM.
- International data are available on the indicators to allow comparison.
- All of the necessary variables are currently collected in HIPE and could any additional variables be included in HIPE that may improve the reliability of an indicator.
- There are sufficient numbers of cases (both numerator and denominator) to support the calculation of rates.
- There are specific ICD-10-AM codes available for the conditions assessed.
- There are sources apart from HIPE available that are more accessible and robust.
- Whether the indicators are representative of a range of process, structure and outcome indicators.

This report examines high level indicators, which are defined not as direct measures of quality but rather as indicators which can be used to draw attention to issues that may need further exploration or action. It should be emphasised that this report does not subscribe causal explanations to any observed variations in the selected indicators. Any variations highlighted require, as with any variations in indicator outcomes, further exploration to elucidate underlying causes, for example in this instance in relation to quality of data, quality of clinical care, and the relative effects of other factors influencing outcomes.

The indicators in this paper focus on:

1. 30 day in-hospital mortality.
2. Time to surgery for hip fracture.
3. Age at hospital admission for treatment of undescended testes in childhood.

The methodology section below describes both the indicators and the process of analysis undertaken for this report. It also highlights some of the limitations inherent in the approach including issues of data quality and the absence of a unique identifier. The concluding section of the report discusses the interpretation of the results and, given that this work should be seen as the preliminary stage of a process, makes recommendations for improving the validity and robustness of these indicators derived from HIPE.

Methodology

This study involved the selection of a number of indicators derived from HIPE for assessment. Their selection was primarily informed by the indicators developed as part of the OECD Health Care Quality Indicators project and also from discussions with relevant experts and clinicians.

The assessment of the indicators included analysis of data derived from the HIPE system on both day cases and inpatients discharged from public hospitals in Ireland over a three to five year period to 2010.

HIPE data are coded for each patient discharged within each hospital. The data are episode-based rather than patient-based. A full description of HIPE and the definition of terms used by the HIPE system (diagnoses, procedures etc.) can be found at www.HIPE.ie.

Initially the final 2010 HIPE file, version December 2011, was used for the analysis. For this analysis it was found that for most hospitals in the study coverage was in excess of 99% complete for 2010 HIPE data. One hospital did not code for a 4-month period in 2010 but the coverage for the rest of the year was sufficient to include this hospital. However this results in a smaller number of cases which is reflected by wider confidence intervals. As there is complete data for this hospital up to August 2010, the issue of selection bias does not arise. Another hospital has been included in HIPE since 2009 but only had complete data for one year and therefore was not included in this study. A small number of non-acute hospitals, which report to HIPE, were also excluded from the analysis.

Paediatric hospitals were included in only two indicators: age at hospital admission for treatment of developmental dysplasia of the hip (DDH) and age at orchidopexy for treatment of undescended testes.

The in-hospital mortality indicators for acute myocardial infarction (AMI) and stroke are based on the principal diagnosis. This is defined as the diagnosis established after study to be chiefly responsible for occasioning an episode of admitted patient care. It should be noted that the principal diagnosis may not be the cause of death.

For these mortality indicators data were examined by individual year and in many cases the numbers were found to be too small to allow the calculation of meaningful rates for individual hospitals. Therefore, the indicators were calculated with data aggregated over 3 years, and in some cases 5 years, to ensure sufficient numbers for the calculation of rates.

In order to control for the effect of age on death rates, age standardisation was carried out. Age-standardised mortality ratios (SMRs) were calculated for all of the in-hospital mortality indicators. SMRs show whether more deaths than expected (SMR>100) or fewer deaths than expected (SMR <100) occurred if the study population (i.e. the admitted patients with the relevant diagnosis or procedure in each hospital) experienced the same age-specific mortality as the general population (i.e. the total admitted patients nationally with the relevant diagnosis or procedure during the chosen time period). Upper and lower 95% confidence intervals for SMRs were also calculated.[5]

Note that the purpose of SMRs is to compare the rates for hospitals with the national rate only. SMRs cannot be used to compare one hospital with another, as the age structure of each hospital weights the age-specific rates differently.

While the HIPE system collects data on secondary diagnoses (i.e. co-morbidities), medical card status (which can be considered a proxy for socio-economic status), and admission and discharge types including transfer status, these factors were not included in this report’s analysis as this was a preliminary high level study to determine the feasibility of HIPE as a source for these indicators. The inclusion of these additional confounding variables should be a further stage in the process of development and refinement of performance indicators based on HIPE.

[5] See Appendix 3 for the age-standardisation methodology.

Selected indicators:

- **In-hospital mortality within 30 days after acute myocardial infarction (AMI)**
  This indicator is defined as the number of patients who die in hospital within 30 days of being admitted to hospital with an AMI as a proportion of the total number of patients admitted to that hospital with an AMI. Both crude mortality rates and age-standardised mortality ratios were calculated and presented by hospital, aggregated over the three-year period 2008 to 2010. This is an OECD indicator.

- **In-hospital mortality within 30 days after ischaemic stroke**
  This indicator is defined as the number of patients who die in hospital within 30 days of being admitted to hospital with ischaemic stroke as a proportion of the total number of patients admitted to that hospital with ischaemic stroke. Both crude mortality rates and age-standardised mortality ratios were calculated and presented by hospital, aggregated over the three-year period 2008 to 2010. This is an OECD indicator.

- **In-hospital mortality within 30 days after haemorrhagic stroke**
  This indicator is defined as the number of patients who die in hospital within 30 days of being admitted to hospital with haemorrhagic stroke as a proportion of the total number of patients admitted to that hospital with haemorrhagic stroke. Both crude mortality rates and age-standardised mortality ratios were calculated and presented by hospital, aggregated over the three-year period 2008 to 2010. This is an OECD indicator.

- **In-hospital mortality within 30 days following hip fracture surgery**
  This indicator is defined as the number of patients undergoing hip fracture surgery who die in hospital within 30 days of admission as a proportion of the total number of patients who underwent hip fracture surgery. Both crude mortality rates and age-standardised mortality ratios were calculated and presented by hospital, aggregated over the five-year period 2006 to 2010. This is not an OECD indicator.

- **In-hospital mortality within 30 days after colectomy for emergency admissions**
  This indicator is defined as the number of patients undergoing colectomy surgery and admitted as an emergency who die in hospital within 30 days of admission as a proportion of the total number of emergency admissions who underwent a colectomy. Both crude mortality rates and age-standardised mortality ratios were calculated and presented by hospital, aggregated over the five-year period 2006 to 2010. This is not an OECD indicator.

- **Time to hip fracture surgery**
  This indicator is defined as the time from admission of a person 65 years or older with a principal diagnosis of fractured neck of femur to time of surgery for the fracture aggregated over the period 2008-2010. This is an OECD indicator.

- **Age at orchidopexy**
  This indicator is defined as age at which orchidopexy is undertaken for the treatment of undescended testes. This is reported as number and proportion of cases by age group and HSE region of residence over the five-year period 2006 to 2010. This is not an OECD indicator.

Other indicators considered:

- Age at first hospital admission with developmental dysplasia of hip (DDH) was calculated from age at first admission to hospital with a principal diagnosis of DDH. This is not an OECD indicator.

- Rate of postoperative pulmonary embolism (PE) or deep vein thrombosis (DVT). This is an OECD indicator.

- Rate of catheter related blood stream infections. This was an OECD indicator.

- Number and percentage of patients with ST elevated myocardial infarction who received thrombolysis or cardiac catheterisation within the following 24 hours. This is not an OECD indicator.

- Number of falls in hospitals as a percentage of all inpatient discharges. This is not an OECD indicator.

- Rate of ventilator associated pneumonia (VAP). This is not an OECD indicator.

For a full description of the selected indicator definitions see Appendix 1. The reasons for the non-inclusion of the other indicators under consideration are set out in the next chapter. Note that hospital names are not included in this report. The data in each table has been sorted by the highest number of cases, and the hospitals have been numbered accordingly with the same hospital number used in the associated graphs. Hospitals have been numbered for each indicator separately, and so for example, hospital 1 in one table is not necessarily the same hospital as hospital 1 in a different table.

Initial analysis of the data revealed that a small number of hospitals reported 30-day in hospital mortality rates after AMI or stroke that were statistically significantly higher than expected at the 95% confidence level.[6] Following discussion with the Quality and Patient Safety Directorate of the Health Service Executive (HSE) these hospitals were sent these preliminary findings in relation to their data. Many of these hospitals reviewed their HIPE and/or certain healthcare records. The extent and method of review varied by hospital, but the majority of hospitals undertook a review, led by a senior clinician, of the healthcare records of patients who died in hospital following admission with the principal diagnosis under investigation. As stated these hospitals identified a number of issues in relation to their data, including incorrect recording of the primary reason for admission (principal diagnosis) in the healthcare record and, to lesser extent, incorrect coding from the healthcare record into the HIPE system. The findings from these reviews are included in the text of the report.

When this issue of data quality was highlighted by the hospitals which reviewed their data, all publicly funded acute hospitals were then communicated with by the office of Chief Medical Officer and the Quality and Patient Safety Directorate of the HSE. The hospitals were informed of this issue in relation to data quality and given the opportunity to review their data including the accuracy of their HIPE data specifically focusing on HIPE data for 2011.

HIPE files for all hospitals from 2005 to 2010 were reopened on a phased basis starting with the 2010 HIPE file in December 2011. During this phased opening some hospitals made retrospective changes to their data on the HIPE system. The hospitals that reviewed their records utilised different, and in some cases not comparable, methodologies in reviewing their data.

Initially this study reviewed data from 2006 to 2010 using the closed HIPE files available in 2011. However the data presented in this final report are based on the revised HIPE files issued in 2012 to 2013 for the years 2006 to 2010 unless otherwise stated.

[6] Note that rates are said to be statistically significantly higher than expected when the lower limit of the 95% confidence interval is greater than 100. See Appendix 3 for further details.

Findings

1. In-hospital mortality within 30 days after acute myocardial infarction (AMI, heart attack)

Indicator definition

In-hospital mortality within 30 days after AMI is defined as the number of patients who die in hospital within 30 days of being admitted to hospital with a principal diagnosis of an AMI as a proportion of the total number of patients admitted to that hospital with a principal diagnosis of an AMI. Both crude mortality rates and age-standardised mortality ratios are calculated and presented by hospital, aggregated over the three-year period 2008–2010. This is an OECD indicator.

Why is this important?

Heart attack, or acute myocardial infarction (AMI), is one of the leading causes of death in Ireland. Heart attacks are life-threatening emergencies that happen when the coronary arteries, the blood vessels supplying blood to the heart muscle, are suddenly blocked. Lack of blood damages the heart muscle, weakening its function or stopping it altogether. AMI accounts for about half of the deaths from coronary artery disease (CAD), with the cost of care for CAD accounting for as much as 10% of healthcare expenditures in industrialised countries.

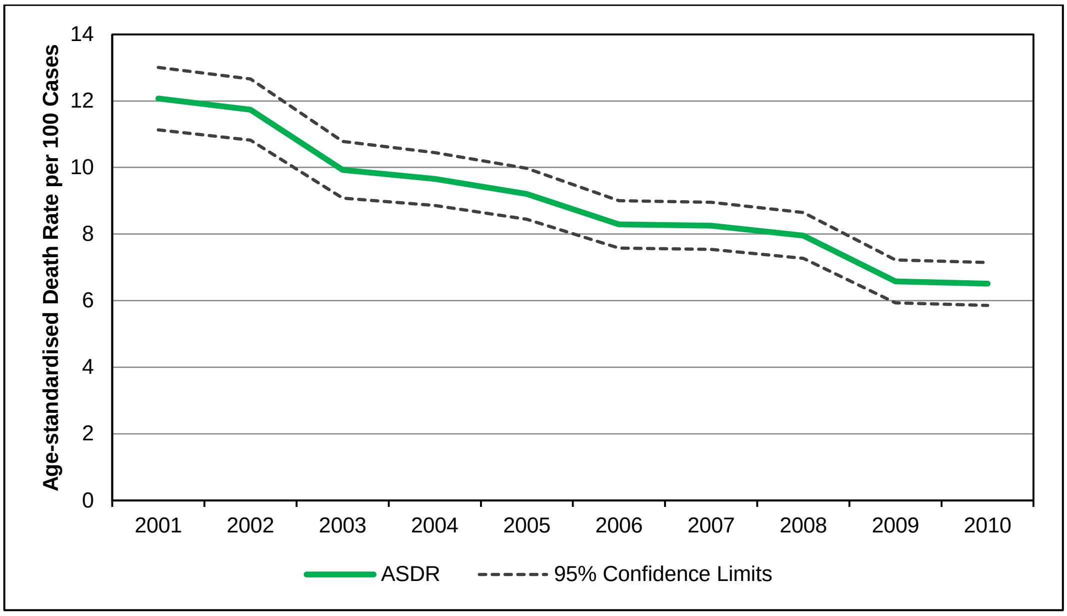
Medical care for AMI has changed radically in recent decades, with the introduction of coronary care units in the 1960s, and the advent of drug treatment (thrombolysis) in the 1980s and cardiac procedures in the 1990s (angioplasty) aimed at rapidly restoring coronary blood flow. Evidence links the processes of care for AMI, such as thrombolysis and early treatment with aspirin and beta-blockers, to survival improvements. The use of the 30-day mortality rate after AMI is a recognised outcome measure of acute care quality, and is one of the OECD Health Care Quality Indicators (HCQI).

In-hospital mortality rates are considered by the OECD and other international agencies to be useful indicators of hospital care (AHRQ, 2013). These are high-level measures, the benefit of which is that they provide for a standard international approach, which allows for cross-country comparisons. However, there is an inevitable trade-off with the precision of the indicators, particularly the lack of inclusion of co-morbidities and other confounding factors. Another limitation with respect to in-hospital mortality rates is that factors outside of the hospital's control, such as time to seeking treatment and pre-hospital care will affect these rates. In Ireland it is also not possible at present to track deaths which occur outside hospital within the 30-day period. However, in-hospital mortality rates, while they must be interpreted with caution, are useful in identifying variation that should be explored further.

Indicator Analysis

The time trend for in-hospital mortality after AMI demonstrates a significant reduction nationally over the ten year period from 2001 to 2010 (Figure 1).

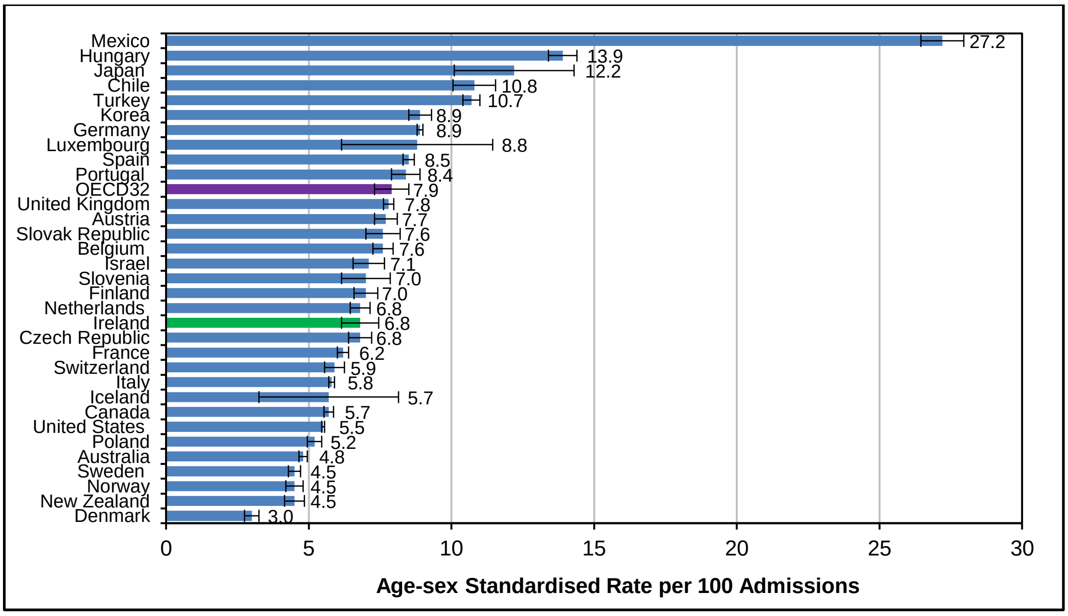
Figure 1: National age-standardised in-hospital mortality rate (ASDR) within 30 days after admission for AMI, 2001 - 2010.



Note: Data have been age-standardised to a standard population based on AMI admissions in 2008-2010.

The OECD collects and reports in-hospital mortality rates for AMI in adults aged 45 and over. The OECD rates are age-sex standardised based on the 2010 OECD population aged 45+ admitted to hospital for AMI. This method of age-sex standardisation results in rates that cannot be directly compared to the ASDRs shown in Figure 1 above, but it allows for comparison among OECD countries.[7] In 2011 (the latest year for which OECD data are currently available), the age-sex standardised rate for Ireland based on the OECD age-sex standardisation was 6.8 deaths per 100 cases which was below the OECD average of 7.9 deaths per 100 cases (Figure 2).

Figure 2: Admission-based in-hospital case-fatality rates in adults aged 45 and over within 30 days after admission for AMI, 2011 (or nearest year).



Note: 95% confidence intervals represented by |—|.
Source: OECD Health Statistics 2013.

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[7] See Appendix 3 for further details on the age standardisation methodology.

Age influences outcomes with, as expected, older age groups experiencing higher mortality rates. Therefore age-standardisation based on the population of admitted patients with AMI has been applied in this study in order to adjust for the differences in the age profile of patients between hospitals. However in this study other potential confounders e.g. co-morbidities, were not included in the analysis as this was a preliminary study to determine the feasibility of these indicators derived from HIPE.

There are also significant volumes of patients transferred in and out of hospitals with AMI. Transfer status, i.e. whether a patient is transferred in or out of hospital, is recorded on HIPE. However, HIPE is not designed to track patients and in the absence of a unique patient identifier it is not possible to accurately track individual patients between hospitals. A preliminary analysis of transfer patterns among hospitals was carried out. This analysis showed that the transfer patterns of each hospital may have a bearing on the mortality rates for that hospital, although the extent of this requires further investigation. The issue of transfers is discussed further in Appendix 2.

The clinical decision-making around both decision to and timing of transfer of patients to a centre for primary percutaneous coronary intervention (PCI) is likely to affect mortality rates. In hospitals that perform primary PCI, transfers in are likely to be patients transferred in for definitive intervention and transfers out are likely to be the repatriation of patients to their local hospital following intervention. In smaller hospitals transfers out are likely to be patients transferred out for definitive intervention and transfers in are likely to be the repatriation of patients to their local hospital following intervention.

The initial analysis (based on HIPE data as of 2011) showed 30 day in-hospital mortality ratios after AMI varied by hospital with some reported mortality ratios that were statistically significantly higher than expected at the 95% confidence level. [8]

Following the initial analysis the Quality and Patient Safety Directorate of the HSE and the small number of hospitals showing mortality rates higher than expected were communicated with. Some of these hospitals then reviewed their healthcare records. This involved clinicians and other staff reviewing the healthcare records and coding practices in relation to AMIs. These reviews found that in some cases the information within the healthcare record that recorded the principal diagnosis of AMI was not correct, that there was not enough evidence of an AMI to diagnose an AMI and that in some cases the AMI was a complicating factor in another major illness. Some hospitals also identified variation in their coding practices and changes have been implemented to bring them into line with national coding guidelines.

These reviews carried out by these hospitals although in some cases focused only on deaths after AMI, provided evidence of inconsistencies in health-care records, which may occur to a greater or lesser extent in all hospitals.

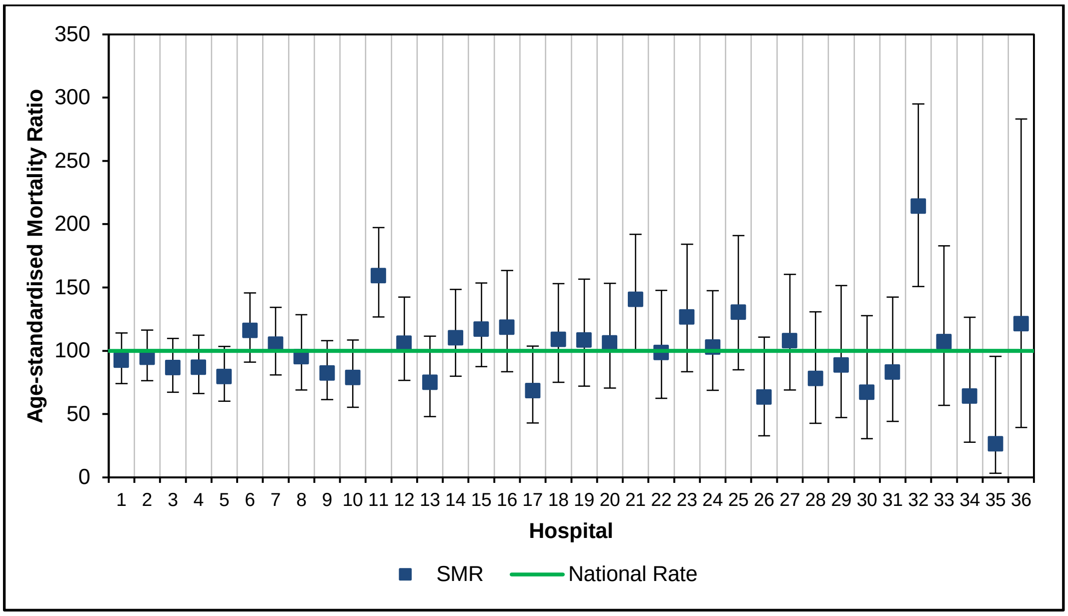
The HIPE files for the years 2005 to 2010 for all hospitals were reopened on a phased basis starting from the end of 2011. A few hospitals took the opportunity to review and revise some of their HIPE data. A further analysis was then carried out in relation to this study of the revised HIPE data following the reopening of the HIPE files. In the case of the AMI indicator there are some differences in the calculated indicators using the original HIPE data and the revised HIPE data. One hospital made changes to their HIPE data for 2009 and 2010, leading to differences in both the numerator and denominator. This resulted in significant changes to their crude mortality rate and their age-standardised mortality ratio, so that the SMR was no longer statistically significantly above the national average. These significant changes were also reflected in a reduction from 7.2 per 100 cases to 7.0 in the overall national mortality rate. This in turn led to minor changes in the age-standardised mortality ratios for all hospitals, although some hospitals still showed mortality ratios that were statistically significantly higher than expected at the 95% confidence level (Table 1 and Figure 3).

[8] Where the lower limit of the 95% confidence interval is above 100 it can be said with 95% confidence that the rate is higher than expected and is statistically significant.

Table 1: In-hospital mortality within 30 days after admission for AMI, 2008 - 2010

Hospital	Number of Cases	Crude Mortality Rate per 100 Cases	Age-standardised Mortality Ratio (SMR)	Lower 95% Confidence Limit for SMR	Upper 95% Confidence Limit for SMR
1	1575	5.5	92.4	74.0	114.0
2	1433	6.4	94.7	76.3	116.3
3	1139	6.0	86.6	67.3	109.8
4	1126	5.2	87.0	66.2	112.2
5	994	5.6	79.6	60.1	103.4
6	969	7.6	116.0	91.1	145.6
7	862	7.4	105.2	81.0	134.4
8	858	5.0	95.3	69.0	128.4
9	852	6.1	82.3	61.5	107.9
10	737	5.0	78.7	55.4	108.4
11	573	14.5	159.2	126.8	197.4
12	565	7.6	105.8	76.6	142.5
13	538	4.5	74.9	48.0	111.5
14	529	8.1	110.2	79.8	148.5
15	510	10.2	117.1	87.5	153.6
16	481	7.7	118.5	83.4	163.3
17	419	5.3	68.4	42.9	103.6
18	373	8.8	108.9	75.0	153.0
19	366	7.7	108.3	72.0	156.5
20	356	7.9	106.1	70.5	153.3
21	336	11.6	140.4	99.8	191.9
22	320	7.2	98.4	62.4	147.7
23	313	8.6	126.5	83.4	184.1
24	306	9.5	102.7	68.8	147.6
25	277	9.4	130.3	85.1	190.9
26	274	4.4	63.4	32.8	110.8
27	270	8.9	107.9	69.1	160.5
28	248	5.6	77.9	42.6	130.7
29	190	6.8	88.7	47.2	151.6
30	176	5.1	67.2	30.7	127.7
31	175	7.4	83.2	44.3	142.4
32	174	21.3	214.1	150.7	295.1
33	161	8.1	107.0	57.0	182.9
34	117	6.8	64.2	27.7	126.4
35	94	2.1	26.4	3.2	95.5
36	52	9.6	121.3	39.4	283.1
Total	**18738**	**7.0**	**100**	**94.6**	**105.4**

Figure 3: Age-standardised mortality ratios (SMRs) and 95% confidence intervals for in-hospital mortality within 30 days after admissions with AMI, 2008 – 2010



Note: 95% confidence intervals represented by |—|.

Conclusion on the feasibility of the performance indicator

This indicator fulfils some of the criteria for feasibility assessed in this study. For example the required variables are available in HIPE and there are sufficient numbers of cases for meaningful analysis. The indicator is based on an OECD indicator, 30-day in-hospital mortality following AMI, which has a standard definition therefore facilitating international comparison. However, as a result of changes in definition and the availability of new biomarkers in the last decade the term, AMI, is little used now in clinical practice. It is likely that at hospital level there is some crossover in assignment and coding of non ST elevated myocardial infarction (within AMI definition) and unstable angina (within the acute coronary syndrome definition). [9]

30 day in-hospital mortality after AMI measures death in hospital after AMI. It is important to note that the indicator does not attribute the mortality to the principal diagnosis. It does not attribute the death to AMI as such. While on the one hand this may be seen as a limitation, on the other hand death in hospital following an AMI, whether from the AMI or another cause, may also be a reflection of quality of care.

However this indicator does have a number of limitations. As there is no unique patient identifier the data are presented by admission episodes rather than by patient. Episode based indicators may lead to overestimation of the number of cases (denominator). The inclusion of a unique patient identifier would allow for the calculation of a patient based indicator. This would also support the tracking of patients between hospitals leading to an improvement in the reliability of this indicator.

The 30-day mortality in hospital rates are likely to be affected by factors that occur before or after treatment within hospital, such as access and care prior to reaching hospital, within the emergency department or following discharge from hospital. Another factor that may be important is the transfer patterns among hospitals, and therefore development of systems that can capture this data would improve the measure.

Patient factors including co-morbidities and medication use, patient help-seeking behaviour following onset of symptoms and social deprivation were not included in this analysis and are likely to affect

[9] Note that the Australian Coding Standard ACS 0940 (Ischaemic Heart Disease) provides guidance on coding these conditions.

mortality rates. A more developed analysis that accounts for these may improve this aspect of the measure.

However, one of the main issues highlighted by this preliminary analysis and the subsequent review by the HSE and the hospitals was that the reliability of this indicator is impacted on by a lack of consistency in the documentation of AMI in the healthcare record and coding onto the HIPE system.

The observed variation in recorded in-hospital mortality rates is based directly on the data returned by each hospital to HIPE and so even in this preliminary form can be used by the hospitals and the HSE to indicate that further exploration and analysis would be beneficial in monitoring the quality of the care provided.

A number of issues have been highlighted in this study including the quality of the data and the possible addition of other co-variables in the analysis that would strengthen this indicator. These issues should be taken into account in the further development and analysis of mortality indicators post AMI.

2. In-hospital mortality within 30 days after stroke

Indicator definition

This study assessed two indicators on in-hospital mortality rate after stroke. Based on OECD definitions, the study analysed mortality rates after both ischaemic stroke and haemorrhagic stroke. This study reports the findings and conclusions for each indicator separately. The indicators are defined as the number of patients who die in hospital within 30 days of being admitted to hospital with a principal diagnosis of ischaemic or haemorrhagic stroke as a proportion of the total number of patients admitted to that hospital with ischaemic or haemorrhagic stroke. Both crude mortality rates and age-standardised mortality ratios are calculated and presented by hospital, aggregated over the three-year period 2008 – 2010. These are OECD indicators.

Why is this important?

Stroke is a leading cause of mortality in Ireland. A stroke is the sudden death of brain cells in a localized area due to inadequate blood flow caused by a haemorrhage or ischaemia.

Many patients who survive a stroke are left with disability. The impact of a stroke depends on what part of the brain is affected and how severe the damage is. The effects can range from mild impairments to devastating loss of abilities, including mobility, speech, vision or memory. These disabling effects of stroke leave more than half of stroke survivors needing some assistance in their day-to-day activities.

Treatment for stroke has changed dramatically over the last decade. Until the 1990s, it was largely accepted that the damage to the brain was irreversible and treatment focused on prevention of complications and on rehabilitation. Now it is clear that thrombolytic treatment for ischemic stroke and timely diagnosis and therapy for all stroke victims in dedicated stroke units improves survival and limits disability.

Variations in stroke mortality rates reflect many factors including early recognition of symptoms, seeking medical care as quickly as possible and possible differences in the care provided.

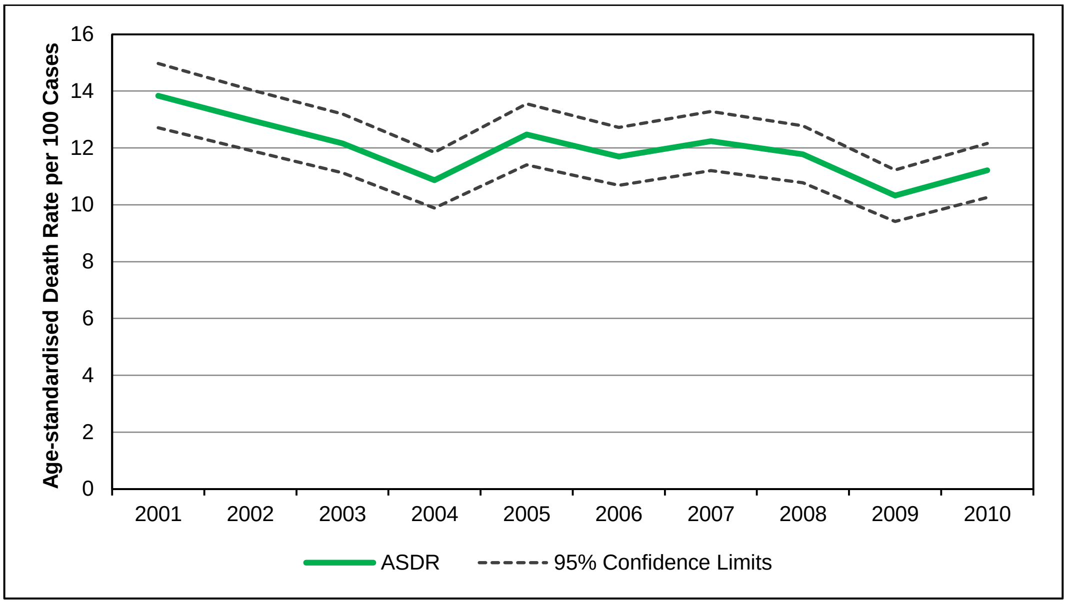
Monitoring the proportion of patients who die in hospital after a stroke can be used to review practice patterns, monitor performance, and can lead to improvements in care. In-hospital mortality rates are considered by the OECD and other international agencies to be useful indicators of hospital care. These are high-level measures, the benefit of which is that they provide for a standard international approach, which allows for cross-country comparisons. However, as there is a lack of inclusion of other variables, for example co-morbidities, in these indicators there is an inevitable trade-off with the precision of the indicators. Another important limitation with respect to these in-hospital mortality rates are that factors outside of the hospital's control, such as time to seeking treatment and pre-hospital care will affect these rates. In Ireland it has not been possible to track deaths which occur outside hospital within the 30-day period although this is something that may be possible in the future. However, in-hospital mortality rates, while they must be interpreted with caution, are useful in identifying variation that should be explored further.

2.1 Indicator analysis: In-hospital mortality within 30 days after ischaemic stroke.

Initially this study reviewed data from 2008 to 2010 using the closed HIPE files available in 2011. Subsequently all HIPE files from 2005 to 2010 were reopened and some hospitals made revisions to their HIPE data, e.g. some hospitals coded additional cases or revised the coding of previously reported cases. The data presented here are based on the revised HIPE files. An analysis was carried out of the HIPE data before and after the reopening of the HIPE files, and it was found that there were only minimal changes in the data which did not affect the identified statistically significant findings for the age-standardised mortality ratios.

There has been a reduction in the 30-day age-standardised in-hospital mortality rate after ischaemic stroke over the ten year period from 2001 to 2010 (Figure 4).

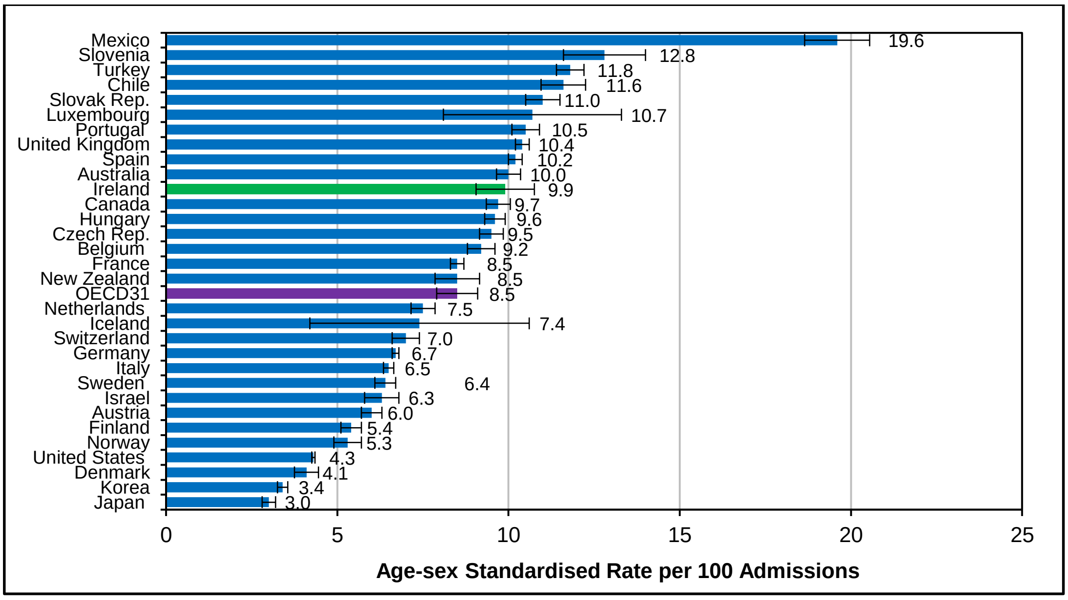
Figure 4: National, age-standardised in-hospital mortality rate (ASDR) within 30 days after admission for ischaemic stroke, 2001 - 2010.



Note: Data have been age-standardised to a standard population based on ischaemic stroke admissions in 2008-2010.

The OECD collects and reports in-hospital mortality rates for ischaemic stroke in adults aged 45+. The OECD rates are age-sex standardised based on the 2010 OECD population aged 45+ admitted to hospital for ischaemic stroke. This method of age-sex standardisation results in rates that cannot be directly compared to the ASDRs shown in Figure 4 above, but it allows for comparison among OECD countries.[10] In 2011 (the latest year for which OECD data are currently available), the age-sex standardised rate for Ireland based on the OECD age-sex standardisation was 9.9 deaths per 100 cases which did not compare favourably with the average OECD rate of 8.5 per 100 cases (Figure 5).

Figure 5: Admission-based in-hospital case-fatality rates in adults aged 45 and over within 30 days after admission for Ischaemic Stroke, 2011 (or nearest year)



Note: 95% confidence intervals represented by |—|.
Source: OECD Health Statistics 2013.

[10] See Appendix 3 for further details on the age standardisation methodology.

There was variation in the mortality ratios of hospitals when age-standardised mortality ratios based on the population of admitted patients with ischaemic stroke were calculated as compared with the crude rates. This reflects and takes account of differences in the patient age profiles across hospitals (Table 2).

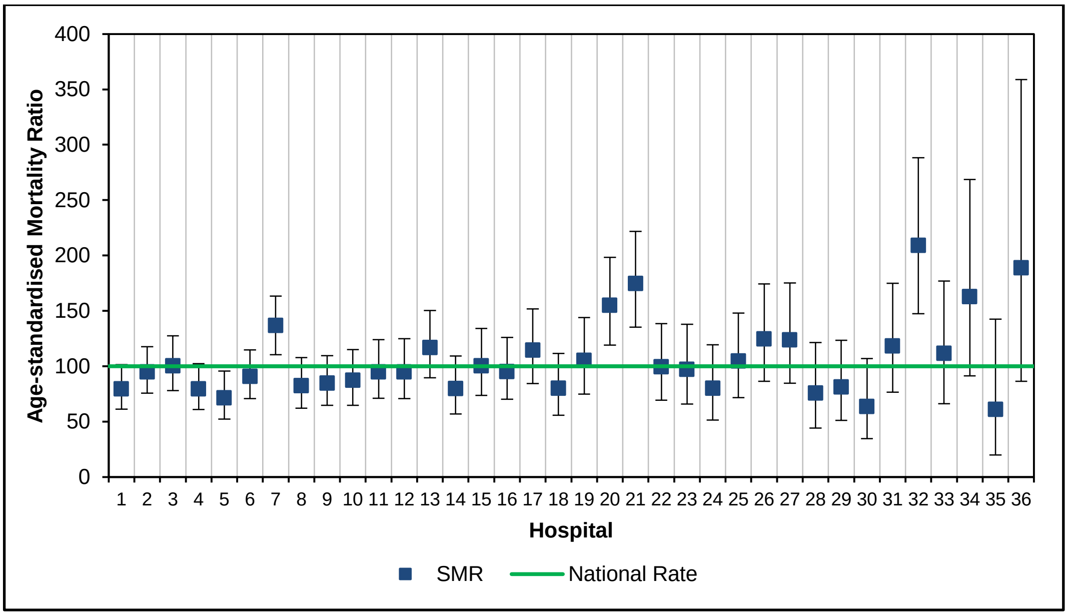
There are significant volumes of patients transferred in and out of hospitals with stroke. Transfer status, i.e. whether a patient is transferred in or out of hospital, is recorded on HIPE. However, HIPE is not designed to track patients and in the absence of a unique patient identifier it is not possible to accurately track individual patient between hospitals. A preliminary analysis of transfer patterns among hospitals was carried out. This analysis showed that the transfer patterns of each hospital may have a bearing on the mortality rates for that hospital, although the extent of this requires further investigation (see Appendix 2).

Table 2: In-hospital mortality rate following ischaemic stroke within 30 days, by hospital, 2008 - 2010

Hospital	Number of Cases	Crude Mortality Rate per 100 Cases	Age-standardised Mortality Ratio (SMR)	Lower 95% Confidence Limit for SMR	Upper 95% Confidence Limit for SMR
1	806	8.1	79.6	61.4	101.5
2	756	11.0	94.9	75.6	117.7
3	732	9.2	100.5	77.9	127.6
4	720	8.6	79.7	61.1	102.2
5	719	6.3	71.5	52.2	95.7
6	680	10.3	90.8	70.8	114.7
7	680	15.1	136.9	110.5	163.4
8	662	8.2	82.6	62.1	107.8
9	582	10.1	84.9	64.6	109.5
10	474	10.5	87.3	64.8	115.1
11	473	11.2	94.9	71.1	124.1
12	468	10.9	95.0	70.8	125.0
13	445	13.7	116.9	89.5	150.2
14	441	8.8	80.0	56.9	109.4
15	410	11.2	100.5	73.6	134.1
16	410	11.7	95.1	70.1	126.1
17	392	12.2	114.5	84.4	151.8
18	384	9.1	80.2	55.9	111.5
19	356	11.0	105.3	74.9	144.0
20	344	18.3	155.1	119.1	198.4
21	317	21.1	174.8	135.4	221.9
22	313	11.2	99.7	69.4	138.6
23	293	10.6	97.2	66.0	137.9
24	290	8.3	80.3	51.5	119.5
25	237	13.5	104.9	71.7	148.1
26	219	15.5	124.8	86.4	174.4
27	218	14.7	124.0	84.8	175.1
28	212	8.0	75.9	44.2	121.5
29	200	11.0	81.5	51.1	123.3
30	195	7.2	63.7	34.8	106.9
31	166	15.1	118.5	76.7	174.9
32	145	25.5	209.2	147.3	288.4
33	127	14.2	111.8	66.3	176.8
34	75	20.0	162.9	91.2	268.6
35	62	8.1	61.0	19.8	142.5
36	51	17.6	189.0	86.4	358.8
Total	**14054**	**11.1**	**100**	**95.0**	**105.0**

When adjusted for age some hospitals reported rates statistically higher than expected at the 95% confidence level in the period 2008-2010 (Table 2 and Figure 6). These hospitals were contacted by the Quality and Patient Safety Directorate of the HSE to highlight these issues. Some of these hospitals reviewed the healthcare records of all deaths after an admission for ischaemic stroke. The senior clinicians who reviewed the healthcare records concluded that based on the information within the healthcare record, the principal diagnosis of stroke as written in the healthcare record was not correct in a proportion of those records. These reviews were limited by the fact that they examined only deaths after ischaemic stroke, rather than examining all cases with a principal diagnosis of ischaemic stroke, and therefore the degree or direction by which these inconsistencies would affect the mortality rates could not be identified. However, they do provide evidence of inconsistencies in record keeping, which may occur to a greater or lesser extent in all hospitals.

Figure 6: In-hospital Mortality rate following ischaemic stroke within 30 days, by hospital, 2008 – 2010



Note: 95% confidence intervals represented by |—|.

It was also noted that there were many instances where on review the primary cause of death was not stroke, although it was an antecedent cause. This highlights a characteristic of the OECD 30 day in-hospital indicator used. 30-day in-hospital mortality after stroke measures death in hospital, after stroke. It does not attribute the death to stroke as such. While on one hand this may be seen as a limitation, on the other hand death in hospital following a stroke, whether from the stroke or another cause, may also be a reflection of quality of care.

Other hospitals identified variation in coding practice in their HIPE records compared with their in-house stroke register and other hospitals referred to developments in clinical care.

Conclusion on feasibility of performance indicator: In-hospital mortality within 30 days after ischaemic stroke.

This analysis shows that it should be feasible to use an indicator on in-hospital mortality rate within 30 days after ischaemic stroke, derived from HIPE. However there are a number of significant limitations that impact on the reliability of this indicator.

The reviews undertaken by a small number of hospitals showed a lack of consistency in the documentation of stroke in the healthcare record and the subsequent coding onto the HIPE system. Therefore the quality of the healthcare record and the data inputted should be improved to support the use of this indicator in the future.

It is important to note that the indicator does not attribute the mortality to the principal diagnosis. As there is no unique patient identifier the data are presented by admission episodes rather than by patient. Episode based indicators may lead to overestimation of the number of cases (denominator). The inclusion of a unique patient identifier would allow for the calculation of a patient based indicator. This would also support the tracking of patients between hospitals leading to an improvement in the reliability of this indicator.

Patient factors including co-morbidities and medication use are likely to affect mortality rates and more developed analyses that may account for some of these issues may improve this measure.

The 30-day mortality in hospital rates are likely to be affected by factors that occur before or after treatment within hospital, such as access and care prior to reaching hospital, within the emergency department or following discharge from hospital. Another factor that may be important is the transfer patterns among hospitals, and therefore development of systems that can capture this data would improve the measure.

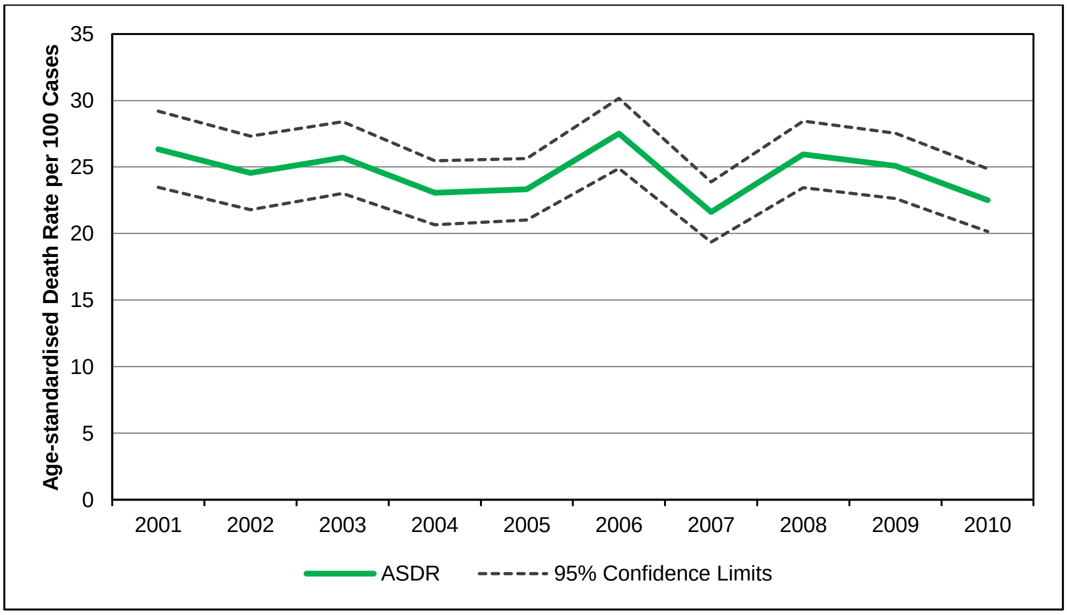
However it should also be noted that the observed variation in the recorded 30 day in-hospital mortality rates for ischaemic stroke is based directly on the data returned by each hospital to HIPE. Therefore even with the highlighted limitations it is still a useful measure in identifying areas requiring further exploration both in relation to data collection and quality clinical care. Further developments as described above can support this indicator in becoming a more reliable and useful indicator in the Irish health system.

2.2 Indicator analysis: In-hospital mortality within 30 days after haemorrhagic stroke.

Initially this study reviewed data from 2008 to 2010 using the closed HIPE files available in 2011. Subsequently all HIPE files from 2005 - 2010 were reopened and some hospitals made revisions to their HIPE data, e.g. some hospitals coded additional cases or revised the coding of previously reported cases. The data presented here are based on the revised HIPE files. An analysis was carried out of the HIPE data before and after the reopening of the HIPE files, and it was found that there were only minimal changes in the data which didn't affect the identified statistically significant findings for the age-standardised mortality ratios.

There has been little change in the 30-day age-standardised in-hospital mortality rate after haemorrhagic stroke over the ten year period from 2001 to 2010 (Figure 7).

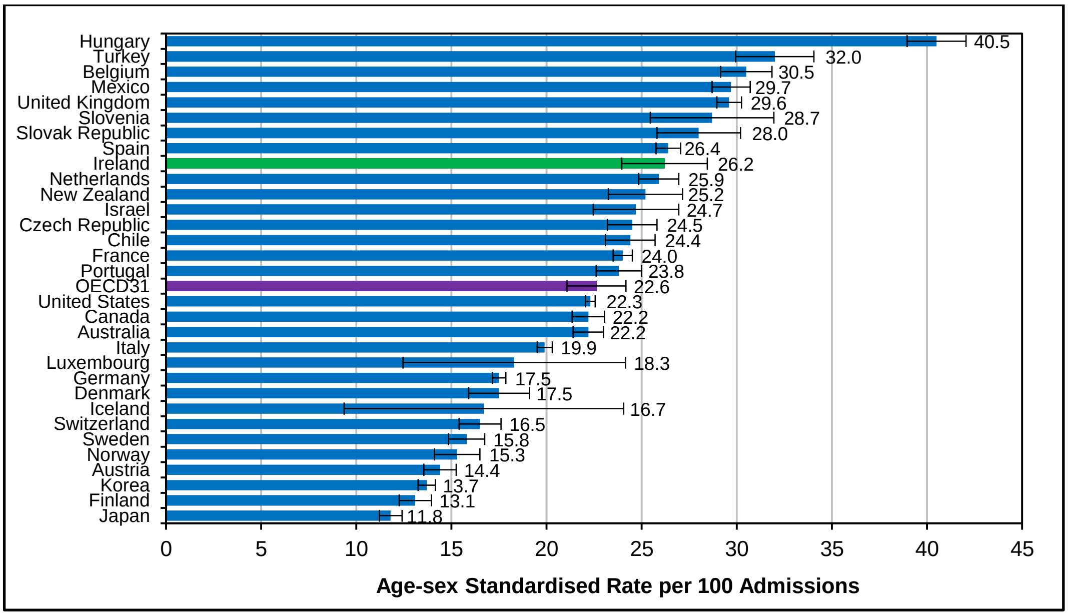
Figure 7: National, age-standardised in-hospital mortality rate (ASDR) within 30 days after admission for haemorrhagic stroke, as reported to HIPE, 2001 - 2010.



Note: Data have been age-standardised to a standard population based on haemorrhagic stroke admissions in 2008-2010.

The OECD collects and reports in-hospital mortality rates for haemorrhagic stroke in adults aged 45 and over. The OECD rates are age-sex standardised based on the 2010 OECD population aged 45+ admitted to hospital for haemorrhagic stroke. This method of age-sex standardisation results in rates that cannot be directly compared to the ASDRs shown in Figure 7 above, but it allows for comparison among OECD countries.[11] In 2011 (the latest year for which OECD data are currently available), the age-sex standardised rate for Ireland based on the OECD age-sex standardisation was 26.2 deaths per 100 cases which was above the OECD average of 22.6 deaths per 100 cases (Figure 8).

Figure 8: Admission-based in-hospital case-fatality rates in adults aged 45 and over within 30 days after admission for Haemorrhagic Stroke, 2011 (or nearest year)



Note: 95% confidence intervals represented by |—|.
Source: OECD Health Statistics 2013.

There was variation in the mortality rates of hospitals when age-standardised mortality ratios based on the population admitted with haemorrhagic stroke were calculated as compared with the crude rates. This reflects and takes account of differences in the patient age profiles across hospitals.

There are significant volumes of patients transferred in and out of hospitals with stroke. Transfer status, i.e. whether a patient is transferred in or out of hospital, is recorded on HIPE. However, HIPE is not designed to track patients and in the absence of a unique patient identifier it is not possible to accurately track individual patient between hospitals. A preliminary analysis of transfer patterns among hospitals was carried out. This analysis shows that the transfer patterns of each hospital may have a bearing on the mortality rates for that hospital, although the extent of this requires further investigation (see Appendix 2).

When adjusted for age a small number of hospitals reported rates that were statistically significantly higher than expected at the 95% confidence level while one hospital reported a statistically significant lower rate than expected (Table 3 and Figure 9). The hospitals with reported rates that were statistically significantly higher than expected were contacted by the Quality and Patient Safety Directorate of the HSE to highlight these issues and to provide follow up.

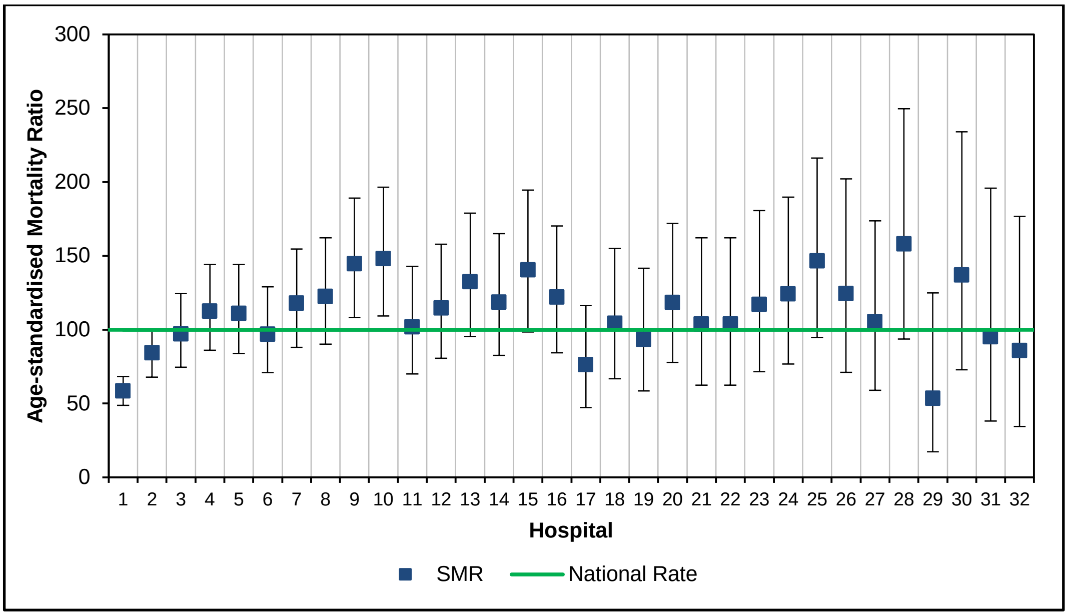
[11] See Appendix 3 for further details on the age standardisation methodology.

Table 3: In-hospital Mortality rate following haemorrhagic stroke within 30 days, by hospital, 2008 - 2010

Hospital	Number of Cases	Crude Mortality Rate per 100 Cases	Age-standardised Mortality Ratio (SMR)	Lower 95% Confidence Limit for SMR	Upper 95% Confidence Limit for SMR
1	1131	12.1	58.5	48.7	68.2
2	550	18.4	84.3	67.9	100.8
3	219	28.3	97.1	74.5	124.5
4	213	28.6	112.4	86.0	144.3
5	201	27.9	111.0	83.9	144.2
6	197	23.4	96.7	70.8	129.0
7	180	28.9	117.9	88.0	154.6
8	168	28.6	122.3	90.1	162.1
9	145	36.6	144.6	108.3	189.1
10	130	36.9	148.1	109.2	196.4
11	116	28.4	101.8	70.1	143.0
12	115	32.2	114.6	80.7	157.9
13	113	37.2	132.4	95.4	179.0
14	107	32.7	118.6	82.6	165.0
15	101	35.6	140.5	98.4	194.5
16	99	34.3	121.9	84.4	170.3
17	98	21.4	76.2	47.2	116.5
18	95	25.3	104.2	66.8	155.1
19	84	26.2	93.4	58.6	141.5
20	84	32.1	118.2	77.9	172.0
21	72	26.4	103.8	62.5	162.2
22	68	27.9	103.8	62.5	162.1
23	63	31.7	117.0	71.5	180.7
24	59	35.6	124.1	76.8	189.7
25	59	42.4	146.5	94.8	216.3
26	57	28.1	124.4	71.1	202.1
27	50	30.0	105.3	58.9	173.6
28	48	37.5	157.9	93.6	249.6
29	38	13.2	53.5	17.4	124.8
30	33	39.4	136.9	72.9	234.0
31	28	25.0	95.0	38.2	195.8
32	27	25.9	85.8	34.5	176.8
33	20	-	-	-	-
34	17	-	-	-	-
35	9	-	-	-	-
36	8	-	-	-	-
Total	**4802**	**24.5**	**100**	**94.3**	**105.7**

Note: Rates based on small numbers of cases can be unreliable and as a result have very wide confidence intervals. For this reason the rates for hospitals with less than 25 cases are not shown in this table.

Figure 9: In-hospital Mortality rate following haemorrhagic stroke within 30 days, by hospital, 2008 – 2010



Note: 95% confidence intervals represented by |—|. Hospitals with less than 25 cases are not shown in this graph.

A senior clinician at one hospital audited the admissions for haemorrhagic stroke. It was found that there was insufficient information in a small number of records, but all the remaining cases had been correctly recorded in the healthcare record and entered onto the HIPE system as a haemorrhagic stroke as per the OECD definition. Another hospital identified variation in coding practice in their HIPE records compared with their in-house stroke register.

It should be noted that although the OECD names the indicator 'haemorrhagic stroke', the ICD codes included cover other forms of non-traumatic intracranial bleeding, including non-traumatic subdural haemorrhage.

Conclusion on feasibility of performance indicator: In-hospital mortality within 30 days after haemorrhagic stroke.

This analysis shows that it should be feasible to use an indicator on in-hospital mortality rate within 30 days after haemorrhagic stroke derived from HIPE. However there are a number of significant limitations that impact on the reliability of this indicator.

The reviews undertaken by a small number of hospitals showed a lack of consistency in the documentation of stroke in the healthcare record and the subsequent coding onto the HIPE system. Therefore the quality of the healthcare record and the data inputted should to be improved to support the use of this indicator in the future.

It is important to note that the indicator does not attribute the mortality to the principal diagnosis. As there is no unique patient identifier the data are presented by admission episodes rather than by patient. Episode-based indicators may lead to overestimation of the number of cases (denominator). The inclusion of a unique patient identifier would allow for the calculation of a patient based indicator. This would also support the tracking of patients between hospitals leading to an improvement in the reliability of this indicator.

Patient factors including co-morbidities and medication use are likely to affect mortality rates and more developed analyses that may account for some of these issues may improve this measure.

The 30-day mortality in hospital rates are likely to be affected by factors that occur before or after treatment within hospital, such as access and care prior to reaching hospital, within the emergency department or following discharge from hospital. Another factor that may be important is the transfer patterns among hospitals, and therefore development of systems that can capture this data would improve the measure.

However it should also be noted that the observed variation in the recorded 30-day in-hospital mortality rates for haemorrhagic stroke is based directly on the data returned by each hospital to HIPE. Therefore even with the highlighted limitations it is still a useful measure in identifying areas requiring further exploration both in relation to data collection and clinical care. Further developments as described above can support this indicator in becoming a more reliable and useful indicator in the Irish health system.

3. In-hospital mortality within 30 days after hip fracture surgery

Indicator definition

In-hospital mortality within 30 days after hip fracture surgery is defined as the number of patients undergoing hip fracture surgery who die in hospital within 30 days of admission as a proportion of the total number of patients who underwent hip fracture surgery. Both crude mortality rates and age-standardised mortality ratios are calculated and presented by hospital, aggregated over the five year period 2006 to 2010. This is not an OECD indicator.

Why is this important?

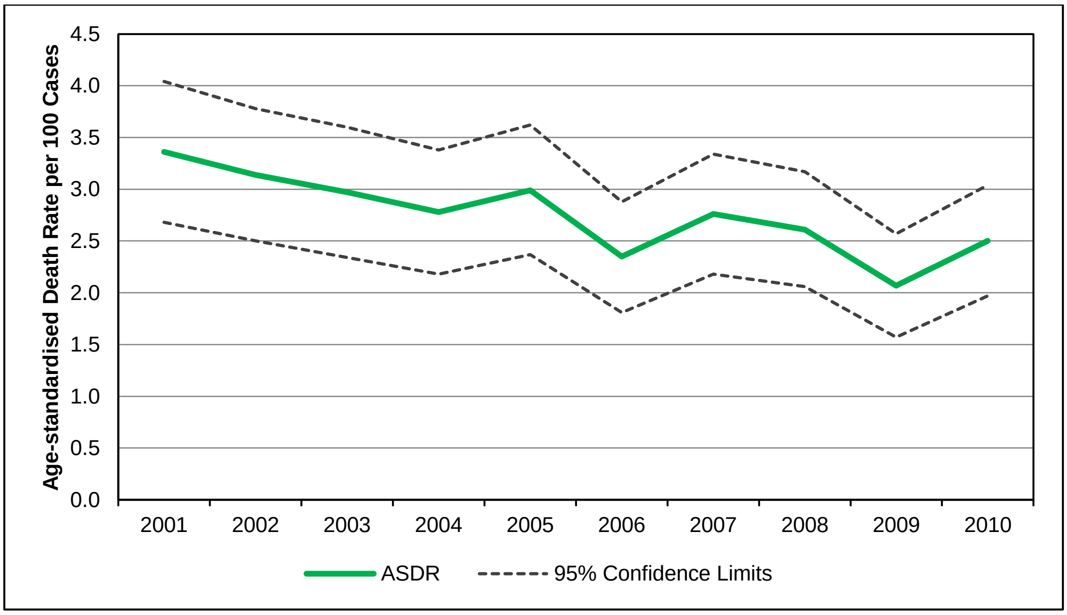
The international literature has found that surgical mortality may vary widely across hospitals and surgeons more so than would be predicted by chance alone or differences in case mix. Factors that may affect surgical mortality are procedure volume and access to effective multidisciplinary care. (Birkmeyer JD, et al, 2002; Ghaferi AA, Birkmeyer JD, and Dimick JB, 2009; Birkmeyer. JD and Dimick. JB, 2009)

Indicator analysis

Initially this indicator was based on data from 2006 to 2010 using the closed HIPE files available in 2011. Subsequently all HIPE files from 2005 to 2010 were reopened and some hospitals made revisions to their HIPE data, e.g. some hospitals coded additional cases or revised the coding of previously reported cases. The data presented here are based on the revised HIPE files. An analysis was carried out of the HIPE data before and after the reopening of the HIPE files, and it was found that there were only minimal changes in the data which didn't affect the findings for the age-standardised mortality ratios.

Nationally, age-standardised in-hospital mortality following hip fracture surgery has reduced over the 10 year period from 2001 to 2010 (Figure 10).

Figure 10: National, age standardised in-hospital mortality rate (ASDR) within 30 days following hip fracture surgery, as reported to HIPE, 2001 - 2010



Note: Data have been age-standardised to a standard population based on admissions with hip fracture surgery in 2006-2010.

For the period 2006 to 2010, the national 30 day mortality rate following hip fracture surgery was 2.46 deaths per 100 cases (Table 4 and Figure 11). Focusing on hospitals performing more than 500 operations (over the five-year period), their crude mortality rates (unadjusted for age) ranged from 1.43 deaths per 100 cases to 3.68 deaths per 100 cases. However, when adjusted for age no statistically significant differences were observed at the 95% level of confidence.

Table 4: In-hospital Mortality rate following hip fracture surgery within 30 days, by hospital, 2006 - 2010

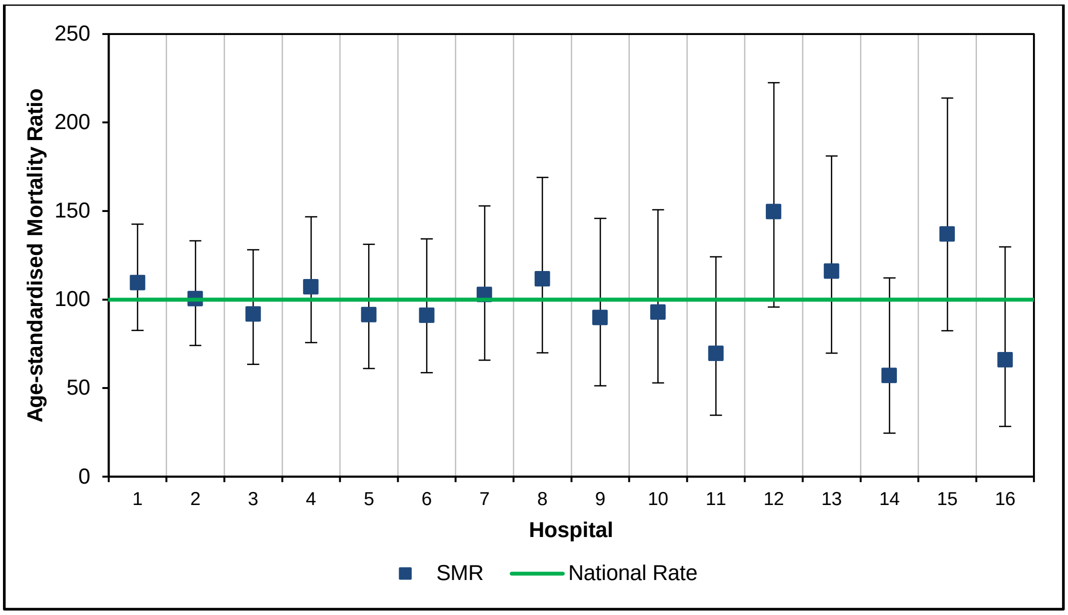
Hospital	Number of Cases	Crude Mortality Rate per 100 Cases	Age-standardised Mortality Ratio (SMR)	Lower 95% Confidence Limit for SMR	Upper 95% Confidence Limit for SMR
1	2045	2.69	109.5	82.5	142.6
2	1923	2.50	100.4	74.0	133.1
3	1438	2.36	91.7	63.5	128.2
4	1435	2.65	107.0	75.7	146.8
5	1289	2.25	91.3	61.1	131.1
6	1067	2.34	90.9	58.8	134.2
7	979	2.45	102.7	65.8	152.8
8	825	2.67	111.6	69.9	168.9
9	774	2.07	89.8	51.3	145.9
10	740	2.16	92.8	53.0	150.7
11	668	1.65	69.4	34.7	124.2
12	653	3.68	149.5	95.8	222.5
13	639	2.97	116.0	69.8	181.1
14	558	1.43	57.0	24.6	112.3
15	543	3.50	136.8	82.4	213.7
16	521	1.54	65.9	28.4	129.8
17	16	-	-	-	-
18	8	-	-	-	-
19	6	-	-	-	-
20	<5	-	-	-	-
Total	**16128**	**2.46**	**100**	**90.2**	**109.8**

Note: Rates based on small numbers of cases can be unreliable and as a result have very wide confidence intervals. For this reason the rates for hospitals with less than 25 cases are not shown in this table.

The international evidence would suggest that low surgical volume is associated with poorer outcomes (Forte M et al, 2010; Ames JB et al, 2010) and it should be noted that the four hospitals that undertook fewer than 100 surgeries over the five-year period had ceased surgery by June 2010.

Findings in hospitals with small numbers need to be interpreted with caution. Even aggregating the data over the 5 year period 2006 to 2010, the numbers of deaths remain small. The observed variations in this indicator do not result in statistical significance for any hospital.

Figure 11: In-hospital mortality rate following hip fracture surgery within 30 days, 2006 – 2010



Note: 95% confidence intervals represented by |—|. Hospitals with less than 25 cases are not shown in this graph.

Conclusion on the feasibility of the performance indicator

Preliminary assessment of this indicator as derived from HIPE suggests that it offers good potential as an outcome measure. However, due to small relatively small numbers of procedures the observation of statistically significant variation is reduced even where that variation may be important clinically.

In relation to the quality of inputting data to HIPE it is probable that both surgery and death are accurately recorded and therefore this is likely to enhance the reliability of this indicator.

As the indicator refers to a procedure the lack of an individual patient identifier is less problematic in terms of potential double-counting, although its absence still restricts the ability to follow-up on patients after discharge from hospital.

It is important to note that the indicator does not attribute the mortality to the principal procedure. Also the 30-day mortality in hospital rates are likely to be affected by factors that occur before or after treatment within hospital, such as access and care prior to reaching hospital, within the emergency department or following discharge from hospital. Another factor that may be important is the transfer patterns among hospitals, and therefore development of systems that can capture this data would improve the measure.

It is also important to note that mortality following hip fracture is generally due to a medical condition and therefore medical care and the provision of an ortho-geriatric service may affect variation in outcomes following hip fractures.

Patient factors including co-morbidities and medication use are likely to affect mortality rates and more developed analyses that account for some of these factors would improve this measure.

4. In-hospital mortality within 30 days after colectomy following emergency admission

Indicator definition

In-hospital mortality after colectomy following emergency admission is defined as the number of patients undergoing colectomy surgery following an emergency admission who die in hospital within 30 days of admission as a proportion of the total number of patients who underwent a colectomy following emergency admission. Deaths following elective colectomies are rare and so elective admissions were excluded from this study. Crude mortality rates and age-standardised mortality ratios are calculated and presented by hospital, aggregated over the five year period 2006 to 2010. This is not an OECD indicator.

Why is this important?

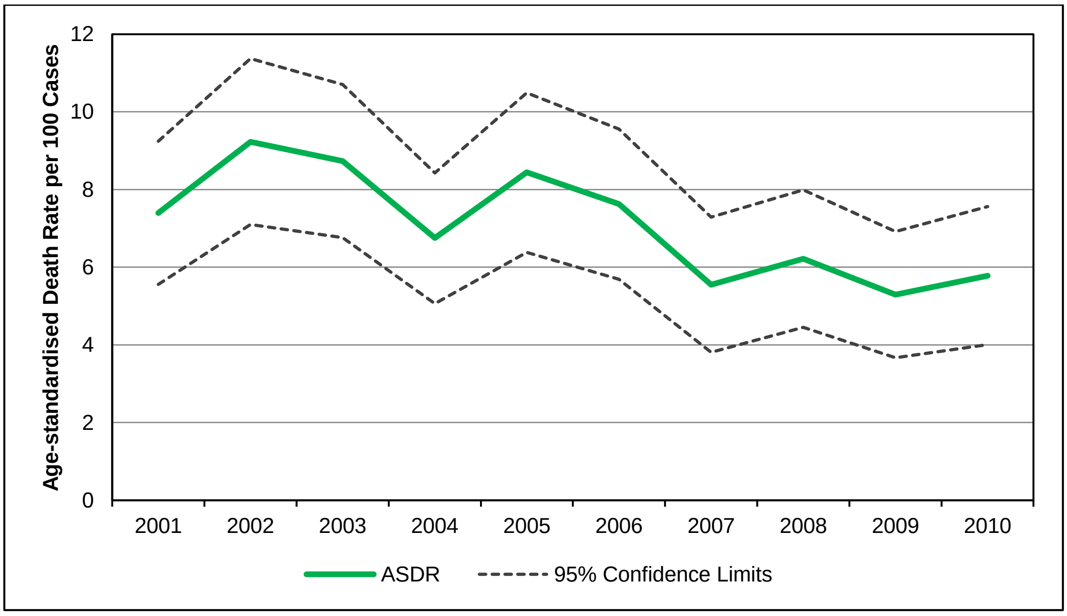
The international literature has found that surgical mortality may vary widely across hospitals and surgeons more so than would be predicted by chance alone or differences in case mix. Factors that may affect surgical mortality are procedure volume and access to effective multidisciplinary care. Internationally 30-day mortality rates following surgery, including colectomies, are commonly used to measure quality of surgical care. (Birkmeyer JD, et al, 2002; Ghaferi AA, Birkmeyer JD, and Dimick JB, 2009; Birkmeyer. JD and Dimick. JB, 2009)

Indicator analysis

Initially this study reviewed data from 2006 to 2010 using the closed HIPE files available in 2011. Subsequently all HIPE files from 2005 to 2010 were reopened and some hospitals made revisions to their HIPE data, e.g. some hospitals coded additional cases or revised the coding of previously reported cases. The data presented here are based on the revised HIPE files. An analysis was carried out of the HIPE data before and after the reopening of the HIPE files, and it was found that there were only minimal changes in the data which did not affect the findings.

Nationally age-standardised in-hospital mortality following colectomy after an emergency admission has reduced over the ten year period from 2001 to 2010 (Figure 12).

Figure 12: National, age-standardised in-hospital mortality rate (ASDR) within 30 days after emergency admission and colectomy surgery, as reported to HIPE, 2001 - 2010.



Note: Data have been age-standardised to a standard population based on emergency admissions with a colectomy procedure in 2006-2010.

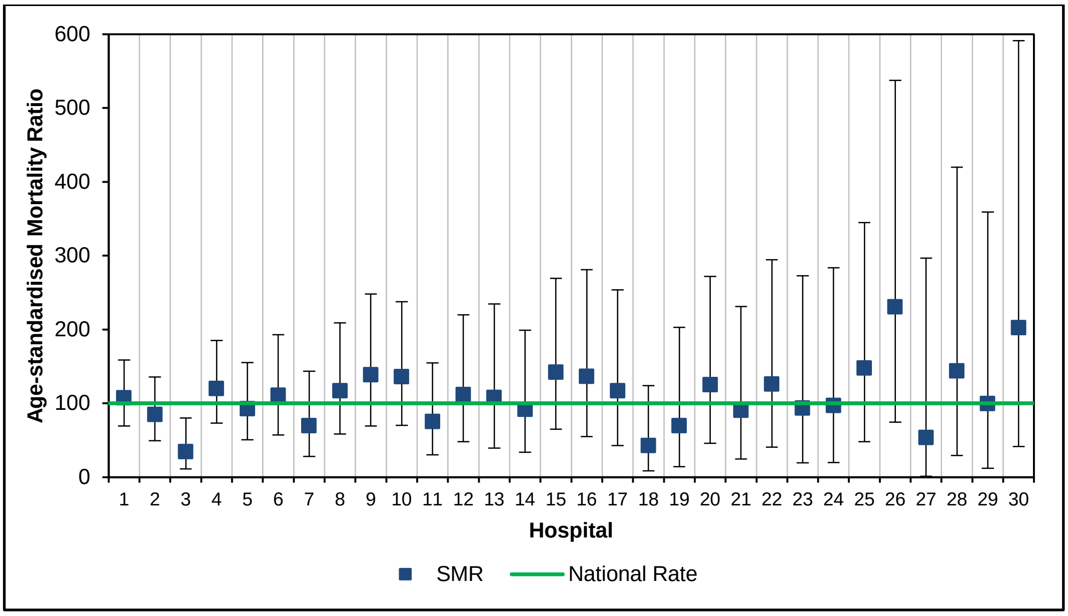
For the period 2006 to 2010, the national 30-day mortality rate following colectomy after an emergency admission was 6.11 deaths per 100 cases. There was variation in the mortality ratios of hospitals when age-standardised ratios were calculated as compared with the crude rates. This reflects and takes account of differences in the patient age profiles across hospitals (Table 5 and Figure 13).

Table 5: In-hospital Mortality rate following emergency admission & colectomy surgery within 30 days, by hospital, 2006 - 2010

Hospital	Number of Cases	Crude Mortality Rate per 100 Cases	Age-standardised Mortality Ratio (SMR)	Lower 95% Confidence Limit for SMR	Upper 95% Confidence Limit for SMR
1	379	6.6	107.4	69.5	158.5
2	363	4.7	84.7	49.3	135.6
3	299	1.7	34.4	11.2	80.3
4	269	7.4	120.0	73.3	185.3
5	225	6.2	92.5	50.6	155.2
6	186	6.5	110.6	57.1	193.1
7	175	4.0	69.6	28.0	143.4
8	163	6.8	116.8	58.3	208.9
9	133	8.3	138.5	69.2	247.9
10	130	9.2	136.0	70.3	237.6
11	124	5.7	75.1	30.2	154.7
12	114	7.0	111.6	48.2	219.8
13	103	5.8	107.9	39.6	234.8
14	102	5.9	91.5	33.6	199.1
15	102	8.8	141.9	64.9	269.4
16	93	7.5	136.5	54.9	281.2
17	86	7.0	116.7	42.8	253.9
18	84	3.6	42.5	8.8	124.1
19	82	3.7	69.4	14.3	202.9
20	75	8.0	125.0	45.9	272.1
21	69	5.8	90.2	24.6	231.0
22	60	8.3	126.1	40.9	294.3
23	53	5.7	93.4	19.3	272.9
24	51	5.9	97.0	20.0	283.5
25	49	10.2	147.7	48.0	344.8
26	32	15.6	230.3	74.7	537.3
27	30	3.3	53.3	1.3	296.8
28	29	10.3	143.7	29.6	419.9
29	28	7.1	99.3	12.0	358.9
30	25	12.0	202.3	41.7	591.3
31	21	-	-	-	-
32	17	-	-	-	-
33	8	-	-	-	-
34	<5	-	-	-	-
35	<5	-	-	-	-
36	<5	-	-	-	-
Total	**3767**	**6.11**	**100**	**87.1**	**112.9**

Note: Rates based on small numbers of cases can be unreliable and as a result have very wide confidence intervals. For this reason the rates for hospitals with less than 25 cases are not shown in this table.

Figure 13: In-hospital mortality rate following emergency admission & colectomy surgery within 30 days, by hospital, 2006 – 2010



Note: 95% confidence intervals represented by |—|. Hospitals with less than 25 cases are not shown in this graph.

There were no statistically significant higher than expected mortality ratios at the 95% confidence level recorded for emergency colectomy for any hospital, while one hospital recorded a statistically significantly lower than expected age-standardised mortality ratio.

As with the other indicators in this analysis factors such as treatment prior to and after hospital admission and patient factors are not included in this analysis.

Conclusion on the feasibility of the performance indicator

Preliminary assessment of this indicator derived from HIPE suggests that it offers good potential as a future outcome measure. In statistical terms, small numbers, even with aggregation over several years, present a problem as the likelihood of observation of statistically significant variation is reduced. However on the other hand it is probable that details of surgery and the date of death are accurately recorded. It is also important to note that the indicator does not attribute the mortality to the principal procedure.

Based on one hospital's review of its data, the data recorded on the healthcare record and on HIPE appear to be reliable but a more extensive review would be required to assess data quality more widely across hospitals.

As the indicator refers to a procedure the lack of an individual patient identifier is less of a problem in terms of potential double-counting, although its absence still restricts the ability to follow-up on patients after discharge from hospital.

30-day mortality after colorectal surgery is a measure used frequently internationally as an indicator of care (although not always "in-hospital"), but this may not represent the true risk as it has been suggested by clinicians that longer than 30 days post operatively would provide a better measure of the risk of death after colorectal surgery. (Visser BC, Keegan H, Martin M, Wren SM., 2009)

The 30-day in-hospital mortality rates are likely to be affected by factors that occur before or after treatment within hospital, such as access and care prior to reaching the hospital, within the emergency department or following discharge from hospital. Another factor that may be important is the transfer patterns among hospitals, and therefore development of systems that can capture this data would improve the measure. Patient factors including co-morbidities are likely to affect mortality rates and more developed analyses that accurately account for these would improve this measure.

5. Time to hip fracture surgery

Indicator definition

The time to hip fracture surgery indicator is defined as the time from admission of a person aged 65 years or older with a principal diagnosis of fractured neck of femur to time of surgery for the fracture. This is an OECD health care quality indicator.

Why is this important?

In Ireland the population is growing older and as the frequency of hip fracture is associated with increasing age this leads to a significant and increasing burden of illness in the community, including an increased risk of mortality and morbidity (Parker, 2006, Bentler 2009).

Delay between admission and surgery, whether for medical stabilisation of the person's co-morbidities, or for administrative/logistical reasons, may increase length of hospital stay, and may also be associated with increased morbidity and mortality. A timely operation is known to improve outcomes (Simunovic N, Devereaux P, Spraque S et al, 2010).

Indicator analysis

Initially the study reviewed data for 2008 to 2010 based on the closed HIPE files available in 2011. All HIPE files from 2005 to 2010 were reopened and some hospitals made revisions to their HIPE data. The data presented here are based on the revised HIPE files. An analysis was carried out of the HIPE data before and after the reopening of the HIPE files, and it was found that there were only minimal changes in the data which did not affect the findings.

Nationally, 80% of patients undergo surgery for hip fracture on the day of admission, the day after admission or 2 days after admission. There is a large variation across the country with the best performing hospital performing surgery on 95% of cases by day two and at the other end a hospital performing 58% of surgeries by day two (Table 6).

Table 6: Time to hip fracture surgery, age 65+, by hospital, 2008 – 2010

Hospital	Number of Cases Aged 65+ with Hip Fracture Surgery	Surgery on Day of Admission %	Surgery 1 Day after Admission %	Surgery 2 Days after Admission %	Surgery 3 or More Days after Admission %	Total % within 2 Days after Admission
1	1094	14.4	32.8	23.6	29.3	70.7
2	1037	25.5	46.7	10.2	17.6	82.4
3	760	58.2	25.8	4.6	11.4	88.6
4	756	26.2	38.1	18.7	17.1	82.9
5	626	22.7	34.5	14.9	28.0	72.0
6	551	40.8	43.6	4.7	10.9	89.1
7	505	51.1	25.7	6.7	16.4	83.6
8	420	22.9	44.8	9.0	23.3	76.7
9	412	54.1	24.3	7.5	14.1	85.9
10	389	41.4	31.6	10.8	16.2	83.8
11	369	3.0	47.2	20.1	29.8	70.2
12	356	37.6	53.7	3.4	5.3	94.7
13	352	17.0	42.3	13.4	27.3	72.7
14	300	15.3	30.0	13.0	41.7	58.3
15	297	23.2	47.8	11.4	17.5	82.5
16	268	24.3	45.1	13.8	16.8	83.2
17	14	14.3	21.4	35.7	28.6	71.4
Total	**8506**	**30.0**	**37.5**	**12.4**	**20.1**	**79.9**

The trend over the ten year period from 2001 to 2010 showed no significant change with a steady percentage in each time period. However there has been a slight rise in the proportion of cases with surgery on the day of admission (Figure 14).

It should be noted that the time to hip fracture operation is based on day of admission rather than time at presentation and therefore it is likely that the actual times to surgery may be longer and that hospitals with long delays from ED to admission may appear to be performing better than they are.

Figure 14: Time to hip fracture surgery for cases aged 65+, 2001 – 2010. Percentage of cases with surgery on day of admission, 1 day after admission or 2 days after admission

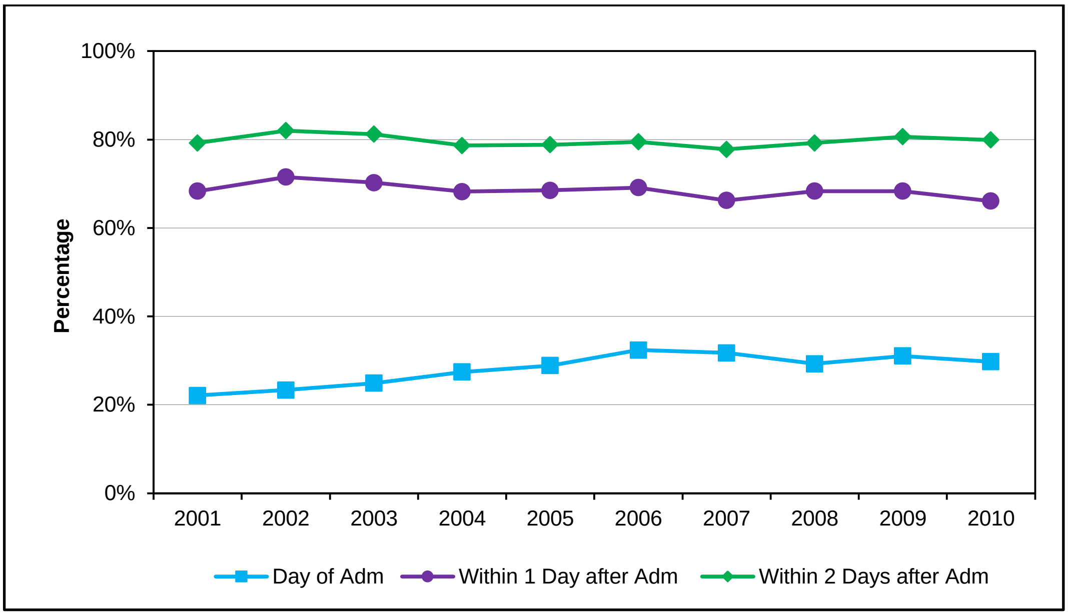
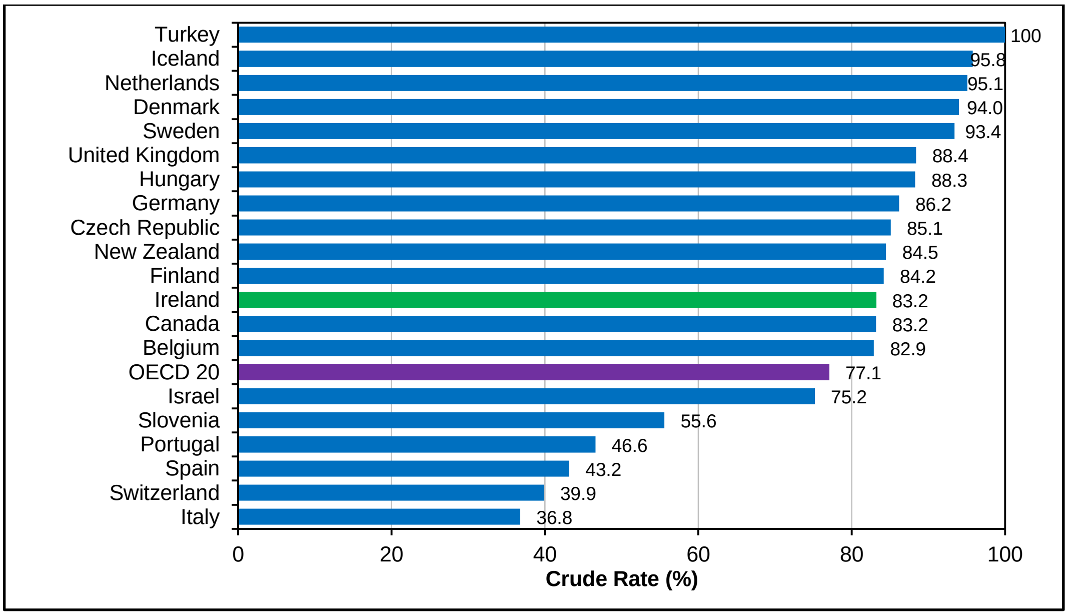


Figure 15 shows the indicator on in-hospital waiting time for hip fracture surgery (age 65+) for the OECD in 2011 (the latest year for which data are available); with Ireland being above the OECD average. However a number of other countries achieve rates of over 90% suggesting that there may be potential for improvement.

Figure 15: In-hospital waiting time for hip fracture surgery (age 65+), percentage within 2 Days. 2011 or latest year



Source: OECD Health Statistics 2013.

Conclusion on feasibility of performance indicator

This indicator derived from HIPE is useful as a high level indicator but has two significant limitations. Comprehensive time data is not recorded in HIPE. The international recommendation is to operate within 48 hours of admission. However without times of admission, day 2 could be anywhere from just over 24 hours to just under 72 hours following admission and therefore the indicator may not measure accurately best practice. However it should be noted that times of admission and discharge have been included in HIPE since 2011, although times of procedures are still not collected.

Currently time in days from date of admission only is measured. This indicator could be improved if time from presentation in the emergency department (ED) to admission was also reported. Where delay occurs from ED to admission this is not reflected in the measure and therefore hospitals with long delays from ED to admission may appear to perform well where this is not the case.

6. Age at orchidopexy

Indicator definition

Age at orchidopexy for the treatment of undescended testes is defined as the age at which orchidopexy is undertaken. This is reported as total number and proportion of cases by age group and region of residence. This is not an OECD indicator.

Why is this important?

Cryptorchidism is the absence of one or both testes from the scrotum. About 3% of full-term and 30% of premature infant boys are born with at least one undescended testis, making cryptorchidism the most common birth defect of the male genitalia. However, about 80% of cryptorchid testes descend by the first year of life (the majority within three months), making the true incidence of cryptorchidism around 1% overall.

The goal of a screening program is to detect all patients with undescended testes at an appropriate age and to refer them for orchidopexy (surgery to fasten an undescended testis into the scrotum). International evidence would suggest that timely surgery (at less than 2 years of age) reduces the risk of torsion, infertility and malignant transformation in later life (Ritzen E, 2008).

Infants are screened for undescended testes upon discharge from the obstetric unit, at the six week GP check, by the public health nurse during routine visits, and in some areas by community medical officers at developmental assessment clinics. Delayed treatment can be an indication of differences in policies with respect to screening programmes; limited access to, or availability of, screening services; lack of clinical competence in identifying the diagnosis; or poor access to definitive surgical treatment. It is probable that some portion of late diagnosis is due to the testes ascending after an initial screen. There is evidence that acquired cryptorchidism, i.e. a testis present at birth which subsequently ascends, is more prevalent than previously thought.

Indicator analysis

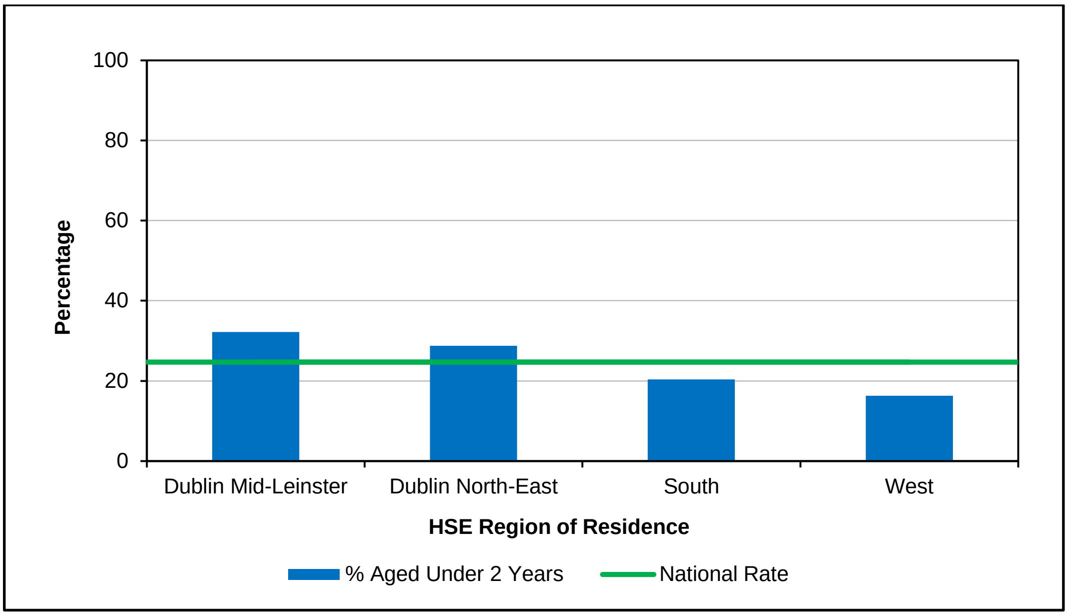
Initially the study reviewed data for 2006 to 2010 based on the closed HIPE files available in 2011. HIPE files from 2005 to 2010 were reopened and some hospitals made revisions to their HIPE data. The data presented here are based on the revised HIPE files. An analysis was carried out of the HIPE data before and after the reopening of the HIPE files, and it was found that there were only minimal changes in the data which did not affect the findings.

HIPE records children admitted for orchidopexy and therefore this indicator can be derived from HIPE. The number of cases of undescended testes undergoing orchidopexy at less than 2 years of age has not changed since 2006. However the indicator does show some variation across the country from 16% in HSE West to 32% in Dublin Mid-Leinster (Table 7, Figure 16).

Table 7: Orchidopexy - Total number and proportion by age group for orchidopexy, by HSE region of residence, as reported to HIPE, 2006 – 2010

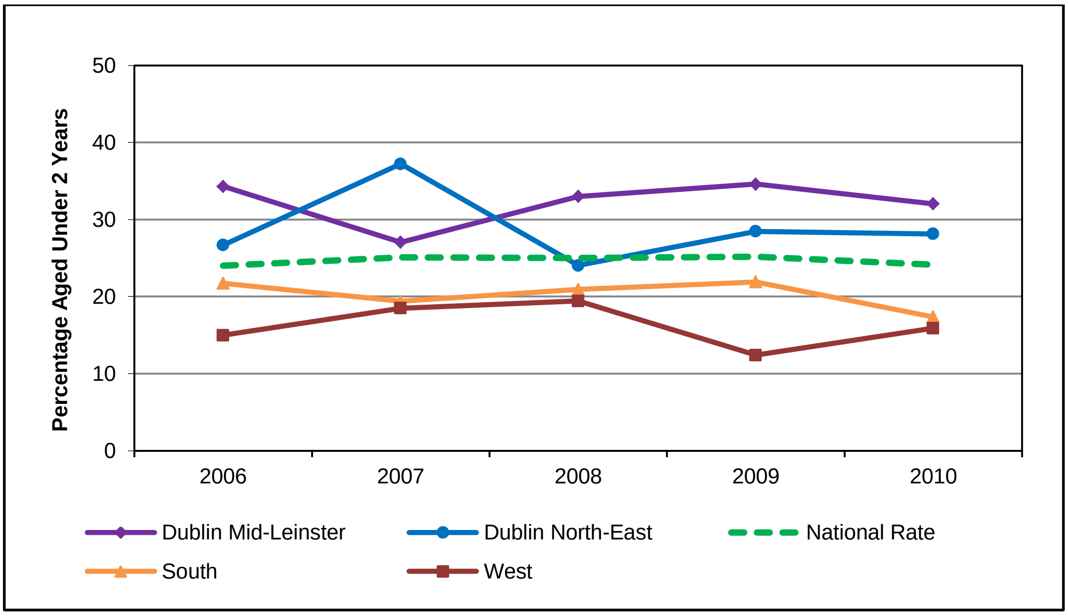
HSE Region of Residence	Total Number of Orchidopexy Procedures	Percentage Aged Under 2 Years	Percentage Aged Under 5 Years
Dublin Mid-Leinster	867	32.2	59.3
Dublin North-East	685	28.8	61.3
South	737	20.4	59.7
West	720	16.3	55.6
Total	**3009**	**24.7**	**59.0**

Figure 16: Orchidopexy - Percentage of procedures undertaken at age less than 2 years, by HSE region of residence, as reported to HIPE, 2006 - 2010.



Overall, just over 40% of orchidopexy procedures undertaken in public hospitals are carried out at 5 years of age or older. Figure 17 shows data for individual years by region and indicates little change in the percentage of procedures undertaken at less than 2 years of age since 2006.

Figure 17: Orchidopexy: Percentage of procedures undertaken at age less than 2 years, by year and region of residence, as reported to HIPE, 2006-2010.



Conclusion on feasibility of performance indicator

Preliminary assessment of this indicator suggests that it offers good potential as an outcome measure. Analysis of this indicator showed that there is a clearly defined procedure code in HIPE for this specific treatment of undescended testes. Age of admission for this procedure is likely to be documented accurately.

However, there are a number of limitations, which should be borne in mind. It is not possible using HIPE data to ascertain the reason for later surgery, whether the problem was a failure of the screening process or difficulty accessing hospital or specialist care resulting in late treatment. Further exploration will be required to ascertain the underlying reasons for these findings.

Therefore this indicator as derived from HIPE is a feasible measure of the timeliness of the treatment of undescended testes, although the reason for any delay would require further exploration.

7. Other indicators considered

(a) Age at first hospital admission with developmental dysplasia of the hip (DDH)

Indicator definition

Age at first hospital admission with developmental dysplasia of the hip (DDH) is defined as age at first admission to hospital with a principal diagnosis of DDH. This is not an OECD indicator.

Left untreated, DDH can lead to pain and osteoarthritis by early adulthood. The earlier DDH is detected the simpler and more effective the treatment is, with most children regaining normal hip joint function. The goal of the new-born screening programmes for DDH is to detect all children with DDH at the appropriate age and commence treatment.

Infants are screened for developmental dysplasia of the hip upon discharge from the obstetric unit, at the six week GP check, by the public health nurse during routine visits, and in some areas by community medical officers at developmental assessment clinics. Therefore delayed diagnosis and treatment can be an indication of different policies with respect to the screening programme; poor access to, or availability of, screening services including targeted ultrasound; lack of clinical competence in identifying the diagnosis; or poor access to specialist services and definitive treatment.

Indicator analysis

The initial analysis showed higher numbers than expected being admitted at age 2 years and over, and suggested an increasing trend in admissions of older children, which may highlight that further analysis and exploration is required. However there could be multiple reasons why children aged over 2 could be admitted or re-admitted, including diagnosis and treatment without previous admission, or repeat admissions for follow up of late diagnosis of DDH.

From HIPE it is not possible to identify age at first assessment, as there is no record of outpatient attendances in the HIPE system. Therefore it is not possible to differentiate those children who were appropriately identified, initially managed conservatively in the outpatient clinic and then admitted after a decision was made to move to more invasive treatment, from those children who were identified late and hence required more invasive treatment from first presentation.

Conclusion on the feasibility of the performance indicator

The analysis found that there are a number of limitations with using HIPE data for this indicator. For example, it is possible that children who present to different hospitals may be counted more than once due to the fact that HIPE is not designed to track patients between hospitals. In some areas due to upgrades to the patient administration system (PAS), patients who were readmitted to the same hospitals received new medical record numbers and so it was not possible to track these patients in the same hospitals. Lack of primary care and outpatient data in HIPE means that it is not possible to measure cases which are treated in primary care or on an outpatient basis.

While HIPE data can provide some information on hospital admissions for DDH, it cannot be interpreted as a commentary on the management of this condition. Therefore a childhood registry or other data system with more comprehensive information on the management of DDH both in community, primary care and acute care services could be of more benefit in developing performance indicators to monitor how a service manages this condition.

(b) Rate of pulmonary embolism (PE) or deep vein thrombosis (DVT) following surgery

Indicator definition

Number and percentage of patients who develop pulmonary embolism (PE) or deep vein thrombosis (DVT) following surgery. This is an OECD indicator.

A PE post-surgery is a serious and possibly life threatening condition. However below knee DVTs are often asymptomatic and may not need any treatment.

Conclusion on the feasibility of the performance indicator

This indicator was calculated but rejected due to the small numbers being recorded in the HIPE system. The findings of low rates and large variations may indicate that these data are not being systematically recorded, either in the patient notes or else are being recorded in the patient notes and are not being inputted onto the HIPE system. Discussion with clinicians indicated that it is likely to be a variation in clinical practice around screening for and identifying DVT that is leading to variations in the findings. PE rates are generally considered accurate given that this is such a serious complication. However, the rate of diagnosis of DVT is likely to vary greatly by hospital. If all patients are scanned post-surgery for DVT then the detection rate will be high; if only symptomatic patients are scanned then the detection rate will be much lower.

This is currently an OECD indicator although the OECD HCQI expert group is reviewing this indicator with a view to further refinement and improvement. Therefore the feasibility of this indicator may be reconsidered in the future.

(c) Rate of catheter-related blood stream infections

Indicator definition

Number and percentage of patients who develop catheter-related blood stream infections as a consequence of their hospital care.

Conclusion on the feasibility of the performance indicator

This indicator was calculated but rejected due to small numbers being recorded in the HIPE system. The findings of low rates and large variation may indicate that these data are not being systematically recorded, either in the patient notes or else are being recorded in the patient notes and are not being inputted onto the HIPE system. This was confirmed by clinical experience. Another factor that may affect this indicator is the implementation of hospital screening policies which could increase numbers in these hospitals.

Data for this indicator sourced from hospital discharges databases was previously collected by the OECD, but this was discontinued as it was considered that ambiguities in the definition meant the indicator was not fit for reporting.

There are other potential data sources within the Irish health system that may provide more comprehensive and reliable information on catheter-related blood stream infections. Therefore it was concluded that the HIPE system is unlikely to be the most useful source of information for this indicator in the future.

(d) Patients with STEMI who have received thrombolysis or cardiac catheterisation within the following 24 hours

Indicator definition

Number and percentage of patients with STEMI who have received thrombolysis or cardiac catheterisation within the following 24 hours**.**

ST segment elevation myocardial infarction (STEMI) occurs when a coronary artery is totally occluded by a blood clot.

Conclusion on the feasibility of the performance indicator

This indicator as derived from HIPE was not considered feasible for two reasons. Firstly, HIPE does not provide a measure of time in hours which precludes accurate calculation of this indicator. Secondly, HIPE is not designed to capture emergency department activity. Since door to needle time is the key measure for this indicator, the HIPE system cannot, therefore, provide an accurate estimation of response times.

Alternative methods and potential data sources to support the measurement of this indicator should be examined.

(e) Number of falls in hospitals as a percentage of all inpatient discharges

Indicator definition

Number of falls in hospitals as a percentage of all inpatient discharges.

Conclusion on the feasibility of the performance indicator

The intention of this indicator is to reflect care during a hospital stay. This indicator as derived from HIPE was not considered to be feasible for a number of reasons. In order to calculate this indicator reliably, reasonably complete information is required for the external cause variable "place of occurrence" where a fall is recorded as an external cause of injury. However it was found on review that approximately 40% of discharges with an external cause of injury had the place of occurrence coded as unspecified or else not coded at all.

Also, prior to 2011, it was not possible to determine from HIPE data whether the fall took place in the hospital of treatment or if it took place in some other health service area. The inclusion of the hospital acquired diagnosis flag in HIPE since 2011 should assist in overcoming this and support the implementation of this indicator in the future.

An indicator on falls in hospitals and in other healthcare settings is currently being developed as part of the national suite of nursing performance indicators.

(f) Rate of ventilator associated pneumonia (VAP)

Indicator definition

Number of ventilated patients who develop associated pneumonia (VAP).

Conclusion on the feasibility of the performance indicator

According to the literature VAP complicates the course of up to 47% of intubated patients and may have a mortality rate as high as 50%.

However for ventilator associated pneumonia, there is no specific code in the edition of the ICD-10-AM classification currently used for HIPE data. Instead, the coding guidelines state that this diagnosis should be coded using a combination of 4 diagnoses:

- J95.8 [Other post-procedural respiratory disorders]
- type of pneumonia
- Y84.8 [Other medical procedures as the cause of abnormal reaction of the patient, or of later complication, without mention of misadventure at the time of the procedure, Other medical procedures]
- Y92.22 [Place of occurrence: health service area].

This combination of codes is rarely recorded on HIPE which suggests that VAP is not being fully coded when it occurs. This may be due to the limit of 20 diagnoses on HIPE which pertained prior to 2011. Patients requiring ventilation may have over 20 diagnoses recorded on the healthcare record, and it is possible that some of the 4 diagnoses required for VAP to be identified may be omitted from HIPE. It is important to note that the number of diagnoses that can be recorded per case on HIPE was increased to 30 in 2011. However, at present the VAP indicator is not considered feasible. It would appear likely that the increased number of diagnoses permissible on HIPE will only marginally improve identification of VAP cases and that other options (e.g. inclusion of a specific ICD-10-AM code for VAP) will need to be considered if accurate measurement of this indicator is to become feasible in the future.

Discussion

While it must be stressed that HIPE was originally established as a discharge-based system to measure type and volume of hospital activity, it also provides a rich source of data on patient discharges from all publicly funded acute hospitals in Ireland. It is a well-developed database and care is taken to ensure its accuracy and completeness. This study confirms that there are many strengths of the HIPE system, as a suitable database, albeit with some improvements, to derive indicators to measure outcomes in Irish healthcare. HIPE data are routinely collected and therefore much less additional cost or resources would be required in utilising/developing it to measure outcomes compared with developing a de novo indicator dataset. The data are collected in all public hospitals enabling comparison across the entire acute public hospital system. It is a flexible system where improvements and additions are made on an on-going basis in response to service need and recommendations, e.g. a flag for hospital acquired diagnoses was added to HIPE for discharges from 2011.

To a large extent this work builds on the Health Care Quality Indicators (HCQI) project led by the OECD, and it should be viewed as a starting point in utilising hospital discharge data to monitor quality of care at hospital level. The OECD HCQI project shows that high level indicators based on specific diagnoses and/or procedures are valuable as a first step in the comparison of performance and, where possible, relevant indicator definitions and guidelines from the HCQI project have been adopted for this paper. This provides for a standard international approach and allows for cross-country comparisons. The use of high level indicators (i.e. based on principal diagnosis) by the OECD is one way in which the effect of differences in coding practices can be minimised since the policy and practice of coding secondary diagnoses can vary significantly between countries.

In relation to the indicator definitions a number of caveats must be highlighted. In-hospital mortality rates and ratios are considered by the OECD and others to be useful indicators but must be interpreted with particular caution. International literature on performance indicators warns against the precise interpretation of the correlation between in-hospital mortality rates and hospital performance. The literature supports the approach that there should not be a single measure of performance or safety but that there needs to be a range of indicators.

The indicators in this report are high level indicators which adjust for differences in the age distribution of patients between hospitals. They do not purport to take account of other significant factors which may affect the comparison of outcomes. Such factors include, inter alia, co-morbidities, levels of deprivation, transfer patterns, pre-hospital care etc. Analysis of the effect of the presence of co-morbidities and other potential confounding factors would be an obvious further step in the development of these indicators.

It is important to note that the mortality measures here are based on patients who die within 30 days of hospital admission following the principal diagnosis or procedure under examination and that the measure does not directly attribute the death to that principal diagnosis or procedure. This may be a limitation or it may also be a valid measure of care, as unexpected death in hospital may in itself reflect a broader view of care received.

In some cases, indicators initially considered were not included after review of initial results and the identification of limitations associated with the data. For example, number and percentage of patients with ST elevated myocardial infarction (STEMI) who have received thrombolysis or cardiac catheterisation within the following 24 hours was not feasible to measure since data on any treatment and time to treatment given in the emergency department is not included in HIPE.

Three to five years of data were aggregated in order to have adequate numbers to test for significance in smaller hospitals. However by aggregating data, changes in outcomes over the period studied could not be identified, although 10 year trends at national level were examined. Despite aggregating data over several years, in certain instances, age-standardised ratios were still based on small numbers. The statistical confidence limits associated with these ratios were very wide and do not provide evidence of a significant difference from the national.

It is recognised that there are limitations in utilising the data as currently recorded in the HIPE system in order to measure outcomes related to quality of care. A small number of hospitals showed statistically significantly higher rates than expected at the 95% confidence level for specific indicators. Some of these hospitals reviewed their healthcare records and HIPE data and identified inconsistencies in both the accuracy and completeness of their healthcare records and their HIPE data. Most hospitals that reviewed their healthcare records found that some portion of those healthcare records had the principal diagnosis incorrectly recorded in the healthcare record. These hospitals found that the errors or omissions occurred principally in the healthcare record rather than in the recording of the healthcare record information by the HIPE coders. These problems may be occurring more widely across hospitals. However in order to identify the full extent of these issues a more systematic audit approach is needed, for example an audit of stroke and AMI admissions data across all hospitals. The ESRI provided a HIPE Coder Audit Tool that may provide a useful support in undertaking such audits.

The reviews undertaken by the hospitals that showed statistically significantly higher rates in specific indicators identified documentation, data and clinical care issues that may have explained this variation. However it is important to note that the review by these hospitals used different methodologies and therefore their findings may not be comparable or transferrable.

The HIPE files for 2005 to 2010 were reopened on a phased basis starting in 2011. Subsequently a number of hospitals made changes to their data, including some of the hospitals that reviewed their data as a follow-up to the issues highlighted in this study. However, caution must be exercised in making selective changes retrospectively to HIPE data following identification of an outlying result, as there is the potential that data may be adjusted at the expense of identifying a real clinical problem.

Conclusions

Internationally the use of quality indicators to measure health service performance is recognised as an important initiative in improving the quality, effectiveness and safety of healthcare. In line with this approach and building on the work of the OECD through the Health Care Quality Indicators (HCQI) project, the Department initiated this study as an important first step in assessing the feasibility of indicators derived from HIPE as potential indicators to be used by the Irish health system to measure health service performance.

The report highlights important issues in a number of areas including the importance of data quality in developing and implementing indicators. Its focus is on the value of HIPE, on the importance of data quality and on the benefit to the health system of good quality data. For this reason individual hospitals are not identified in this report.

This report confirms the value of the HIPE system as a resource for the development of indicators of quality of care in hospitals in Ireland. At the same time it draws attention to areas where HIPE may not be suitable and/or where additions and improvements to HIPE will be required prior to using these measures as reliable outcome indicators. The report also highlights the requirement for hospitals, with guidance from the HSE, to improve the quality and accuracy of the information that they record, both in the healthcare record and subsequently onto the HIPE system. It is also the case that in the context of the health reform programme the quality of HIPE data is becoming ever more important since the implementation of policies such as “Money follows the Patient” and Universal Health Insurance require the use of Diagnosis Related Groups (DRGs) which are based on HIPE.

The preliminary analysis undertaken as part of this study has highlighted factors that may have a confounding effect on the findings, particularly in relation to the in-hospital mortality indicators. One of the most significant risk factors affecting mortality is age as the number and severity of co-morbidities usually increases with age. The in-hospital mortality indicators have been age-standardised as part of the methodology used in this study in order to adjust for varying age profiles of patients in different hospitals. However, other confounding factors such as co-morbidities, which may influence outcomes, need to be addressed through subsequent refinements of the methodology including the addition of further variables in the analysis. The potential effect of transfers of cases between hospitals also requires further study.

The analysis of hospital level data has highlighted the limitation of small or very small numbers when developing and reporting indicators. Small numbers can result in unstable and unreliable rates and problems with confidentiality. There are ways to try and counteract this for example by aggregating years, by grouping hospitals, or combining clinical groups. This report has addressed some of these issues through the aggregation of several years of data and the inclusion of 95% confidence intervals.

Analysis of the effect of the presence of co-morbidities and other confounding variables such as social deprivation would be an obvious next step in any further analysis of these indicators. However it would also be very beneficial if a further assessment and implementation of identified improvements to data quality were carried out in advance of this process. It should also be noted that the introduction of a unique patient identifier would greatly assist in developing accurate and robust indicators. Linking to other datasets, such as Central Statistics Office mortality data also has the potential to improve indicators.

This study has shown that some of the data used in the calculation of these indicators was unreliable due to lack of consistency in the documentation in the healthcare record and subsequently the transfer onto the HIPE system. However this is data entered directly by the hospitals and therefore the quality of the healthcare record and the inputted data is the responsibility of the hospital. This data is an important source of information for the hospitals, for the health system and also for the public. Indicators derived from data entered by the hospital onto HIPE allow hospitals to monitor their own performance over time. This ability to compare outcomes over time and across services is an important function and it is essential for service providers to have high quality information available to them that allows them to do this.

The observed variations across hospitals found in this study may be due to a number of factors including quality of care issues, data quality issues or issues in relation to the inclusion of confounding factors in the analysis. It identifies issues in regard to the quality of the data, and in particular the medical record, which need to be addressed in order to support further analysis and more targeted interpretation of results. Nevertheless, the report has demonstrated the value of calculating quality indicators based on HIPE data and has identified areas requiring further exploration both in relation to data collection and clinical care.

The findings set out in this report should not be taken as making any inferences concerning quality of care in hospitals and certainly should not be interpreted as ranking hospitals with respect to the selected indicators. It is accepted that indicators are alerts or flags to identify areas of performance that may require further exploration. In addition indicators can help to identify good practice which can then be disseminated throughout the system. However it must be noted that the international literature on performance indicators warns against using a specific measure as a generic indicator of an organisation's performance and safety and also highlights the limitations of the precise interpretation of the correlation between in-hospital mortality rates and hospital performance. Indicators should be assessed within the context in which care is delivered and should not be reviewed in isolation.

Quality indicators should be used by clinical and management teams to measure the quality of care delivered. Following further exploration, and if required, a quality improvement plan that can be monitored and evaluated over time should be put in place and systematically implemented.

This report provides a preliminary analysis of indicators derived from reported HIPE data, which serves principally to highlight the potential of the selected indicators but also raises important questions. This study will inform the future development of healthcare quality indicators for Ireland. These indicators, aligned with international evidence-based practice, should be implemented and reported on at all levels of the Irish health system and internationally.

Response to the Report

The Hospital Inpatient Enquiry System (HIPE), within certain parameters, will be used by the Department of Health (DoH), the Health Service Executive (HSE) and other relevant health service providers, to derive performance indicators to measure the performance of health services in delivering quality and safe healthcare. These parameters include that the data in HIPE is validated, accurate high quality data.

Clear governance mechanisms at both a national, regional and local level for the quality of HIPE will be established including a national governance group and clear service level agreements with service providers. Those responsible for the quality of HIPE both at the national level, that is the HSE and at a local level, for example acute hospitals, should ensure continuous improvement in the quality of HIPE through implementation of quality improvement programmes. These quality improvement programmes should include regular audits along the data flow pathway and education and training programmes for clinical staff and administrative staff involved in HIPE. Under these governance arrangements and as part of the annual review process of HIPE variables, specific additions will be considered which would enhance the value of HIPE for measuring performance.

The Department of Health will develop a formal public national reporting system by the Minister for Health in relation to National Healthcare System Quality Performance Indicators for Ireland. These performance indicators and targets will be aligned with evidence-based international practice and linked to international norms, e.g. OECD Health Care Quality Indicators, wherever possible. The DoH in establishing the reporting mechanism for National Healthcare System Performance Quality Indicators will engage with all key stakeholders including the HSE and HIQA.

The indicators which were assessed to be feasible in this report will be further developed and evaluated by the DoH and the HSE in consultation with key stakeholders. The DoH, the HSE and the wider healthcare system will also continue to develop and report evidence-based quality of care and outcome indicators in line with each organisation’s mandate.

Resources

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Appendix 1: Detailed Methodology

HIPE Files

The analysis presented in this report was updated in 2013 to include the revisions made to the HIPE files in 2012. The versions of the HIPE files used were as follows:

2006_AsOf_0113_V27_Close
2007_AsOf_0213_V26_Close
2008_AsOf_0213_V28_Close
2009_AsOf_0812_V21_Close
2010_AsOf_1212_V21_Close

Presentation of Tables & Graphs

Hospital names are not included in this report. The data in each table has been sorted by the highest number of cases, and the hospitals have been numbered accordingly. Note that hospitals have been numbered for each indicator separately, and so for example, hospital 1 in one table is not necessarily the same hospital as hospital 1 in a different table.

The same hospital numbers have been used in the associated graphs. Note that rates based on small numbers of cases can be unreliable and as a result have very wide confidence intervals. Therefore rates for hospitals with less than 25 cases are not shown in the tables or displayed in the graphs. The data from these hospitals have however been included in the calculation of the overall national rates.

Method of Calculation of Indicators

1. In-hospital mortality within 30 days following acute myocardial infarction (AMI)

Numerator: Discharges with a discharge code of 06 (died with post mortem) or 07 (died no post mortem) and length of stay of ≤ 30 days, among cases in the denominator with principal diagnosis of AMI (ICD-10-AM I21 or I22).

Denominator: The total number of discharges with a principal diagnosis of ICD-10-AM I21 or I22 and aged 15 years or over.

Time period: 2008-2010

Note: As this is one of the OECD Health Care Quality Indicators, the OECD definitions were used in order to provide for international comparability.

2. In-hospital mortality within 30 days following stroke

Numerator: Discharges with a discharge code of 06 (died with post mortem) or 07 (died no post mortem) and length of stay of ≤ 30 days, among cases in the denominator with principal diagnosis of ischaemic or haemorrhagic stroke.

Denominator: Total discharges with a principal diagnosis of ICD-10-AM I63 or I64 (ischaemic stroke) or ICD-10-AM I60-I62 (haemorrhagic stroke), aged 15 years and over.

Time period: 2008-2010

Note: As this is one of the OECD Health Care Quality Indicators, the OECD definitions were used in order to provide for international comparability.

3. In-hospital mortality within 30 days following hip fracture surgery

Numerator: Discharges with a discharge code of 06 (died with post mortem) or 07 (died no post mortem) and length of stay of ≤ 30 days, among cases in the denominator.

Denominator: The number of discharges aged 15 years and older with a principal diagnosis of fracture of neck of femur (ICD-10-AM S72.0, S72.1, S72.2) and a principal procedure for treatment of the hip fracture (ICD-10-AM ACHI procedure blocks 1479,1486,1489,1487,1488,1491,1492).

Time period: 2006-2010.

Note: The procedure codes were selected after investigation of the types of procedures that patients with hip fractures were undergoing. The principal diagnosis codes selected were those used by the OECD to identify hip fractures.

4. In-hospital mortality within 30 days following emergency admission and colectomy

Numerator: Discharges with a discharge code of 06 (died with post mortem) or 07 (died no post mortem) and length of stay of ≤ 30 days, among cases in the denominator.

Denominator: The number of patients aged 15 and older with a principal procedure code of ICD-10-AM ACHI procedure blocks 913 (colectomy) or 936 (total proctocolectomy), excluding cases with an elective admission or elective readmission (admission codes 1 or 2).

Time period: 2006-2010.

5. Time to surgery following hip fracture

Numerator: The number of cases in the denominator based on the difference between the date of the principal procedure and the date of admission.

Denominator: The number of discharges aged 65+ with a principal diagnosis of hip fracture (ICD-10-AM S72.0, S72.1, S72.2) and a principal procedure of hip fracture surgery (ICD-10-AM ACHI Procedure Blocks 1479, 1486,1487, 1488, 1489, 1491 or 1492).

Time to surgery calculation: In the absence of data on times of admission and procedures, surgery within 2 days refers to discharges where surgery took place on the day of admission, the following day or 2 days after admission (i.e. day 0, day 1 or day 2). Date of the principal procedure is used, rather than date of first procedure, as the principal procedure is one that is performed for definitive treatment, rather than one performed for diagnostic or exploratory purposes.

Time period: 2008-2010

Note: As this is one of the OECD Health Care Quality Indicators, the OECD definitions were used in order to provide for international comparability.

6. Age at orchidopexy

Numerator: The number of cases under 2 years of age, and under 5 years of age among cases in the denominator.

Denominator: Total discharges with a principal or secondary procedure of orchidopexy for undescended testes (ICD-10-AM ACHI Procedure Block 1186)

Area: HSE region of residence

Time period: 2006-2010

Note: Revision orchidopexy procedures were excluded.

Appendix 2: Transfers

An important consideration in the assessment of in-hospital mortality rates is the issue of transfers. Patients can be discharged from one hospital by being transferred into another hospital. For example in the case of an AMI, a patient may first be admitted to a hospital and then transferred to a different hospital for further treatment. In this case the patient will be counted in both hospitals in the analysis presented here if the principal diagnosis in both cases is recorded as an AMI. Patients can also be temporarily transferred to another hospital for a particular purpose, for example for a day case cardiac procedure, while also remaining as an inpatient in the first hospital. The patients who are transferred in or out of hospitals may have different complexity issues or comorbidities than those patients who were not transferred. These factors have the potential to influence the in-hospital mortality rates.

In order to investigate this, the volume of transfers was investigated for each of the in-hospital mortality indicators. Where the data showed that there were large numbers of cases being transferred between hospitals, preliminary analysis was undertaken whereby the mortality rates were examined for different groups of cases, i.e. cases who were transferred into hospitals; cases who were not transferred into hospitals, and cases who were not transferred out to other hospitals. Note that cases that were transferred out to other hospitals were all by definition, alive on discharge and so the in-hospital mortality rates were not relevant for this group of cases.

The preliminary analysis showed that for some of the indicators considered in this study, there were significant numbers of patients being transferred both in and out of hospital, which has the potential to have a bearing on the in-hospital mortality rates. However a more refined analysis would be required in order to assess the full effect.

A summary of the analysis of the transfers data for each of the in-hospital mortality indicators is included below.

In-hospital mortality rate within 30 days after AMI

A significant number of cases had a discharge type indicating a transfer out to another hospital (30%) or had a source of admission indicating a transfer in from another hospital (19%). Overall 39% of cases were either transferred in to one hospital or transferred out of another. As expected the number of transfers into hospital does not match the number of transfers out of hospitals. There are a number of reasons for this, including transfers to or from hospitals that do not participate in HIPE (e.g. private hospitals or non-acute hospitals) and temporary transfers of patients to a different hospital for a particular procedure. Also, patients are assigned a principal diagnosis in each hospital independently of the principal diagnosis that was assigned in a previous hospital. For example a patient may be admitted to a hospital with a principal diagnosis of an AMI, and subsequently transferred to a different hospital where an alternative principal diagnosis may be assigned if appropriate.

In-hospital mortality rate within 30 days after stroke

There was a relatively low volume of transfers of cases within the ischaemic stroke indicator. Less than 3% of cases with ischaemic stroke had a source of admission indicating a transfer in from another hospital.

A higher proportion of cases within the haemorrhagic stroke indicator were transferred. 27% of cases had a source of admission indicating a transfer in.

In-hospital mortality rate within 30 days after hip fracture surgery

Approximately 11% of cases within this indicator had a source of admission indicating a transfer in. 96% of these transfers were recorded as emergencies, and the remaining 4% were elective transfers. Given that for cases to be included in this indicator they were required to have both a principal diagnosis of a hip fracture, and a principal procedure related to the repair of the hip fracture, the issue of counting cases in more than one hospital does not arise. It is likely that each patient is only having surgery for the hip fracture in one hospital. Cases that are admitted to one hospital with a hip fracture and then transferred to a second hospital for surgery would only be counted in the second hospital in this indicator. Therefore the transferring of cases between hospitals is unlikely affect the calculation of this indicator, although further analysis would be required to assess the full effect.

In-hospital mortality rate within 30 days after colectomy following emergency admission

The data on colectomy procedures showed a relatively low volume of patients being transferred in or out of hospitals with this procedure. Approximately 6% of emergency admissions with a colectomy procedure between 2006 and 2010 had been transferred in from another hospital. Almost 4% of cases had a colectomy procedure and were then transferred out to another hospital. Patients who are transferred from one hospital to another are unlikely to have surgery in both hospitals. Therefore the issue of transfers between hospitals should not substantially impact on the findings for this indicator, although further analysis would be required to assess the full effect.

Appendix 3: Methodology for Age-standardisation of In-hospital Mortality Rates

The crude death rate per 100 cases for the in-hospital mortality indicators is calculated as the number of deaths within 30 days in each hospital with the relevant principal diagnosis and/or procedure, divided by the number of cases in each hospital with the relevant principal diagnosis and/or procedure, and then multiplied by 100.

However crude death rates do not take variations in the age profile of patients in different hospitals into account, and so both direct and indirect age-standardisation was carried out using SAS. Direct standardisation results in age-standardised death rates (ASDRs), which express the number of deaths (per 100 cases) that would occur in a hospital if that hospital had the same age structure as the national population of admitted patients and the age-specific rates for that hospital applied.

Direct standardisation has the advantage of producing a hospital mortality rate that can be compared to other rates based on the same standard population. It can be possible therefore to compare ASDRs in one hospital with the national mortality rate, and also with all other hospitals. However, difficulties arise in the use of ASDRs when the population being compared contains only a small number of deaths in some or all age-groups. Where the number of deaths is relatively small, the chance occurrence of one or two additional deaths can distort the rate significantly. This is a major limitation of the direct method of age-standardisation when examining in-hospital mortality rates at hospital level as opposed to a national level.

Indirect standardisation is used as an alternative to the direct method of age-standardisation where the study population is small and the age-specific rates are unstable. The indirect method of standardisation involves applying the age-specific rates of the national population (i.e. all admitted patients with the relevant diagnosis or procedure) to the age distribution of the study population (i.e. the admitted patients with the relevant diagnosis or procedure in each hospital), and expressing the observed deaths compared to the expected deaths as a ratio (age-standardised mortality ratio, SMR).

Therefore SMRs express the difference between the observed deaths in a hospital compared to the expected deaths if the age-specific death rates of the total cases nationally applied. A ratio that is greater than 100 suggests that the hospital experienced a higher number of deaths than expected. A ratio of less than 100 suggests that the hospital experienced a lower number of deaths than expected.

95% confidence intervals for the SMRs are also presented, and these should be considered when interpreting the results. If the lower limit of the 95% confidence interval is greater than the national rate (i.e. 100) then it can be said that the rate is statistically significantly higher than expected at the 95% confidence level. Note that if a hospital has a relatively small number of cases, there is more uncertainty around the rate. Therefore wide confidence intervals for a particular hospital are as a result of the small number of cases. The statistical confidence limits associated with these ratios generally do not provide evidence of a significant difference from the national rate. Further investigation would need to be carried out in order to determine whether any true variation exists. Hospitals with a large number of cases have smaller confidence intervals, as their rates are more stable.

The purpose of SMRs is to compare each hospital with the national rate only, and unlike ASDRs, the SMRs among hospitals are not directly comparable as the age structure of each hospital weights the age-specific rates differently. Therefore SMRs should not be used to compare one hospital against another.

Both the direct and indirect methods of age-standardisation produced similar results in relation to statistical significance. The number of deaths in each 5 year age-group at hospital level was relatively small for all of the indicators considered, and so only the indirect method of age-standardisation is presented in the hospital level tables in this report. By definition, SMRs always have a ratio of 100 at a national level, and so ASDRs are displayed in the 10 year trends graphs which are at national level only. This allows for comparison of age-standardised mortality rates at a national level over time.

The OECD produce age-sex standardised rates based on the total admitted population in the OECD countries with the relevant condition aged 45+. While the same principal diagnoses for AMI and stroke were used in this study as are used for the OECD indicators, the data were age standardised according to the admitted population in Irish hospitals over the three year period 2008 to 2010.

Age-sex standardised rates were also considered but a preliminary scoping analysis showed that in many cases the numbers were too small for statistical significance. Where the numbers were sufficiently large, in general the preliminary analysis suggested that the age-sex standardisation produced similar results to the age-standardised rates; however this would require further exploration as part of the refinement of these indicators. Therefore for this initial study age-standardised rates only are presented.

In order to calculate the SMRs the following steps are followed (using the example of AMI):

1. The numbers of deaths and cases of AMI in each hospital (based on the numerator and denominator specifications) are reported by 5 year age-groups (15-19, 20-24, etc., up to 85+).

2. The total number of cases of AMI (based on the denominator specification) for all hospitals nationally are reported by the same 5 year age-groups.

3. The national age-specific mortality rates for each of the 5 year age-groups are calculated, i.e. deaths within 30 days in all hospitals divided by cases in all hospitals.

4. Each of the national age-specific mortality rates is then multiplied by the number of cases within that age-group in each hospital, i.e. multiplying the age-specific national rates by the number of cases in each hospital to give the 'expected deaths' within each age-group if the national age-specific mortality rates applied.

5. The age-standardised mortality ratio (SMR) is then calculated as the number of actual (observed) deaths in each hospital divided by the sum of the 'expected deaths' and then multiplied by 100. It is a ratio of the number of observed deaths compared to the number of deaths that would be expected if the national age-specific mortality rates applied. It eliminates any bias in a hospital's mortality rate caused by having younger or older patients than other hospitals.

6. The upper and lower 95% confidence intervals are then calculated. If the number of observed deaths in a hospital is 100 or less, the upper and lower confidence intervals are obtained directly from a table of exact confidence limits for a Poisson count using the following formula:

   Lower limit: $x_1/e*100$

   Upper limit: $x_2/e*100$

   where $\boldsymbol{x_1}$ and $\boldsymbol{x_2}$ are the lower and upper limits respectively for the observed number of deaths from the table of exact 95% confidence limits for a Poisson count, and $\boldsymbol{e}$ is the expected number of deaths.

   Note that the Poisson distribution is asymmetrical, and so the use of the Poisson count results in confidence limits that are not symmetrical around the SMR.

   If the observed number of deaths is over 100, the following formula is used for the confidence limits:

   $$(d \pm (1.96 * \sqrt{d}))/e*100$$

   where $\boldsymbol{d}$ is the observed number of deaths and $\boldsymbol{e}$ is the expected number of deaths.
   (Daly LE, Bourke GJ: Interpretation and Uses of Medical Statistics)