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National audit of hospital mortality annual report 2020

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National Audit of Hospital Mortality

SUPPORTING APPENDIX 2020

This document is supplemental to the
National Audit of Hospital Mortality Annual Report 2020.

For further information, please refer to the main report, which is available from:
https://www.noca.ie/publications/publications-listing/P0/category/3

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GLOSSARY

ACRONYM	FULL TERM
ADST	Analysis and Display Scientific Team
AMI	acute myocardial infarction
CCI	Charlson Comorbidity Index
COPD	chronic obstructive pulmonary disease
COVID-19	Coronavirus disease 2019
HIPE	Hospital In-Patient Enquiry scheme
HSCIC	Health and Social Care Information Centre
HSE	Health Service Executive
ICD-10-AM/ACHI/ACS	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification/Australian Classification of Health Interventions/Australian Coding Standards
NAHM	National Audit of Hospital Mortality
NHIU	National Health Intelligence Unit, Strategic Planning and Transformation, HSE
NOCA	National Office of Clinical Audit
NPEC	National Perinatal Epidemiology Centre
NPIRS	National Psychiatric Inpatient Reporting System
NQAIS	National Quality Assurance Improvement System. A suite of audit and performance-monitoring tools developed by the National Health Intelligence Unit, Strategic Planning and Transformation, Health Service Executive.
NQAIS NAHM	National Quality Assurance Improvement System, National Audit of Hospital Mortality web-based tool
OECD	Organisation for Economic Co-operation and Development
RCSI	Royal College of Surgeons in Ireland
ROC	receiver operating characteristic
SMR	standardised mortality ratio
UL	University of Limerick

METHODOLOGY FOR MEASURING IN-HOSPITAL MORTALITY

NQAIS NAHM web-based tool

National Quality Assurance Improvement System, National Audit of Hospital Mortality (NQAIS NAHM) is a web-based interactive online tool. It analyses Hospital In-Patient Enquiry (HIPE) scheme data using standardisation techniques that take into account factors such as clinical complexity, so that the best use can be made of available information in supporting hospitals to drive improvements in healthcare.

The statistical analysis within the NQAIS NAHM model is primarily driven by the principal diagnosis as recorded in HIPE. The principal diagnosis is defined as the diagnosis established after study to be chiefly responsible for occasioning the episode of admitted patient care (Healthcare Pricing Office, 2020). It is important to note that it does not refer to a subsequent diagnosis made while the patient is in hospital or indeed the underlying cause of death, should this occur. HIPE also collects up to 29 additional diagnoses (Dx 2 – 30) which are conditions either coexisting with the principal diagnosis or a condition which arose during the same episode of care.

Day care discharges and maternity care discharges are excluded from the risk model, as these typically show high volumes of activity but very low death rates. Maternity-related mortality is analysed in the National Perinatal Epidemiology Centre (NPEC) National Audit of Severe Maternal Morbidity. Psychiatric admissions have not yet been included in the model as such patient data is primarily captured in the National Psychiatric Inpatient Reporting System (NPIRS) which is a psychiatric database providing detailed information on all admissions and discharges to inpatient psychiatric services in Ireland.

The metrics are dynamically available to all participating hospitals at all diagnostic levels in numeric and graphical format for selectable time periods. Users are identified in each hospital and monthly training sessions are conducted by the National Office of Clinical Audit (NOCA).

MORTALITY RATES

Introduction

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

- **Expected variation:** Due to the nature of data, there will always be some fluctuation in the precise measure between one reporting period and the next.
- **Differences in patient factors:** Patients differ from one another in terms of age, gender, comorbidities and behaviour.
- **Differences in data collection:** Hospitals and healthcare providers may differ in terms of how a patient's medical chart is completed or how conditions are recorded and coded.

There are a number of approaches to measuring mortality rates. They are calculated in different ways and used for different purposes. The three main approaches are:

1. Crude in-hospital mortality rate;
2. Directly standardised in-hospital mortality rate;
3. Indirectly standardised in-hospital mortality ratio.

1. Crude in-hospital mortality rate

The crude in-hospital mortality rate is a measure of the number of deaths per 100 admissions. It is important to remember that it does not attempt to adjust for differences in patient populations (such as age and comorbidity). It is usually presented with reference to a specific disease, such as stroke or acute myocardial infarction (AMI). It is typically expressed as the number of deaths per 100 of the total number of admissions for that specific condition per year.

$$\text{Crude in-hospital mortality rate for a given diagnosis} = \frac{\text{No. of deaths*}}{\text{Total admissions *}} \times 100 \text{ per year}$$

*For that specific diagnosis

The crude in-hospital mortality rate gives an overview of the extent to which a given condition adds to the overall burden from death in a particular hospital or group of hospitals. It is not a standardised measure because it does not take into consideration confounding factors such as age, type of admission, previous admissions or existing background illness (case mix and comorbidity) in a population of patients. This method therefore has some limitations, but it is still useful in that it allows each hospital to take a bird's-eye view of its number of deaths as well as time trends, providing there has been no significant change in case mix during the period in question.

However, it is not appropriate to compare hospitals against one another using the crude in-hospital mortality rate because it does not take into account any of the other important factors affecting mortality. Crude in-hospital mortality is used in the main report to show the national trend.

2. Directly standardised mortality rate

The direct standardisation method provides more adjustment for population differences. Standardisation in this context means that a common age-structured population is used as the standard, and study populations or groups are compared against this. Age and gender are the two most common variables used for direct standardisation, and the national population may be used as the '"standard population" (see Figure 1).

Age-specific mortality rates (known)

Population(s) of interest → **STANDARD POPULATION** → **Compare the age-adjusted mortality rates**

(Source Naing, 2000, Figure 1)

FIGURE 1: CONCEPT OF DIRECT STANDARDISATION

Standardisation therefore means that the mortality rates produced for a population or condition in a hospital are those that they would have had if they had the same attributes as the standard population. Direct standardisation methods are more powerful when numbers are larger, and are best used for a single or otherwise homogeneous group of diagnoses. It is important to note that only a limited number of variables may be standardised using this method.

The Organisation for Economic Co-operation and Development (OECD) uses the directly standardised death rate as the basis for its methodological approach (OECD, 2021). The reference population is based on the age and gender profile of a standard OECD population admitted to hospital with selected conditions. This allows direct comparison between OECD member states and is of greatest value when it is used to compare practices across international boundaries. This is the approach used by the Department of Health for the *National Healthcare Quality Reporting System Annual Report* (Department of Health, 2020) for selected diagnoses, specifically AMI, haemorrhagic stroke and ischaemic stroke. Due to the differences in methodology, it is not possible to compare in-hospital mortality indicators in the main report against those reported by the Department of Health.

3. Indirectly standardised mortality ratio

The standardised mortality ratio (SMR) is another method that adjusts for population differences. It is a measure of mortality that allows individual hospitals to compare their observed death rate against the rate that would be expected in that hospital if other variables affecting mortality could be taken into consideration. Analysis of SMRs is based on the principal diagnosis of the patient recorded in HIPE, i.e. the diagnosis that was established after investigation and found to be responsible for the episode of admitted patient care. It is important to note, however, that the principal reason for a person's hospitalisation is not always the reason for their death.

In equation format:

$$\text{Standardised mortality ratio} = \frac{\text{Observed deaths}}{\text{Expected deaths}} \times 100$$

The "expected deaths" are calculated from national data using statistical techniques to account for differences in patient factors. These factors include: age; sex; deprivation; whether patients were in receipt of palliative care treatment in hospital; number of previous admissions in the past year; source and type of admission (for example, from home or a nursing home, or an emergency transfer from another acute hospital); and the Charlson Comorbidity Index (CCI) (Charlson *et al*., 1987), which is a measure of comorbidity. The CCI data are derived from additional diagnoses coded on the HIPE episode. Additional diagnoses (Dx 2 – 30) are conditions that either coexist with the principal diagnosis or that arose during the same episode of care and which affect the patient's management.

NQAIS NAHM employs the new Health and Social Care Information Centre's (HSCIC's) weighting factors in CCI, outlined in Table 1, as they are reflective of the improved clinical outcomes resulting from advances in clinical care (HSCIC, 2015).

Within the NQAIS NAHM standardised mortality ratio risk model, and as used by the HSCIC, the CCI is categorised as follows: <1, 1–5, >5.

TABLE 1: NEW AND OLD WEIGHTINGS APPLIED TO CHARLSON COMORBIDITY INDEX CATEGORIES

	Condition Name	ICD-10/10-AM codes	New weight	Old weight
1	Acute myocardial infarction	I21, I22, I23, I252, I258	5	1
2	Cancer	C00–C76, C81–C97	8	2
3	Cancer - metastatic	C77, C78, C79, C80	14	3
4	Cerebral vascular accident	G450, G451, G452, G454, G458, G459, G46, I60–I69	11	1
5	Congestive heart failure	I50	13	1
6	Connective tissue disorder	M05, M060, M063, M069, M32, M332, M34, M353	4	1
7	Dementia	F00, F01, F02, F03, F051	14	1
8	Diabetes	E101, E105, E106, E108, E109, E111, E115, E116, E118, E119, E131, E136, E138, E139, E141, E145, E146, E148, E149	3	1
9	Diabetes complications	E102, E103, E104, E107, E112, E113, E114, E117, E132, E133, E134, E137, E142, E143, E144, E147	−1	2
10	HIV	B20, B21, B22, B23, B24, O987	2	6
11	Liver disease	K702, K703, K717, K73, K74	8	1
12	Liver disease – severe	K721, K729, K766, K767	18	3
13	Paraplegia	G041, G81, G820, G821, G822	1	2
14	Peptic ulcer	K25, K26, K27, K28	9	1
15	Peripheral vascular disease	I71, I739, I790, R02, Z958, Z959	6	1
16	Pulmonary disease	J40–J47, J60–J67	4	1
17	Renal disease	I12, I13, N01, N03, N052–N056, N072–N074, N18, N19, N25	10	2

Source: HSCIC (2015)

The CCI assigns a weighting to the degree to which the patient is debilitated by background illnesses and conditions; therefore, it is evident that the indirect approach to standardisation allows a greater number of variables to be controlled for, which is very useful in dealing with complex conditions and presentations.

Overall, the SMR is an appropriate method of measuring in-hospital mortality in Ireland because:
• there is a large number of hospitals in Ireland, many of very different sizes
• it takes account of a larger number of variables that impact on in-hospital mortality.

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

Control limits

While the national average is set at 100, it is unlikely that any calculated SMR will be exactly 100. A certain amount of variation above or below this average is to be expected, and the control limit approach is a method of accounting for this. Control limits are statistical calculations based on the number of admissions and deaths within each hospital, showing the variation that is normally expected to occur in that hospital's data. The control limits are set at 99.8%, meaning that there is a 1 in 500 chance of a hospital being outside these limits by chance alone. This means, therefore, that an SMR that is above (or below) the 99.8% control limits is unlikely to have occurred by chance and may indicate greater (or fewer) deaths than would otherwise be expected.

IMPACT OF COVID-19 ON METHODOLOGY

In the early days of the coronavirus disease 2019 (COVID-19) pandemic, little was known about the disease or the resulting clinical presentation and complications that could be suffered by patients. Initially, it was thought to be a primarily respiratory disease, and that it might be possible to include a COVID-19 factor in the calculation of expected respiratory deaths. As more was learned about the disease, however, and as it was more closely studied, it became apparent that it is a multi-system viral condition, potentially involving the cardiovascular, respiratory, renal, metabolic, skin, neurological and immunological systems. Because of the inability to link the disease to any single system, and because of the current lack of data about the comparative impact of the disease on each of these (and other) systems, it has not been possible to incorporate COVID-19 codes in trying to calculate expected mortality outcomes for patients. This is a potential limitation in the methodology, but it is a limitation that is also being reported by other countries and organisations that use SMRs in their hospital mortality estimations. As more is understood about the disease, and as its impact can be further verified, it may be possible to include it in future risk estimations; however, this will depend on international agreement as to methodology.

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FRAMEWORK FOR THE NATIONAL AUDIT OF HOSPITAL MORTALITY ANNUAL REPORT

The National Audit of Hospital Mortality (NAHM) Governance Committee defined inclusion criteria in order to select a cohort of key diagnoses for the National Audit of Hospital Mortality Annual Report, as shown in Table 2.

TABLE 2: CRITERIA FOR SELECTION OF KEY DIAGNOSES

	Criterion	Comment	Rationale
Clinical	**Alignment to National Clinical Programme**	Is there an aligned Health Service Executive (HSE) National Clinical Programme?	HSE National Clinical Programmes provide national leadership for improvement.
	Burden of the clinical topic	Is the key diagnosis considered of high volume?	Priority in this report is given to diseases associated with the greatest burden to public health and the health system.
	Significant clinical risk	Is the key diagnosis considered of significant clinical risk, for example high mortality?	
Methodological	**Definition**	Is the key diagnosis clearly clinically defined?	Only key diagnoses which are explicitly defined are selected for reporting.
	Number of hospitals with defined number of admissions and expected events	Is the volume of expected deaths ≥5? Is the volume of admissions for the individual diagnosis >100 over the reporting period?	The model is more statistically reliable when these criteria are met.
	Statistical validity of the model	Is the receiver operating characteristic (ROC) statistic >0.7?	This measure calculates the performance of the model in predicting death. A result of >0.7 is considered a satisfactory predictor.

While not all hospitals' data for all diagnoses are published in the *National Audit of Hospital Mortality Annual Report 2020,* hospitals can view their in-hospital mortality data for all diagnoses (high and low volume) via the National Quality Assurance Improvement System (NQAIS) NAHM web-based tool throughout the year.

NAHM GOVERNANCE STRUCTURE

NAHM is deployed under the governance framework of the National Office of Clinical Audit (NOCA). The NOCA Governance Board guides NOCA's clinical decision-making and strategic direction, and it provides oversight for nine national clinical audits.

NOCA has established the NAHM Governance Committee with multidisciplinary membership, including clinical and executive leadership from Irish hospitals and the health service. The NAHM Governance Committee oversees two subcommittees and the NOCA Operational Team.

- In consultation with the National Health Intelligence Unit (NHIU), Strategic Planning and Transformation in the HSE, NOCA has developed a subcommittee called the NQAIS NAHM Analysis and Display Scientific Team (ADST). This team provides specialist expertise in order to achieve excellence in the development and enhancement of the NQAIS NAHM web-based tool. Members of the team are drawn from the NHIU, NOCA, the NAHM Governance Committee and the software developer. This aligns NQAIS NAHM with developments on other NQAIS projects under the NHIU umbrella.
- The NAHM Writing Group is a subcommittee of the NAHM Governance Committee; this subcommittee is convened specifically to write the annual report.
- The NAHM Operational Team oversees the day-to-day management of NAHM in line with NOCA policies and guidelines.
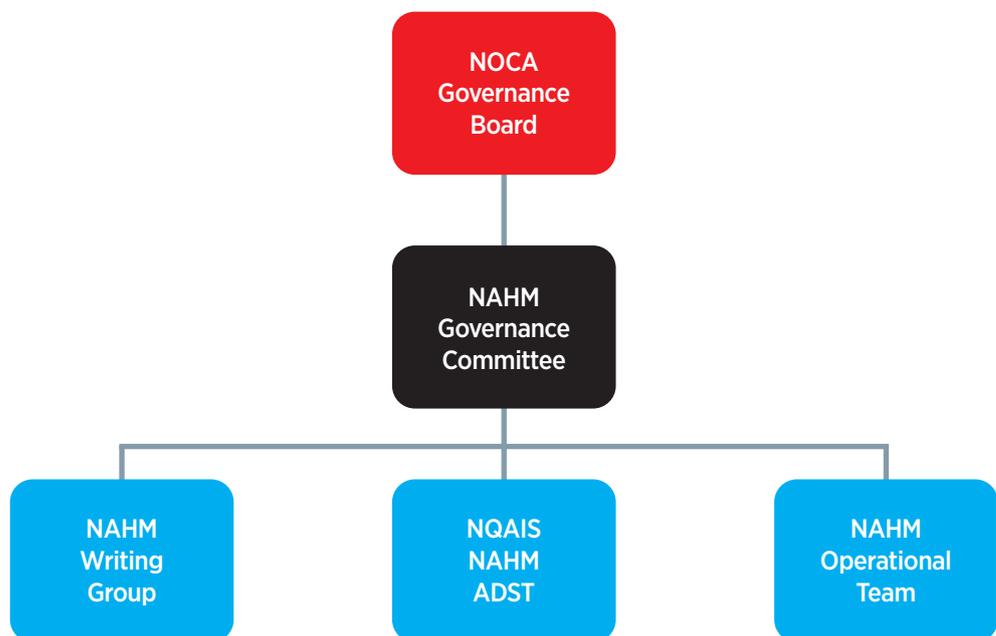
FIGURE 2: NATIONAL AUDIT OF HOSPITAL MORTALITY GOVERNANCE STRUCTURE

TABLE 3: ATTENDANCE AT NATIONAL AUDIT OF HOSPITAL MORTALITY GOVERNANCE COMMITTEE MEETINGS, 2020

Name	Representing	Joined	Meeting 28/01/20	Meeting 28/04/20	Meeting 17/06/20	Meeting 26/08/20	Meeting 13/10/20	Comment
Jennifer Martin	**NAHM Chair** HSE Quality Improvement Division	2015	✓		✓	✓	✓	
Bridget Egan	**NAHM Clinical Lead** Royal College of Surgeons in Ireland	2015	✓		✓	✓	✓	
Ruth Buckley	NAHM User Representative	2019	✓		✓	✓	✓	
Camilla Carroll	Royal College of Surgeons in Ireland	2019	-	Meeting cancelled due to unavailability of members as a result of COVID-19 pandemic	-	-	-	Stepped down Jan 2021
Avilene Casey	HSE Office of Nursing and Midwifery	2020	N/A		✓	✓	✓	Joined Feb 2020
Kevin Clarkson	College of Anaesthesiologists of Ireland	2019	✓		✓	A	A	
Gareth Clifford	HSE Acute Operations	2020	✓		✓	✓	✓	
Alan Egan	Public and Patient Interest Representative	2017	✓		✓	✓	A	
Adrienne Foran	HSE Clinical Directors Forum	2020	N/A		✓	A	A	Joined Feb 2020
Eilísh Hardiman	HSE Hospital Groups Forum	2015	A		✓	A	✓	
Howard Johnson	HSE National Health Intelligence Unit	2015	✓		✓	A	✓	
Simon Jones	International Expert	2015	✓		A	✓	✓	
Sean Kennelly	General Internal Medicine, Royal College of Physicians of Ireland	2019	A		✓	A	A	Retired Nov 2020
Deirdre King de Montano	NAHM User Representative	2019	✓		A	A	A	
Jeanne Moriarty	Joint Faculty of Intensive Care Medicine of Ireland	2018	✓		✓	✓	✓	
Deirdre Murphy	HSE Healthcare Pricing Office	2015	✓		✓	✓	✓	
Regina McQuillan	Palliative Care Representative, Royal College of Physicians of Ireland	2019	✓		✓	A	A	
Deirdre Burke	NOCA National Audit of Hospital Mortality Manager	2015	✓		✓	✓	✓	

✓ Attended Meeting   A Apologies received   N/A not yet appointed or resigned from committee

INDICATORS FOR KEY DIAGNOSIS AND TABULAR INFORMATION TO SUPPORT FUNNEL PLOTS IN THE MAIN REPORT

ACUTE MYOCARDIAL INFARCTION

TABLE 4: ACUTE MYOCARDIAL INFARCTION INDICATOR	
Definition	**Standardised mortality ratio with a principal diagnosis of AMI**
Year covered	2020
ICD-10-AM/ ACHI/ACS codes 10th Edition	I21, I210, I211, I212, I213, I214, I219, I22, I220, I221, I228, I229
Methodology	**Numerator** Number of actual deaths following admission to hospital with the following International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification/ Australian Classification of Health Interventions/Australian Coding Standards (ICD-10-AM/ACHI/ACS) principal diagnoses: 'Acute myocardial infarction', 'Acute transmural MI of anterior wall', 'Acute transmural MI of inferior wall', 'Acute transmural MI of other sites', 'Acute transmural MI of unspecified site', 'Acute sub-endocardial MI', 'Acute myocardial infarction unspecified', 'Subsequent myocardial infarction', 'Subsequent MI of anterior wall', 'Subsequent MI of inferior wall', 'Subsequent MI of other sites', 'Subsequent MI of unspecified site' **Denominator** Number of expected deaths for AMI. This is calculated using an indirect standardisation and logistic regression modelling of all patients admitted to hospital with a principal diagnosis of AMI.

TABLE 5: TABULAR PRESENTATION FOR ACUTE MYOCARDIAL INFARCTION IN-HOSPITAL MORTALITY, 2020

Hospital Group	Hospital name	No. of admissions for AMI, 2020	SMR-AMI, 2020	99.8% control limits
Dublin Midlands Hospital Group	Naas General Hospital	181	35	−12–244
	St James's Hospital	361	149	36–173
	Tallaght University Hospital (Adult)	219	57	−15–250
Ireland East Hospital Group	Mater Misericordiae University Hospital	673	158	31–180
	Regional Hospital Mullingar	109	70	0–228
	Our Lady's Hospital, Navan	125	93	−5–234
	St Luke's General Hospital, Carlow/Kilkenny	209	56	15–203
	St Vincent's University Hospital	280	84	15–203
	Wexford General Hospital	217	78	21–193
RCSI* Hospital Group	Connolly Hospital	176	35	−12–242
	Beaumont Hospital	185	119	5–217
	Cavan General Hospital	125	61	12–208
	Our Lady of Lourdes Hospital, Drogheda	238	94	21–193
Saolta University Health Care Group	Galway University Hospitals	352	101	31–181
	Letterkenny University Hospital	244	128	23–192
	Mayo University Hospital	177	95	14–203
	Sligo University Hospital	149	83	5–217
South / South West Hospital Group	Cork University Hospital	561	120	39–169
	University Hospital Kerry	160	84	4–217
	South Tipperary General Hospital	104	57	7–214
	University Hospital Waterford	211	109	13–206
UL* Hospitals Group	University Hospital Limerick	397	104	42–165

* Royal College of Surgeons in Ireland (RCSI)
* University of Limerick (UL)

HEART FAILURE

TABLE 6: HEART FAILURE INDICATOR

Definition	Standardised mortality ratio with a principal diagnosis of heart failure
Year covered	2020
ICD-10-AM/ ACHI/ACS codes 10th Edition	I50, I500, I501, I509, U822
Methodology	**Numerator** Number of actual deaths following admission to hospital with the following ICD-10-AM/ACHI/ACS principal diagnoses: 'Heart failure', 'Congestive heart failure', 'Left ventricular failure', 'Heart failure unspecified', 'Chronic heart failure' **Denominator** Number of expected deaths for heart failure. This is calculated using an indirect standardisation and logistic regression modelling of all patients admitted to hospital with a principal diagnosis of heart failure.

TABLE 7: TABULAR PRESENTATION FOR HEART FAILURE IN-HOSPITAL MORTALITY, 2020

Hospital Group	Hospital name	No. of admissions for heart failure, 2020	SMR – heart failure, 2020	99.8% control limits
Dublin Midlands Hospital Group	Naas General Hospital	142	108	19–196
	Midland Regional Hospital, Portlaoise	126	94	−6–234
	St James's Hospital	282	137	40–169
	Tallaght University Hospital (Adult)	199	100	23–192
	Midland Regional Hospital, Tullamore	151	89	9–212
Ireland East Hospital Group	Mater Misericordiae University Hospital	311	104	42–165
	Regional Hospital Mullingar	141	57	0–229
	Our Lady's Hospital, Navan	161	150	15–203
	St Luke's General Hospital, Carlow/Kilkenny	223	148	15–202
	St Vincent's University Hospital	365	121	40–168
	Wexford General Hospital	274	150	23–191
RCSI Hospital Group	Connolly Hospital	220	63	21–194
	Beaumont Hospital	311	140	38–171
	Cavan General Hospital	135	100	3–221
	Our Lady of Lourdes Hospital, Drogheda	241	126	27–185
Saolta University Health Care Group	Portiuncula University Hospital	137	21	11–208
	Galway University Hospitals	361	85	42–165
	Letterkenny University Hospital	167	60	12–207
	Mayo University Hospital	268	92	34–176
	Sligo University Hospital	260	90	25–187
South / South West Hospital Group	Cork University Hospital	417	120	37–172
	University Hospital Kerry	167	108	13–205
	Mercy University Hospital, Cork	162	99	12–206
	South Tipperary General Hospital	144	33	9–212
	University Hospital Waterford	232	98	23–192
UL Hospitals Group	University Hospital Limerick	240	86	29–182
	Ennis Hospital	192	60	23–191

ISCHAEMIC STROKE

TABLE 8: ISCHAEMIC STROKE INDICATOR	
Definition	**Standardised mortality ratio with a principal diagnosis of ischaemic stroke**
Year covered	2020
ICD-10-AM/ ACHI/ACS codes 10th Edition	I63, I630, I631, I632, I633, I634, I635, I636, I638, I639
Methodology	**Numerator** Number of actual deaths following admission to hospital with the following ICD-10-AM/ACHI/ACS principal diagnoses: 'Cerebral infarction', 'Cerebral infarction due to thrombosis of the pre-cerebral artery', 'Cerebral infarction due to embolism of pre-cerebral artery', 'Cerebral infarction due to unspecified occlusion of pre-cerebral artery', 'Cerebral infarction due to thrombosis of the cerebral artery', 'Cerebral infarction due to embolism of the cerebral artery', 'Cerebral infarction due to unspecified occlusion of the cerebral artery', 'Cerebral infarction due to central venous thrombosis non-pyogenic', 'Other cerebral infarction', 'Cerebral infarction unspecified' **Denominator** Number of expected deaths for ischaemic stroke. This is calculated using an indirect standardisation and logistic regression modelling of all patients admitted to hospital with a principal diagnosis of ischaemic stroke.

TABLE 9: TABULAR PRESENTATION FOR ISCHAEMIC STROKE IN-HOSPITAL MORTALITY, 2020

Hospital Group	Hospital name	No. of admissions for ischaemic stroke, 2020	SMR – ischaemic stroke, 2020	99.8% control limits
Dublin Midlands Hospital Group	Naas General Hospital	170	92	19–197
	St James's Hospital	209	98	19–195
	Tallaght University Hospital (Adult)	243	131	26–187
Ireland East Hospital Group	Mater Misericordiae University Hospital	249	107	34–176
	Regional Hospital Mullingar	128	62	12–208
	St Luke's General Hospital, Carlow/Kilkenny	118	139	1–227
	St Vincent's University Hospital	332	110	44–163
RCSI Hospital Group	Connolly Hospital	192	56	15–203
	Beaumont Hospital	650	98	52–153
	Cavan General Hospital	125	69	28–183
	Our Lady of Lourdes Hospital, Drogheda	221	110	24–190
Saolta University Health Care Group	Galway University Hospitals	207	66	23–190
	Letterkenny University Hospital	166	110	26–187
	Mayo University Hospital	191	113	35–174
	Sligo University Hospital	150	71	21–194
South / South West Hospital Group	Cork University Hospital	428	149	45–162
	University Hospital Kerry	126	62	12–208
	University Hospital Waterford	127	116	18–200
UL Hospitals Group	University Hospital Limerick	360	109	50–156

HAEMORRHAGIC STROKE

TABLE 10: HAEMORRHAGIC STROKE INDICATOR	
Definition	**Standardised mortality ratio with a principal diagnosis of haemorrhagic stroke**
Years covered	2018–2020
ICD-10-AM/ ACHI/ACS codes 10th Edition	I61, I610, I611, I612, I613, I614, I615, I616, I618, I619
Methodology	**Numerator** Number of actual deaths following admission to hospital with the following ICD-10-AM/ACHI/ACS principal diagnoses: 'Intracerebral haemorrhage', 'Intracerebral haemorrhage in hemisphere subcortical', 'Intracerebral haemorrhage in hemisphere cortical', 'Intracerebral haemorrhage in hemisphere unspecified', 'Intracerebral haemorrhage in brain stem', 'Intracerebral haemorrhage in cerebellum', 'Intracerebral haemorrhage intraventricular', 'Intracerebral haemorrhage multiple localised', 'Other intracerebral haemorrhage', 'Intracerebral haemorrhage unspecified'. **Denominator** Number of expected deaths for haemorrhagic stroke. This is calculated using an indirect standardisation and logistic regression modelling of all patients admitted to hospital with a principal diagnosis of haemorrhagic stroke.

TABLE 11: TABULAR PRESENTATION FOR HAEMORRHAGIC STROKE IN-HOSPITAL MORTALITY, 2018–2020

Hospital Group	Hospital name	No. of admissions for haemorrhagic stroke, 2018–2020	SMR – haemorrhagic stroke, 2018–2020	99.8% control limits
Dublin Midlands Hospital Group	St James's Hospital	127	108	49–157
	Tallaght University Hospital (Adult)	105	99	46–160
Ireland East Hospital Group	Mater Misericordiae University Hospital	173	87	58–146
	St Vincent's University Hospital	270	98	69–133
RCSI Hospital Group	Beaumont Hospital	333	101	64–139
Saolta University Health Care Group	Galway University Hospitals	136	90	55–149
South / South West Hospital Group	Cork University Hospital	267	136	65–137
UL Hospitals Group	University Hospital Limerick	162	93	58–145

CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Definition	**Standardised mortality ratio with a principal diagnosis of chronic obstructive pulmonary disease (COPD)**
Year covered	2020
ICD-10-AM/ ACHI/ACS codes 10th Edition	J40, J41, J410, J411, J418, J42, J43, J430, J431, J432, J438, J439, J44, J440, J441, J448, J449, J47, U83, U831, U832, U834.
Methodology	**Numerator** Number of actual deaths following admission to hospital with the following ICD-10-AM/ACHI/ACS principal diagnoses: 'Bronchitis not specified as acute or chronic', 'Simple and mucopurulent chronic bronchitis', 'Simple chronic bronchitis', 'Mucopurulent chronic bronchitis', 'Mixed simple and mucopurulent chronic bronchitis', 'Unspecified chronic bronchitis', 'Emphysema', 'MacLeod's syndrome', 'Pan-lobular emphysema', 'Centrilobular emphysema', 'Other emphysema', 'Emphysema unspecified', 'Other COPD', 'COPD with acute lower respiratory infection', 'COPD with acute exacerbation unspecified', 'Other specified COPD', 'COPD unspecified', 'Bronchiectasis', 'Diseases of the respiratory system', 'Emphysema without mention of COPD', 'Chronic obstructive pulmonary disease', 'Bronchiectasis without mention of CF'. **Denominator** Number of expected deaths for COPD. This is calculated using an indirect standardisation and logistic regression modelling of all patients admitted to hospital with a principal diagnosis of COPD.

TABLE 13: TABULAR PRESENTATION FOR COPD IN-HOSPITAL MORTALITY, 2020

Hospital Group	Hospital name	No. of admissions COPD, 2020	SMR – COPD, 2020	99.8% control limits
Dublin Midlands Hospital Group	Naas General Hospital	296	118	26–187
	Midland Regional Hospital, Portlaoise	187	143	5–217
	St James's Hospital	440	68	32–178
	Tallaght University Hospital (Adult)	531	150	28–185
	Midland Regional Hospital, Tullamore	334	122	14–203
Ireland East Hospital Group	Mater Misericordiae University Hospital	746	107	39–169
	Regional Hospital Mullingar	309	88	18–199
	Our Lady's Hospital, Navan	241	102	7–214
	St Luke's General Hospital, Carlow/Kilkenny	451	124	27–185
	St Michael's Hospital, Dun Laoghaire	142	32	−7–236
	St Vincent's University Hospital	386	73	24–190
	Wexford General Hospital	489	142	21–194
RCSI Hospital Group	Connolly Hospital	387	101	19–197
	Beaumont Hospital	499	100	40–168
	Cavan General Hospital	293	106	23–192
	Our Lady of Lourdes Hospital, Drogheda	452	134	21–194
Saolta University Health Care Group	Portiuncula University Hospital	227	79	8–213
	Galway University Hospitals	376	50	33–177
	Letterkenny University Hospital	566	53	37–172
	Mayo University Hospital	418	114	36–173
	Sligo University Hospital	322	95	11–209
South / South West Hospital Group	Cork University Hospital	602	142	43–164
	University Hospital Kerry	332	113	23–191
	Mercy University Hospital, Cork	382	83	26–187
	South Tipperary General Hospital	285	81	20–195
	University Hospital Waterford	269	95	5–217
UL Hospitals Group	University Hospital Limerick	513	102	39–169
	Ennis Hospital	250	40	27–185
	St John's Hospital, Limerick	226	39	2–223

PNEUMONIA

Definition	Standardised mortality ratio with a principal diagnosis of pneumonia
Year covered	2020
ICD-10-AM/ ACHI/ACS codes 10th Edition	A202, A212, A221, A310, A420, A430, A481, B012, B052, B250, B371, B380, B381, B382, B390, B391, B392, B583, B59, B671, J12, J120, J121, J122, J123, J128, J129, J13, J14, J15, J150, J151, J152, J153, J154, J155, J156, J157, J158, J159, J16, J160, J168, J17, J170, J171, J172, J173, J178, J18, J180, J181, J182, J188, J189, J85, J850, J851
Methodology	**Numerator** Number of actual deaths following admission to hospital with the following ICD-10-AM/ACHI/ACS principal diagnoses: 'Pneumonic plague', 'Pulmonary tularaemia', 'Pulmonary anthrax', 'Pulmonary mycobacterial infection', 'Pulmonary actinomycosis', 'Pulmonary nocardiosis', 'Legionnaires' disease', 'Varicella pneumonia', 'Measles complicated by pneumonia', 'Cytomegaloviral pneumonitis', 'Pulmonary candidiasis', 'Acute pulmonary coccidioidomycosis', 'Chronic pulmonary coccidioidomycosis', 'Pulmonary coccidioidomycosis unspecified', 'Acute pulmonary histoplasmosis capsulati', 'Chronic pulmonary histoplasmosis capsulati', 'Pulmonary histoplasmosis capsulati unspecified', 'Pulmonary toxoplasmosis', 'Pneumocystosis', 'Echinococcus granulosus infection lung', 'Viral pneumonia not elsewhere classified', 'Adenoviral pneumonia', 'Respiratory syncytial virus pneumonia', 'Parainfluenza virus pneumonia', 'Human metapneumovirus pneumonia', 'Other viral pneumonia', 'Viral pneumonia unspecified', 'Pneumonia due to Streptococcus pneumoniae', 'Pneumonia due to Haemophilus influenzae', 'Bacterial pneumonia NEC', 'Pneumonia due to Klebsiella pneumoniae', 'Pneumonia due to Pseudomonas', 'Pneumonia due to staphylococcus', 'Pneumonia due to streptococcus group B', 'Pneumonia due to other streptococci', 'Pneumonia due to Escherichia coli', 'Pneumonia due to other (aerobic) gram negative bacteria', 'Pneumonia due to Mycoplasma pneumoniae', 'Other bacterial pneumonia', 'Bacterial pneumonia unspecified', 'Pneumonia due to other infect organisms NEC', 'Chlamydial pneumonia', 'Pneumonia due to other spec infect organisms', 'Pneumonia in diseases class elsewhere', 'Pneumonia in bacteria disease classified elsewhere', 'Pneumonia in viral disease classified elsewhere', 'Pneumonia in mycoses', 'Pneumonia in parasitic diseases', 'Pneumonia in other disease classified elsewhere', 'Pneumonia organism unspecified', 'Bronchopneumonia unspecified', 'Lobar pneumonia unspecified', 'Hypostatic pneumonia unspecified', 'Other pneumonia organism unspecified', 'Pneumonia unspecified', 'Abscess of lung and mediastinum', 'Gangrene and necrosis of lung', 'Abscess of lung with pneumonia' **Denominator** Number of expected deaths for pneumonia. This is calculated using an indirect standardisation and logistic regression modelling of all patients admitted to hospital with a principal diagnosis of pneumonia.

TABLE 15: TABULAR PRESENTATION FOR PNEUMONIA IN-HOSPITAL MORTALITY, 2020

Hospital Group	Hospital name	No. of admissions pneumonia, 2020	SMR – pneumonia, 2020	99.8% control limits
Dublin Midlands Hospital Group	Naas General Hospital	305	113	60–143
	Midland Regional Hospital, Portlaoise	154	111	38–170
	St James's Hospital	1165	86	76–125
	Tallaght University Hospital (Adult)	656	127	66–137
	Midland Regional Hospital, Tullamore	225	117	49–157
Ireland East Hospital Group	St Columcille's Hospital, Loughlinstown	105	75	11–211
	Mater Misericordiae University Hospital	787	125	68–134
	Regional Hospital Mullingar	213	112	44–163
	Our Lady's Hospital, Navan	262	75	47–159
	St Luke's General Hospital, Carlow/Kilkenny	592	83	66–136
	St Vincent's University Hospital	916	112	72–130
	Wexford General Hospital	326	94	48–158
RCSI Hospital Group	Connolly Hospital	572	132	63–140
	Beaumont Hospital	562	115	65–138
	Cavan General Hospital	399	87	66–137
	Our Lady of Lourdes Hospital, Drogheda	587	123	68–134
Saolta University Health Care Group	Portiuncula University Hospital	371	70	60–143
	Galway University Hospitals	513	74	64–138
	Letterkenny University Hospital	564	117	64–139
	Mayo University Hospital	356	106	62–141
	Sligo University Hospital	398	64	60–144
South / South West Hospital Group	Cork University Hospital	466	121	60–144
	University Hospital Kerry	253	118	46–161
	Mercy University Hospital, Cork	242	116	46–161
	South Tipperary General Hospital	223	88	49–157
	University Hospital Waterford	335	85	54–150
UL Hospitals Group	University Hospital Limerick	384	99	57–147
	Ennis Hospital	127	52	37–171
	St John's Hospital, Limerick	131	28	43–165