

Mortality following hospitalisation for seven clinical conditions

Technical Supplement

July 2021 – June 2024

BUREAU OF HEALTH INFORMATION

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Please note there is the potential for minor revisions of data in this report.

Please check the online version at bhi.nsw.gov.au for any amendments or errata.

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The conclusions in this report are those of BHI and no official endorsement by the NSW Minister for Health, the NSW Ministry of Health or any other NSW public health organisation is intended or should be inferred.

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Introduction

This technical supplement outlines the methodology and analysis behind the results of the Bureau of Health Information's (BHI) report on 30-day mortality following hospitalisation for seven clinical conditions. Further supporting information is available in historical technical supplements, available at bhi.nsw.gov.au.

The report presents results for seven clinical conditions in the 30 days following admission to a NSW public hospital, for the period July 2021 – June 2024. The seven conditions were acute myocardial infarction (AMI), ischaemic stroke, haemorrhagic stroke, congestive heart failure (CHF), pneumonia, chronic obstructive pulmonary disease (COPD) and hip fracture surgery.

The analyses include patients who were hospitalised during the period for an acute emergency admission with a principal diagnosis of the condition of interest. Planned admissions were also included for hip fracture surgery. The outcome was death from any cause, in or out of hospital, within 30 days of admission.

This technical supplement describes sensitivity analyses including:

- Impact of COVID-19 on mortality indicators (July 2021 – June 2024)
- Endovascular clot retrieval (ECR) for ischaemic stroke patients – the influence of ECR procedures on mortality and the rationale for suppressing results for hospitals that provide ECR services (July 2021 – June 2024)
- Palliative care patients – the impact of excluding episodes of acute care with a secondary diagnosis code indicating palliative care (July 2018 – June 2021).

This supplement is technical in nature and intended for audiences interested in the creation and analysis of health system performance information. It builds on *Spotlight on Measurement: Measuring 30-day mortality following hospitalisation, NSW, July 2012 – June 2015, 2nd edition*¹, which describes the development and validation processes that underpin BHI's mortality reporting.

Impact of COVID-19

The impact of the COVID-19 pandemic on mortality results was assessed by calculating crude (unadjusted) 30-day mortality rates, both including and excluding episodes with a secondary diagnosis of COVID-19. As shown in Table 1 for the period from July 2021 to June 2024, the differences in mortality rates between the two approaches were small.

Additionally, risk-standardised mortality ratios (RSMRs) for pneumonia were calculated both with and without adjustment for a diagnoses of COVID-19 in the year prior to admission. For 60 out of 69 hospitals, the RSMRs were identical using both approaches. As shown in Table 2 for the period July 2021 to June 2024, nine hospitals had small differences in their RSMRs, depending on whether the adjustment was applied. However, the outlier status of all hospitals remained the same, regardless of the adjustment.

Analysis was also undertaken to assess the impact of COVID-19 for the period July 2018 to June 2021, with similar findings.

This means that the impact of the pandemic on mortality results was small enough for fair public reporting. Nevertheless, hospital results should be interpreted in the context of the COVID-19 pandemic and with the local knowledge of health professionals.

Episodes involving COVID-19 were identified by searching the secondary diagnosis fields for the codes 'U07.1' and/or 'U07.2'.

Table 1 30-day mortality rate (deaths per 100 patients), NSW, July 2021 – June 2024

Condition	Including episodes with a secondary diagnosis code of COVID-19	Excluding episodes with a secondary diagnosis code of COVID-19
Acute myocardial infarction	4.8	4.7
Ischaemic stroke	7.5	7.5
Haemorrhagic stroke	21.6	21.7
Congestive heart failure	10.4	10.2
Pneumonia	7.3	7.2
Chronic obstructive pulmonary disease	8.4	8.2
Hip fracture surgery	5.8	5.7

Table 2 Pneumonia 30-day risk-standardised mortality ratios with and without adjustment for a diagnosis of COVID-19 in the year prior to admission, NSW public hospitals, July 2021 – June 2024

Hospital	Without adjustment for COVID-19	With adjustment for COVID-19
Hospital 1	1.00	0.99
Hospital 2	0.82	0.81
Hospital 3	0.78	0.79
Hospital 4	1.20	1.21
Hospital 5	1.70	1.71
Hospital 6	1.12	1.13
Hospital 7	1.22	1.21
Hospital 8	1.65	1.66
Hospital 9	0.84	0.85

Note: Only hospitals whose RSMR changed with risk adjustment are shown. Hospital names have been de-identified.

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Endovascular clot retrieval for ischaemic stroke patients

For the treatment of ischaemic stroke, endovascular clot retrieval (ECR) centres often receive transferred patients for ECR procedures. These patients may have more severe clinical conditions, which can contribute to higher-than-expected mortality rates, as current BHI prediction models do not fully adjust for stroke severity.

John Hunter, Liverpool, Prince of Wales, Royal Prince Alfred, Royal North Shore and Westmead hospitals provide ECR services for patients presenting with acute emergency ischaemic stroke. ECR is a time-critical procedure and if suitable patients are not already at an ECR referral centre, they need to be quickly transported to one.

Episodes involving an ECR procedure were identified using the procedure codes '33800-00', '35317-01', '35414-00' and '96196-01'. These episodes were concentrated in hospitals that provide ECR services (data not shown).

Table 3 shows that in the hospitals that provided most of the ECR services in NSW between July 2021 and June 2024, 30-day mortality rates were higher among patients who underwent an ECR procedure. It also illustrates the effect of excluding these patients on overall 30-day mortality rates.

Due to the impact of ECR services on mortality rates, hospitals with ECR centres have been included in the overall NSW results but are not reported individually from July 2018 onwards. Instead, their results have been provided directly to the relevant local health districts (LHDs) and the NSW Ministry of Health.

A similar analysis was conducted for hospitals providing all-hours ECR services during the period July 2018 to June 2021 (i.e. John Hunter, Liverpool, Prince of Wales and Royal Prince Alfred). As similar findings were observed, their results were also provided directly to the relevant LHDs and the NSW Ministry of Health and are not reported publicly.

Table 3 Ischaemic stroke 30-day mortality rate (deaths per 100 patients), NSW ECR centre hospitals, July 2021 – June 2024

Hospital	Patients with an ECR procedure code	Patients without an ECR procedure code	All patients
Hospital 1	13.5	6.1	7.8
Hospital 2	7.6	7.7	7.7
Hospital 3	9.9	6.5	7.6
Hospital 4	15.0	9.9	11.3
Hospital 5	9.9	6.0	6.9
Hospital 6	12.4	6.8	8.3
Total for ECR centres	12.2	7.3	8.5

Palliative care patients

In palliative care, the clinical intent or treatment goal is primarily quality of life for a patient with an active, progressive disease with little or no prospect of cure.² It includes care provided in a palliative care unit or as part of a palliative care program, care directly under the management of a palliative care physician, or care where the primary clinical intent is palliation.³ Patients receiving this type of care have mortality rates that are much higher than patients admitted for acute or other types of care.

In New South Wales admitted patient records, palliative care episodes are classified separately from acute care episodes. Before calculating 30-day risk-standardised mortality rates (RSMRs), BHI limits its analysis to patients admitted for acute care. As a result, patients formally admitted for palliative care are excluded from the analyses.

However, hospitals also provide acute care to patients who are receiving palliative support. These palliative-related acute episodes can be identified by the presence of a secondary diagnosis code (Z51.5). The proportion of such episodes varies by condition – for example, 0.8% for acute myocardial infarction (AMI), 1.7% for ischaemic stroke, 6.6% for haemorrhagic stroke, 2.8% for congestive heart failure (CHF), 1.9% for pneumonia, 2.2% for chronic obstructive pulmonary disease (COPD) and 0.9% for hip fracture surgery.

Although these episodes make up only a small share of total acute admissions, patients with a secondary palliative care diagnosis have higher mortality rates than other patients (Table 4). If not adjusted for, these cases may contribute to higher-than-expected mortality rates in some hospitals.

Reporting on palliative care patients in 2015–2018

Accordingly, hospitals that had a higher than expected RSMR following risk-adjustment and with a substantially higher proportion of palliative patients relative to NSW (identified with a secondary diagnosis code of Z51.5) were flagged with an ‘interpret with caution’ note in the report, *Mortality following hospitalisation for seven clinical conditions, July 2015 – June 2018*,⁴ and in the associated profiles, which contain detailed information about each hospital’s patient cohorts for each of the seven clinical conditions.

Reporting on palliative care patients from 2018–2021

The Australian Institute of Health and Welfare (AIHW) recommends that palliative care patients in hospital administrative data be identified using both the care-type classification and the secondary diagnosis code Z51.5.³

Sensitivity analyses were conducted to investigate the impact of excluding patients with a secondary diagnosis code of Z51.5 for the period July 2018 – June 2021.

At NSW-level, a time series was produced for each condition, plotting the mortality rate from July 2009 – June 2021, excluding these acute patients from July 2018 onwards. A notable decrease in the mortality rate can be seen from July 2018 onwards across all conditions but most notably for haemorrhagic stroke. (Figures 1 to 7).

At a hospital-level, RSMRs were reproduced and outliers were identified for each condition based on the new RSMRs. There was a small change in the number of outliers for all conditions across 72 hospitals (Table 5). The circuit graph is shown for CHF, which had one of the highest percentages of hospitals that changed outlier status (Figure 8).

In line with the AIHW's recommendation³, patients with a secondary diagnosis code of Z51.5 are also excluded from July 2018 onwards, and comparison of results before and after this time should be made with caution.

Information on the impact of excluding patients with a secondary diagnosis code of Z51.5 can be provided to hospitals on request to further contextualise their RSMRs.

Table 4 30-day mortality rate (deaths per 100 patients), NSW, July 2018 – June 2021

Condition	Patients with a secondary diagnosis code of Z51.5	Patients without a secondary diagnosis code of Z51.5
Acute myocardial infarction	72.5	5.2
Ischaemic stroke	84.1	9.0
Haemorrhagic stroke	90.0	25.5
Congestive heart failure	65.0	11.3
Pneumonia	65.0	7.8
Chronic obstructive pulmonary disease	48.4	7.9
Hip fracture surgery	62.2	6.2

Figure 1 Acute myocardial infarction, 30-day mortality rate (deaths per 100 patients), NSW, July 2001 – June 2021

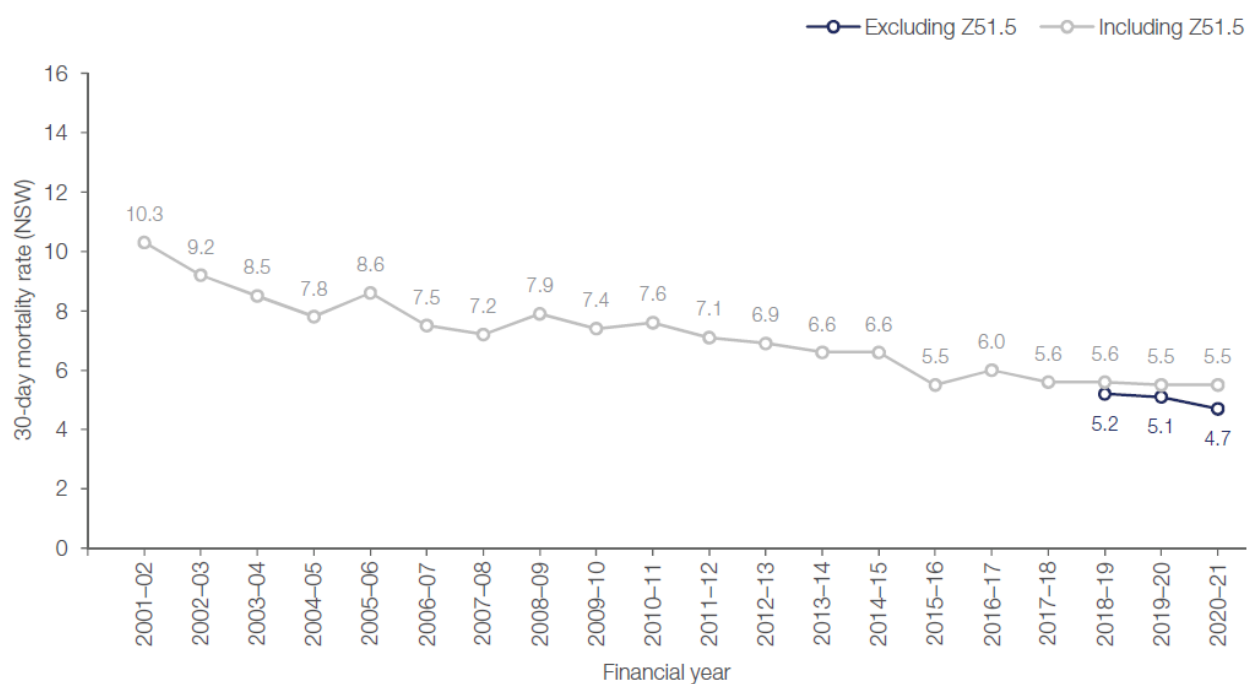


Figure 2 Ischaemic stroke, 30-day mortality rate (deaths per 100 patients), NSW, July 2001 – June 2021

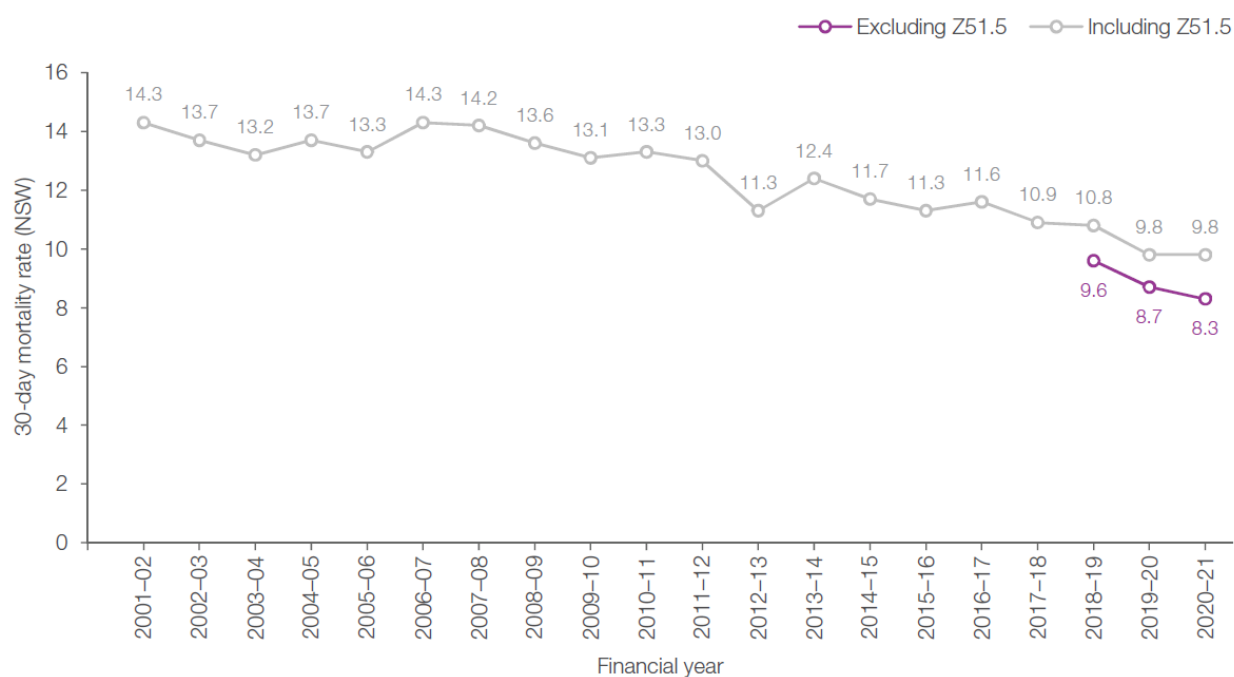


Figure 3 Haemorrhagic stroke, 30-day mortality rate (deaths per 100 patients), NSW, July 2001 – June 2021

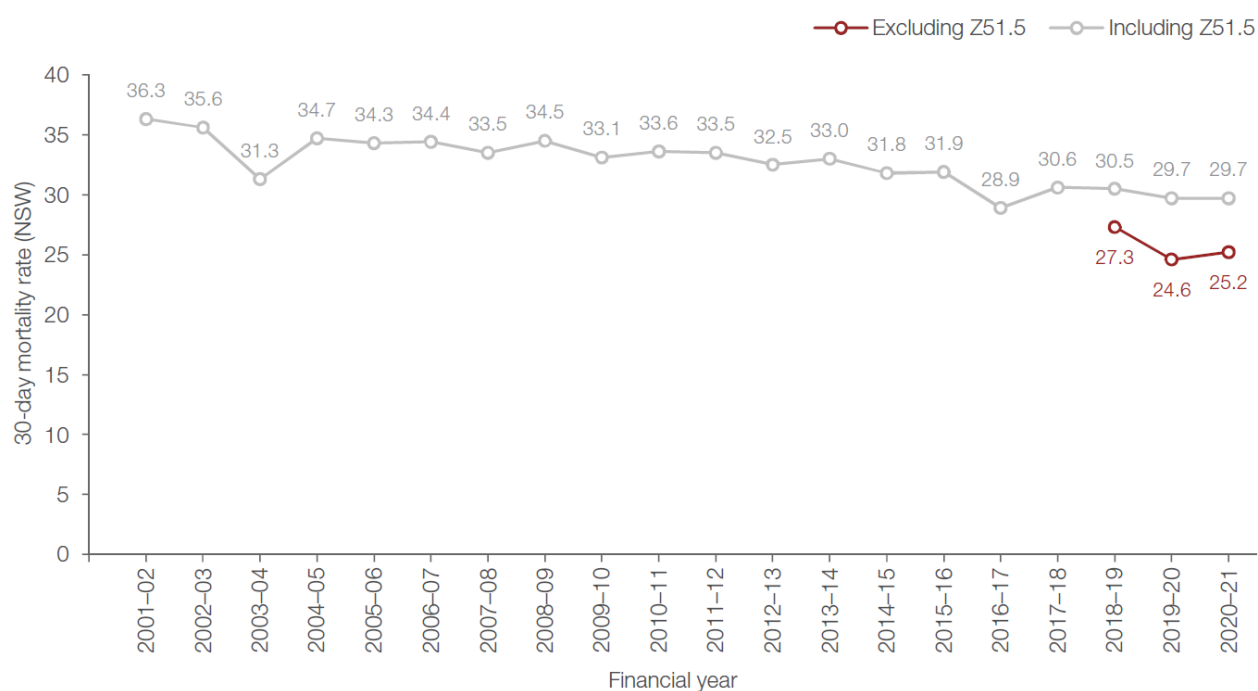


Figure 4 Congestive heart failure, 30-day mortality rate (deaths per 100 patients), NSW, July 2001 – June 2021

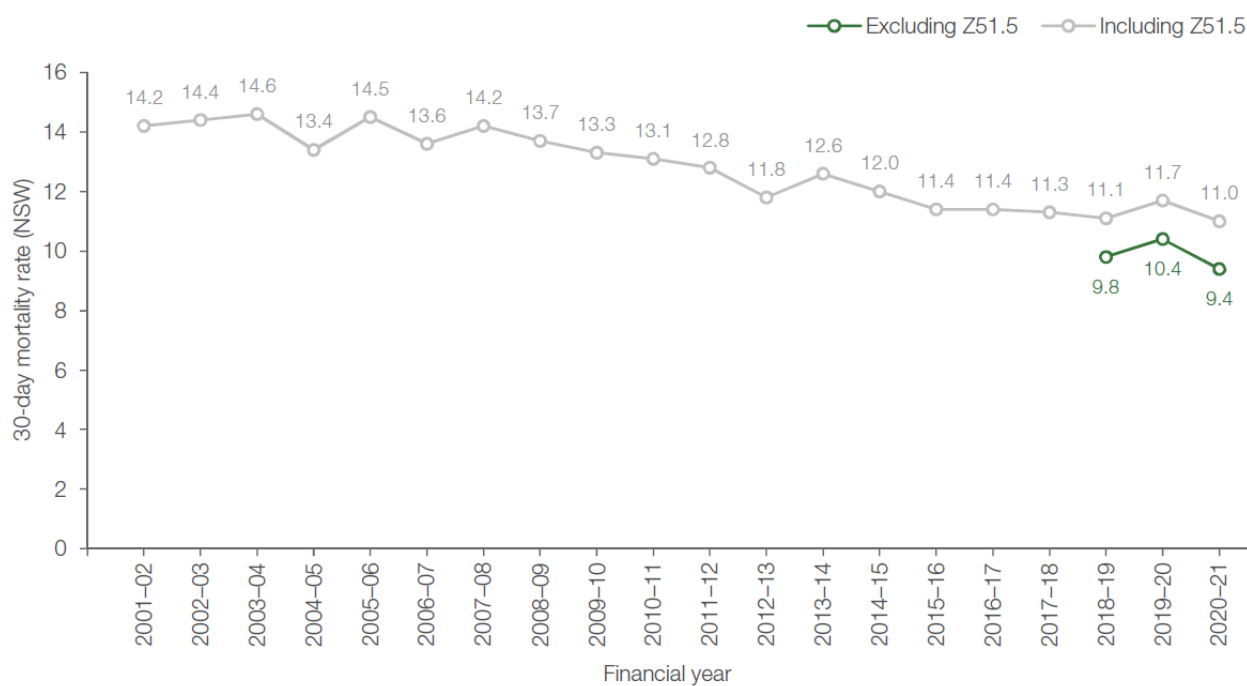


Figure 5 Pneumonia, 30-day mortality rate (deaths per 100 patients), NSW, July 2001 – June 2021

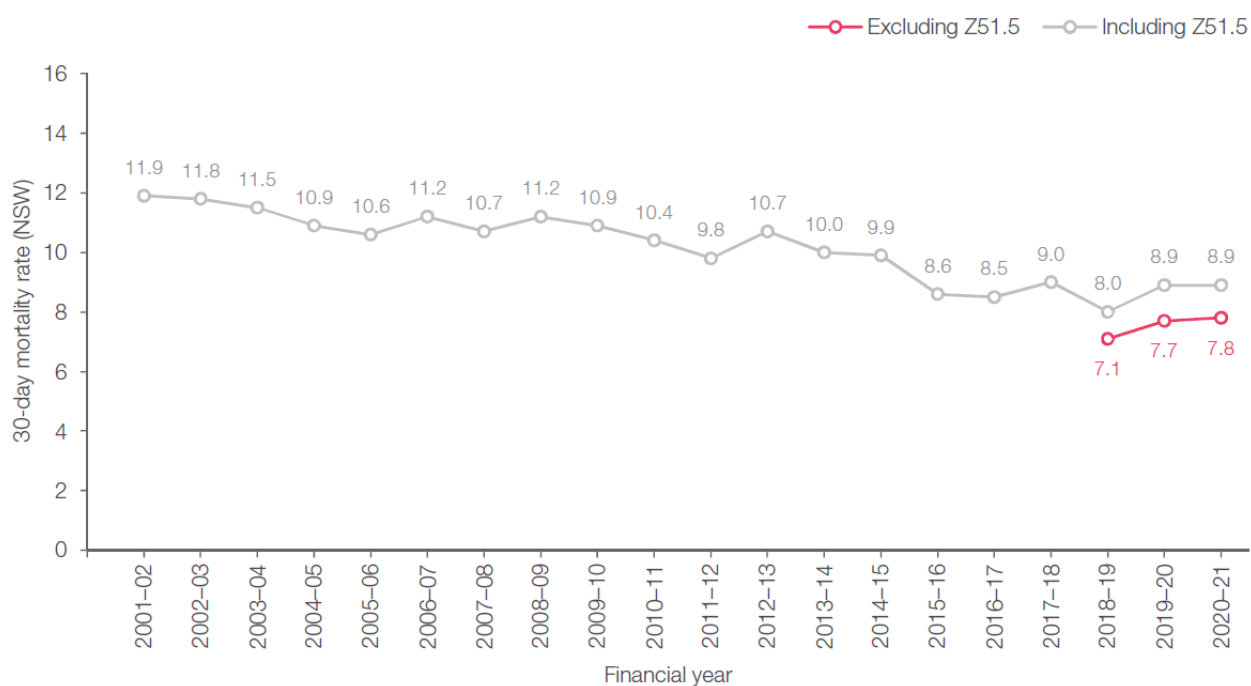


Figure 6 Chronic obstructive pulmonary disease, 30-day mortality rate (deaths per 100 patients), NSW, July 2001 – June 2021

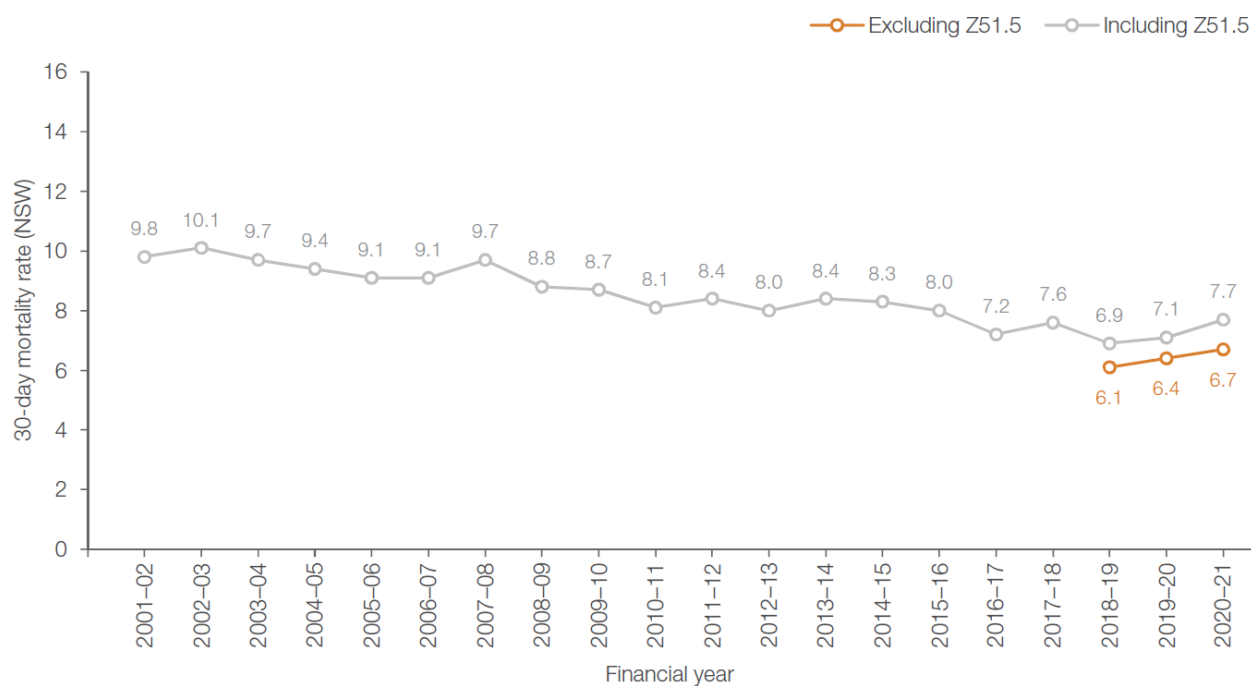


Figure 7 Hip fracture surgery, 30-day mortality rate (deaths per 100 patients), NSW, July 2001 – June 2021

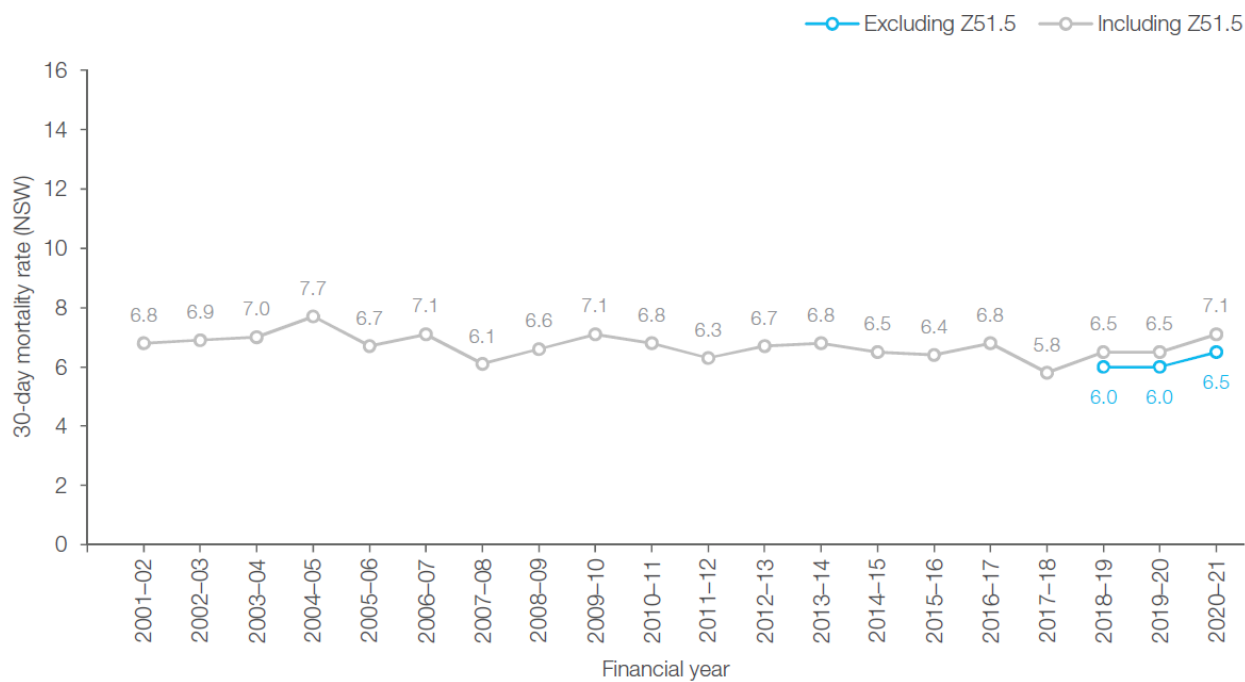
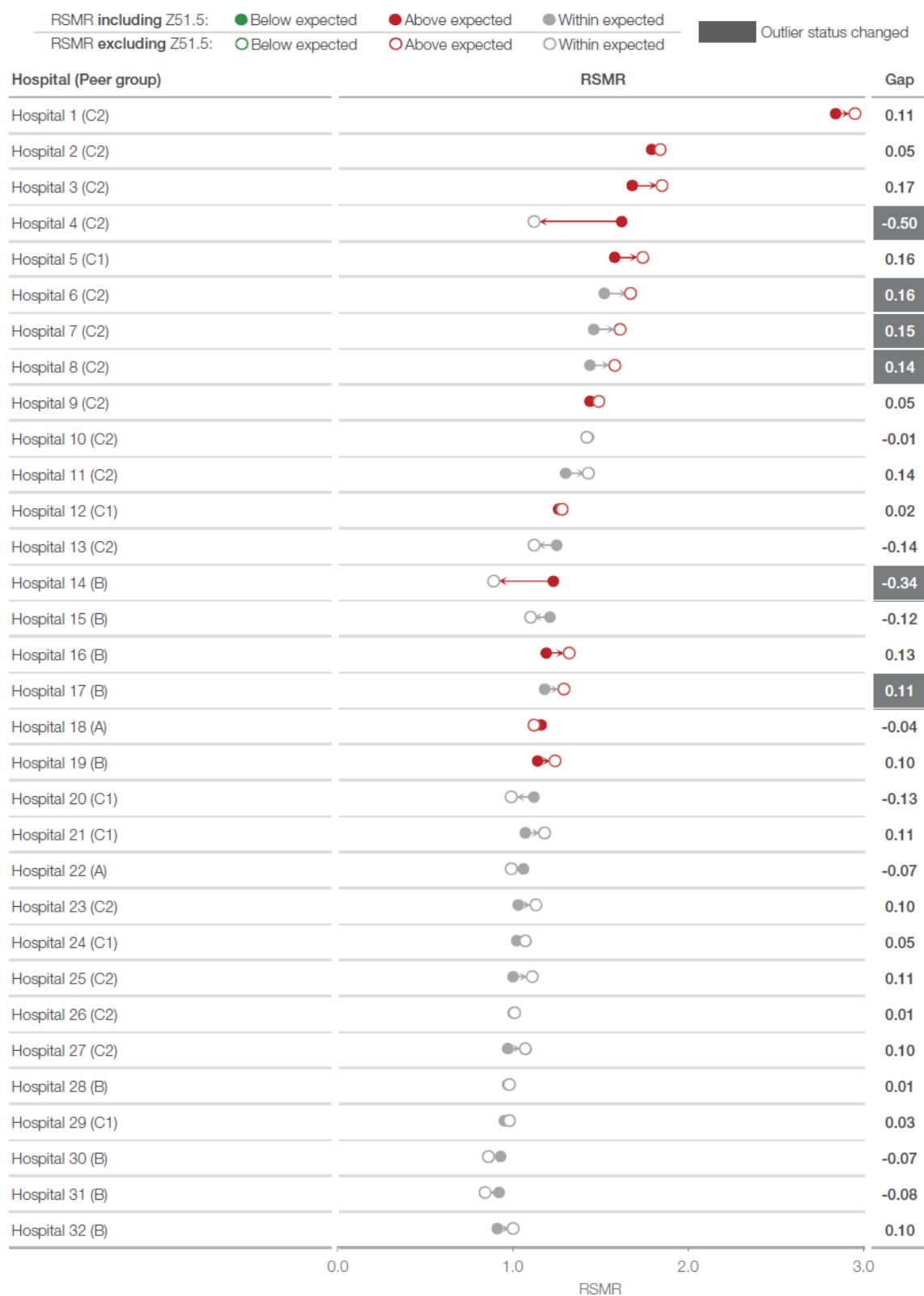


Table 5 Effect on outliers when patients with a secondary diagnosis code of Z51.5 are excluded from the cohorts, NSW public hospitals, July 2018 – June 2021 (among 72 hospitals)

Condition	Change in hospital outliers after excluding patients with a secondary diagnosis code of Z51.5
Acute myocardial infarction	One hospital was no longer higher than expected and two hospitals became higher than expected. One hospital became lower than expected.
Ischaemic stroke	One hospital was no longer higher than expected.
Haemorrhagic stroke	Two hospitals became higher than expected and one hospital was no longer lower than expected.
Congestive heart failure	Two hospitals were no longer higher than expected and four hospitals became higher than expected. Two hospitals became lower than expected.
Pneumonia	One hospital was no longer higher than expected and two hospitals became higher than expected. One hospital was no longer lower than expected.
Chronic obstructive pulmonary disease	Three hospitals became higher than expected. Two hospitals were no longer lower than expected and four hospitals became lower than expected.
Hip fracture surgery	One hospital was no longer higher than expected. Two hospitals were no longer lower than expected and one hospital became lower than expected.

Figure 8 Congestive heart failure 30-day risk-standardised mortality ratio including and excluding patients with a secondary diagnosis code of Z51.5, NSW public hospitals, July 2018 – June 2021





Appendix

Data source

Data were drawn from the Hospital Performance Dataset, NSW Ministry of Health Secure Analytics for Population Health Research and Intelligence. Record linkage was carried out by the Centre for Health Record Linkage (www.cherel.org.au). SAS Enterprise Guide Version 8.4 was used for the analyses.

Period of care and transfers

Multiple acute, contiguous hospitalisations were considered as a single, acute period of care. Acute admissions on the same day of separation from another acute hospitalisation were included in the same acute period of care, regardless of the mode of separation recorded in the initial hospital. If an acute admission was coded as ending in a transfer, and there was another acute admission within one day of that transfer, the second admission was concatenated into the same period of care. For patients who had multiple periods of care for a condition, only the last period of care was considered in the analysis for that condition.

In cases of patient transfers, index admissions and deaths were attributed to the first admitting hospital within the period of care.

Prediction models

The NSW-level prediction model was developed using index admissions between July 2021 and June 2024, and using random intercept logistic regression models, taking into account patient-level risk factors (age, sex and comorbidities) and clustering within hospitals.⁵ The prediction ability of the model was assessed using C-statistics.

The prediction models for AMI, ischaemic stroke, haemorrhagic stroke, pneumonia and hip fracture surgery were developed from age at index admission, sex and comorbidities identified using the Australian Commission on Safety and Quality in Health Care comorbidity list⁶ with a one-year lookback in hospital data.

The prediction models for CHF and COPD were developed from age at index admission, sex and Elixhauser comorbidities⁷ with a one-year lookback period in hospital data.

The clinical relevance of the variables in the final model and their direction of association with the outcome were reviewed by clinicians.

Risk-standardised mortality ratio

The RSMR provides a fair comparison of a particular hospital's results for deaths in or out of hospital within 30 days of admission given its case mix, with an average NSW hospital with the same case mix.

The numerator of the RSMR is the observed number of deaths in or out of hospital within 30 days of admission for the condition of interest. The denominator is the expected number of deaths at a given hospital, on the basis of an average NSW hospital's performance with the same case mix, calculated as the sum of the estimated probabilities of deaths using a NSW-level prediction model.

Funnel plots

RSMRs are presented in a funnel plot. Hospitals with an RSMR that falls beyond the 95% control limits are flagged. Control limits are calculated based on a Poisson distribution.⁸

Acute myocardial infarction indicator specification

Cohort

Inclusions:

- principal diagnosis of AMI (ICD-10-AM code I21)
- aged 15+ years
- acute emergency admissions
- discharged between 1 July 2021 and 30 June 2024.

Exclusions:

- episodes where patients were treated in, and discharged from, an emergency department only
- acute episodes with a secondary diagnosis of palliative care (Z51.5)
- discharges from NSW hospitals administered by agencies external to NSW
- patients with hospitalisations coded as 'STEMI, not specified' (ICD-10-AM code I21.9) were excluded from the base model.

Risk-adjustment variables

The final set of risk-adjustment variables for AMI were: age, dementia, Alzheimer's, hypotension, shock, renal failure, heart failure, dysrhythmia, malignancy, hypertension and cerebrovascular disease and STEMI/non-STEMI status (Table 6).

Table 6 Acute myocardial infarction prediction model for deaths in or out of hospital within 30 days, July 2021 – June 2024. C-statistic = 0.85.

Predictor	Adjusted odds ratio (95% confidence interval)
Age (per year increase)	1.06 (1.05 – 1.06)
Age squared	1.00 (1.00 – 1.00)
Dementia	2.15 (1.53 – 3.02)
Alzheimer's	1.10 (0.64 – 1.91)
Hypotension	1.36 (1.19 – 1.56)
Shock	6.43 (5.36 – 7.73)
Renal failure	2.06 (1.80 – 2.36)
Heart failure	1.70 (1.49 – 1.95)
Dysrhythmia	1.40 (1.23 – 1.59)
Malignancy	1.98 (1.54 – 2.53)
Hypertension	0.83 (0.71 – 0.98)
Cerebrovascular disease	2.16 (1.68 – 2.77)
STEMI	2.82 (2.46 – 3.23)

Ischaemic stroke indicator specification

Cohort

Inclusions:

- principal diagnosis of ischaemic stroke (ICD-10-AM code I63)
- aged 15+ years
- acute emergency admissions
- discharged between 1 July 2021 and 30 June 2024.

Exclusions:

- episodes where patients were treated in, and discharged from, an emergency department only
- acute episodes with a secondary diagnosis of palliative care (Z51.5)
- discharges from NSW hospitals administered by agencies external to NSW.

Risk-adjustment variables

The final set of risk-adjustment variables for ischaemic stroke were: age, sex, renal failure, heart failure and malignancy (Table 7).

Table 7 Ischaemic stroke prediction model for deaths in or out of hospital within 30 days, July 2021 – June 2024. C-statistic = 0.73.

Predictor	Adjusted odds ratio (95% confidence interval)
Age (per year increase)	1.06 (1.06 – 1.07)
Age squared	1.00 (1.00 – 1.00)
Female	1.15 (1.03 – 1.29)
Renal failure	1.35 (1.18 – 1.55)
Heart failure	1.74 (1.45 – 2.08)
Malignancy	2.84 (2.33 – 3.46)

Haemorrhagic stroke indicator specification

Cohort

Inclusions:

- principal diagnosis of haemorrhagic stroke (ICD-10-AM codes I61, I62)
- aged 15+ years
- acute emergency admissions
- discharged between 1 July 2021 and 30 June 2024.

Exclusions:

- episodes where patients were treated in, and discharged from, an emergency department only
- acute episodes with a secondary diagnosis of palliative care (Z51.5)
- discharges from NSW hospitals administered by agencies external to NSW.

Risk-adjustment variables

The final set of risk-adjustment variables for haemorrhagic stroke were: age, sex, heart failure, malignancy and history of haemorrhagic stroke (Table 8).

Table 8 Haemorrhagic stroke prediction model for deaths in or out of hospital within 30 days, July 2021 – June 2024. C-statistic = 0.65.

Predictor	Adjusted odds ratio (95% confidence interval)
Age	1.04 (1.03 – 1.05)
Age squared	1.00 (1.00 – 1.00)
Female	1.11 (0.96 – 1.28)
Heart failure	1.22 (0.88 – 1.69)
Malignancy	2.15 (1.65 – 2.80)
Previous haemorrhagic stroke	0.55 (0.39 – 0.76)

Congestive heart failure indicator specification

Cohort

Inclusions:

- principal diagnosis of congestive heart failure (ICD10-AM codes I11.0, I13.0, I13.2, I50.0, I50.1, I50.9)
- aged 45+ years
- acute emergency admissions
- discharged between 1 July 2021 and 30 June 2024.

Exclusions:

- episodes where patients were treated in, and discharged from, an emergency department only
- acute episodes with a secondary diagnosis of palliative care (Z51.5)
- discharges from NSW hospitals administered by agencies external to NSW.

Risk-adjustment variables

The final set of risk-adjustment variables for CHF were: age, valvular disease, pulmonary circulation disorders, hypertension, other neurological disorders, chronic pulmonary disease, diabetes – uncomplicated, diabetes – complicated, renal failure, liver disease, peptic ulcer disease excluding bleeding, metastatic cancer, coagulopathy, weight loss, fluid and electrolyte disorders, deficiency anaemia, dementia and number of previous acute admissions for CHF (Table 9).

Table 9 Congestive heart failure prediction model for deaths in or out of hospital within 30 days, July 2021 – June 2024. C-statistic = 0.72.

Predictor	Adjusted odds ratio (95% confidence interval)
Age	1.06 (1.05 – 1.06)
Age squared	1.00 (1.00 – 1.00)
Valvular disease	1.14 (1.01 – 1.28)
Pulmonary circulation disorders	1.37 (1.21 – 1.54)
Hypertension	0.85 (0.76 – 0.94)
Other neurological disorders	1.48 (1.20 – 1.84)
Chronic pulmonary disease	1.27 (1.15 – 1.39)
Diabetes, uncomplicated	0.89 (0.79 – 1.00)
Diabetes, complicated	1.11 (1.01 – 1.23)
Renal failure	1.90 (1.73 – 2.08)
Liver disease	1.84 (1.55 – 2.20)
Peptic ulcer disease excluding bleeding	0.41 (0.17 – 1.02)
Metastatic cancer	2.61 (2.05 – 3.32)
Coagulopathy	1.30 (1.12 – 1.51)
Weight Loss	1.44 (1.28 – 1.61)
Fluid and electrolyte disorders	1.58 (1.45 – 1.73)
Deficiency anaemia	0.78 (0.69 – 0.88)
Dementia	1.42 (1.19 – 1.69)
One previous admission	1.27 (1.14 – 1.41)
Two previous admissions	1.47 (1.25 – 1.73)
Three or more previous admissions	1.78 (1.47 – 2.15)

Pneumonia indicator specification

Cohort

Inclusions:

- principal diagnosis of pneumonia (ICD-10-AM codes J13, J14, J15, J16, J18)
- aged 18+ years
- acute emergency admissions
- discharged between 1 July 2021 and 30 June 2024.

Exclusions:

- episodes where patients were treated in, and discharged from, an emergency department only
- acute episodes with a secondary diagnosis of palliative care (Z51.5)
- discharges from NSW hospitals administered by agencies external to NSW.

Risk-adjustment variables

The final set of risk-adjustment variables for pneumonia were: age, dementia, hypotension, shock, renal failure, heart failure, dysrhythmia, malignancy, cerebrovascular disease, other chronic obstructive pulmonary disease, liver disease and Parkinson's disease (Table 10).

Table 10 Pneumonia prediction model for deaths in or out of hospital within 30 days, July 2021 – June 2024. C-statistic = 0.80.

Predictor	Adjusted odds ratio (95% confidence interval)
Age (per year increase)	1.06 (1.05 – 1.06)
Age squared	1.00 (1.00 – 1.00)
Dementia	1.95 (1.70 – 2.24)
Hypotension	1.40 (1.28 – 1.52)
Shock	2.85 (2.41 – 3.36)
Renal failure	1.49 (1.38 – 1.62)
Heart failure	1.53 (1.40 – 1.67)
Dysrhythmia	1.24 (1.13 – 1.36)
Malignancy	3.54 (3.20 – 3.91)
Cerebrovascular disease	1.71 (1.41 – 2.06)
Other COPD	1.34 (1.23 – 1.46)
Liver disease	2.09 (1.69 – 2.58)
Parkinson's disease	1.52 (1.10 – 2.11)

Chronic obstructive pulmonary disease indicator specification

Cohort

Inclusions:

- principal diagnosis of COPD (ICD-10-AM codes J20*, J40*, J41, J42, J43, J44, J47) (*only if accompanied by a secondary diagnosis of J41, J42, J43, J44 or J47)
- aged 45+ years
- acute emergency admissions
- discharged between 1 July 2021 and 30 June 2024.

Exclusions:

- episodes where patients were treated in, and discharged from, an emergency department only
- acute episodes with a secondary diagnosis of palliative care (Z51.5)
- discharges from NSW hospitals administered by agencies external to NSW.

Risk-adjustment variables

The final set of risk-adjustment variables for COPD were: age, sex, congestive heart failure, cardiac arrhythmia, pulmonary circulation disorders, other neurological disorders, diabetes – complicated, metastatic cancer, solid tumour without metastasis, coagulopathy, weight loss, fluid and electrolyte disorders, dementia and number of previous acute admissions for COPD (Table 11).

Table 11 **Chronic obstructive pulmonary disease prediction model for deaths in or out of hospital within 30 days, July 2021 – June 2024. C-statistic = 0.74.**

Predictor	Adjusted odds ratio (95% confidence interval)
Age (per year increase)	1.03 (1.03 – 1.04)
Age squared	1.00 (1.00 – 1.00)
Female	0.79 (0.72 – 0.87)
Congestive heart failure	1.51 (1.36 – 1.69)
Cardiac arrhythmia	1.06 (0.95 – 1.19)
Pulmonary circulation disorders	1.65 (1.42 – 1.92)
Other neurological disorders	1.25 (0.91 – 1.70)
Diabetes, complicated	0.88 (0.78 – 1.00)
Metastatic cancer	2.36 (1.76 – 3.18)
Solid tumour without metastasis	1.42 (1.12 – 1.79)
Coagulopathy	1.32 (1.03 – 1.69)
Weight Loss	2.22 (1.99 – 2.49)
Fluid and electrolyte disorders	1.64 (1.48 – 1.81)
Dementia	1.58 (1.23 – 2.02)
One previous admission for COPD	1.55 (1.37 – 1.75)
Two previous admissions for COPD	2.02 (1.71 – 2.38)
Three or more previous admissions for COPD	2.55 (2.18 – 2.97)

Hip fracture surgery indicator specification

Cohort

Inclusions:

- principal diagnosis of hip fracture (ICD-10-AM codes S72.0, S72.1, S72.2)
- an additional diagnosis indicating the hip fracture was related to a fall (ICD-10-AM codes W00-W19, R29.6)
- a procedure code indicating that the patient was admitted for surgery (ACHI code 47519-00, 47522-00, 47528-01, 47531-00, 49315-00, 49318-00*, 49319-00*) (*only if accompanied by one of the following Australian Refined Diagnostic Related Group codes: I03A, I03B, I08A, I08B, I78A, I78B, I73A, Z63A)
- aged 50+ years
- acute admissions
- discharged between 1 July 2021 and 30 June 2024.

Exclusions:

- episodes where patients were treated in, and discharged from, an emergency department only
- acute episodes with a secondary diagnosis of palliative care (Z51.5)
- discharges from NSW hospitals administered by agencies external to NSW.

Risk-adjustment variables

The final set of risk-adjustment variables for hip fracture surgery were: age, sex, dementia, renal failure, heart failure, dysrhythmia, malignancy, ischaemic heart disease and respiratory infection (Table 12).

Table 12 Hip fracture surgery prediction model for deaths in or out of hospital within 30 days, July 2021 – June 2024. C-statistic = 0.75.

Predictor	Adjusted odds ratio (95% confidence interval)
Age (per year increase)	1.08 (1.07 – 1.09)
Female	0.59 (0.51 – 0.68)
Dementia	2.55 (2.18 – 2.98)
Renal failure	1.43 (1.23 – 1.67)
Heart failure	1.75 (1.42 – 2.16)
Dysrhythmia	1.13 (0.94 – 1.36)
Malignancy	1.64 (1.21 – 2.20)
Ischaemic heart disease	1.23 (0.95 – 1.61)
Respiratory infection	1.42 (1.18 – 1.70)

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