Acute Readmissions

Analytical Definition Document

**By Acute Readmission Technical Working Group**

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# Introduction: Acute Readmissions

This document defines the acute readmissions measure and provides details on how this is calculated. It also describes the value and rationale for redeveloping the measure.

An acute readmission is usually an unexpected emergency or acute return of a patient to hospital.

In New Zealand, as in most of the developed world, acute readmissions have been increasing year on year. Acute readmissions may sometimes be a part of an expected course of patient care. However, it may indicate quality problems, either in terms of direct quality of care or failures to integrate care around the patient. This lack of quality or integration may lead to an unnecessary and hence inefficient use of health care resources. For many patients, returning acutely to hospital is an undesirable outcome.

The historical model for measuring acute readmissions was not effective due to technical issues with the model, lack of clarity on its use and little alignment with other related measures.

The revised measure is aligned with the five strategic themes of people-powered, closer to home, value and high performance, one team and smart system from the New Zealand Health Strategy, and it is explicitly linked to the system level measure of acute hospital bed days. It serves the following purposes:

* better understanding of readmission variability and its causes
* promoting best practice in terms of patient management
* understanding what would help reduce acute demand
* providing information to facilitate improvement of District Health Boards’ performance with a focus on efficiency
* enhancing understanding of system integration between community, primary and secondary care for better patient outcomes.

The revised model has been co-designed by representatives from the District Health Boards (DHBs), the Health Quality and Safety Commission, and the Ministry of Health (the Ministry).

## Value and Rationale

Acute readmissions is being used internationally for a number of purposes such as cost control, quality improvement, evaluating clinical practices and whole of system improvement.

Studies overseas have shown that 30-day readmission rates can be reduced by 20% to 40% through quality of care initiatives. These initiatives include improvement in communication with patients, their caregivers, and their clinicians; patient education; pre-discharge assessment; and coordination of care after discharge.

Increasing focus on readmissions to improve quality and efficiency of health care has led to hospitals redesigning their discharge processes, improving transitions of care and evaluating their clinical practices such as the interventions provided.

Nevertheless, there are ongoing debates on the value of the measure due to its complexity such as issues with definitions, timeframes being reviewed and adjusting for various factors that influence the measure. The measure has also been described as an imperfect proxy for broader health system failures but is thought to provide a foundation for building better policies that are useful for improvement, fair for accountability and relevant to patients.

Overall readmission rates are a marker of safety and inconvenience to patients, and some resources could potentially be re-invested. However, when disaggregated, the measure could be a useful diagnostic of specific problems.

Readmissions up to 3 and 7 days are likely to be associated with clinical and discharge issues. The 8 to 28 day interval can be associated with a combination of discharge and coordination issues. Readmissions between 29 to 180 days, alongside frequent users measure, especially for older and/or complex patients, can be linked to the availability and access to good community care.

The value of the measure is recognised when used in conjunction with related measures such as acute admissions, length of stay, frequent users, emergency department attendances and other indicators on the social determinants of health.

Some of the valuable outcomes of this model are to provide good quality data for future evaluation of readmissions and other aspects of acute demand, as well as to promote sharing of information and tools across the sector.

## High Level Definition

The measure is a standardised readmission ratio of the observed number of readmission stays to the predicted number of readmission stays of a DHB. The numbers are derived based on the number of admissions and readmissions for patients presenting to New Zealand hospitals.

The model also produces the crude readmission rates that is calculated based on the observed number of readmission stays over the observed number of index stays expressed as a percentage.

The standardised readmission ratios are illustrated at a national and DHB level with standardisation for admission type, prior stays, primary diagnosis group, Patient Clinical Complexity Level (PCCL), length of stay, age, prior morbidities, and current morbidities.

The measure will be calculated quarterly. Both the DHB of domicile and DHB of service are relevant and potentially associated with different areas of clinical and care focus. The data will be broken down by these two DHB views depending on the time period (0-28 days, 0-3 days, 4-7 days, 8-28 days and 29-180 days) of the measure.

DHB of domicile is determined based on the first event of an index stay. DHB of service from individual events that make up a stay can be different. For the purpose of high level summary, the ‘principal’ DHB of service is used. It is determined based on the last event of an index stay (see section 2.1.2 below). Table 1 below summarises indicative DHB views for analysis.

**Table 1: Indicative DHB views for index and readmission stay (in the summarised report)**

|  |  |  |
| --- | --- | --- |
| **Readmission measure interval** | **Index stay** | **Readmission stay** |
| **0-28 days** | DHB of Service | DHB of Service |
| **0-3 days** | DHB of Service  | DHB of Service |
| **4-7 days** | DHB of Service | DHB of Service |
| **8-28 days** | DHB of Service | DHB of Service |
| **29-180 days** | DHB of Domicile | DHB of Domicile |

The data will be able to be stratified for other demographic variables.

# Key Concepts for the Model

## Key Concepts: District Health Boards

### DHB of Domicile

DHB of domicile refers to the DHB geographical area (location boundaries) where the patient usually lives or resides. It is defined by the domicile code of the resident address of the patient at the time of their event. In this model, the first event of the index stay is used.

### DHB of Service

DHB of service refers to a DHB who manages or contracts facilities that provide treatment and care to the patients. DHB of service is usually defined by agency code regardless of where the patient lives.

In the model there are various logical ways by which DHB of Service can be defined:

* Using the first event of an index stay – on the basis that the first DHB of Service plans out the management of the patient. Actions taken by the first DHB of Service would impact on the progression of illness and patient outcomes, e.g. delays in referral or treatment, provision of life saving treatment, etc.
* Using the last event of an index stay – on the basis that the last DHB of Service is closest to the readmission stay. Therefore actions taken by last DHB of Service are more likely to influence subsequent events leading to readmission, e.g. discharge planning, inter-provider communication between hospital and non-hospital care.
* Using the event that has the highest case-weights in the index stay – on the basis that these events are most resource intensive and likely to have greater treatment involvement or longer length of stay.

Each event has its own DHB of Service. However, when reporting at an aggregated DHB view, DHB of service based on the last event of an index stay is applied.

## Key Concepts: Inpatient Events & Stays

From the outset of this technical document, three important concepts need to be understood: inpatient, events [1] and stays [2]. These concepts are consistent with the Acute Hospital Bed Days measure under development.

### Inpatient

While better defined in other places, the broad concept of an ‘inpatient’ in the NZ public health setting refers to a patient who has been admitted to a facility for the purposes of treatment and care for a period of time. An inpatient can be identified by unique National Health Index (NHI) number in the routinely collected administration dataset.

### Events

An ‘event’ refers to the period of care undertaken for a patient that has a specific start and end date and times. They identify the distinct elements of duration, period, facility, health specialty responsible, diagnosis and treatments for the individual patient as well as many administrative attributes like funder, admission type and patient demographics, etc.

### Stays

The concept of a ‘stay’ aligns largely with other analytical efforts with relevant measures, such as Ownership OS3: Inpatient Average Length of Stay (ALOS) and system level measure SL6: Acute Hospital Bed Days under the wider system level measures and the DHB non-financial monitoring framework. In this measure, it refers to a sequence of patient events (each with a distinct admit and discharge date and time) that can be logically joined together to form an inpatient ‘stay’.

Multiple events are considered to be part of the same stay if the following criteria are met:

1. The first and subsequent events have the same National Health Index,
	1. The events are associated with the same person and have the same patient identifier i.e. NHI
	2. The events may be at facilities overseen by different DHBs.

and,

either:

1. the second event starts within 6 hours,
	1. Sequential events that are up to 6 hours in the difference between the patient’s discharge time (of the prior event) and admit date and time, do not require a transfer flag to be deemed part of the stay.

or,

1. the first event has a valid transfer flag and the second event starts within 24 hours
	1. The prior event ends in a transfer i.e. each event in the sequence ends with a transfer indicator, aside from the last event
	2. There is less than 24 hours between the end of one event and the start of the next event.

Transfer flag is identified with the following event end type codes:

* DA Discharge to acute specialist facility
* DF Change of funder
* DO Discharge of a patient kept sustainable for organ donation
* DP Psychiatric patient transferred for further psychiatric care
* DT Discharge of patient to another healthcare facility
* DW Discharge to other service within same facility
* ET Discharge from ED acute facility to another healthcare facility

All events within a stay will be counted as an acute stay if the **first event is acute**, regardless of whether any other events in that stay are acute or not.

A stay is deemed to be a complete stay when the last event of the stay is within the reporting period with no transfer flag indicating that the patient has been transferred.

Day case events, non-casemix events and mental health events, where ever they occur in the sequence of events, are included in a stay.

## Key Concepts: Index and Readmission Stays

The analysis, reporting, performance and quality improvement effort regarding acute readmissions, require definitions of an individual patient’s first stay (known as the ‘Index Stay’) and the second emergency inpatient stay (known as the ‘Acute Readmission Stay’).

The key elements when defining an acute readmission for a patient, include:

* The index stay
* The acute readmission stay
* The period between the index stay discharge date and the acute readmission admit date.

### Description of an Index Stay

The source of index stay data for the measure will be the National Minimum Dataset (NMDS). The events in NMDS will be used to count the denominator of this measure, index stays. Events will be joined together into stays. The rules that define the joining together of individual patient events to form an index stay are listed in section 2.2.3 above.

### Decision Flow for an Index Stay

The following process decision flow diagram (Figure 1) shows the logical process for identifying index stays. The order is not necessarily relevant since the exclusions applied can be overlapped.

**Figure 1. Index stay decision flow diagram**



### Description of a Readmission Stay

The source of readmission stay data for the measure will be the National Minimum Dataset (NMDS). The events in NMDS will be used to count the numerator of this measure, acute readmission stays. Events will be joined together into stays. The rules that define the joining together of individual patient events to form an acute readmission stay are listed in section 2.2.3 above.

All events within a stay will be counted as an acute readmission stay if the **first event is acute**, regardless of whether any other events in that stay are acute or not.

### Decision Flow for a Readmission Stay

The following process decision flow diagram (Figure 2) shows the logical process in identifying readmission inpatient stays. The order is not necessarily relevant since the exclusions applied can be overlapped.

**Figure 2. Readmission inpatient stay decision flow diagram**



### The Algorithm of Index and Readmission Stays

Figure 3 illustrates an example of an index stay, a corresponding acute readmission stay and the period between the index and the readmission stay in a timeline graph.

It should be acknowledged that a patient may potentially have a number of stays over a set length of time which each could qualify as index and readmission stay pairs. This highlights an important feature for the counting of readmission stays, i.e. by stay, and not individual patient. Hence, each time an inpatient stay has been identified, it has the potential to become:

* A readmission stay for a prior index stay, or
* An index stay for a future readmission stay.

**Figure 3. Example of patient events joined as index and readmission stays**



### Interval between Index and Readmission Stays

As demonstrated in Figure 3, the time interval is specified as the days between the index stay discharge date and the acute readmission stay admit date for the patient.

Acute readmission can occur for a number of reasons which change over time from a discharge. Therefore readmission defined at different time points can reflect that patients have a range of needs and receive different services at different points on their journey. Four intervals of readmissions measure are derived (Table 2). Each of these intervals are mutually exclusive of one and others.

**Table 2. Four intervals of readmission measure based on the difference between index stay discharge date and readmission stay admit date**

|  |  |
| --- | --- |
| **Interval** | **Description** |
| **0-3 days** | Readmissions within three days represent a potential failure in clinical care and discharge. There is a high probability that readmission stay will be for the same or similar clinical reasons to the index stay.Key focus – clinical issues. |
| **4-7 days** | Readmissions between four and seven days also represent a potential failure in discharge. Again, there is a higher probability that readmission will be for the same or similar clinical reasons to the index stay, with services supporting the discharge in place.Key focus – discharge and coordination issues. |
| **8-28 days** | Readmissions between eight and 28 days have been the traditional performance measure in New Zealand. The majority of readmissions occur before this time point. After this point, readmissions appear to be more constant across time. It may also be the time after which readmissions are more likely to be for conditions unrelated to the index admission.Key focus – discharge, coordination and community care issues. |
| **29-180 days** | Readmissions occurring after a longer interval allow consideration of community services and general practice to support care. Towards 180 days, long-term conditions and frailty are likely to be key contributors.Key focus – support and community care issues. |

# Counting of Index and Readmission Stays

The measure is meant to be comprehensive. So all types of hospital inpatient stays associated with an acute readmission stay should be included unless there is a strong rationale for exclusion. For the prevention of confusion, the activities that are explicitly included or excluded are outlined below.

Both the inclusion and exclusion rules are applied at ‘Inpatient stay’ level rather than ‘Inpatient event’ level in all four intervals of the readmission measure. Counting of index and readmission stays under each interval is restricted to the specific interval criteria, i.e. readmission within 0-3 days, 4-7 days, etc.

For example, if a stay contains both casemix events and non-casemix events, the stay will be determined as a casemix stay. Therefore the non-casemix events that form a part of the stay will not be excluded since non-casemix exclusion is applied at the ‘Inpatient stay’ level rather than ‘Inpatient event’ level. As an example, many non-casemix Assessment, treatment and rehabilitation (ATR) inpatient events are admitted immediately after the discharge from casemix events (e.g. Surgical discharge events). These inpatient stays will be deemed as casemix stays. As a result, the ATR events will be included since they form a part of the casemix stays.

## Outline of Inclusions

An ‘inclusion’ refers to an activity that remains in the dataset. Some of these activities are flagged or grouped as a way to stratify the data to assist information users to conduct additional analysis to understand their patient’s care and stay data. For instance, further clinical analysis can be done to compare readmissions between different clinical categories of patients.

The following are included in both the index and readmission stays and have been flagged to allow further analysis:

With a flag:

* Inpatient short stays at emergency department (ED), aka ED short stays
* Palliative care
* Cancer treatments
* Paediatric services
* Geriatric services
* Long term conditions
* Mental health events (that is, individual events embedded in stays, except when a stay started with the first event being a mental health event)
* Overseas patients.

If Ambulatory Sensitive Hospitalisation (ASH) conditions such as ischaemic heart disease, diabetes, stroke, asthma and COPD were to be included the future revised model, this would require significant changes on the current model and definitions would need to be agreed to.

Without a flag:

* Assessment, treatment and rehabilitation services (that is, individual events embedded in stays)
* Event leave days (that is, leave days are not subtracted).

The following are included in the index stays but excluded from the readmission stays:

* Non-acute stays (the first event has a non-acute admission type)
* Maternity services

The following are included in the readmission stays but excluded from the index stay:

* Deceased patients.
* Incomplete stays

The rule for these inclusions are in section 3.4 below.

## Outline of Exclusions

An ‘exclusion’ identifies data features that have been removed from the counting of index and/or readmission stays, with the intention of improving the integrity of the model. Data that are ‘excluded’ are not available in the output.

The following are excluded in both the index and readmission stays:

* Non-casemix stays (all events in the stay are non-casemix, defined using casemix filter wiesnz14 (Ministry of Health, 2015)). The future revised model is expected to use the wiesnz of the year. This would allow DHBs to reconcile their data to the current year’s methodology based on which they are funded and monitored. It would also address issues with changing ICD and DRG versions. The drawback of using wiesnz of the year is it would limit trend analysis across years.
* Mental health stays (that is, the first event being identified as a mental health event).

The following are excluded in the index stays but included in the readmission stays:

* Deceased patients
* Incomplete stays.

The following are excluded in the readmission stays but included in the index stays:

* Non-acute stays (the first event has a non-acute admission type)
* Maternity services

The rule for these inclusions are in section 3.5 below. Very small amount of incomplete data are also excluded in the model, i.e. unknown gender.

## Summary Table of Inclusions and Exclusions

Table 3 summaries the exclusions and inclusions applied to index and readmission stays. Detail of the exclusions and inclusions are described in the sections that follow. The table also shows which groups have been flagged in the data for further analysis.

**Table 3. Summary of Exclusions, Inclusions and Flags**

|  |  |  |  |
| --- | --- | --- | --- |
| **Criteria** | **Index Stay** | **Readmission Stay** | **Flags** |
| **Inclusion** | **Exclusion** | **Inclusion** | **Exclusion** |
| ED short stays | √ |  | √ |  | √ |
| Palliative care | √ |  | √ |  | √ |
| Cancer treatments | √ |  | √ |  | √ |
| Paediatric services | √ |  | √ |  | √ |
| Geriatric services | √ |  | √ |  | √ |
| Long term conditions | √ |  | √ |  | √ |
| Mental Health events | √ |  | √ |  | √ |
| Overseas patients | √ |  | √ |  | √ |
| ATR services | √ |  | √ |  |  |
| Event leave days | √ |  | √ |  |  |
| Non-acute stays | √ |  |  | √ |  |
| Maternity services | √ |  |  | √ |  |
| Deceased patients |  | √ | √ |  |  |
| Incomplete stays |  | √ | √ |  |  |
| Non-casemix stays |  | √ |  | √ |  |
| Mental Health stays |  | √ |  | √ |  |

## Details of Inclusions

### Inpatient Short Stays at Emergency Department

#### Description

The Ministry of Health defines short stay emergency department events as any hospital discharge where both:

* length of stay is zero or one midnight spent in hospital
* health specialty code is M05, M06, M07 or M08.

In the model, short stay ED events are identified if the duration of the event is less than 24 hours and if the discharge was by an emergency department specialist using the above health specialty codes.

#### Explanation

DHBs have different models of care. Generally all patients in an emergency department who received treatment for more than three hours would be required to be admitted as an inpatient event.

Some debates around whether these ED events should be excluded because of inconsistent practice of the admission rules for these events across DHBs. Some questions were asked about whether ED bed days are the same as other acute bed days and on how much of ED services are amenable to intervention.

ED is a hospital resource. The measure is about helping the sector to use health resources efficiently but the model should not dis-incentivise models of care. One of the options is to perhaps move short stay patient numbers to a separate measure. On the other hand, there are concerns about not counting this activity as this type of patient forms a considerable proportion of inpatients in some DHBs and therefore cannot be simply excluded from the readmission dataset.

Excluding ED short stays may systematically exclude higher users of this service from the measure, e.g. Maori, and therefore may omit certain disparity issues to be addressed.

DHBs are encouraged to make improvements based on their own baseline. It is therefore less of a concern for inconsistency in reporting across DHBs. In practice, it is important to acknowledge that the measure cannot address everything and ED short stays may be a limitation of the measure.

Counting the length of stay of an event less than two days stay has been difficult prior to the introduction of the times stamps data (i.e. event start datetime and event end datetime) in NMDS in June 2011. Day cases or short stay EDs events had been excluded in analysis such as the historical Average Length of Stay measure. A constant such as 0.5 day had also been used in past analysis to accommodate these events.

Time stamps data has since improved and it is deemed to be suitable to be used to get fractional number of stays. Other alternatives and proposals could include having a minimum stay of half or one day. These alternative approaches are considered to be less adequate then the time stamps approach.

#### Recommendation

ED short stays are included in the model.

**A flag has been introduced for ED short stays using health specialty codes M05, M06, M07 or M08 with less than 24 hours length of stay, and if the entire stay consists of ED short stay events.**

### Palliative Care

#### Description

Inpatient events that are discharged with the health specialty codes of M80 or M81 are considered as a palliative care event.

#### Explanation

Patients with terminal illness, undergoing end of life care can be admitted acutely as inpatients or non-acutely as part of the whole stay. The characteristics of the patients are significantly different from others in terms of medical nature and service required. However, these patients would benefit from having good non-hospital alternative care.

It is also technically difficult to identify Palliative care events accurately due to inconsistent recording of the service.

#### Recommendation

Palliative care events are included in the measure.

**A flag has been introduced using health specialty codes M80 or M8 for stays with palliative care events.**

### Cancer Treatments

#### Description

Inpatients events with a Diagnosis-related group (DRG) code starting with ‘R’, including Chemotherapy (R63) or Radiotherapy (R64).

#### Explanation

Cancer patients can be admitted acutely for chemotherapy, radiotherapy and other procedures. The admission may be a scheduled treatment. The characteristic of this type of patients are likely to be different from other inpatients. In terms of clinical and health resource management, these patients cannot be simply excluded from readmission analysis. These patients require adequate care planning both in and out of the hospital settings.

#### Recommendation

Cancer treatments are included in the measure with the exception of same day cancer chemotherapy or same day radiotherapy events if these are a standalone non-casemix event.

**A flag has been introduced using DRG codes starting with ‘R’.**

### Paediatric Services

#### Description

Paediatric services are identified if a patient is:

* Under 15 years of age as at the first admission date of the index stay, and
* the first event of the index stay was discharged with health specialty codes of paediatric medicine, using M14, M19, M24, M29, M34, M39, M44, M49, M54 to M59, M64, M69, M74, M79, M84, M94, M97, M98, P41 to P43, or S55 to S59.

#### Explanation

Characteristics of paediatric patients are considerably different from other patients in terms of the medical nature of the conditions. Within the group of paediatric patients, further break down of age groups can be done to identify neonate, infant, young child, child and adolescent, to provide insights into the different clinical scenarios for readmissions.

#### Recommendation

Paediatric services are included in the measure.

**A flag has been introduced using age and health specialty codes listed above.**

### Geriatric Services

#### Description

Geriatric services are identified if a patient is:

* 75 years of age and over as at the first admission date of the index stay, and
* the first event of the index stay was discharged with health specialty codes of geriatric medicine, using D01 to D04, D10 to D14, or D20 to D34.

#### Explanation

Characteristics of geriatric patients are considerably different from other patients. Geriatric patients can have multiple long term conditions, physical and/or mental impairment and increased likelihood of polypharmacy. Additional analysis is needed to look at the mechanism of readmissions in the patients.

#### Recommendation

Geriatric services are included in the measure.

**A flag has been introduced using age and health specialty codes listed above.**

### Long Term Conditions

#### Description

Long term conditions are identified if a patient has been hospitalised in the previous 12 months from the first admission date in an index stay for the following medical conditions:

* Colorectal cancer, trachea and lung cancer, female breast cancer, prostate cancer and melanoma
* Ischaemic heart disease, chronic rheumatic heart disease, cerebrovascular disease (stroke)
* Diabetes
* Chronic obstructive pulmonary disease (COPD), asthma
* Hepatic failure and cirrhosis of the liver
* Chronic kidney disease, chronic kidney failure
* Major depressive disorder, anxiety disorders, bipolar disorder, schizophrenia, alcohol use disorder, drug use disorder, dementia and Alzheimer’s disease
* Traumatic brain injury, spinal cord injury.

Table 4 below illustrates a list of medical conditions and their associated International Classification of Diseases codes (ICD-10-AM) used in the model.

**Table 4. ICD-10-AM codes for long term conditions**

|  |  |  |
| --- | --- | --- |
| **Medical condition** | **ICD-10-AM (6th or 8th edition)**  | **Note** |
| Colorectal cancer | C18 – C21 |  |
| Trachea and lung cancer | C33 – C34 |  |
| Female breast cancer | C50 | Female only |
| Prostate cancer | C61 |  |
| Melanoma | C43 |  |
| Ischaemic heart disease | I20 – I25 |  |
| Chronic rheumatic heart disease | I05 – I09 |  |
| Cerebrovascular disease | I60 – I69 |  |
| Diabetes | E10 – E14  | Including diabetic renal complications |
| Chronic obstructive pulmonary disease (COPD) | J44 |  |
| Asthma | J45 – J46 |  |
| Hepatic failure and cirrhosis of the liver | K70.3, K70.4, K72, K74 |  |
| Chronic kidney disease | N03, N11, I12.9, I13.0, I13.9 | Including hypertensive renal disease |
| Chronic kidney failure | N18, N19, I12.0, I13.1,I13.2 | Including hypertensive renal failure, and unspecified kidney failure |
| Major depressive disorder | F32.2, F32.3, F33.2, F33.3, F33.8 |  |
| Anxiety disorders | F064, F41 |  |
| Bipolar disorder | F30, F31 |  |
| Schizophrenia | F20 |  |
| Alcohol use disorder | F10 |  |
| Dementia and Alzheimer’s disease | F00, F01, F02, F03, G30 | F00 and F02 are unlikely to be a primary diagnosis |
| Traumatic brain injury | S06, T90.5 | T90.5 is unlikely to be a primary diagnosis |
| Spinal cord injury | S14.1, S14.7, S24.1, S24.7, S34.1,S34.7, T06.0, T06.1, T91.3, T09.3 | S14.7, S24.7, S34.7 and T09.3 are unlikely to be a primary diagnosis |

#### Explanation

Patients who are identified with ongoing, long term or recurring medical conditions could potentially have an impact on readmissions.

#### Recommendation

Patients with long term conditions are included in the measure.

**A flag has been introduced using the International Classification of Diseases (ICD) codes above for patients with long term conditions within 12 months of hospitalisation.**

### Mental Health Events

#### Description

Mental health events are identified based on the health specialty codes with ‘Y’ prefix, Y00 to Y99 being recorded in any part of the entire stay except for the first event. There could be a surgical or medical event followed by a mental health event in a stay.

This is not the same as a mental health stay where the first event of a stay is identified as a mental health event.

#### Explanation

Mental health services are an integral part of the patient stays in the hospital. It is important that we include these activities. However, additional challenges associated with mental health patients may have an effect on their readmission patterns, even when they were admitted or readmitted with similar clinical conditions as non-mental health patients.

Mental health patients could also be over represented in certain conditions such as Chronic Obstructive Pulmonary Disease (COPD) which could be linked with smoking and mental health illnesses. This could be an important risk factor for readmissions. There is clinical interest in identifying stays with sub diagnosis of mental health illness through more detailed subgroup analysis.

#### Recommendation

Mental health events, if they are part of an index or readmission stay, are included in the measure. However, mental health stays where the first event in the stay is identified as a mental health event, are excluded. (see section 3.5.2 below)

**A flag has been introduced using health specialty codes with ‘Y’ prefix for mental health activities.**

### Overseas Patients

#### Description

Patients who usually live overseas, as defined by their residential address and identified by patient domicile code of ‘999’.

#### Explanation

From the perspectives of quality improvement and system performance, there is little rationale for excluding overseas patients from acute readmission analysis. In addition, with the overseas patient flag, further analyses can be conducted for example to look at the characteristics of this group of patients and their impact on different DHBs.

This is not the same as the Acute Hospital Bed Days measure where it was believed that DHBs have constraints managing demand of service for overseas residents getting into the hospital to begin with.

#### Recommendation

Overseas patients are included in the measure.

**A flag has been introduced using patient domicile code of ‘999’ for overseas patients.**

### Assessment, Treatment and Rehabilitation (ATR) Services

#### Description

ATR services are identified using the following DRG codes.

* Z60A Rehabilitation with catastrophic complication and/or comorbidity
* Z60B Rehabilitation without catastrophic complication and/or comorbidity
* Z60C Rehabilitation, Sameday

These services are included in the measure if they are part of a stay. However, if the entire stay consists of ATR services, it will be considered as a non-casemix stay.

#### Explanation

From the perspectives of quality improvement and system performance, there is little rationale for excluding these ATR services from acute readmission analysis, if they are part of the entire stay. Further analyses can be conducted for example to look at the characteristics of these services and their impact on different DHBs.

#### Recommendation

ATR services with a DRG code Z60A, Z60B, or Z60C, if it is part of a stay, are included in the measure. However, if the entire stay consists of ATR services, it will be considered as a non-casemix stay. (see section 3.5.1 below)

### Event Leave Days

#### Description

Event leave days are the number of days an inpatient is absent from the hospital at midnight.

#### Explanation

Each DHB has their own models of care, so they have different policies on the use of event leave days. Excluding leave days would not accommodate DHBs that choose certain models of care for their patients.

Leave days are included in the Average Length of Stay and Acute Hospital Bed Days measures.

A variable identifying the total number of leave days for analysis purpose can be added to the model.

#### Recommendation

Leave days are included in the measure. That is, leave days should not be subtracted.

### Non-acute Stays under Index Stays

#### Description

A non-acute inpatient stay is included in the index stays when the first event of the stay is not an acute admission. For example admission type of the first event is coded as Arranged (AA or ZA), Elective (WN or AP or WN), rather than Acute (AC or ZC or ZW).

#### Explanation

Non-acute stays are legitimate activities that can potentially result in a readmission. The quality of these activities should be looked at alongside acute stays.

#### Recommendation

Non-acute stays are included in the index stays (the denominator) but are excluded in the readmission stays (the numerator) of the measure. (see section 3.5.5 below)

### Maternity Services under Index Stays

#### Description

Maternity services can be identified by health specialty codes, purchase unit codes, DRG codes and ICD codes. In the model, an inpatient maternity stay is defined if the first event of the stay was discharged with a maternity delivery DRG codes O01A, O01B, O02A, O02B, O06Z or O64Z.

#### Explanation

Maternity events are included in the index stay to allow any related complications (e.g. postpartum complications) to be captured in the readmission stay. This is relevant for quality and service improvement purposes.

#### Recommendation

Maternity services are included in the index stays but are excluded in the readmission stays. (see section 3.5.6 below)

## Details of Exclusions

### Non-casemix Stays

#### Description

A non-casemix inpatient stay only involves a single or multiple inpatient events that all are discharged as non-casemix events. It is defined by the purchase unit code of ‘EXCLU’. None of the events that formed the stay was discharged with a casemix purchase unit code.

ATR, mental health, or non-casemix events are included if they are part of a casemix stay.

#### Explanation

Inpatient events and stays need proper comparison between facilities for the variety of patient activity and reporting methods across DHBs. While the current casemix approach is primarily used for funding purposes, this approach can also be applied on inpatient stays to ensure that inpatient stays are relatively homogenous across the sector.

#### Recommendation

Non-casemix stays, not the individual non-casemix events as part of a casemix stay, are excluded in the measure.

### Mental Health Stays

#### Description

Mental health stays are identified based on the health specialty codes with ‘Y’ prefix, Y00 to Y99 being recorded in the first event of the entire stay.

#### Explanation

Mental health services are an integral part of the system. It is important that we measure these activities. However, mental health services often have a different acute care and readmission pathway for their patients compared with care provided under medical and surgical services. Characteristics of mental health inpatients are also considerably different from those of medical-surgical patients.

Measuring them separately will reduce the skew effects of the model for non-mental health services. There is a suite of Key Performance Indicators (KPIs) and quality improvement measures for mental health services which the Ministry and the sector are actively monitoring. These are clinically well defined and used in the mental health service context.

Along with other key mental health initiatives and investments, these KPIs have proven to be effective in promoting better care management in the community settings. They could be served as contributory measures to help understand the drivers for acute hospital bed days demand.

#### Recommendation

Mental health stays are excluded in the measure. However, mental health events are included if they are part of an index or readmission stay. (see section 3.4.7 above)

### Deceased Patients under Index Stays

#### Description

Deceased patients are patients discharged as deceased at the end of their stay. They are identified based on the following event end type codes of the last event of the entire stay:

* DD Died
* DO Discharge of a patient kept sustainable for organ donation
* ED Died while still in emergency department acute facility

#### Explanation

When a patient died in hospital, the patient was discharged as deceased. Their stay in the hospital is a valid count for the measure. However the patient can then be acutely readmitted to donate organs for transplantation purposes. The second event can be mistakenly counted as an acute readmission. Although the number of events with this scenario is insignificant, excluding these in the index stays prevents penalising extraordinary situations that have no bearing on the objectives of measuring acute readmissions.

On the other hand, when a patient died in hospital during their readmission stay, it is considered a valid readmission stay count for the measure.

#### Recommendation

Patients discharged as deceased with the event end type codes DD, DO or ED are excluded in the index stays (the denominator) but are included in the readmission stays (the numerator).

### Incomplete Stays under Index Stays

#### Description

An incomplete stay is identified when the last event of the stay has a transfer flag. The transfer flag indicates that the patient was transferred. Section 2.2.3 above describes the event end type codes that are used for a transfer flag.

#### Explanation

The last event of the stay with the transfer flag in an index stay may indicate that the patient journey in the health system has not been completed. This could happen when the patient is in the middle of the stay during the end of the reporting period.

There are other scenarios for a transfer flag to be identified in the last event of an index stay. For example, a patient could be transferred to a private facility where the following events may not be included in the publicly funded activities or not being collected in the NMDS.

Incomplete stays are not excluded in the readmission stays because the rationale is to identify all readmissions.

#### Recommendation

Incomplete stays are excluded in the index stays (the denominator) of the measure but are included in the readmission stays (the numerator).

### Non-acute Stays under Readmission Stays

#### Description

A non-acute inpatient stay is excluded when the first event of the stay is not an acute admission. For example admission type of the first event is coded as Arranged (AA or ZA), Elective (WN or AP or WN), rather than Acute (AC or ZC or ZW).

#### Explanation

A key element of an acute readmission stay is that the first event in the readmission sequence has to be an unexpected emergency inpatient event. This exclusion removes patient stays that the first events are admitted as elective or arranged.

#### Recommendation

Non-acute stays are excluded in the readmission stays (the numerator) but are included in the index stays (the denominator) of the measure.

### Maternity Services under Readmission Stays

#### Description

Maternity services are identified based on the first event of the stay being discharged with a maternity delivery DRG codes O01A, O01B, O02A, O02B, O06Z or O64Z.

#### Explanation

Maternity is a large service and may have an influence over other elements in the measure. The nature of maternity services requires multiple visits culminating in the delivery event.

Maternity events are excluded from the readmission stay, given that the delivery event is an expected occurrence and can skew readmission rates.

#### Recommendation

Maternity services are excluded in the readmission stays but are included in the index stays. (see section 3.4.12 above)

# Standardisation and Stratification

## Description of Approach

### General method

Logistics regression method has been used in the model. Risk factors used for the standardisation process include:

* Prior stays (the number of stays within the last 12 months)
* Admission type (Arranged, Elective, Acute).
* Length of stay of index admission (including leave days)
* Age in 5-year bands (00-04, up to 84, and thereafter 85+)
* Primary diagnosis group (see section 4.2.2 below)
* Patient Clinical Complexity Level (PCCL)
* Prior morbidities, using the Charlson Comorbidity Index (see section 4.2.3 below)
* Current morbidities, using the Charlson Comorbidity Index (see section 4.2.3 below).

The following variables from the NMDS will be included in the summary level analysis and for stratification in the measure data:

* DHB of domicile based on the first event of the index stay (this is for the 28 – 180 day intervals)
* Principal DHB of service (last event of the stay) for the 3,7 and 28 day intervals)
* age in 5-year bands based on the first event of the index stay
* gender
* prioritised ethnicity (Māori, Pacific, and Other in that order) based on the first event of the index stay
* NZDep2013 Index of deprivation quintile based on the first event of the index stay

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* Top 50 DRG clusters of the last non-ATR events of stays.

In addition to the above, additional data will be included at a stay level for further detailed analysis such as:

* Unique person ID (a made up number to identify unique person)
* Principal DHB of service based on the last event of the index stay
* DHB of service for each of the first ten events in an index stay
* Agency code of the last event of an index stay
* Practice Management System Unique Identification (PMSUID) code of the last event of an index stay
* Admission type of the first event of an index stay (Acute, Arranged, Electives)
* Facility of the last event of the index stay
* Facility of the first event of readmission stay

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* Primary Health Organisation (PHO) (from the PHO registers linked in using NHIs, last date of the stay against the quarter of the PHO enrolment data the patient is enrolled in)
* General practice name
* Ethnicity (from PHO register)
* Lead DHB of PHO

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* Health specialty of the first event in an index stay
* Health specialty of the last event in an index stay
* Health specialty of the highest caseweight non-ATR event in an index stay
* Health specialty of the last non ATR event of index stay
* Health specialty of the first event of the readmission stay

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* DRGs for the first ten events of an index stay
* DRG of the last event of the index stay
* DRG of the highest caseweight non-ATR event of the index stay
* DRG of the first event of the readmission stay
* DRG of the last non-ATR event of the index stay

-------------

* Start date of the index stay
* End date of the index stay
* Start date of the readmission stay
* Total length of the index stay (i.e. total bed days)
* Total leave days of the index stay
* Total ATR days of the index stay

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* Service flags (e.g. ED short stays, Palliative care, etc.) (See section 3.3 above)

### Sharing of quarterly results

Results for the quarter will be issued in two stages, interim results and final results. This is in reflection of the delayed readmission activities not being fully captured in the national collections that are relevant to the index stays ended in the reporting quarter.

Interim results cover index stays ended within the first two months of the three months in a quarter. This is because, the model takes into account that some readmissions associated with the last month of index stays may not have been discharged or recorded in the national collections.

Final results cover a re-calculation of the quarter to cover index stays ended in all three months of the quarter in anticipating that most first event of readmissions would have been discharged and captured in the national collections with an extra three months after the quarter ends for the 3, 7, 28 days readmission intervals in the model. An extra nine months after the quarter ends has been allowed for when measuring the 180 days readmission interval.

In general, report for each quarter covers index stays ended in that quarter and readmissions associated with those index stays. For completeness purposes, the model extends its search for index stays started twelve months prior to the beginning of the quarter being measured. Table 5 below shows examples of how the reporting works.

**Table 5. Examples of quarterly reporting**

|  |  |  |
| --- | --- | --- |
| **Quarter being measured** | **2016/17 Quarter 1**July to September 2016 | **2016/17 Quarter 2**October to December 2016 |
| **Index stays ending** | July to August 2016 (2 months) | July to September 2016 | October to November 2016 (2 months) | October to December 2016 |
| **Index stays starting** | July 2015 to August 2016 (14 months) | July 2015 to September 2016 (15 months) | October 2015 to November 2016 (14 months) | October 2015 to December 2016 (15 months) |
| **Results status** | Interim | Final (rerun) | Interim | Final (rerun) |
| **For the 3, 7, 28 days intervals** |
| **Readmission stays starting** | July to September 2016 | July to October 2016 | October to December 2016 | October 2016 to January 2017 |
| **Results available** | November / December 2016 | February / March 2017 | February / March 2017 | May / June 2017 |
| **For the 180 days intervals** |
| **Readmission stays starting** | January to March 2017 | January to April 2017 | April to June 2017 | April to July 2017 |
| **Results available** | May / June 2017 | August / September 2017 | August / September 2017 | November / December 2017 |

## Explanation

Standardisation is often used when comparing rates or ratios between different groups, for example different DHBs or health services. Rates are often standardised by risk factors so that these factors or variables measured at different scenarios contributes equally to the analysis.

For instance, the prevalence of many conditions is associated with age which makes age one of the major confounding factors for explaining differences between groups. It could reflect that older people are more likely to get long term conditions than younger people. Controlling for age would allow the data to be transformed into a more compatible state.

DHBs and facilities have different types of specialties and serve different types of patients. Therefore unadjusted readmission rates (i.e. the observed number of readmission stays divided by the observed number of index stays) cannot be used to compare against the national readmission rate average or other DHBs. This is because the differences in patient characteristics between the groups have not been taken into account.

Learning from the national data, a logistic regression formula is derived to enable the calculation of the probability of readmission taking into account the characteristics of the stays (i.e. the risk factors in section 4.1 above). This was then applied to the reporting period for individual DHBs at a stay level to calculate the probability of readmission for each stay. Probability of readmission for each stay were then aggregated up to form the predicted number of readmission stays for that DHB.

DHB standardised readmission ratio is calculated using the observed number of readmission stays divided by the predicted number of readmission stays for that DHB. It is a form of indirect standardisation.

The indirect standardisation process does not take into account the differences in patient characteristics between DHBs, therefore it is not advised to compare the indirectly standardised readmission ratios between DHBs.

Three baseline years for standardisation have been considered:

* Standardised to a single fixed year data

Using a fixed baseline data (e.g. data in 2014) to develop a logistic regression formula that can be applied to the reporting period (e.g. 2015/16, 2016/17)

* Standardised to the reporting year data

Using the national data 12 months immediately prior to the beginning of the reporting period (e.g. July 2015 to June 2016) to develop a logistic regression formula that can be applied to the reporting period (e.g. quarter one of 2016/17 or July to September 2016)

* Standardised to three years data

Using the data 36 months immediately prior to the beginning of the reporting period (e.g. data from July 2013 to June 2016) to develop a logistic regression formula that can be applied to the reporting period (e.g. quarter one of 2016/17 or July to September 2016).

All these baselines would have a 12 month extension of data prior to the baseline year(s) to enable searching of index stays. It also includes three months of data delay to allow the readmission activities to be discharged and captured in the NMDS.

The advantages and disadvantages of baseline selection is described in table 6 below.

**Table 6. Comparison of baseline for standardisation**

|  |  |  |
| --- | --- | --- |
| **Baseline** | **Advantages** | **Disadvantages** |
| 1. **Standardised to a single fixed year data**
 | * Comparable DHB standardised readmission ratios across years within a DHB
 | * DHB standardised readmission ratio for the reporting year cannot be compared with the national standardised readmission ratio of that year
* It does not keep up with changes in service model or readmission patterns
* Historical baseline can get out of date
 |
| 1. **Standardised to the reporting year data**
 | * DHB standardised readmission ratio can be compared with the national standardised readmission ratio to determine whether the ratio is higher or lower than the national average in the reporting year
* It reflects system changes in the baseline data for prediction
 | * Incomparable DHB standardised readmission ratios across years within a DHB
* It can be subjected to small sample size issues
 |
| 1. **Standardised to three years data**
 | * Similar to baseline 2, *plus*
* It resolves issues with small sample size
* It is possible to compare DHB standardised readmission ratio of one reporting year with the year directly prior to the reporting year due to the overlapping of baseline data for both periods (e.g. comparing 2015 with 2014)
 | * Not adequate to compare multiple years’ DHB standardised readmission ratios (e.g. not adequate to compare 2015 with 2013 or 2012)
 |

The results are expressed as standardised readmission ratios after adjusting for the risk factors. They can be interpreted as the following:

* If a DHB standardised readmission ratio is equal to 1.0, it means that the observed number of readmissions is equivalent to the predicted number of readmissions
* If a DHB standardised readmission ratio is less than 1.0, it means that the observed number of readmissions is lower than the predicted number of readmissions
* If a DHB standardised readmission ratio is greater than 1.0, it means that the observed number of readmissions is higher than the predicted number of readmissions.

The measure is modelled on standardisation with three year baseline data. DHB standardised readmission ratios can be compared with the National standardised readmission ratio as it takes into account the risk factors of the admitted patients in a DHB learning from the risk factors of all other patients nationally. However, it is not adequate to compare one DHB standardised readmission ratio with another.

There has been considerable amount of discussions around whether to adjust for deprivation in the readmission measure. With the exception of deprivation, other indications for socioeconomic status are not recorded in the National Minimum Dataset. This model does not adjust or standardise readmissions for deprivation. Such adjustments can lead to over-standardisation, and potentially mask the disparities between populations and minimise incentives to improve the health outcomes of disadvantaged groups.

Stratification allows users to drill down to specific patient groups including ethnicity and deprivation groups, and for causal relationship analysis.

### Patient Risk Factors

A list of variables in table 7 below described patient risk factors and their statistical significance (Chi Square) in the logistic regression model for the 8-28 days readmission interval. (Tested as at 30 November 2016)

**Table 7. Variables included in the standardisation**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **Description** | **Chi Square** | **P value** |
| Prior Stays | The number of prior stays in the last 12 months | 32,110 | <.0001 |
| Admission Type | The admission type of the first event of index admission | 7,365 | <.0001 |
| Length of Stay | The length of stay of the index admission |  3,310  |  <.0001 |
| Age | The patient's age at admission |  2,156  |  <.0001 |
| Primary Diagnosis Group | Primary diagnosis grouped by cluster analysis using readmission rates from the model | 2,067 | <.0001 |
| PCCL | The Patient Clinical Complexity Level (PCCL) | 1,279 | <.0001 |
| Prior Morbidities | The total Charlson Comorbidity Index for all prior stays in the last 12 months |  344  | <.0001 |
| Current Morbidities | The Charlson Comorbidity Index of the index admission |  399 | <.0001 |

Deprivation, ethnicity and gender have been tested but not included in the model. Deprivation has been removed as it is considered to be amenable to intervention. Including deprivation in the model will remove transparency over the need to address disparity. Ethnicity and gender have been removed due to its low statistical significance in the model.

### Primary Diagnosis Group for Standardisation

**Cluster Analysis**

The primary diagnoses were grouped into diagnostic clusters in the model (Table 8). The diagnostic clusters are based on a cluster analysis that grouped ICD codes into different clusters according to their statistical distribution of crude readmission rates.

**Table 8. Diagnostic cluster and ICD code**

|  |  |
| --- | --- |
| **Diagnostic cluster** | **ICD codes included** |
| I | "J6", "J7", "J8" |
| II | "C7", "C3", "K7", "C2", "J9", "C1", "D6", "L1", "B4" |
| III | "I5", "J4" |
| IV | "B5", "C8", "D7", "D4", "I0", "C9", "O2", "Q4", "G9", "G0", "K8", "N2" |
| V | "Z8", "O1", "O4", "D8", "Z2", "E3", "G6", "D2", "L6", "O3", "J3", "S6", "A9", "O6", "Q5", "O8", "O7", "Q1", "H6", "K0", "H7", "Z9" |
| VI | "L3", "L8", "I9", "B9", "I2", "J2", "F5", "E1", "F0", "I4", "N3", "G2", "F4", "J1", "Z7", "R4", "E5", "F1", "I6" |
| VII | "T8", "I3", "K9", "I7", "K5", "B6", "R1", "E2", "M8", "N0", "C0", "I1", "N1", "L9", "R6", "R2", "M5", "S7", "L2,", "K2", "D5", "B8" ,"F3", "L0", "R5", "G1", "T4", "R0", "T3", "T5", "G4", "A0", "Z6", "Q9", "T0" |
| VIII | "D3", "K3", "M0", "N8", "R8", "P6", "K4", "K1", "E0", "Q3", "S4", "L4", "S5", "G7", "S8", "Q7", "N5", "S9", "C4", "D0", "N4", "A8", "O0", "N9", "E7","T1", "P8", "L7", "T2", "Q6", "Q8", "Z0", "G3", "M6", "D1", "H3", "Z1", "B2", "L5", "T6", "Z5", "Z3", "P1", "H9", "H5", "G5", "F8", "H2", "H1", "H0","A2", "B7" |
| IX | "E4", "F6", "E8", "A4", "R3" |
| X | "A1", "M3", "C6", "O9", "C5", "Z4", "M4", "Q2", "A3", "Q0", "F9", "K6", "P0", "B1", "F2", "P3", "S3", "R9", "P9", "I8", "M1", "B0", "S2", "E6","M2","N6", "N7", "M7", "R7" ,"A6", "P5" ,"M9", "P2", "G8", "S1", "H4", "J0", "T7", "A5", "B3", "P7", "S0", "H8", "F7", "A7" |

**Clinical Grouping – Scottish HSMR Model**

Another approach for defining the primary diagnosis group would be to use the 26 clinical groupings defined by the Scottish NHS based on medical intelligence and crude mortality rates. These groups are made up of a series of system categories (e.g. CVS, Malignancy, Neurological) subdivided according to the level of crude mortality (e.g. Malignancy 1 is the lowest mortality rate in the malignancy groupings and Malignancy 3 is the highest). [4]

However, the grouping is partially based on mortality rates for those conditions in Scotland, which may not be easily applied to the readmissions measure. Hence this approach was not considered suitable for our purpose.

**ICD Chapters**

Another approach which has been considered is to group primary diagnoses by ICD chapters based on the ICD codes. This classification is considered suitable for general epidemiological purposes and the evaluation of health care. There are 22 groupings based on the chapters as follows:

|  |  |
| --- | --- |
|  | **ICD-10-AM Chapter** |
| 1 | Certain infectious and parasitic diseases  |
| 2 | Neoplasms  |
| 3 | Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism |
| 4 | Endocrine, nutritional and metabolic diseases  |
| 5 | Mental and behavioural disorders  |
| 6 | Diseases of the nervous system  |
| 7 | Diseases of the eye and adnexa  |
| 8 | Diseases of the ear and mastoid process  |
| 9 | Diseases of the circulatory system  |
| 10 | Diseases of the respiratory system  |
| 11 | Diseases of the digestive system  |
| 12 | Diseases of the skin and subcutaneous tissue  |
| 13 | Diseases of the musculoskeletal system and connective tissue  |
| 14 | Diseases of the genitourinary system  |
| 15 | Pregnancy, childbirth and the puerperium  |
| 16 | Certain conditions originating in the perinatal period  |
| 17 | Congenital malformations, deformations and chromosomal abnormalities  |
| 18 | Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified  |
| 19 | Injury, poisoning and certain other consequences of external causes  |
| 20 | External causes of morbidity and mortality  |
| 21 | Factors influencing health status and contact with health services  |
| 22 | Codes for special purposes  |

However, testing the above approach did not indicate a strong predictive power.

**Major Diagnostic Categories**

Group and standardised activities by using the 23 major diagnostic categories based on the following DRGs (AR-DRG v6.0) could also be an option.

|  |  |  |
| --- | --- | --- |
| **MDC Code** | **MDC Description** | **AR-DRG Range** |
| Pre-MDC | Major procedures where the principal diagnosis may be associated with any MDC | A01Z-A41Z |
| 01 | Diseases and disorders of the nervous system | B01Z-B81B |
| 02 | Diseases and disorders of the eye | C01Z-C63B |
| 03 | Diseases and disorders of the ear, nose, mouth and throat | D01Z-D67Z |
| 04 | Diseases and disorders of the respiratory system | E01A-E75C |
| 05 | Diseases and disorders of the circulatory system | F01Z-F75C |
| 06 | Diseases and disorders of the digestive system | G01A-G70B |
| 07 | Diseases and disorders of the hepatobiliary system and pancreas | H01A-H64B |
| 08 | Diseases and disorders of the musculoskeletal system and connective tissue | I01Z-I76C |
| 09 | Diseases and disorders of the skin, subcutaneous tissue and breast | J01Z-J67B |
| 10 | Endocrine, nutritional and metabolic diseases and disorders | K01Z-K64B |
| 11 | Diseases and disorders of the kidney and urinary tract | L01A-L67C |
| 12 | Diseases and disorders of the male reproductive system | M01Z-M64Z |
| 13 | Diseases and disorders of the female reproductive system | N01Z-N62B |
| 14 | Pregnancy, childbirth and the puerperium | O01A-O65B |
| 15 | Newborn and other neonates | P01Z-P67D |
| 16 | Diseases and disorders of blood, blood-forming organs and immunological disorders | Q01Z-Q62B |
| 17 | Neoplastic disorders (haematological and solid neoplasm's) | R01A-R64Z |
| 18 | Infectious and parasitic diseases (systemic or unspecified sites) | S60Z-T64B |
| 19 | Mental diseases and disorders | U40Z-U68Z |
| 20 | Alcohol/drug use and alcohol/drug-induced organic mental conditions | V60Z-V64Z |
| 21 | Injuries, poisoning and toxic effects of drugs | W01Z-X64B |
| 22 | Burns | Y01Z-Y62B |
| 23 | Factors influencing health status and other contacts with health services | Z01A-Z65Z |
| Error-DRG | Error DRGs | 801Z-963Z |

### Charlson Comorbidity Index for Standardisation

The Charlson Index is an indicator of disease burden and a strong indicator of mortality. In the context of the readmissions work, the Charlson index has been applied to both prior morbidities and the current diagnosis. For prior morbidities, data is screened back from the index admission for one year, looking at the main diagnosis on all records for a given patient. If the main diagnosis (ICD-10-AM) maps to any of the 17 Charlson groups the appropriate weighting is attributed for that group and added to any previously attributed weighting. Once a weighting has been applied for a given group it is not further applied for the same group, even if there is multiple activity for the same grouping.

Similarly, for the current diagnosis the appropriate weighting is applied and listed in table 8 below.

**Table 8.Clinical groups under the Charlson Comorbidity Index**

|  |  |
| --- | --- |
| **Clinical Groups** | **Weighting** |
| Acute myocardial infarction | 1 |
| Congestive heart failure | 1 |
| Peripheral vascular disease | 1 |
| Cerebral vascular accident | 1 |
| Dementia | 1 |
| Pulmonary disease  | 1 |
| Connective tissue disorder  | 1 |
| Peptic ulcer | 1 |
| Liver disease | 1 |
| Diabetes | 2 |
| Diabetes complications | 2 |
| Paraplegia | 2 |
| Renal disease | 2 |
| Cancer | 2 |
| Metastatic cancer | 3 |
| Severe liver disease  | 3 |
| HIV  | 6 |

## Recommendation

The draft model includes both crude and standardised rates. An indirect standardisation process has been applied to the data for the standardised rates in the model. The data will be able to be stratified for different demographic groups to enable analysis of their impact and inform interventions.

# References

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