

## NHS Choices Indicator: Adjusted Relative Risk of Readmission

### Description of Indicator (as displayed on NHS Choices)

This measure shows the percentage of patients who were readmitted to hospital as an emergency within one month of being discharged. The more stars a hospital has, the lower its rate of readmission.

The reasons for readmission are complex, and relate to the patient's overall health and the care they receive after leaving hospital, as well as the quality of care in hospital. Hospitals will always have some emergency readmissions, as it is not possible to be sure how a patient's condition will change after they leave hospital. The percentage displayed is an average for each NHS trust. The rate of readmission may also vary from one hospital to another within a large NHS trust. You may want to ask your doctor or NHS trust about the readmission numbers in your particular hospital, or about the department where your operation will be done.

### Definition of Indicator

This indicator is the relative risk of 28 day emergency readmissions, that is, the ratio of the observed number of emergency readmissions at a given trust to the expected number of 28 day readmissions for a particular procedure this ratio is multiplied by 100 and then multiplied by the English 28-day emergency readmission rate (defined as ratio of the number of 28-day emergency readmissions aggregated over all English trusts to the number of spells aggregated over all English trusts with a discharge date falling within the relevant time period expressed as a percentage). The expected number is derived from a model developed by the Imperial College Unit at Dr Fosters. The indicator is banded using a 97.5% confidence interval for the calculated statistic.

<b>Statistic</b>	<b>Sex</b>	<b>Age</b>	<b>Organisation</b>	<b>Period</b>
<i>Ratio of the observed number of 28 day emergency readmissions divided by the expected number of such admission, multiplied by 100.</i>	<i>M, F</i>	<i>(strictly) Greater than 18 years age on admission Of first spell</i>	<i>All acute trusts in England (excluding mental health trusts) and all IS sites in England</i>	<i>August 2008 extract (9 months)* Start date: 1<sup>st</sup> March 2007 End date: 31<sup>st</sup> Nov 2007</i>

\* *The extract end date for the readmissions indicator lags by 3 months behind the end date for all other Choices indicators, this is to be certain that all readmissions have been reported (and cleared) by providers.*

## **Numerator:**

*Numerator data* – The total number of emergency readmissions resulting from inpatient spell where the age upon admission is (strictly) greater than 18 years at an acute trust for a given procedure (see Appendix 2 for the OPCS codes serving as definitions for the procedure basket maintained by Choices). Spells due to private patient admissions are included. Both the originating spell (the spell that gave rise to the readmission) and the readmission spell itself must be valid - a spell will be deemed invalid for the following reasons

Unfinished episode - EPISTAT=1

Duplicate - Duplicate of another valid episode (duplicated on NHS number, age, sex and date of birth)

Admission date - ADMIDATE is missing or invalid

Missing last episode - The first spell is missing an episode with a valid DISDATE or an episode with SPELEND=Y and valid EPIEND

Admission (spell) - Missing or invalid admission method, defined as Admission Method = 98 (not applicable/non-elective), 99 (not known) or null on all episodes in this spell

DISDATE earlier than ADMIDATE

The emergency readmission must occur within a 28 day period - 0-28 days inclusive - from the discharge date of the originating spell (readmissions are not counted where the readmission spell has an admidate before the disdate of the original spell).

For NHS trusts the total number of readmissions is aggregated across all sites belonging to the provider. For IS providers the aggregation is performed at site level. All finished inpatient spells which give rise to a readmission where the primary diagnosis (based upon the ICD-10 classification system) upon admission of the first spell is one of cancer is excluded from the calculation – see Appendix 1 for ICD-10 definition of cancer.

*Source of numerator data* – Dr Foster database (a subset of the HES database) intersecting the respective extract period for England containing 9 months of activity, rolling forward on a month-by-month basis. Upon receipt data is cleaned and episode linkage is performed to identify spells by the Imperial College Unit at

Doctor Foster. Episodes are linked into spells by matching NHS number, date of birth, postcode and admission date.

### **Denominator:**

*Denominator data* - The expected number of emergency readmissions resulting from every finished inpatient spell where the age upon admission is (strictly) greater than 18 years at an acute trust for a given (main) procedure (see Appendix 2 for the OPCS codes serving as definitions for the procedure basket maintained by Choices). All spells must be valid (see numerator section above for definitions of invalid spells). The expected number of readmissions is obtained by modelling the risk of readmission using a logistic regression model maintained and developed by the Imperial College Unit at Dr Fosters based upon English data. Each inpatient spell has a risk of readmission associated with it based upon deprivation, sex, age, comorbidity, the number of emergency admissions a patient has had in the previous 12 months and the presence of a palliative care episode. The risks are summed to obtain the overall expected number of readmissions.

### **Statistical Methods:**

Logistic regression models of readmissions are built from all years of HES data from 1996/7 onwards based upon the available case-mix factors. The factors adjusted for are: age, sex and method of admission (non-elective or elective), year of admission, deprivation quintile, the Charlson index of comorbidity (see appendix 3), the number of emergency admissions a patient has had in the previous 12 months and the presence of a palliative care episode. Based upon these parameters a logistic regression model is developed which predicts the risk of readmission for an inpatient spell. Since the admission events to a provider are (assumed) independent these risks are summed at the provider level for NHS Trusts and at a site level for IS providers, to yield the expected number of readmissions. A 97.5% confidence interval is calculated for the indicator using Byar's approximation. The confidence interval enables a banding of the indicator for comparison purposes.

There are three reported bands:

if the lower limit of the confidence interval is greater than 100 then the assigned band is 1 (to be interpreted as "above expected")

if the upper limit of the confidence interval is less than 100 then the assigned band is 3 (to be interpreted as "below expected")

otherwise, the assigned band is 2 (to be interpreted as "as expected")

**Updated:**  
Monthly

## Appendix 1

### ICD-10 Codes for Cancer

Cancer of bladder		C67, D090
Cancer of bone and connective tissue		C40, C41, C461, C49
Cancer of brain and nervous system		C47, C70-C72
Cancer of breast	1 Carcinoma in situ of breast	D05
Cancer of breast	2 Malignant neoplasm of breast	C50
Cancer of bronchus, lung		C34, D022
Cancer of cervix		C53, D06
Cancer of colon		C18, D010
Cancer of head and neck		C00-C14, C30-C32, C462, C760, D000, D020, D092
Cancer of kidney and renal pelvis		C64, C65
Cancer of liver and intrahepatic bile duct		C22, D015
Cancer of oesophagus		C15, D001
Cancer of other female genital organs		C51, C52, C57, C58, D071-D073
Cancer of other GI organs, peritoneum		C17, C23, C24, C26, C451, C48, D014, D017, D019
Cancer of other male genital organs		C60, C63, D074, D076
Cancer of other urinary organs		C66, C68, D091
Cancer of ovary		C56
Cancer of pancreas		C25
Cancer of prostate		C61, D075
Cancer of rectum and anus	1 Carcinoma in situ of other and unspecified digestive or	D01
Cancer of rectum and anus	2 Malignant neoplasm of anus and anal canal	C21
Cancer of rectum and anus	3 Malignant neoplasm of rectum	C20
Cancer of rectum and anus	4 Malignant neoplasm of rectosigmoid junction	C19
Cancer of stomach		C16, D002
Cancer of testis		C62
Cancer of thyroid		C73, D093
Cancer of uterus		C54, C55, D070
Cancer, other and unspecified primary		C37, C380-C383, C452, C457, C459, C467-C469, C69, C74, C75, C761-C768, C960-C962, D097
Cancer, other respiratory and intrathoracic		C33, C384, C388, C39, C450, D021, D023, D024

## Appendix 2

OPCS codes for Choices procedures.

Procedure Name	OPCS Code(s)
Arthroscopy of the knee	W82, W83, W84+Z846, W85, W87, W89+ Z846
Bunion operations	W79, W59, W15.1, W15.2, W15.3
Heart Bypass	K40-K46
Pacemaker implantation	K60
Carpal tunnel release	A65.1
Coronary angiography	K63, K65
Correction of squint	C31, C32, C33, C34, C35
Diagnostic endoscopy of the bladder (Cystoscopy)	M45
Diagnostic endoscopy of the stomach	G16, G19, G45, G55, G65, G80
Keyhole prostate surgery (TURP)	M65
Surgery for Dupuytren's contracture	T521, T522, T541
Ganglion removal	T59, T60
Destruction of kidney stones	M14
Cataract surgery	C71, C72, C73, C74, C75, C77
Extraction of wisdom teeth	F09.1, F09.3
Gallbladder surgery	J18
Surgery for haemorrhoids	H51.1
Hip replacement	W37.0, W37.1, W37.2, W37.3, W37.8, W37.9, W38.0, W38.1, W38.2, W38.3, W38.8, W38.9, W39.0, W39.1, W39.2, W39.3, W39.4, W39.8, W39.9, W93.1, W93.2, W93.3, W93.8, W93.9, W93.0, W94.1, W94.2, W94.3, W94.8, W94.9, W94.0, W95.1, W95.2, W95.3, W95.8, W95.9, W95.0
Hysterectomy	Q07-Q08
Examination of the uterus (Hysteroscopy)	Q18
Knee replacement	W40.0, W40.1, W40.2, W40.3, W40.8, W40.9, W41.0, W41.1, W41.2, W41.8, W41.9, W42.0, W42.1, W42.2, W42.3, W42.4, W42.8, W42.9
Surgery on the lower back (lumbar spine)	V25, V26, V28, V33-V34, V382-6, V393-7, V433, V473, V485-6, V493, V563, V573, V583, V593, V603, V613, V623, V633
Aortic valve replacement	K26, K302
Repair of femoral hernia	T22, T23
Repair of hand tendon	T67 + Z56
Repair of tendon in the knee and lower leg	T67 + Z58
Coronary angioplasty	K49, K50, K75
Carotid artery surgery (endarterectomy)	L29
Repair of abdominal aortic aneurysm	L183-6, L193-6, L203-6, L213-6
Repair of inguinal hernia	T19, T20, T21.1, T21.2, T21.3, T21.8, T21.9
Treatment for trigger finger	T72.3
Repair of umbilical hernia	T24, T97
Therapeutic endoscopy on the stomach	G14, G15, G17, G18, G42, G43, G44, G54, G64,

	G79
Varicose vein stripping	L85, L87
Vasectomy	N17

*n.b. For Arthroscopy of the knee, Repair of hand tendon and Repair of tendon in the knee and lower leg the secondary field following can occur in any episode after the main operation.*

## Appendix 3 Charlson comorbidity conditions

Condition	ICD10 diagnosis codes	Score
Acute myocardial infarction	I21, I22, I252	1
Congestive heart failure	I50	1
Peripheral vascular disease	I71, I790, I739, R02, Z958, Z959	1
Cerebral vascular disease	I60, I61, I62, I63, I65, I66, G450, G451, G452, G458, G459, G46, I64, G454, I670, I671, I672, I674, I675, I676, I677, I678, I679, I681, I682, I688, I69	1
Dementia	F00, F01, F02, F051	1
Pulmonary disease	J40, J41, J42, J44, J43, J45, J46, J47, J67, J44, J60, J61, J62, J63, J66, J64, J65	1
Connective tissue disease	M32, M34, M332, M053, M058, M059, M060, M063, M069, M050, M052, M051, M353	1
Peptic ulcer disease	K25, K26, K27, K28	1
Liver disease	K702, K703, K73, K717, K740, K742, K746, K743, K744, K745	1
Diabetes	E109, E119, E139, E149, E101, E111, E131, E141, E105, E115, E135, E145	1
Diabetes with complications	E102, E112, E132, E142, E103, E113, E133, E143, E104, E114, E134, E144	2
Hemiplegia or paraplegia	G81, G041, G820, G821, G822	2
Renal disease	N03, N052, N053, N054, N055, N056, N072, N073, N074, N01, N18, N19, N25	2
Cancer	C0, C1, C2, C3, C40, C41, C43, C45, C46, C47, C48, C49, C5, C6, C70, C71, C72, C73, C74, C75, C76, C81, C82, C83, C84, C85, C883, C887, C889, C900, C901, C91, C92, C93, C940, C941, C942, C943, C945, C947, C95, C96	2
Metastatic cancer	C77, C78, C79, C80	3
Severe liver disease	K729, K766, K767, K721	3
HIV	B20, B21, B22, B23, B24	6