



A Delphi Study to Identify Potentially Avoidable Hospitalisations in Hong Kong Using the Ambulatory Care Sensitive Conditions

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HA Convention SPP5.7 Clinical Safety and Quality Service I
(8 May 2014)

Background

- Literature review shows increasing emphasis on identifying and reducing avoidable hospitalisations to
 - improve inpatient care quality and
 - reduce costsin particular in the face of aging populations worldwide
- **Ambulatory Care Sensitive Conditions** (ACSCs), which can be easily abstracted from routine hospital databases, are commonly used internationally to define potentially avoidable hospitalisations

Ambulatory Care Sensitive Conditions

Conditions where hospitalization could be prevented or avoided if appropriate timely and effective primary/ ambulatory care is provided

Weissman (1992); Billings et al (1993)

ACSCs – No agreed set of diagnoses due to differences in organisation and financing of care in different countries

Conditions	ICD9- CM codes	Page (Australia)	Niti (Singapore)	Bindman (US)	Weissman (US)
Pneumonia	481, 482, 483, 485, 486	✓			✓
CHF	428, 402.01, 402.11, 402.91	✓	✓	✓	✓
COPD	490, 491, 492.0, 492.8, 494, 495, 496	✓	✓	✓	
Cellulitis	681, 682	✓			✓
Asthma	493	✓	✓	✓	✓
Angina	I20, I24.0, I24.8, I24.9	✓			
Perforated or bleeding ulcer	531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.1, 533.2, 533.4, 533.5, 533.6	✓			✓
Hypokalemia	276.8				✓
Gangrene	785.4	✓			✓
Pyelonephritis/UTI	590.0, 590.1, 590.8	✓			✓
Rupture appendix	540.0, 540.1	✓			✓
DM	250.1, 250.2, 250.3, 251.0	✓	✓	✓	✓
Hypertensions	401.0, 402.00, 403.0, 404.0, 405.0, 437.2	✓	✓	✓	✓
Immunizable condition	032, 033, 037, 072, 045, 055	✓			✓
...

Criteria to Develop ACSCs

- 1) **Existence of prior studies** by an extensive bibliographical search
- 2) **Hospitalization rate of at least 1/10,000 or “risky health problem”** (an important health problem or a condition with a burden of co-morbidity worsening the prognosis)
- 3) **Clarity** in the definition and coding of diagnoses
- 4) Hospitalization **potentially avoidable through primary health care**, considering age, gender and type of care
- 5) **Hospitalization necessary** when health problem occurs

Carminal’s Methodology in development of ACSC list: Judgment by experts of the characteristics of each ICD code regarding its relevance for primary health care, using a **Delphi technique**

Carminal J et al. (2004). The role of primary care in preventing ambulatory care sensitive conditions. European Journal of Public Health; 14: 246-251

Objectives of our Study

- To identify **a validated list of Ambulatory Care Sensitive Conditions** to measure potentially avoidable hospitalisations in Hong Kong
- To assess the **magnitude of avoidable hospitalizations** in Hong Kong

This project is funded by the Health and Medical Research Fund.

Methodology (1): 6-step Approach

Steps	Aspects	Methods
1. Existence of prior studies	Consensus	Literature review before 2013 -- by Investigators
2. Hospitalization rate of at least 1/10,000	Importance/ Significance of disease burden	Review of hospitalization rates using 331,244 HA admission episodes to Medicine corresponding to 195,467 patients in 2007
3. Local context	Consensus	Advice from Expert Panel
4(i). Confirmation of Clarity in definition and coding of diagnoses 4(ii). Establishment of Validity of each condition to be preventable by timely and effective ambulatory care	Clarity Face validity	Delphi Survey
5. Confirmation of ACSCs	All of the above	Review and confirm by Expert Panel
6. Magnitude of avoidable hospitalisation	Disease Burden	Based on HA 2007 admissions

Steps 1-5 adapted from Caminal J et al. (2004)

Methodology (2): Steps 3-5. Developing the Local ACSC List

Develop a potential list of ACSCs for HK
Expert panel

Rate the potential ACSCs to achieve consensus
Delphi survey

Evaluate and confirm the ACSC list based on Delphi results
Expert panel

	No.	Characteristics
Expert Panel Members	3	<ul style="list-style-type: none"> Consultants (<i>Medicine, Geriatrics, Surgery</i>)
Delphi Survey Participants	15	<ul style="list-style-type: none"> Consultants & Associate Consultants (<i>Medicine, Geriatrics, Rehabilitation</i>) Covers 7 clusters 12 males (80%) 9 (60%) from acute hospitals; 6 from non-acute hospitals

Years of Working Experience

Years of Working Experience	Percentage
21-25 yrs	60%
26-30 yrs	27%
31-35 yrs	7%
16-20 yrs	6%

Methodology (3): Step 4. Rating in Delphi Survey

- Participants rate the clarity and validity on a 5-point scale: **Rating of 1-2 = Low; 3 = Average; 4-5 = High**

Clarity	Extent to which the code and description is <u>sufficiently clear and homogeneous</u> to serve as the basis for making a judgment of suitability as an ACSC condition
Validity	Extent to which the <u>admission</u> from this condition <u>can be prevented by timely and effective ambulatory care</u>

- Participants to **comment + provide feedback** for all diagnoses rated 1-3.
- A consensus is achieved if $\geq 75\%$ of respondents rated 4-5 on **Clarity** and **Validity**.



Results: Step 1. Existence of Prior Studies through Extensive Literature Search

- 24 relevant articles were identified from the literature
- By synthesising these ACSC lists, the Expert Panel identified **29 conditions** for assessment of their significance in Step 2

Examples of ACSCs

Conditions	Weissman 1992 (US)	Bindman 1995 (US)	Niti 2003 (Singapore)	Prudy 2009 (UK)
Pneumonia	✓			✓
CHF	✓	✓	✓	✓
COPD		✓	✓	✓
Cellulitis	✓			✓
Asthma	✓	✓	✓	✓
Angina				✓
Perforated or bleeding ulcer	✓			✓
Hypokalemia	✓			
Gangrene	✓			✓
Pyelonephritis/ UTI	✓			✓
Rupture appendix	✓			✓
DM	✓	✓	✓	✓
Hypertensions	✓	✓	✓	✓
Immunizable condition	✓			✓
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Results: Step 2. Hospitalization Rate of at least 1/10,000 (0.01%)

Review of 331,244 medical admission episodes in 2007
 → 9/29 conditions excluded due to low disease burden →
 20 conditions to go to Step 3

Conditions to be rated	n	%
Pneumonia	26,778	8.23
COPD/ COAD	23,970	7.38
CHF	13,755	4.23
Angina	6,293	1.94
Convulsions & epilepsy	4,619	1.42
Asthma	3,326	1.02
Cellutis	2,527	0.78
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Gangrene	205	0.06
Hypertension	47	0.01

Excluded conditions	n	%
Sebaceous cyst	31	0.0094
Fracture of radius & Ulna	29	0.0088
Rupture appendix/ appendicitis with complication	23	0.0069
Pelvic inflammation disease	13	0.00039
Immunizable condition	12	0.0036
Ingrown toenail	4	0.0012
Viral warts	2	0.0006
Nutritional deficiencies	1	0.0003
Dysplasia, mucous polyp, erosion of cervix	-	-

Results: Step 3. Local Context through Consensus of Expert Panel

- 20 conditions → 1 excluded as it is an ENT condition (*Ear, nose and throat infection: 382, 034.0, 462, 463, 472.1*) → **19 conditions**
- Added 5 New Conditions accounting for 8 individual diagnostic codes, admissions from which were found to be avoidable based on a 2007 medical record review for avoidable readmissions

Among 331,244 medical admission episodes in 2007

8 Individual Diagnostic Codes	ICD-9CM	n	%
Unspecified essential hypertension	401.9	12,575	3.80
Urinary tract infection, site not specified	599.0	3,419	1.03
Diabetes with other specified manifestations type 2 or unspecified type, not stated as uncontrolled	250.80	1,629	0.49
Chronic kidney disease, unspecified	585.9	10,743	3.24
Chest pain, unspecified	786.50	8,837	2.67
Dizziness and giddiness	780.4	8,316	2.51
Fluid overload disorder	276.6	1,995	0.60
Atrial fibrillation	427.31	4,640	1.40
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In total, 24 conditions accounting for 82 individual ICD-9CM diagnostic codes were included for use in the Delphi survey

Results: Step 4. Clarity and Validity through Delphi Survey

- Three rounds were conducted in August-October 2013



Measuring Avoidable Hospital Readmissions in Hong Kong Using the Ambulatory Care Sensitive Conditions



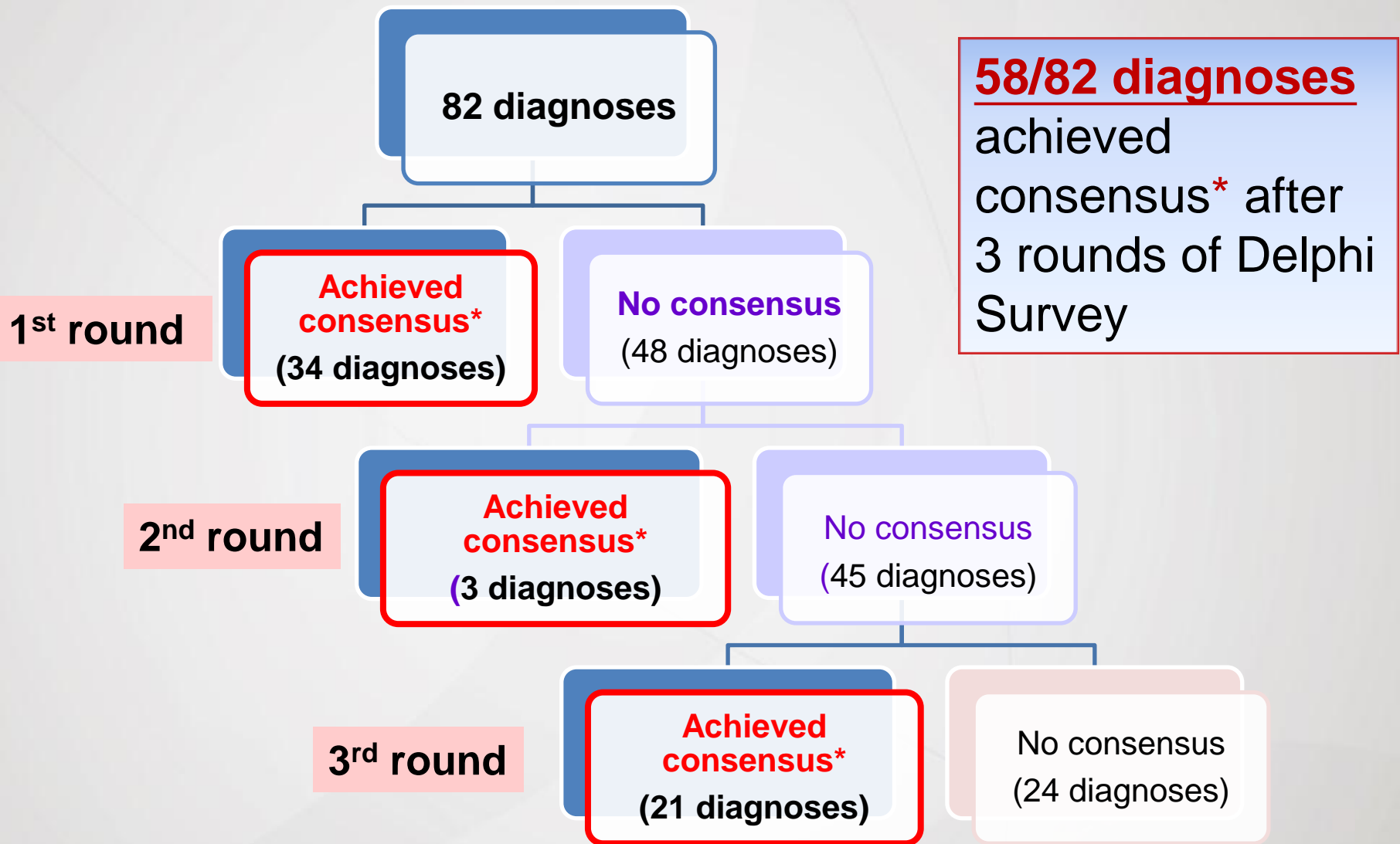
Round 1 Rating

Name: _____

Please circle the appropriate rating of (i) clarity and (ii) validity of each condition, and please comment and provide feedback for those conditions with a rating of 1-3.

		Clarity					Validity					Comments
		Low	Average		High	Low	Average		High			
(1) Pneumonia												
480	Viral pneumonia	1	2	3	4	5	1	2	3	4	5	
481	Pneumococcal pneumonia [Streptococcus pneumoniae pneumonia]	1	2	3	4	5	1	2	3	4	5	
482	Other bacterial pneumonia	1	2	3	4	5	1	2	3	4	5	
483	Pneumonia due to other specified organism	1	2	3	4	5	1	2	3	4	5	
485	Bronchopneumonia, organism unspecified	1	2	3	4	5	1	2	3	4	5	
486	Pneumonia, organism unspecified	1	2	3	4	5	1	2	3	4	5	13

Results: Step 4. Delphi Survey – Consensus



* A consensus is achieved if $\geq 75\%$ of the respondents rated 4-5 on **Clarity** & **Validity**.

Results: Step 4. Delphi Survey – Diagnosis not Reaching Consensus (n=24)

Comments/Feedback for diagnoses rated ≤ 3

- ✓ **Rare diagnoses** which cannot be made clinically *e.g. Eosinophilic gastritis (535.7), Eosinophilic gastroenteritis and colitis (558.4)*
- ✓ **Obsolete diagnosis** *e.g. Prinzmetal angina (413.1)*
- ✓ **Coding unclear or not homogeneous** *e.g. Intermediate coronary syndrome (411.1), dizziness and giddiness (780.4)*
- ✓ **Insufficient knowledge about condition** *e.g. Eclampsia (642.60, 642.61, 642.63, 642.64, 642.72, 642.74)*
- ◆ Diagnoses **need hospitalization** for close monitoring and treatment *e.g. acute gastric/ duodenal/ peptic ulcer (531.0, 531.2, 532.0, 532.2, 533.0, 533.1, 533.2)*
 - *This is a misunderstanding since Caminal's Criteria 5 mandates that the conditions should require hospitalisation when they do occur*

Results: Step 5 . Confirmation by Expert Panel

- **Expert panel confirmed** all 58 ACSC diagnoses with consensus achieved after the 3 Delphi rounds
- **Expert panel reviewed** the other 24 conditions, in particular those described as “**hospitalization needed**”, and those with a **relatively higher consensus reached** ($\leq 75\%$ but $\geq 70\%$)
 - **Expert advice** was sought from senior obstetrician on eclampsia
- **Finally, 20/24 individual diagnoses were re-captured as ACSCs**
 - **Only 4 diagnoses were excluded:** Eosinophilic gastritis (535.7), *Eosinophilic gastroenteritis and colitis* (558.4), *Intermediate coronary syndrome* (411.1) and *Prinzmetal angina* (413.1)

Overall, 24 conditions accounting for 78 individual diagnoses were accepted as ACSCs for Hong Kong

Results: Step 5. Final Validated ACSC List (1)

Condition	ICD-9CM	n	%
Pneumonia	480,481,482,483,485,486	27,265	8.23
CHF	428, 402.01, 402.11, 402.91	13,852	4.18
COPD/ COAD	490, 491, 492.0, 492.8, 494, 496	24,466	7.39
Cellulitis	681, 682	2,546	0.77
Asthma	493	3,425	1.03
Dehydration and gastroenteritis	276.5, 535.7, 558.3, 558.4, 558.9	2,042	0.62
Angina	411.8. 413.9	1,511	0.46
Perforated or bleeding ulcer	531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.1, 533.2, 533.4, 533.5, 533.6	926	0.28
Convulsions and epilepsy	345, 642.44, 642.60, 642.61, 642.63, 642.63, 642.64, 642.72, 642.74, 780.3	4,792	1.45
Iron deficiency anaemia	280.1, 280.8, 280.9	1,283	0.39
Hypokalemia	276.8	986	0.30

Results: Step 5. Final Validated ACSC List (2)

Condition	ICD-9CM	n	%
Influenza	487	1,553	0.47
Gangrene	785.4	205	0.06
Pyelonephritis/ UTI	590.0, 590.1, 590.8, 599.0	12,101	3.65
DM	250.1, 250.2, 250.3, 250.80, 251.0	4,465	1.35
Hypertension	401.0, 401.9, 402.00, 403.0, 404.0, 405.0, 437.2	4,153	1.25
Other respiratory infection	465, 466.0	5,576	1.68
Hypoglycemia	251.2	230	0.07
Constipation	564.0	789	0.24
Dizziness and giddiness	780.4	8,316	2.51
Fluid overload disorder	276.6	1,995	0.60
Atrial fibrillation	427.31	4,640	1.40
Chronic kidney disease, unspecified	585.9	10,743	3.24
Chest pain, unspecified	786.50	8,837	2.67

Results: Step 6. Magnitude of Avoidable Hospitalisations due to ACSCs

- The validated ACSC list of 24 conditions (78 diagnoses) accounted for **44% of all admissions through accident and emergency department or out-patient department in HA in 2007**
- The largest groups of ACSCs, subject to coding accuracy, were
 - ① **Pneumonia (8.2%)**
 - ② **COPD (7.4%)**
 - ③ **CHF (4.2%)**

Results: Step 6. ACSCs vs Non-ACSCs (1)

Among 331,244 medical admissions through A&E or SOPD

	Non-ACSCs (n=184,547)	ACSCs (n=146,697)	All patients (N=331,244)	P-value
Gender (Male) %	52.5	52.6	52.5	0.518
Age in years (mean)	67	73	70	<0.001
Admitted from elderly home %	15.3	24.9	19.6	<0.001
Fee paid by public assistance %	26.5	36.3	30.9	<0.001
Length of stay, in days (mean)	6.4	5.2	5.9	<0.001
Is a unplanned readmission within 30 days (%)	13.3	21.4	16.9	<0.001

*In HA in 2007, ACSC admissions were more likely to be **unplanned readmissions** than non-ACSC admissions, with **OR 1.53 (CI 1.50 – 1.56)** after adjusting for age and gender.*

Results: Step 6. ACSCs vs Non-ACSCs (1)

In HA in 2007, the local ACSCs accounted for **56%** of all **56,025 unplanned readmissions episodes**.

Among **all 56,025 unplanned readmissions (30 days)**

	Non-ACSCs (n=24,582)	ACSCs (n=31,443)	All patients (N=56,025)	P-value
Gender (Male) %	51.1	55.8	53.7	<0.001
Age, in years (mean)	73	77	75	<0.001
Admitted from elderly home %	30.4	37.8	34.6	<0.001
Fee paid by public assistance %	40.0	47.7	44.3	<0.001
Length of stay, in days (mean)	7.3	6.1	5.9	<0.001

Conclusions

- This is the **first attempt** to identify a validated list of **ACSCs specifically for Hong Kong** taking into account local context and system constraints
- We have
 1. Identified **a validated list of Ambulatory Care Sensitive Conditions** to measure potentially avoidable hospitalisations in Hong Kong, and
 2. Assessed the **magnitude of avoidable hospitalizations** in Hong Kong in 2007

Implications and Way Forward

- These HK-specific ACSCs identified
 - May serve as **indicators of avoidable hospitalisations** which can be captured routinely for monitoring purposes
 - May also be used to **measure potentially avoidable hospital readmissions** in lieu of resource-intensive medical record reviews
 - Will be **prioritized for further research and service planning:**
 - *Next Step: We plan to monitor the trend & scale of avoidable admissions & readmissions through quantitative analyses of HA data in the past 10 years.*



Thank you

We are most grateful to Expert Panel members and Delphi participants for taking part in this study.

We sincerely thank the Hospital Authority for providing its data for analysis.

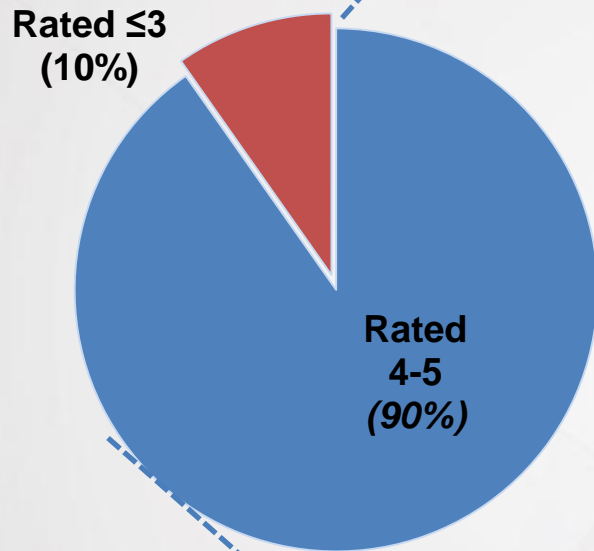
This study is funded by the Health and Medical Research Fund.

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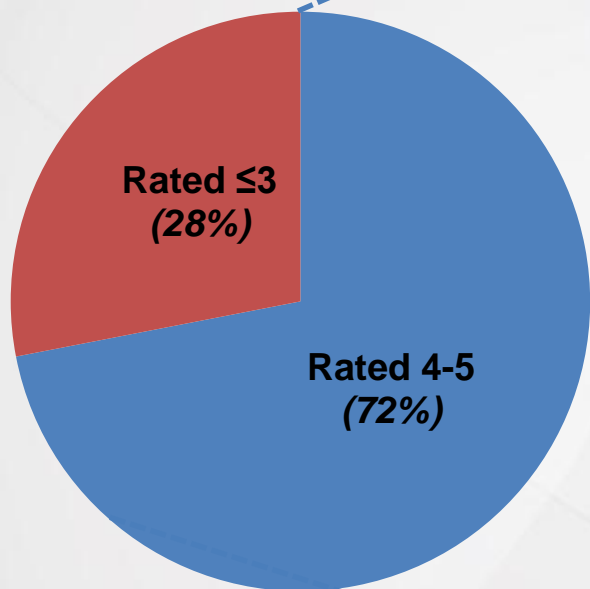
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Level of Consensus by Clarity



Conditions having <u>100%</u> agreement	ICD-9CM
Pneumonia	<ul style="list-style-type: none"> Viral pneumonia (480) Pneumococcal (481)
CHF	<ul style="list-style-type: none"> Heart failure (428) Hypertensive heart disease-Malignant- With heart failure (402.01) Hypertensive heart disease-Unspecified- With heart failure (402.91)
COPD/ COAD	<ul style="list-style-type: none"> Chronic bronchitis (491) Emphysematous bleb (492.0) Bronchiectasis (494)
Asthma	<ul style="list-style-type: none"> Asthma (493)
Perforated or bleeding ulcer	<ul style="list-style-type: none"> Acute duodenal ulcer with hemorrhage (532.0) Chronic or unspecified duodenal ulcer with hemorrhage (532.4) Acute peptic ulcer of unspecified site with hemorrhage (533.0)
Convulsions and epilepsy	<ul style="list-style-type: none"> Epilepsy and recurrent seizures (345)
Iron deficiency anemia	<ul style="list-style-type: none"> Other specified iron deficiency anemia (280.8)
Influenza	<ul style="list-style-type: none"> Influenza (487)
Pyelonephritis/ UTI	<ul style="list-style-type: none"> Acute pyelonephritis (590.1)
Hypertension	<ul style="list-style-type: none"> Unspecified essential hypertension (401.9) Malignant hypertensive renal disease (403.0)
Other respiratory infection	<ul style="list-style-type: none"> Acute bronchitis (466.0)
Hypoglycemia	<ul style="list-style-type: none"> Hypoglycemia, unspecified (251.2)
Atrial fibrillation	<ul style="list-style-type: none"> Atrial fibrillation (427.31)

Level of Consensus by **Validity**



N=82

Conditions having <u>100% agreement</u>	ICD-9CM
CHF	<ul style="list-style-type: none"> Heart failure (428) Hypertensive heart disease- Benign- With heart failure (402.11) Hypertensive heart disease- Unspecified- With heart failure (402.91)
COPD/ COAD	<ul style="list-style-type: none"> Emphysematous bleb (492.0)
Influenza	<ul style="list-style-type: none"> Influenza (487)
DM	<ul style="list-style-type: none"> Diabetes with ketoacidosis (250.1) Diabeetes with hyperosmolarity (250.2) Diabetes with other coma (250.3)
Hypertension	<ul style="list-style-type: none"> Unspecified essential hypertension (401.9)

Diagnosis with No Consensus (n=24)

Condition	ICD-9CM	Clarity (%)	Validity (%)	No. of episodes in 2007 (%)
CHF	• Hypertensive heart disease-Malignant- With heart failure (402.01)	100	73.3	3 (<0.01%)
Dehydration and gastroenteritis	• Eosinophilic gastritis (535.7) • Eosinophilic gastroenteritis and colitis (558.4)	66.7 60.0	46.7 33.3	0 0
Angina	• Intermediate coronary syndrome (411.1) • Prinzemetal angina (413.1)	40.0 80.0	40.0 60.0	4,848 (1.46%) 12 (<0.01%)
Perforated or bleeding ulcer	• Acute gastric ulcer with hemorrhage (531.0) • Acute gastric ulcer with hemorrhage and perforation (531.2) • Acute duodenal ulcer with hemorrhage (532.0) • Acute duodenal ulcer with hemorrhage and perforation (532.2) • Acute peptic ulcer of unspecified site with hemorrhage (533.0) • Acute peptic ulcer of unspecified site with perforation (533.1) • Acute peptic ulcer of unspecified site with hemorrhage and perforation (533.2)	93.3 93.3 100 93.3 100 93.3 93.3	73.3 66.7 73.3 66.7 73.3 66.7 66.7	285 (0.09%) 0 306 (0.09%) 1 (<0.01%) 79 (0.02%) 5 (<0.01%) 0

Diagnosis with No Consensus (n=24)

Condition (Cont'd)	ICD-9CM	Clarity (%)	Validity (%)	No. of episodes in 2007 (%)
Convulsions and epilepsy	• Eclampsia, unspecified as to episode of care or not applicable (642.60)	93.3	46.7	1 (<0.01%)
	• Eclampsia, delivered, with or without mention of antepartum condition (642.61)	93.3	53.3	0
	• Eclampsia, antepartum condition or complication (642.63)	93.3	53.3	0
	• Eclampsia, postpartum condition or complication (642.64)	86.7	46.7	0
	• Pre-eclampsia or eclampsia superimposed on pre-existing hypertension, delivered, with mention of postpartum complication (642.72)	93.3	53.3	0
	• Pre-eclampsia or eclampsia superimposed on pre-existing hypertension, postpartum condition or complication (642.74)	93.3	46.7	0
Pyelonephritis/UTI	• Other pyelonephritis or pyonephrosis, not specified as acute or chronic (590.8)	80	73.3	176 (0.05%)
DM & Complications	• Diabetes with other specified manifestations type 2 or unspecified type, not stated as uncontrolled (250.80)	53.3	93.3	4,147 (1.25%)
Hypertension	• Malignant secondary hypertension (405.0)	93.3	73.3	6 (<0.01%)
	• Hypertensive encephalopathy (437.2)	93.3	73.3	5 (<0.01%)
Dizziness and giddiness	• Dizziness and giddiness (780.4)	73.3	66.7	8,316 (2.51%)
Chest Pain, Unspecified	• Chest Pain, Unspecified (786.50)	60.0	80.0	8,837 (2.67%)