The “HOSPITAL” Score

to identify patients at high risk for readmission

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October 29, 2016 / Zürich

Goals of this talk

1) Importance of readmission
2) What can we do
3) How to identify high-risk patients
4) The HOSPITAL score: development
5) The HOSPITAL score: validation
6) Strengths and limitations of the HOSPITAL score
7) Other scores
8) What is a good prediction model
9) Intervention study using the HOSPITAL score

Importance of readmission

- Readmissions are frequent : 20% in the U.S. and more than 12% in Switzerland. *[Jencks, NEJM 2009; Halfon, J.Clin.Epidemiol. 2002]*
- Quality of care indicator
- Cost of unplanned readmission in the US: $18 billion/year
- Burden for patients and relatives
- 2/3 of these events may be entirely preventable or ameliorable, with 20-30% of readmissions being considered as truly preventable. *[van Walraven, CMAJ 2011]*

What can we do?

- Interventions that have been showed to reduce readmission: telephone follow-up, education program, home visit.

- The most efficient interventions are the most demanding and complex. But on the other hand, limited ressources, pressure on the costs. [Leppin JAMA int med 2014]

→ need to target the patients who are mot likely to benefit, i.e. those who are at high-risk for readmission.

How can we identify these high-risk patients?

Ask the patient

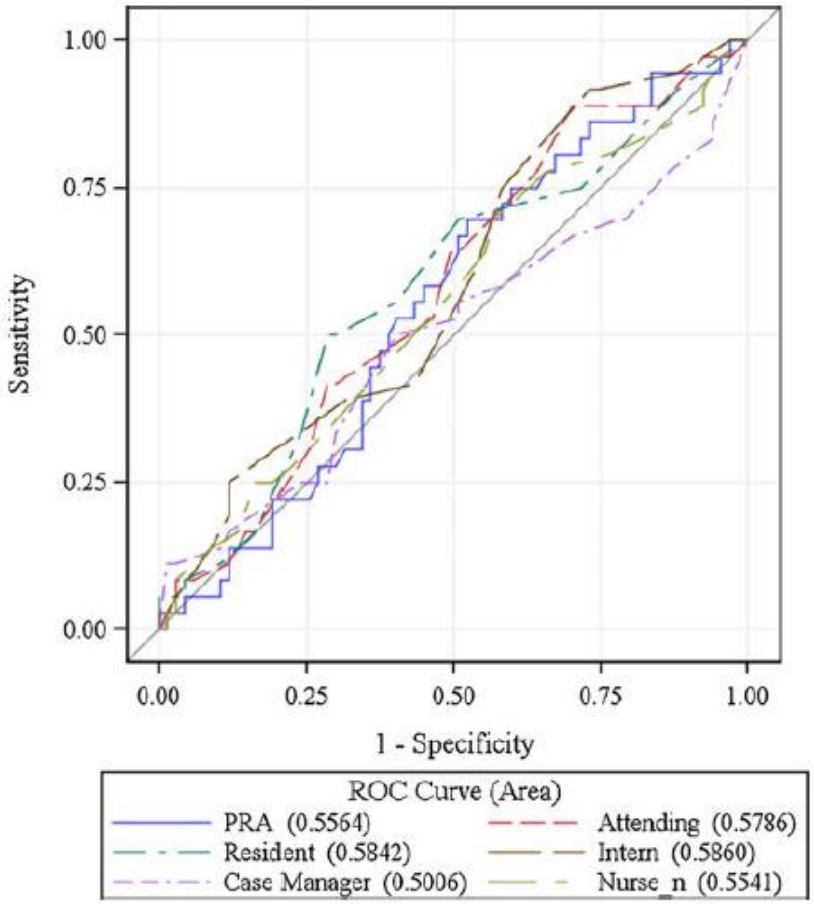
- Little evidence.

- Prospective cohort study in 7 general internal medicine wards in Canada.
- Patient-reported discharge readiness was measured with an 11-point Likert response scale, with scores < 7 indicating subjective unreadiness.
- Patients who reported being unready at the time of discharge did not experience any higher risk of readmission or death in the first 30 days post-discharge, compared with patients who felt ready for discharge.

Data presented at the SGIM annual meeting, Toronto, 2015

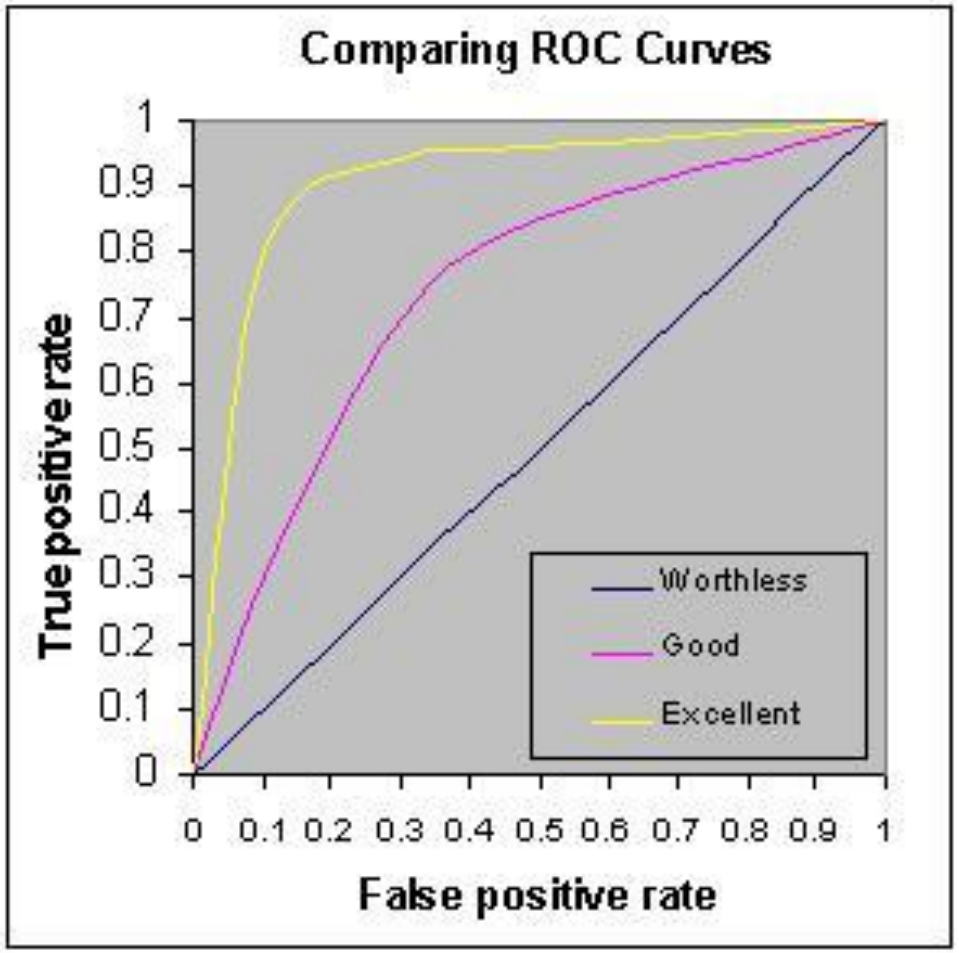
Ask the clinical providers

- Patients aged ≥65 discharged from the general medical service at University of California.
- Prediction of the chance of readmission with a 0–100% scale.
- Of 159 patients, 52 patients (32.7%) were readmitted.
- The ability to discriminate between readmissions and non-readmissions was poor for all provider groups



Allaudeen, J Gen Intern Med 2011 (26)7:771–6

C-statistic = area under the receiver operating curve



0.90-1 = excellent
0.80-0.90 = very good
0.70-0.80 = fair-good
0.60-0.70 = poor
0.50-0.60 = fail

Ask the clinical providers

- Patients aged ≥65 discharged from the general medical service at University of California.
- Prediction of the chance of readmission with a 0–100% scale.
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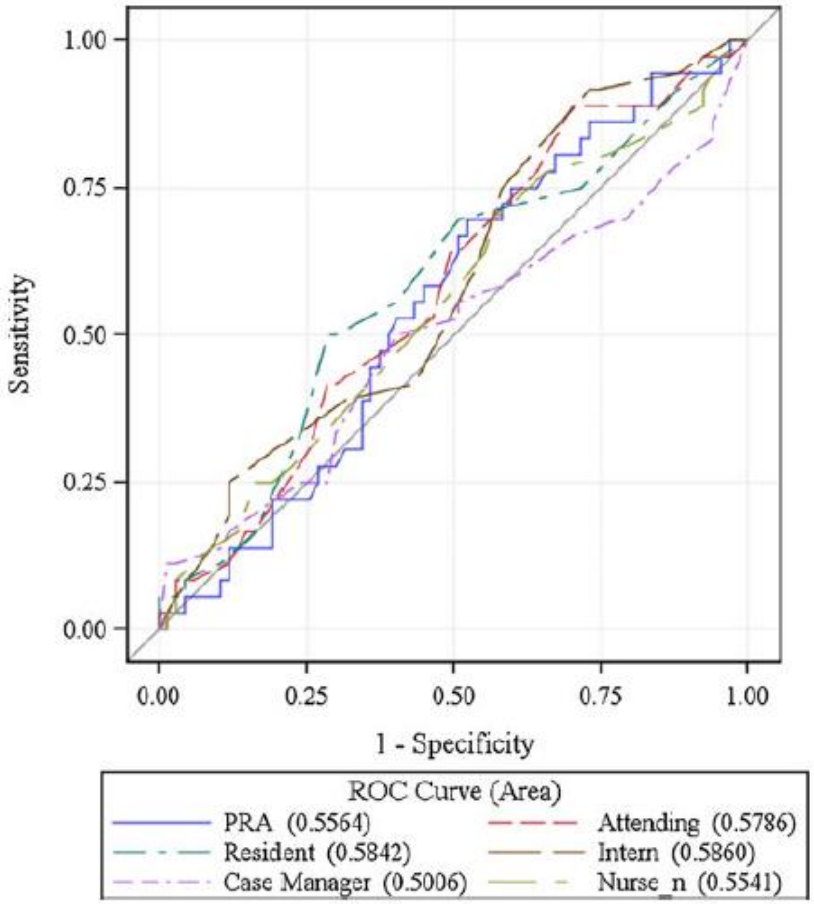

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Prediction model to identify patients at high-risk for readmission

ORIGINAL INVESTIGATION

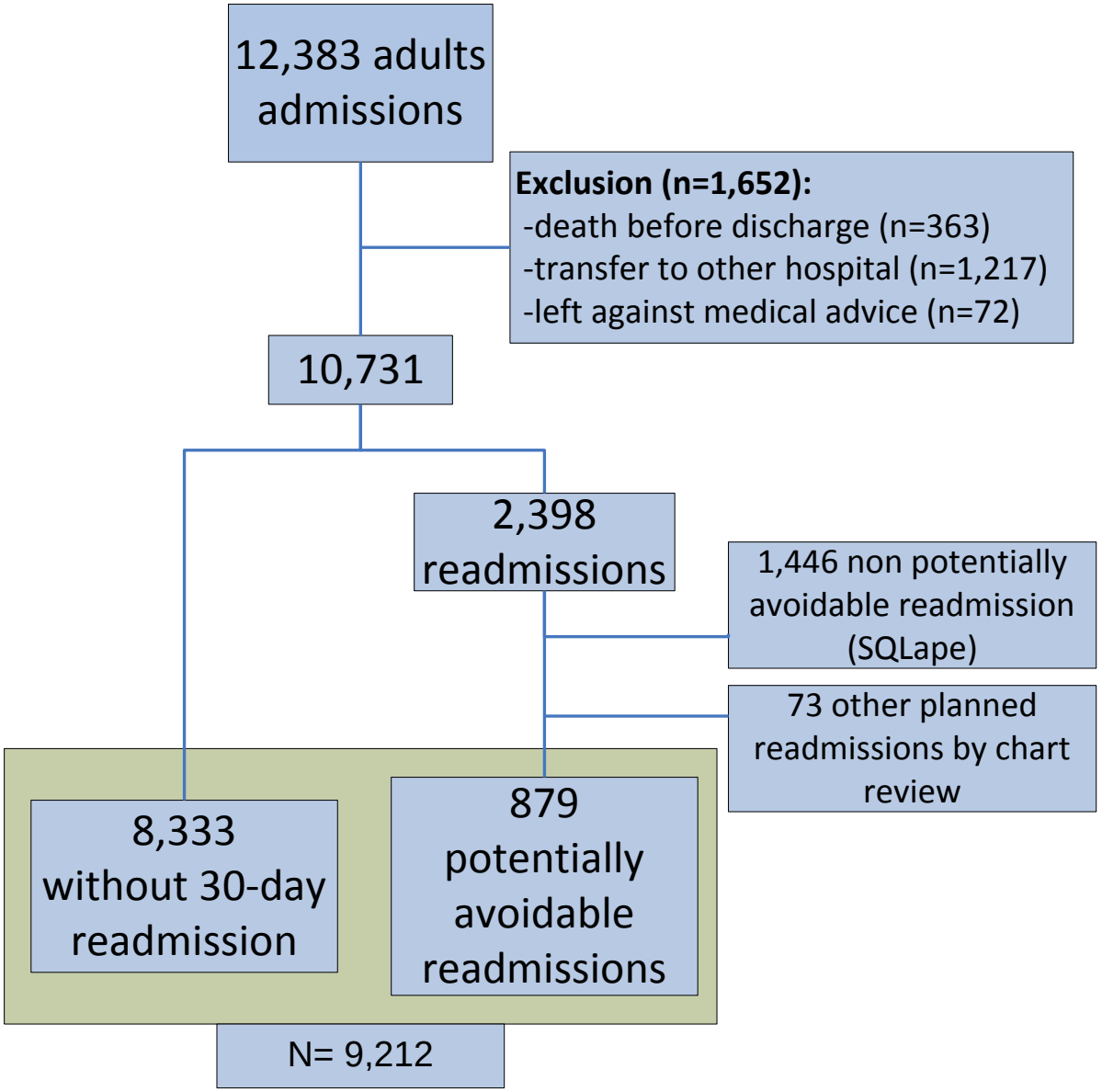
HEALTH CARE REFORM

Potentially Avoidable 30-Day Hospital Readmissions in Medical Patients

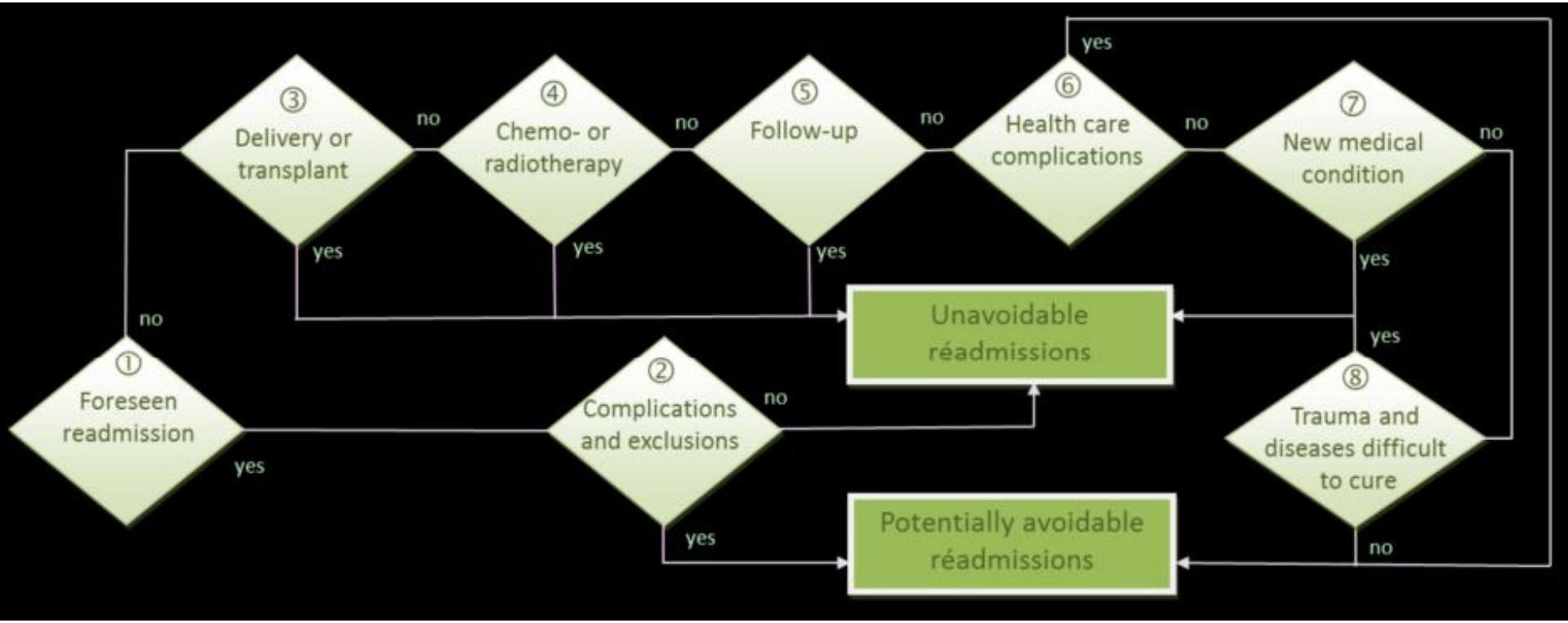
Derivation and Validation of a Prediction Model

Jacques Donzé, MD, MSc; Drahomir Aujesky, MD, MSc; Deborah Williams, MHA; Jeffrey L. Schnipper, MD, MPH

JAMA Intern Med. 2013;173(8):632-638.


12,383 adults admissions
Exclusion (n=1,652):
-death before discharge (n=363)
-transfer to other hospital (n=1,217)
-left against medical advice (n=72)
10,731
2,398 readmissions
1,446 non potentially avoidable readmission (SQLape)
73 other planned readmissions by chart review
8,333 without 30-day readmission
879 potentially avoidable readmissions
N= 9,212

SQLape



Dr Yves Eggli, Institute of Social and Preventive Medicine (IUMSP), Lausanne

Methods

- Candidate predictor categories from the index admission:
  - demographics
  - health-care utilization measures
  - comorbidities
  - hospital stay characteristics
  - laboratory values
- Split-sample approach (derivation 2/3 – validation 1/3)
- Multiple logistic regression with backward elimination

Effect	OR	95%CI
Low hemoglobin level (<12)	1.3	1.1-1.6
Low sodium level (<135)	1.4	1.1-1.7
Any procedure performed	1.4	1.2-1.7
Urgent admission	1.4	1.0-1.8
Length of stay ≥ 5 days	1.5	1.3-1.8
Discharge from oncology	1.8	1.5-2.2
1-5 admissions in the past year	1.7	1.4-2.1
>5 admissions in the past year	3.8	2.8-5.3

The «HOSPITAL» score

H	Low **H**emoglobin level at discharge (< 120 g/L)	1
O	Discharge from an **O**ncology service	2
S	Low **S**odium level at discharge (< 135 mmol/l)	1
P	**P**rocedure during hospital stay (any ICD-9 coded)	1
IT	**I**ndex admission **T**ype: urgent or emergent (non-elective)	1
A	Number of hospital **A**dmission(s) in the previous year: 0 1-5 >5	 0 2 4
L	**L**ength of stay ≥ 5 days	2

Calibration

Agreement between observed outcomes and predicted probabilities

Points	Risk category	Patients in each category, n (%)	Predicted risk of readmission, % *(HOSPITAL score)*	Actual risk of readmission, %
0-4	Low	1,428 (47%)	4.7	4.6
5-6	Inter-mediate	875 (28%)	9.6	9.6
≥ 7	High	768 (25%)	18.2	18.5

Discrimination power

	Derivation set (n=6,141)	Validation set (n=3,071)
C-statistic	0.69	0.71

INTERNATIONAL MULTICENTER VALIDATION OF THE "HOSPITAL" SCORE TO PREDICT 30-DAY POTENTIALLY AVOIDABLE READMISSIONS IN MEDICAL PATIENTS

Jacques D. Donzé, MD, MSc; Mark V. Williams, MD; Edmondo J. Robinson, MD, MBA, MSHP; Eyal Zimlichman, MD, MSc; Drahomir Aujesky, MD, MSc; Eduard E. Vasilevskis, MD MPH; Sunil Kripalini, MD, MSc; Joshua P. Metlay, MD, PhD; Tamara Wallington, MD; Grant S. Fletcher, MD, MPH; Andrew D. Auerbach, MD, MPH; Jeffrey L. Schnipper, MD, MPH.

JAMA Intern Med. doi:10.1001/jamainternmed.2015.8462

Published online March 7, 2016

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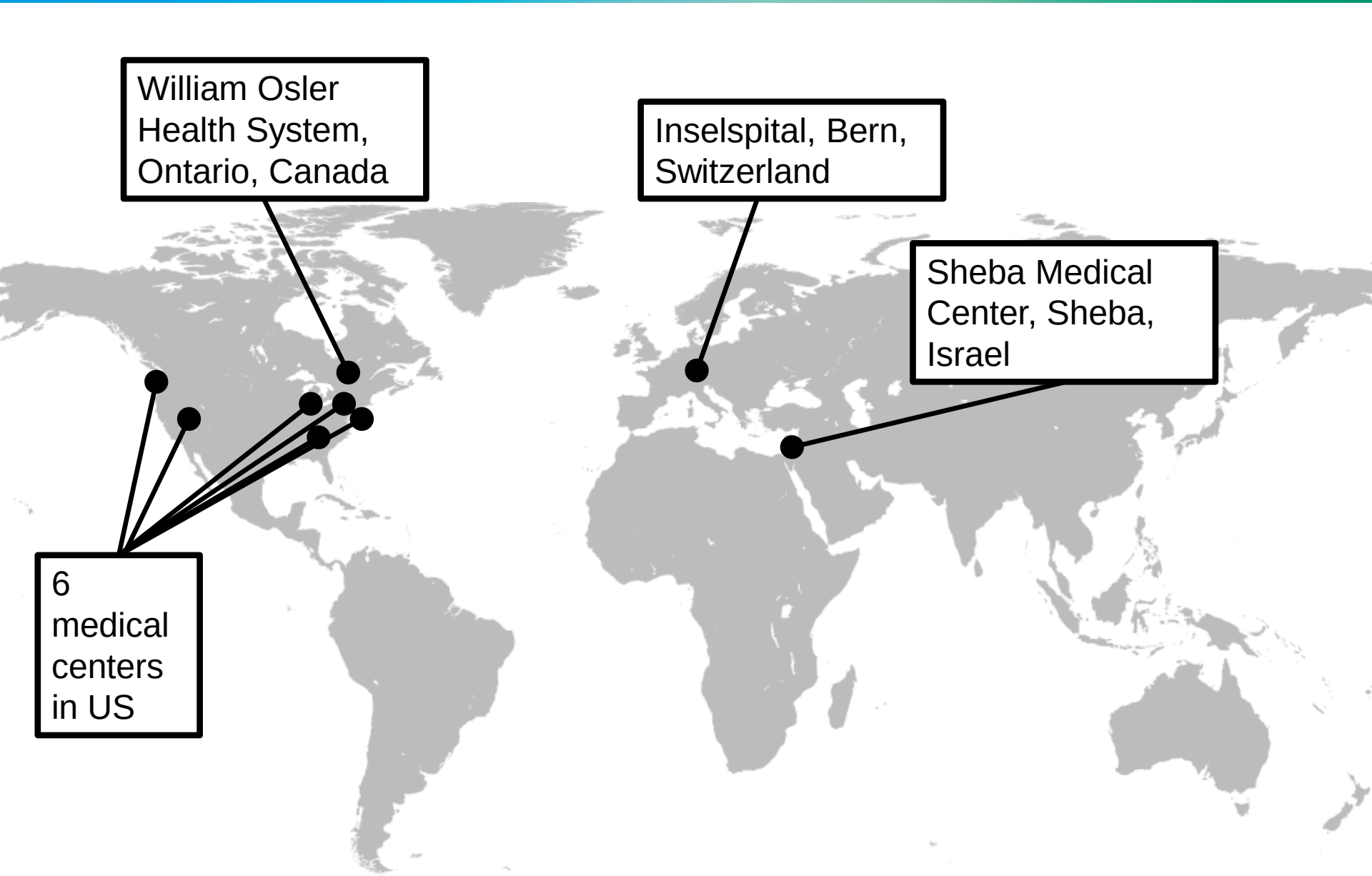
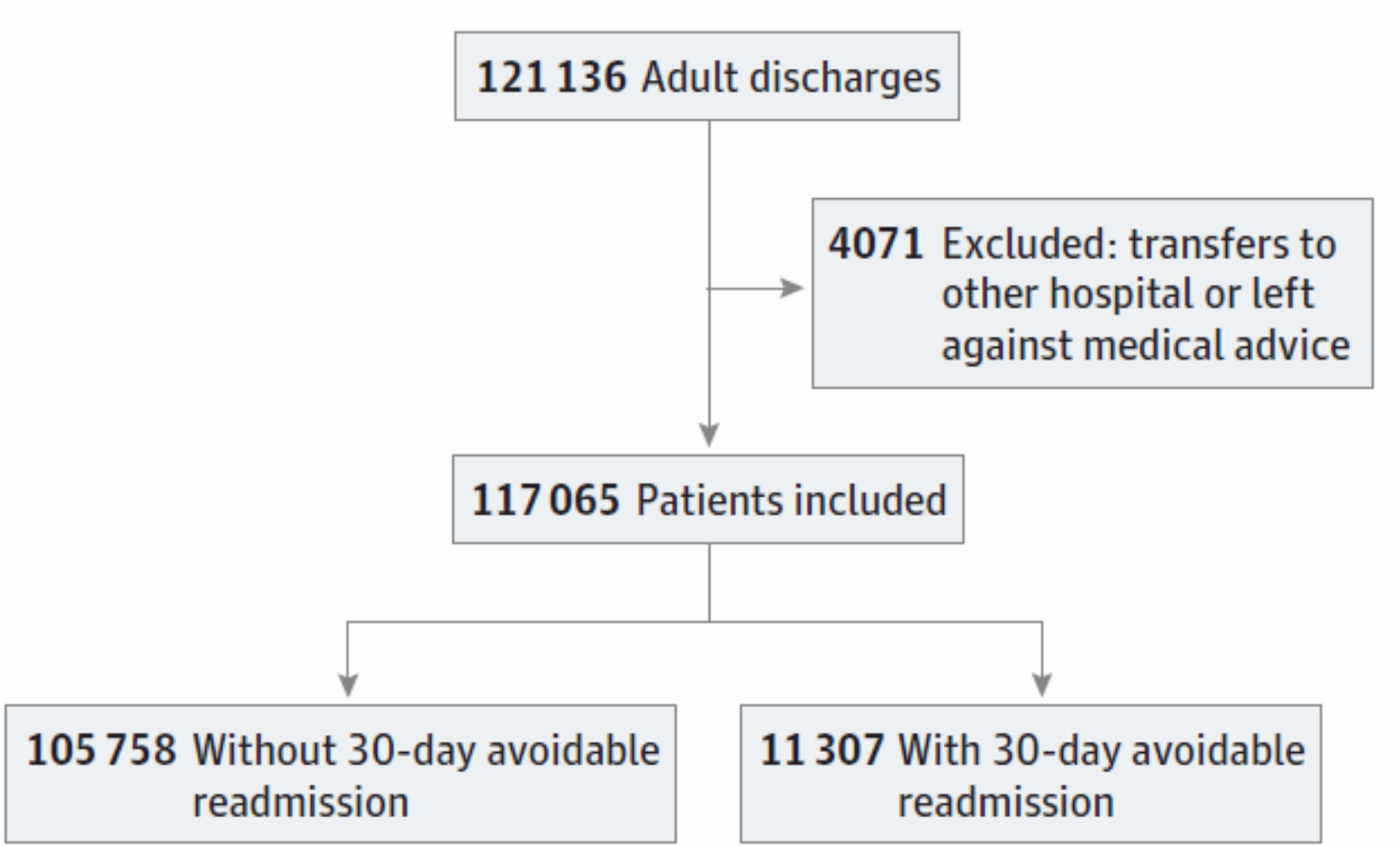

William Osler Health System, Ontario, Canada
Inselspital, Bern, Switzerland
Sheba Medical Center, Sheba, Israel
6 medical centers in US

Methods

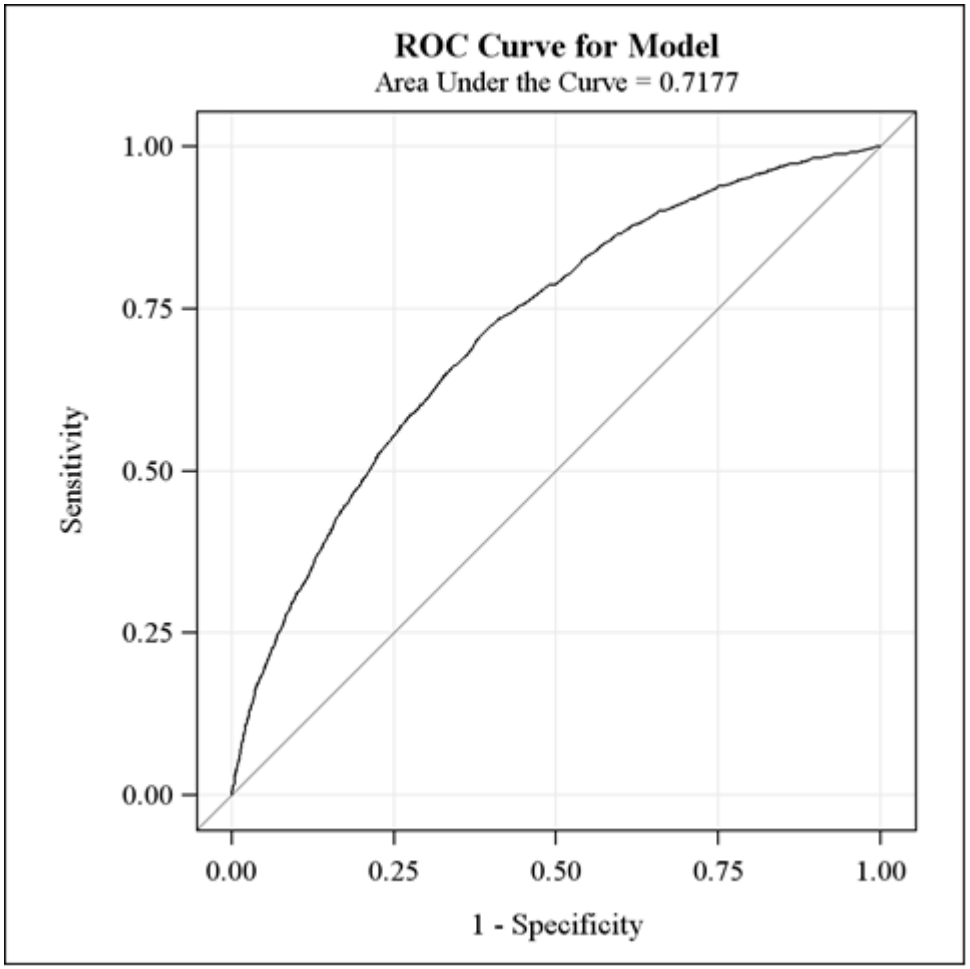
- All adult medical patients consecutively discharged alive from these 9 medical centers, between January and December, 2011
- Primary outcome was any 30-day readmission that was classified as potentially avoidable using the previously validated SQLape algorithm
- The performance of the score was evaluated according to its discrimination (C-statistic) and its calibration.

Results


121 136 Adult discharges
4071 Excluded: transfers to other hospital or left against medical advice
117 065 Patients included
105 758 Without 30-day avoidable readmission
11 307 With 30-day avoidable readmission

Discrimination Power of the «HOSPITAL» score

- C-statistic = 0.72



Calibration

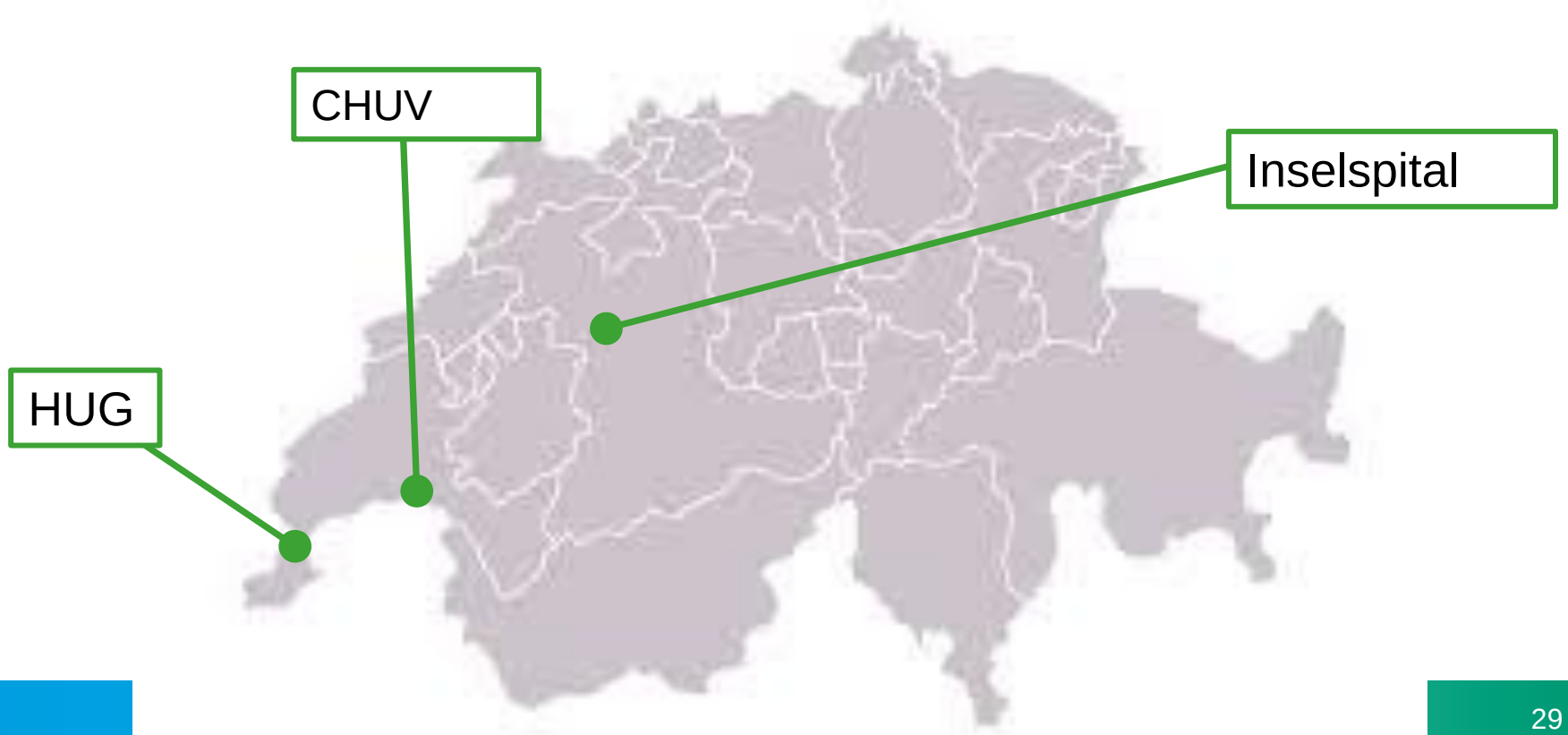
Observed vs. Predicted 30-day Potentially Avoidable Readmissions (PAR)

Points	Risk category	Patients in each category, n (%)	Observed proportion of PAR in the validation study, %	Estimated risk of PAR in the validation study, %
0-4	Low	77,896 (63%)	5.8	5.8
5-6	Intermediate	29,239 (23%)	11.8	11.8
≥ 7	High	17,077 (14%)	22.4	22.4

Pearson goodness-of-fit statistic : excellent calibration P=0.97

“HOSPITAL” score predicts patients at high risk of potentially avoidable readmission: *multicenter validation study in Switzerland*

Jacques Donzé, MD, MSc; Jérôme Stirnemann, MD; Pedro Marques-Vidal, MD; Drahomir Aujesky, MD, MSc.



Methods

- All adult patients consecutively discharged alive from the medical departments of 3 tertiary care hospitals in Switzerland between January 2011 and December, 2012.

- Outcome = any potentially avoidable 30-day readmission according to the validated SQLape algorithm

Results

- 43,058 discharges
- 12.3% (n=5,309) had a 30-day readmission
- 5.2% (n=2,219) a 30-day readmission deemed potentially avoidable.
- Median length of stay was 7 days (IQR 3-12) -> threshold for LOS in the HOSPITAL score changed from 5 days to 8

Original score	Median LOS 4	LOS >= 5	43.8%
Swiss validation	Median LOS 7	LOS >=8	43.8%

The «HOSPITAL» score

H	Low **H**emoglobin level at discharge (< 120 g/L)	1
O	Discharge from an **O**ncology service	2
S	Low **S**odium level at discharge (< 135 mmol/l)	1
P	**P**rocedure during hospital stay (any ICD-9 coded)	1
IT	**I**ndex admission type: urgent or emergent (non-elective)	1
A	Number of hospital **A**dmission(s) in the previous year: 0 1-5 >5	 0 2 4
L	**L**ength of stay ≥ [redacted] days	2

C-statistic of 0.67 (95% CI 0.66-0.68)

Categories	Proportion	Observed	Predicted
Low risk (0-4)	62%	3.9%	4.0%
Intermediate (5-6)	25%	7.4%	6.7%
High risk (≥7 points)	13%	10.4%	11.1%

Prospective validation of the “HOSPITAL” score

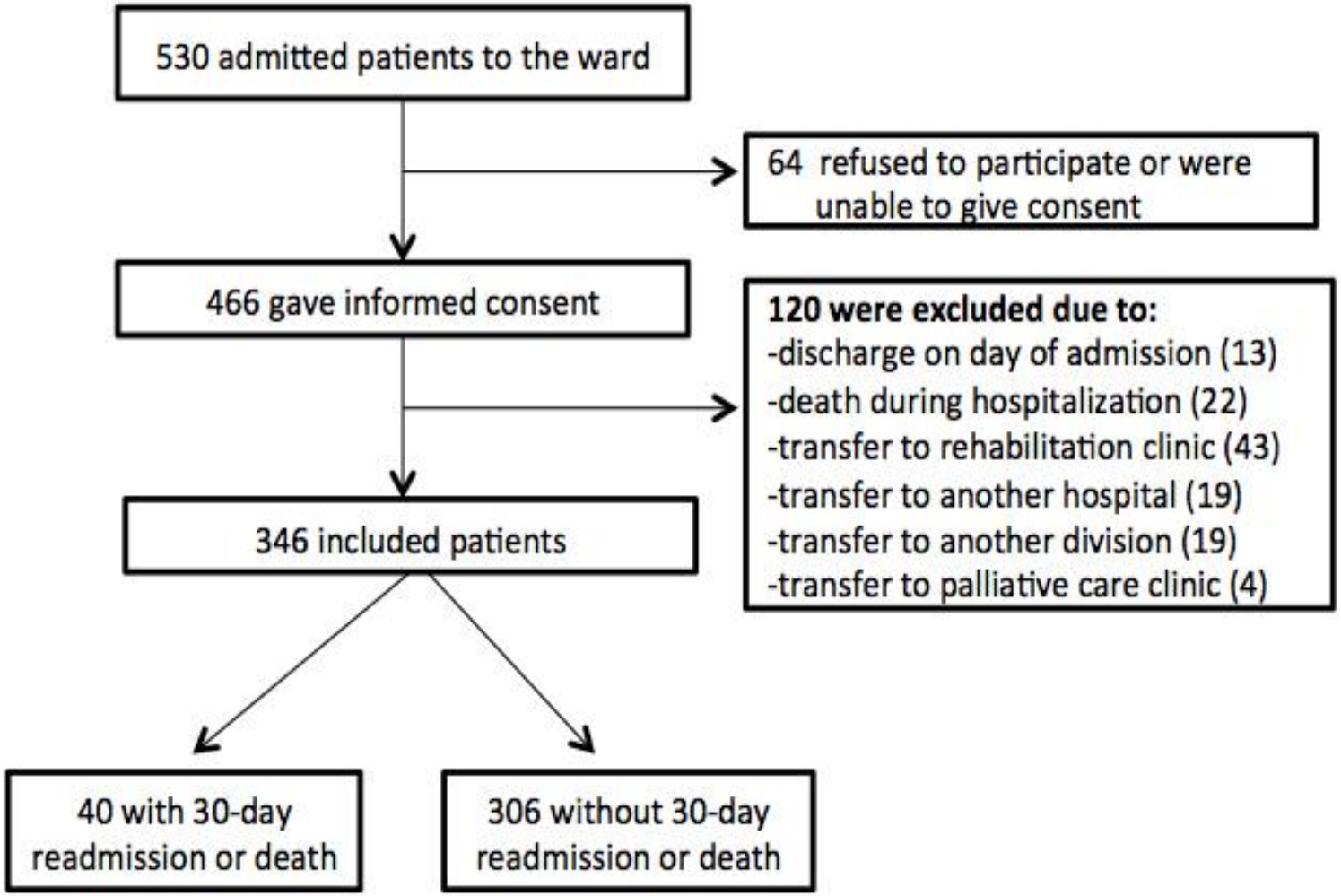
Aim: to prospectively demonstrate the HOSPITAL score accuracy to predict 30-day unplanned readmission and death.

Methods: Prospective cohort study. Medical inpatients ≥50 y.o., discharge between April and September 2013 from the Fribourg Cantonal Hospital.

[Aubert, Swiss Med Wkly. 2016;146:w14335]

HOSPITAL score

	Points
Low **H**emoglobin level at discharge (< 12.0 g/dl)	1
Discharge from an **O**ncology service or cancer	2
Low **S**odium level at discharge (< 135 mmol/l)	1
Procedure during hospital stay (any ICD10 coded)	1
Index admission **T**ype: non-elective	1
Number of hospital **A**dmission(s) <1 year	
0	0
1-5	2
>5	5
Length of stay ≥ 8 days (originally 5 days in US)	2


530 admitted patients to the ward
64 refused to participate or were unable to give consent
466 gave informed consent
120 were excluded due to:
-discharge on day of admission (13)
-death during hospitalization (22)
-transfer to rehabilitation clinic (43)
-transfer to another hospital (19)
-transfer to another division (19)
-transfer to palliative care clinic (4)
346 included patients
40 with 30-day readmission or death
306 without 30-day readmission or death

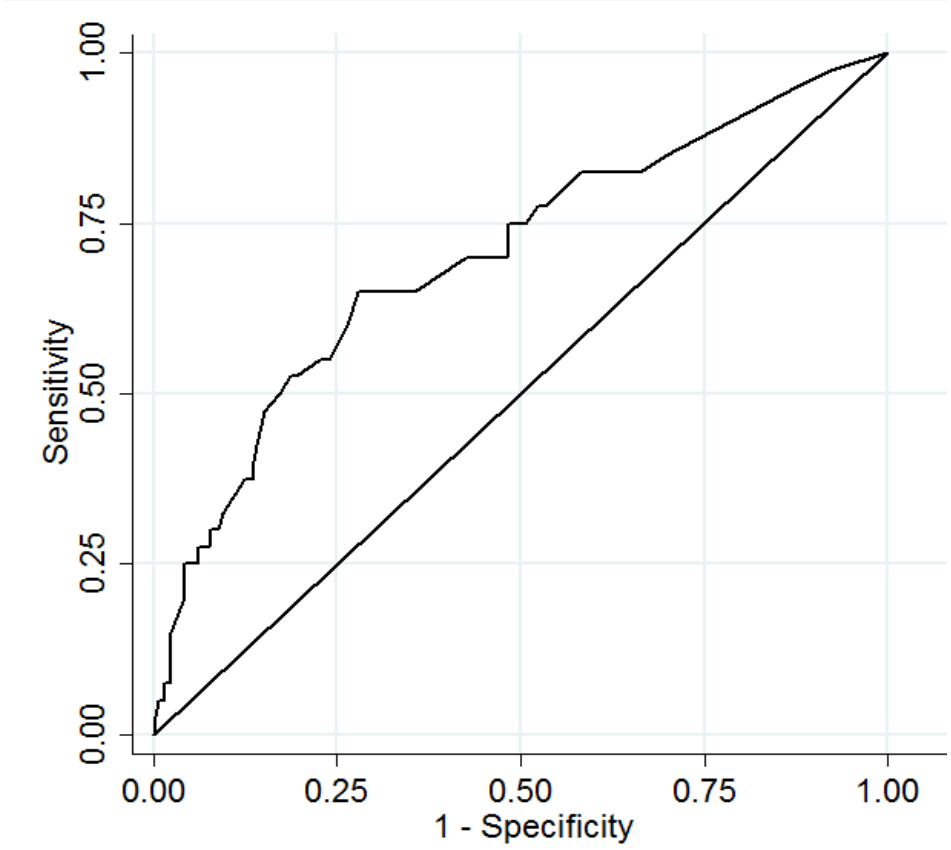
Results

- Among the 346 included patients, 40 (12%) had a 30-day unplanned readmission or death.
- Mean age of the patients was 73.4 years (SD 11.5) and median length of stay 7 days (IQR 4-12).

Points	Risk category	Number of patients in each category, n (%)	Observed proportion with readmission or death in the validation study, %	Estimated risk of readmission or death in the validation study using the HOSPITAL score, %
0-4	Low	204 (59.0)	9.8	8.2
5-6	Inter-mediate	72 (20.8)	8.3	11.3
≥ 7	High	70 (20.2)	20.0	21.6

Calibration: P=0.77 (Hosmer-Lemeshow goodness-of-fit test)

Power discrimination:
C-statistic 0.70 (95%CI 0.62-0.79)



Validation for frequent diseases

9181 medical patients from 6 US medical centers with a diagnosis of either:

- -acute myocardial infarction
- -COPD
- -pneumonia
- -heart failure

C-statistic 0.68

[Burke, Donzé, Med Care 2016]

Other external validations studies in different populations

-Validation study in 19,277 medical patients in Denmark: C-statistic 0.66 [Cooksley QJM 2016]

-Validation study in 931 patients discharged from the hospital service of a moderate sized university hospital in the midwestern US. C-statistic 0.77 [Robinson, PeerJ 2016]

-Validation study in primary care patients (Mayo Clinic). 26,278 admission to any department (only 30% to a general medical service). C-statistic 0.68 [Garrison, J Eval Clin Pract 2016]

Validation Studies – Summary

Design	Setting	Performance
Derivation study Internal validation study	Academic hospital in Boston, MA N=10,701 medical patients	0.71
International external validation study Geographical and time transportability	9 medical centers, 4 countries, N=124,212 medical patients	0.72
External validation in CH Restrospective design	3 academic hospitals in Switzerland, N=43,058 medical patients	0.67
External validation in CH Prospective design	1 large community hospital in Switzerland, N=436	0.70
External validation in specific diseases	6 US medical centers N= 9,181	0.68
External validation in Denmark	N= 19,277 medical patients	0.66
External validation in a US moderate sized university hospital	N= 931	0.77
External validation in primary care patients, admitted to any department	N=26,278	0.68

HOSPITAL score

Strengths

- Easy to use
- Assessment before discharge
- Does not include non-avoidable readmissions
- All medical patients regardless of their main cause of admission
- International validation with good performance
- Retrospective and prospective validation

Limitations

- The variables included in the score are not modifiable
- The score is not mean to be calculated at admission
- The score is not validated for outpatients
- The HOSPITAL Score does not give a specific intervention target

Can the score be even more simplified?

We simplified the score as follow:

Variable	Original score (number of point) if positive	Simplified score (number of points)
Hemoglobin level at discharge <120g/l	1	1
Cancer diagnosis or discharge from an Oncology division[a]	2	2
Sodium level at discharge <135mmol/l	1	1
Any ICD-9 or ICD-10 Procedure during hospitalization[b]	1	NA
Index Type of admission: nonelective[c]	1	1
Number of hospital Admissions during the previous 12 months 0-1 2-5 ≥5	 0 2 5	 0 2 5
Length of stay ≥5 days	2	2
Total	13	12

Can the score be even more simplified?

C-statistic 0.72

Observed proportions versus estimated risk of 30-day potentially avoidable readmission (PAR).

Points	Risk of 30-day readmission	Patients in each category, n (%)	Observed proportion with PAR (%)	Estimated risk of PAR using the simplified HOSPITAL score (%)
0-4	unlikely	82,383 (70.4)	6.4	6.4
≥ 5	likely	34,682 (29.6)	17.3	17.3

Why functional status is not in the HOSPITAL score?

- Functional status, issues:
  - how and when to measure it
  - capture pre-hospitalization functional status or current status?
  - subjective or not well reproducible
  - not routinely available, not in EHR

- Literature:
  - Few studies assessed the association between functional impairment and readmission
  - Limited by a retrospective design and by the use of self-reported functional assessment, such as Activities of Daily Life (ADL).

Why functional status is not in the HOSPITAL score?

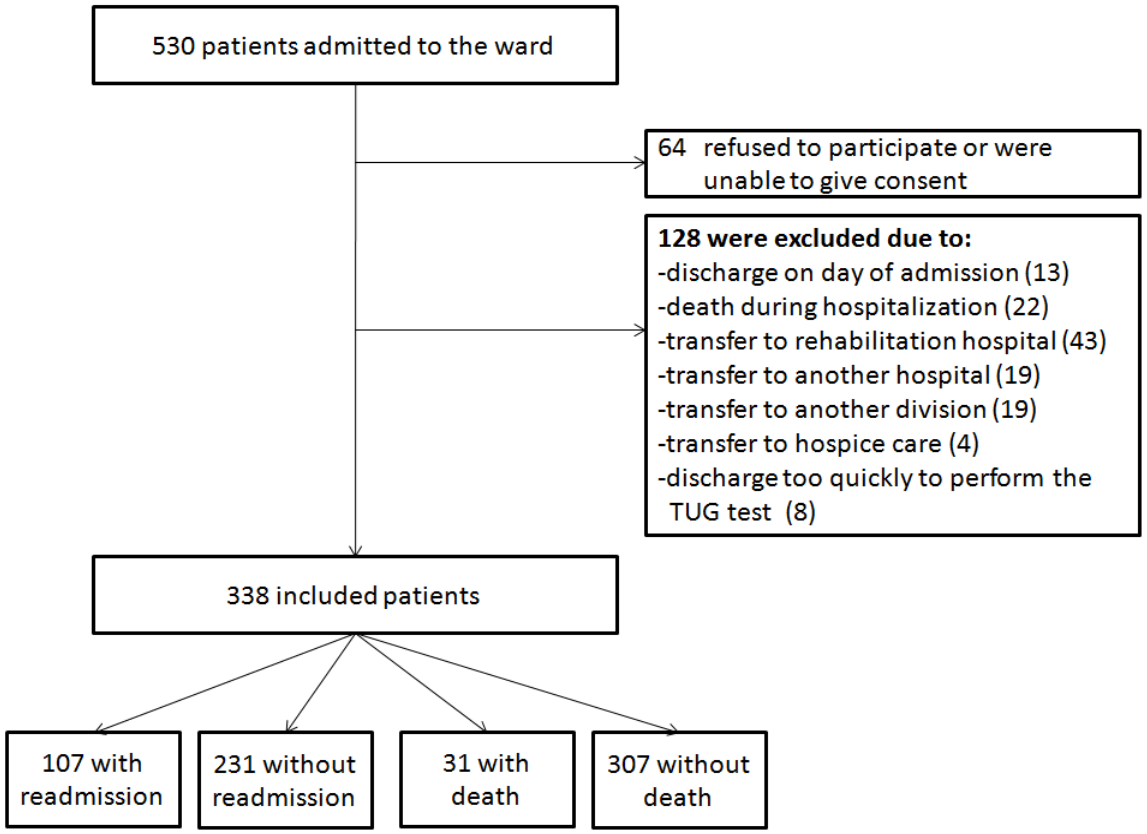
TABLE 2. Variables considered by studies in evaluating the risk of readmission

Variable	Included in final model in (N) studies	Evaluated but not included in (N) studies	Not considered* in (N) studies
Overall health and function			
Functional status; ADL dependence; mobility	(2) 27, 57	(6) 29-32, 58, 59	(14) 15-20, 22-24, 26, 28, 53-55
Self-rated health, quality of life	(3) 27, 31, 32	(2) 28, 57	(17) 15-20, 22-24, 26, 29, 30, 53-55, 58, 59
Cognitive impairment	(7) 15-18, 28, 57, 59	(5) 20, 31, 32, 54, 58	(9) 19, 22-24, 26, 29, 30, 53, 55
Visual or hearing impairment	(1) 27	(1) 32	(21) 15-20, 22-24, 26, 28-32, 53-55, 57-59

Kansagara, JAMA. 2011;306(15):1688-1698

Why functional status is not in the HOSPITAL score?

- Prospective study in Fribourg:



Why functional status is not in the HOSPITAL score?

- Median duration of the TUG test 13.1 seconds for patients with an unplanned readmission, and 11.8 seconds for those without any unplanned readmission (*P* = 0.34).
- The TUG test duration was significantly longer among patients who died < 6 months: 17 versus 12 seconds, *P* = 0.04.
- Functional impairment was associated with a higher risk of death within 6 months after discharge (OR 3.55, 95%CI 1.52-8.25), while the risk of unplanned readmission was not significantly increased (OR 1.58, 95%CI 0.94-2.64). Adjusted for age and gender.
- No significant association between functional impairment and the absolute total number of unplanned rehospitalizations within 6 months (adjusted OR 1.59, 95%CI 0.95-2.67).

Is there alternative to the HOSPITAL score?

Risk Prediction Models for Hospital Readmission

A Systematic Review

JAMA. 2011;306(15):1688-1698

Conclusions:

-Most readmission risk prediction models perform poorly.

LACE score

Attribute	Value	Points
a. LACE index for the risk of 30 day readmissions		
L Length of Stay (Days)	<1	0
	1	1
	2	2
	3	3
	4–6	4
	7–13	5
	>14	7
A Acute Admission	Yes	3
C Comorbidity score (Charlson)	0	0
	1	1
	2	2
	3	3
	>4	5
E Emergency Department attendances in last 6 months	0	0
	1	1
	2	2
	3	3
	>4	4

van Walraven. CMAJ. 2010;182(6):551-557.

Charlson score

Comorbidity	Relative weight assignment
Metastatic solid tumor	6
AIDS	6
Moderate-to-severe liver disease	3
Hemiplegia	2
Moderate-to-severe renal disease	2
Diabetes w/end organ damage	2
Neoplasia	2
Leukemia/lymphoma	2
Myocardial infarct	1
Congestive heart disease	1
Peripheral vascular disease	1
Cerebrovascular disease	1
Dementia	1
Chronic pulmonary disease	1
Connective tissue disease	1
Ulcer disease	1
Mild liver disease	1
Diabetes	1

LACE vs HOSPITAL score

- LACE not validated outside Canada and Singapore.
- LACE more complicated to calculate: need Charlson score (i.e. all ICD codes, available after discharge).

- Poor performance in older patients in the UK (C-stat 0.56).

- HOSPITAL score overperform the LACE score in Denmark and Switzerland.

Comparison with the LACE score

Design	Setting	HOSPITAL score	LACE score
Derivation study Internal validation study	Academic hospital in Boston, MA N=10,701 medical patients	0.71	-
International external validation study Geographical and time transportability	9 medical centers, 4 countries, N=124,212 medical patients	0.72	-
External validation in CH Restrospective design	3 academic hospitals in Switzerland, N=43,058 medical patients	0.67	-
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External validation in Denmark	N= 19,277 medical patients	0.66	0.64
External validation in a US moderate sized university hospital	N= 931	0.77	-
External validation in primary care patients, admitted to any department	N=26,278	0.68	0.68

What is a good prediction model?

- Better than human estimation
- Simple to use
- Predict outcome early enough
- Good performance (C-statistic, calibration)
- Generalizable (validation studies)
- Clinical impact: evidence that rule changes physician behavior and improves patient outcomes and/or reduces costs

What is a good prediction model?

Methodology:

- Careful selection of potential predictors (a priori/literature)
- Good predictors are not necessarily risk factors
- First univariate screening?
- Enough outcomes per predictor tested (rule of thumb: 10 events/variable)
- Good data quality: no missing data.
- Good definition of the outcome
- Internal and external validations

Hierarchy of Evidence for Clinical Decision Rules

Level 1: Rules that can be used in a wide variety of settings with confidence that they can change clinician behavior and improve patient outcomes

> At least 1 prospective validation in a different population and 1 impact analysis, demonstrating change in clinician behavior with beneficial consequences

Level 2: Rules that can be used in various settings with confidence in their accuracy

> Demonstrated accuracy in either 1 large prospective study including a broad spectrum of patients and clinicians or validated in several smaller settings that differ from one another

Level 3: Rules that clinicians may consider using with caution and only if patients in the study are similar to those in the clinician's clinical setting

> Validated in only 1 narrow prospective sample

Level 4: Rules that need further evaluation before they can be applied clinically

> Derived but not validated or validated only in split samples, large retrospective databases, or by statistical techniques

McGinn, JAMA. 2000;284(1):79-84

Generalizability	Ability of a prognostic system to provide accurate predictions in a new sample of patients
Reproducibility	The system is accurate in patients who were not included in development but who are from an identical population
Transportability	The system is accurate in patients drawn from a different but related population or in data collected by using methods that differ from those used in development
Historical	Accuracy is maintained when the system tested in data from different calendar time
Geographic	Accuracy is maintained when the system is tested in data from different locations
Methodologic	Accuracy is maintained when the system is tested in data collected by using different methods
Spectrum	Accuracy is maintained in a patient sample that is, on average, more or less advanced in disease process or that has a somewhat different disease process or trajectory
Follow-up interval	Accuracy is maintained when the system is tested over a longer or shorter period

Justice, Ann Intern Med. 1999;130:515-524

How valid are the score currently used in clinical practice?

- Many prediction models, but…
  - Systematic review of the 6 highest IF general medical journals 2008-11: 71 articles.
  - Only 3 studies were external validation studies, 50% had a too small sample size, performance reported correctly in 12%.

- Study site, reliability, and clinical prediction rule was adequately described in 10.1%, 9.4%, and 7.0% of validation studies respectively.

-Bouwmeester W, (2012) Reporting and Methods in Clinical Prediction Research: A Systematic Review. PLoS Med 9(5): e1001221. doi:10.1371

-Ban J-W, (2016) Design Characteristics Influence Performance of Clinical Prediction Rules in Validation: A Meta-Epidemiological Study. PLoS ONE 11(1): e0145779. doi:10.1371/journal.pone.0145779

Example: bleeding risk

- Patients on oral anticoagulant have a risk of bleeding. If the risk of bleeding is higher than the benefit of the treatment, then it shouln't be prescribed.
- To assess the risk of bleeding, several scores have been developed, e.g. HAS-BLED score:

Letter	Clinical Characteristic[a]	Points Awarded
H	Hypertension	1
A	Abnormal renal and liver function (1 point each)	1 or 2
S	Stroke	1
B	Bleeding	1
L	Labile INRs	1
E	Elderly	1
D	Drugs or alcohol (1 point each)	1 or 2

It’s all about data quality

HAS-BLED score derivation: C-stat 0.72

Issues:

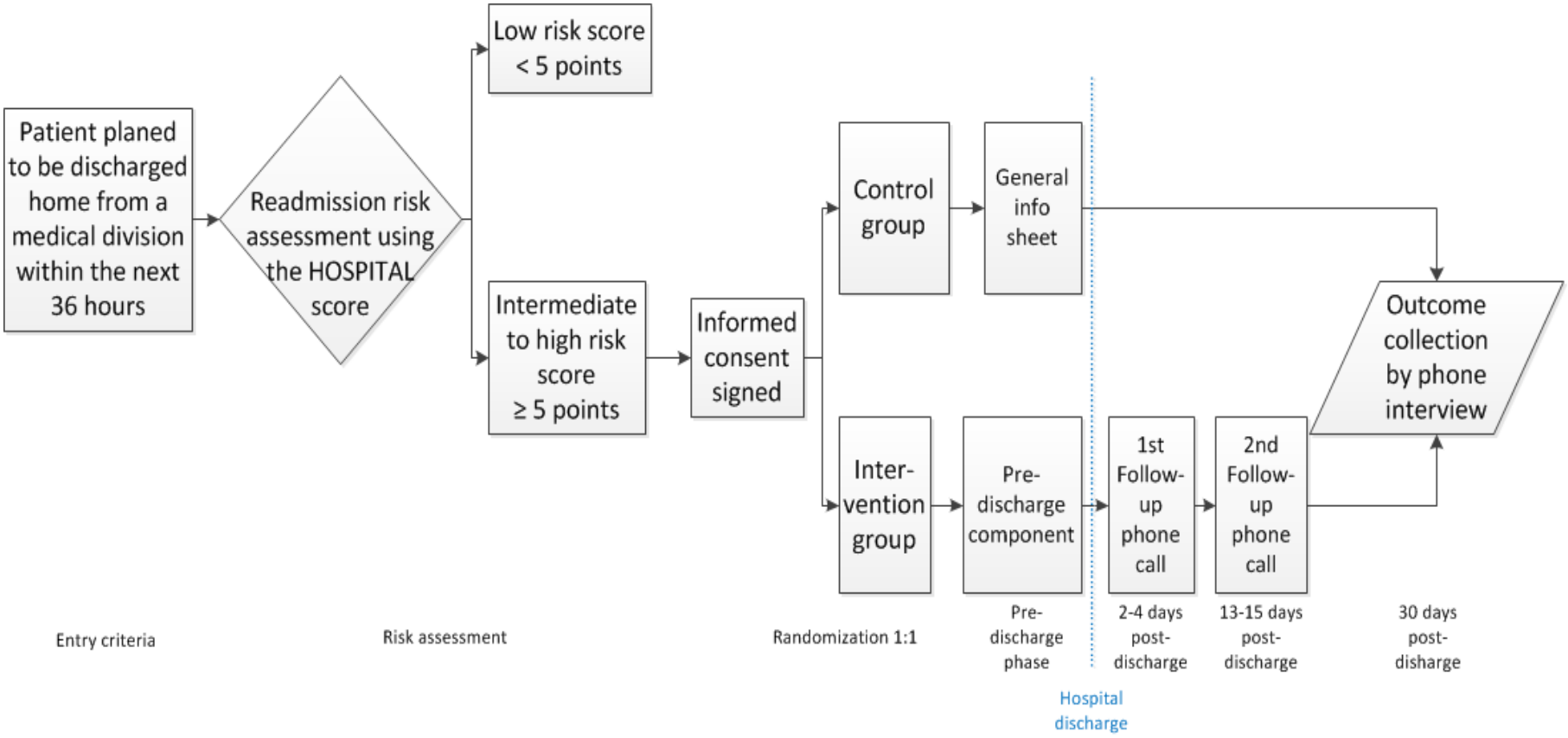
- only 53 outcomes, but 12 risk factors tested.
- No internal validation (reproducibility).
- Missing data: 25%

-> In most of the validation studies, C-stat closer to 0.60.

Meta-analysis (10 studies): C-stat 0.65

Next step with the HOSPITAL score

RCT to test intervention targeted to the patients with higher risk for readmission.



Take home message

- HOSPITAL score is the best validated prediction model for 30-day readmission.

- Functional status may not be associated with a higher risk of readmission

- Many prediction models are developed, but very are well validated, and how many are really used appropriately?

“Life is like a box of chocolates.
You never know what you're gonna get” (Forrest Gump)

But sometimes a prediction model may help…

Thank you for your attention

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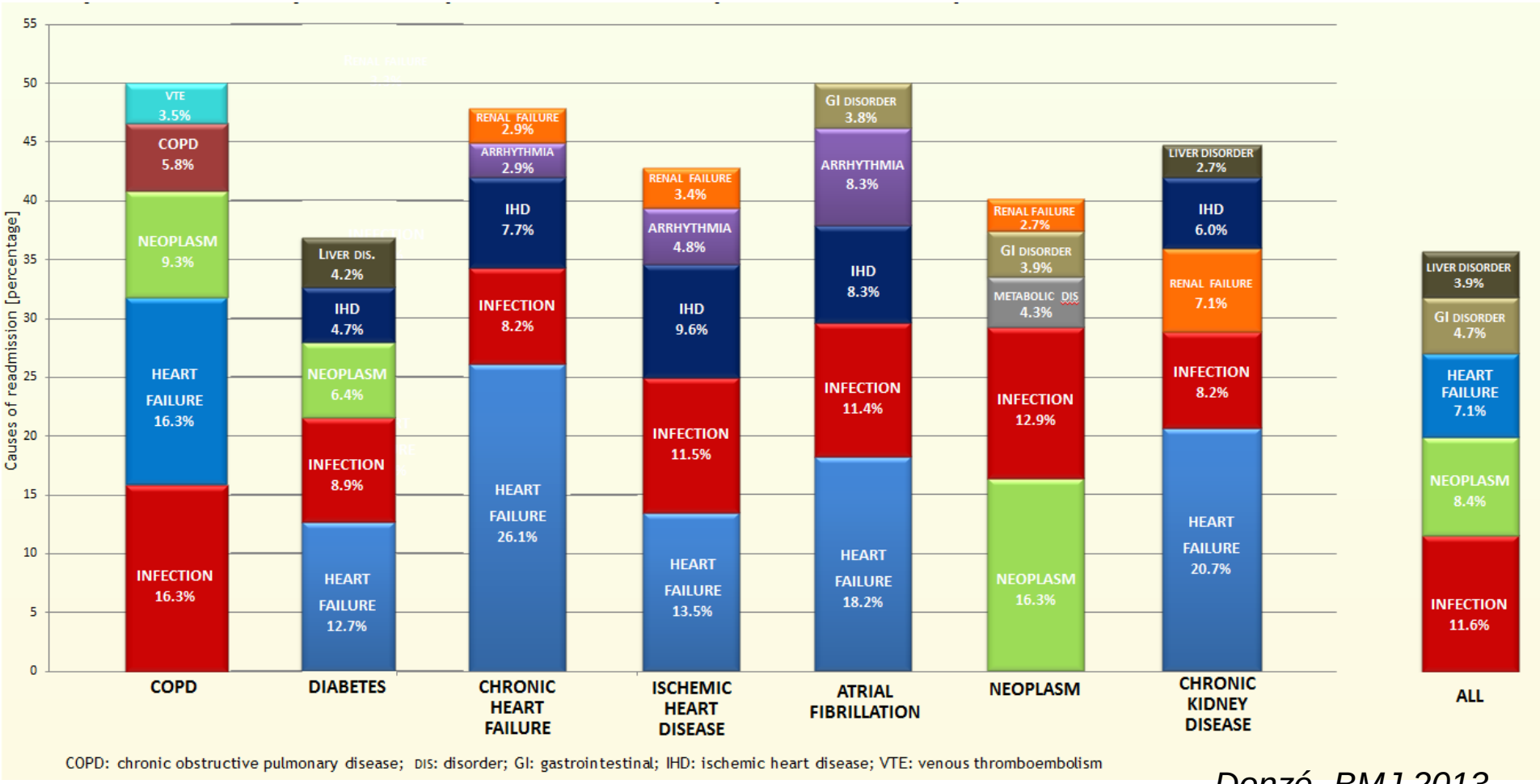
What are the causes of readmission?

- Readmission diagnoses usually differ from the specific acute diagnosis responsible for the index hospital admission. *[Jencks, NEJM 2009]*
- Higher comorbidity has been shown to be associated with an increased risk of readmission. *[Libreiro, J Clin Epidemiol 1999]*
- Role of comorbidities in causing readmissions is complex, but relatively few studies have looked at this.

Top 5 causes of potentially avoidable 30-day readmission by comorbid chronic condition



COPD: chronic obstructive pulmonary disease; DIS: disorder; GI: gastrointestinal; IHD: ischemic heart disease; VTE: venous thromboembolism

Donzé, BMJ 2013

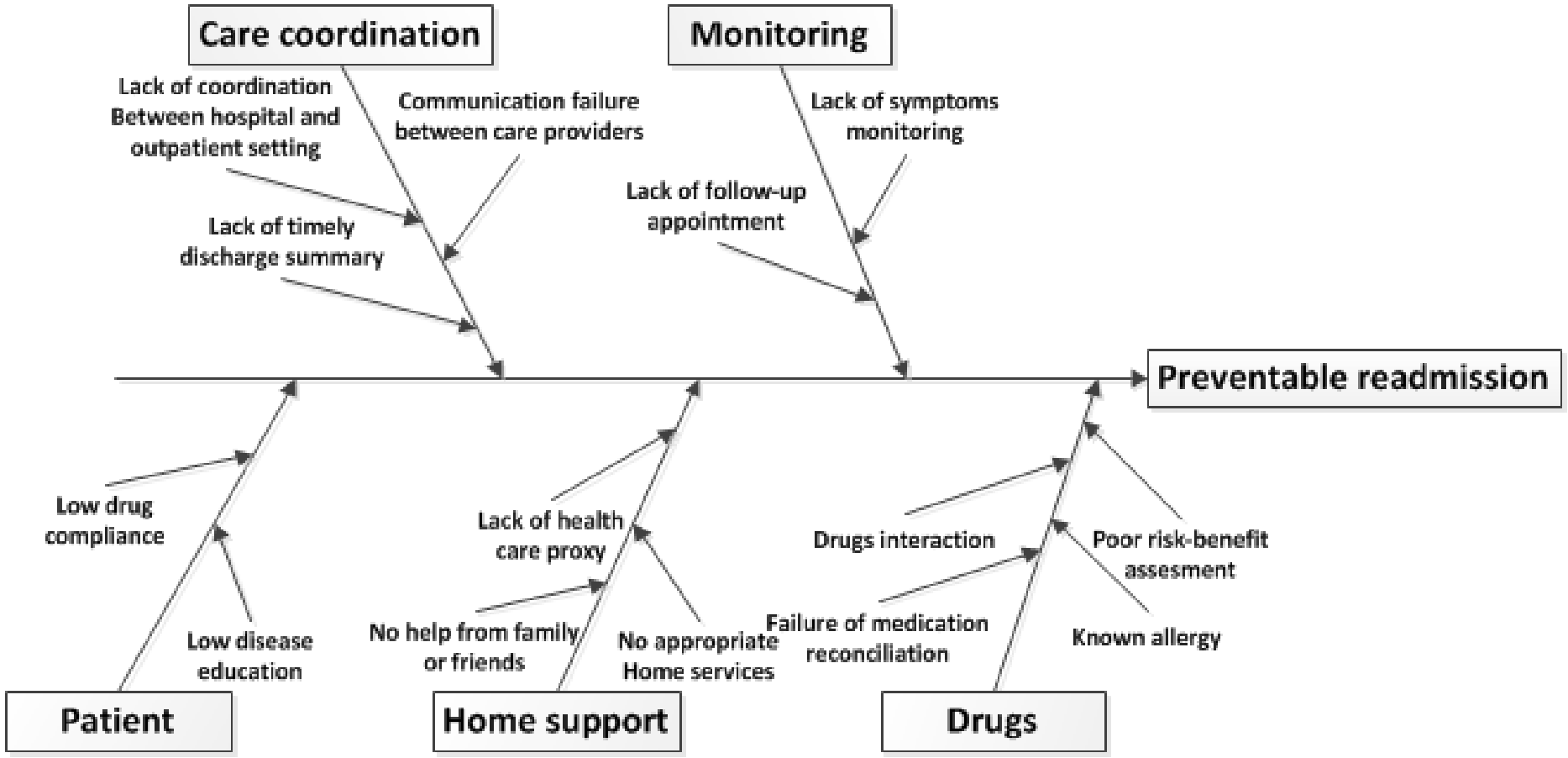
Relative risk of having a 30-day PAR vs. no readmission for each comorbidity (n=9191)

	Adj. RR* (95%CI)
Neoplasm	1.83 (1.55-2.15)
Chronic kidney disease	1.26 (1.04-1.52)
Chronic heart failure	1.23 (1.02-1.48)
Diabetes	1.16 (0.99-1.38)
COPD	1.00 (0.80-1.27)
Ischemic heart disease	0.97 (0.81-1.17)
Atrial fibrillation	0.95 (0.77-1.17)

* Adjusted for: length of stay of index hospitalisation, mode of admission (elective or not), number of admissions in the previous 12 months, number of procedures during the index hospitalisation, and haemoglobin and sodium level at discharge of index hospitalisation.

J. Donzé, BMJ 2013

Causes of readmissions



Implications and conclusions

The five most common primary diagnoses of potentially avoidable readmissions were usually possible complications of an underlying comorbidity.

This study supports the need for post-discharge care to focus attention not just on the primary index hospital admission diagnosis but also on the underlying comorbidities that may cause acute new complications that lead to readmission.

J. Donzé, BMJ 2013

Interventions to reduce readmission

- Several transitional care interventions have showed interesting results: telephone follow-up, medication reconciliation, patient education, home visits, etc.

- A meta-analysis showed that interventions are overall effective at reducing readmission, but also that the interventions that are effective are complex and resources demanding [Leppin JAMA int med 2014]

Challenges in the multinational validation study (1)

- First find the centers:
  - Connexions
  - Press media
- Funding: none except for my salary -> no statistician, etc.
- Agreements: authorship, rights, data to be collected., data use aggreement.
- Be sure they are motivated, and understand the work to do, and have a team to do the work.

Challenges in the multinational validation study (2)

- Supervise the data collection
- Check data accuracy and quality
- Deal with units differences and ICD versions
- Merge 9 databases
- Send to SQLape in CH
- Run the statistical analysis

LACE score validation studies

Design and setting	C-stat
Derivation study in Canada	0.68
Medical department, tertiary care hospital in Singapore 127,550 patients	0.70
Older UK medical patients, mean age 85 years, N=507	0.57
Heart failure patients in the US, N=253	? No significant difference between ORs for readmission in high risk and low risk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HOPITAL UNIVERSITAIRE DE BERNE
BERN UNIVERSITY HOSPITAL

Main research area:

- Hospital readmission
- Prediction modeling
- Patient complexity
- Venous thromboembolism, anticoagulation and risk of bleeding

Other area of interest/fonctions:

- Quality management (SGAIM Qualitätskommission)
- Swiss-DRG panel
- Editorial Board of the Primary and Hospital Care
- Brevimed

Incentives to reduce readmission in the US

- Only for Medicare and Medicaid patients
- Only for specific diseases:
  - Pneumonia
  - Heart failure
  - COPD exacerbations
  - Acute myocardial infarction
  - Hip replacement
- Penalties to the hospital based on the overall readmission rate for these diseases.

Incentives to reduce readmission in Switzerland

- The 2012 Swiss-DRG rules:

  -Pressure to avoid readmission:
  readmissions occurring within 18 days after discharge within the initial hospital stay are grouped.

  -Pressure on hospital length of stay.