Data-Driven Decision Making for Universal Health Coverage:
Leveraging Healthcare Claims Data

IHEA Congress, 2025
Bali, Indonesia

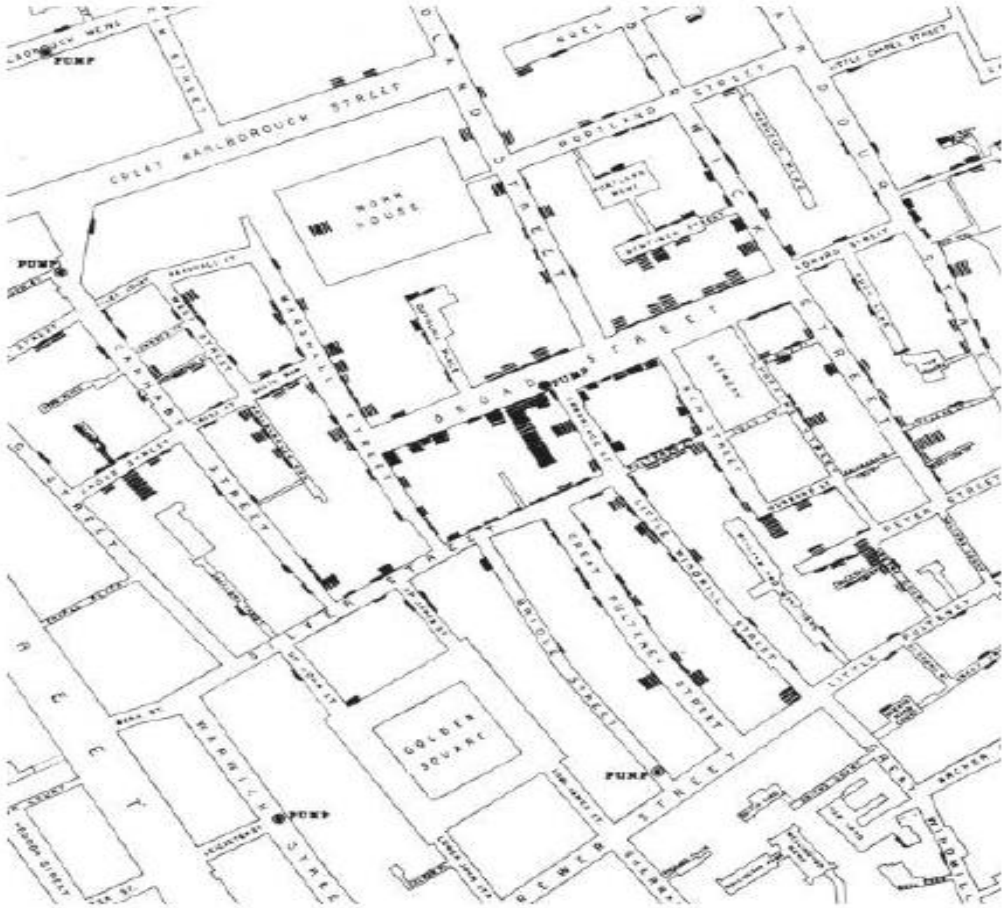
WORLD BANK GROUP

An Overview

Ajay Tandon (Lead Economist) and Somil Nagpal (Lead Health Specialist)
World Bank, Global Practice on Health, Nutrition, and Population

Changing With the Times: Use of Data in Health…

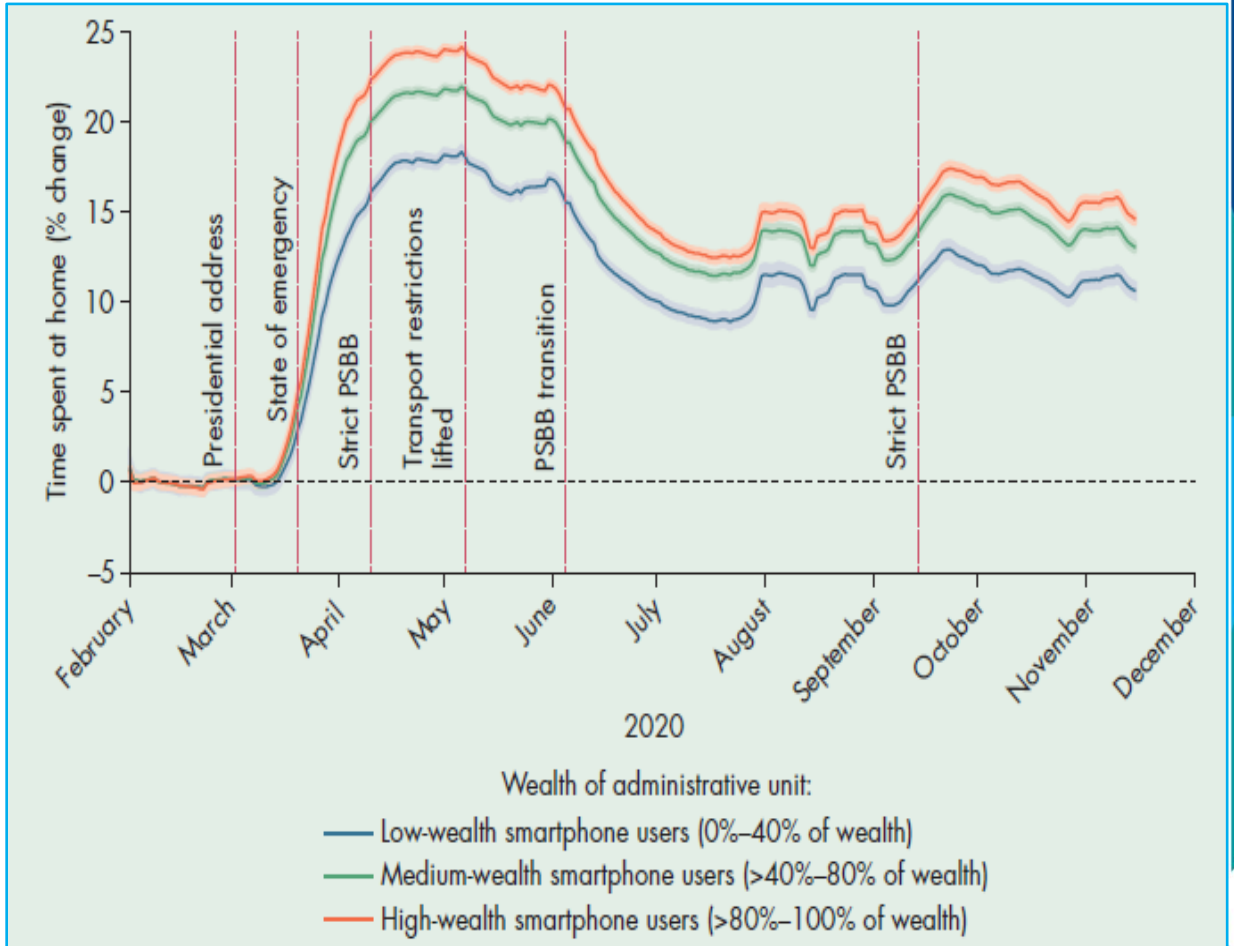
Map: John Snow's innovative mapping of the cholera epidemic in London in 1854 revolutionized tracing of disease



Source: Ball 2009. Map segment reproduced from John Snow, *On the Mode of Communication of Cholera*, 2nd ed. (London: John Churchill, 1855).

Note: The solid black rectangles of various sizes represent deaths from cholera.

Figure: Use of cellphones to combat COVID-19 in Jakarta in 2020; location data reveal changes in the time spent at home



Source: Adapted from Fraiberger et al. 2020. Data at http://bit.do/WDR2021-Fig-B4_1_1.

Note: Figure shows the changes in the time users spent at home from February 1 to November 15, 2020, relative to the baseline period. PSBB = *Pembatasan Sosial Berskala Besar* (large-scale social restrictions).

Huge Amounts of Health Data Are Now Available…

The Skyrocketing Volume Of Healthcare Data Makes Privacy Imperative

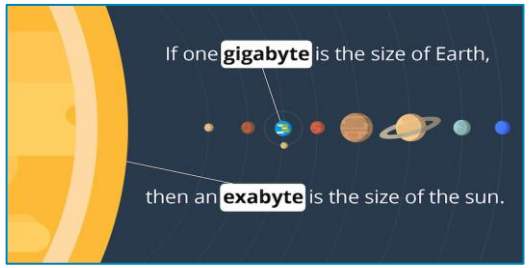
Forbes

Nick Culbertson Forbes Councils Member
Forbes Technology Council COUNCIL POST | Membership (Fee-Based)

Aug 6, 2021, 08:00am EDT

RBC Capital Market

..30% of the world's data volume is being generated by the healthcare industry. By 2025, the compound annual growth rate of data for healthcare will reach 36%.[2]



"Globally, more than 3.6 billion medical imaging procedures are performed each year, collectively generating exabytes of medical imaging data."[1]

August 2023

BRUNSWICK

Brunswick Review

Healthcare's Data Tsunami

February 2022

Science > Biology

Scientists Finally Sequence the Entire Human Genome

While 92% of the human genome was sequenced in 2003, scientists have struggled to map the remaining 8%. Until now.

David Lumb

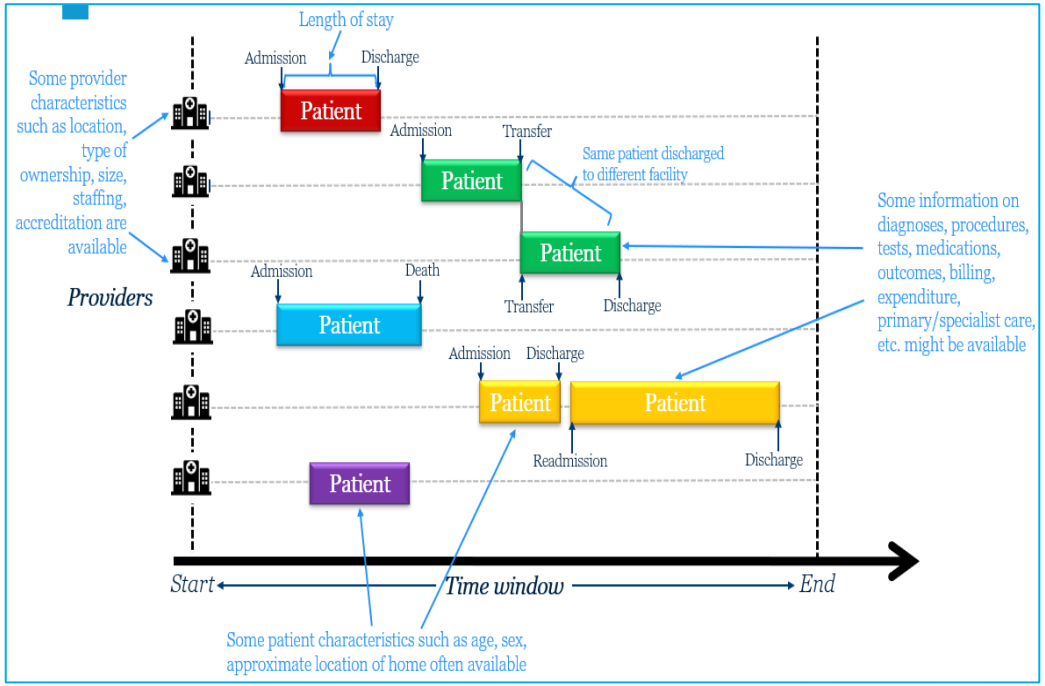
April 1, 2022 9:45 a.m. PT

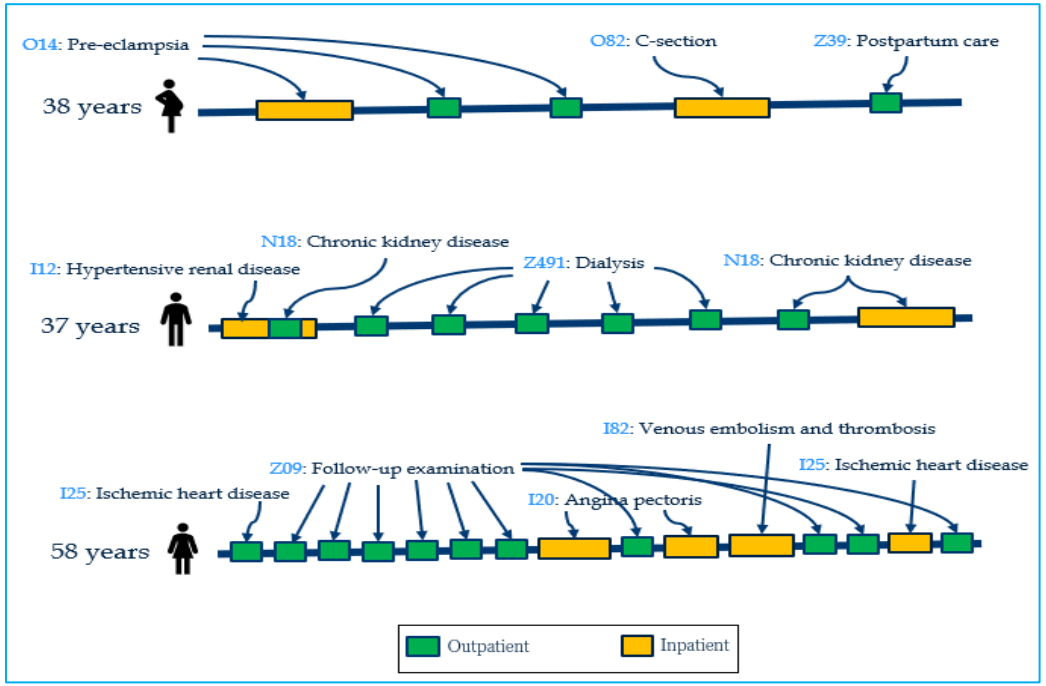
3 min read

1 - https://www.infoq.com/news/2023/08/aws-healthimaging-medical-data/
2 - https://www.rbccm.com/en/gib/healthcare/episode/the_healthcare_data_explosion#content-panel

...Also in Developing Countries...E.g., Claims Data...

- As developing countries implement reforms towards UHC, there is movement away from atomized OOP-based transactions → more prepaid/pooled financing of health → purchaser-provider split (with or without social health or other forms of insurance) → large amounts of digitized clinical/claims data being collected
- Claims data – also referred to as billing data or administrative data -- are digitized/electronic records of transactions that have occurred between payers and providers





...But Not Being Analyzed from Policy Lens

QUALITY OF CARE IN INDIA

By Matthew Morton, Somil Nagpal, Rajeev Sadanandan, and Sebastian Bauhoff

India's Largest Hospital Insurance Program Faces Challenges In Using Claims Data To Measure Quality

DOI: 10.1377/hlthaff.2016.0588
HEALTH AFFAIRS 35,
NO. 10 (2016): 1792–1799

Matthew Morton is a social protection specialist at the World Bank in New Delhi, India.

Somil Nagpal is a senior health specialist at the World Bank in Phnom Penh, Cambodia.

Rajeev Sadanandan is an additional chief secretary (health) in the Government of Kerala, Thiruvananthapuram, India.

Sebastian Bauhoff (sbauhoff@cgdev.org) is a research fellow at the Center for Global Development, in Washington, D.C.

ABSTRACT The routine data generated by India's universal coverage programs offer an important opportunity to evaluate and track the quality of health care systematically and on a large scale. We examined the potential and challenges of measuring the quality of hospital care through claims data from India's hospital insurance program for the poor, Rashtriya Swasthya Bima Yojana (RSBY). Using data from one district in India, we illustrate how these data already provide useful insights and show that simple efforts to enhance data quality and an effort to expand the data captured could facilitate RSBY's ability to track quality of care. The data collected by RSBY has significant potential to characterize and uncover the provision of low-quality care and help inform much-needed efforts to raise the quality of hospital care.

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Review

A systematic analysis of failures in protecting personal health data: A scoping review

Javad Pool [a,b,*], Saeed Akhlaghpour [c], Farhad Fatehi [d,e], Andrew Burton-Jones [c]

[a] ARC Industrial Transformation Training Centre for Information Resilience (CIRES), The University of Queensland, Brisbane, Australia
[b] School of Electrical Engineering and Computer Science, The University of Queensland, Brisbane, Australia
[c] Business School, The University of Queensland, Brisbane, Australia
[d] Centre for Health Services Research, Faculty of Medicine, The University of Queensland, Brisbane, Australia
[e] School of Psychological Sciences, Monash University, Melbourne, Australia

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Personal health data
Data breach
Data protection
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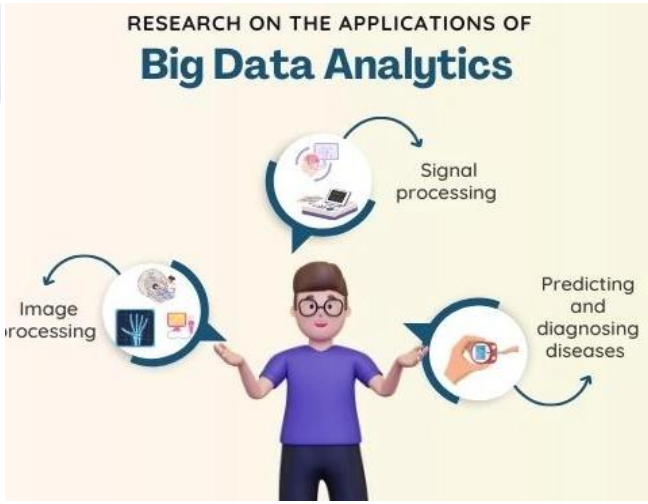
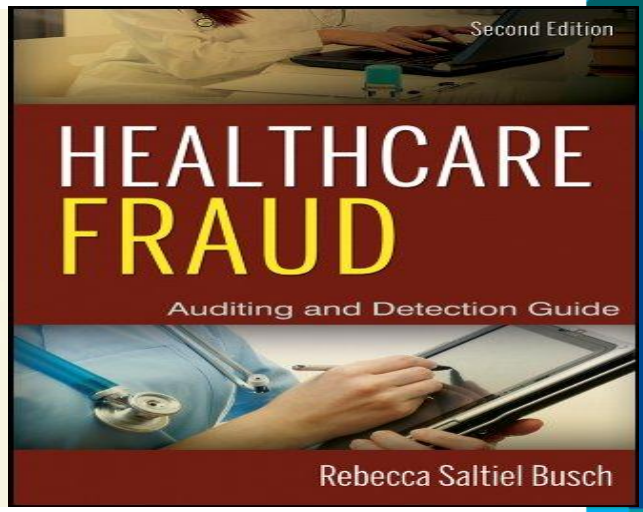
ABSTRACT

Personal health data breaches pose significant challenges to healthcare providers and clients. This study systematically analyzes 5470 records and reviews 120 articles on this theoretically and practically important topic. It summarizes the existing literature and develops an integrative model with eleven propositions explaining the multifaceted nature of health data breaches, their facilitators, and their impacts. We report on the gaps in the current literature and discuss six promising avenues of future research, including specific suggestions for multi-level analysis, use of novel methods, contributions to information systems theory, stakeholder analysis, under-explored themes, and boundary-breaching opportunities. Beyond these findings, our study offers implications for key stakeholders in healthcare settings. This study equips practitioners and researchers with a valuable model for evidence-based data breach risk management and offers guidance for future investigations, enhancing our collective understanding of personal health data breaches within healthcare.





Sometimes claims data are not of sufficient quality to enable credible analytics → necessitating foundational data quality improvements

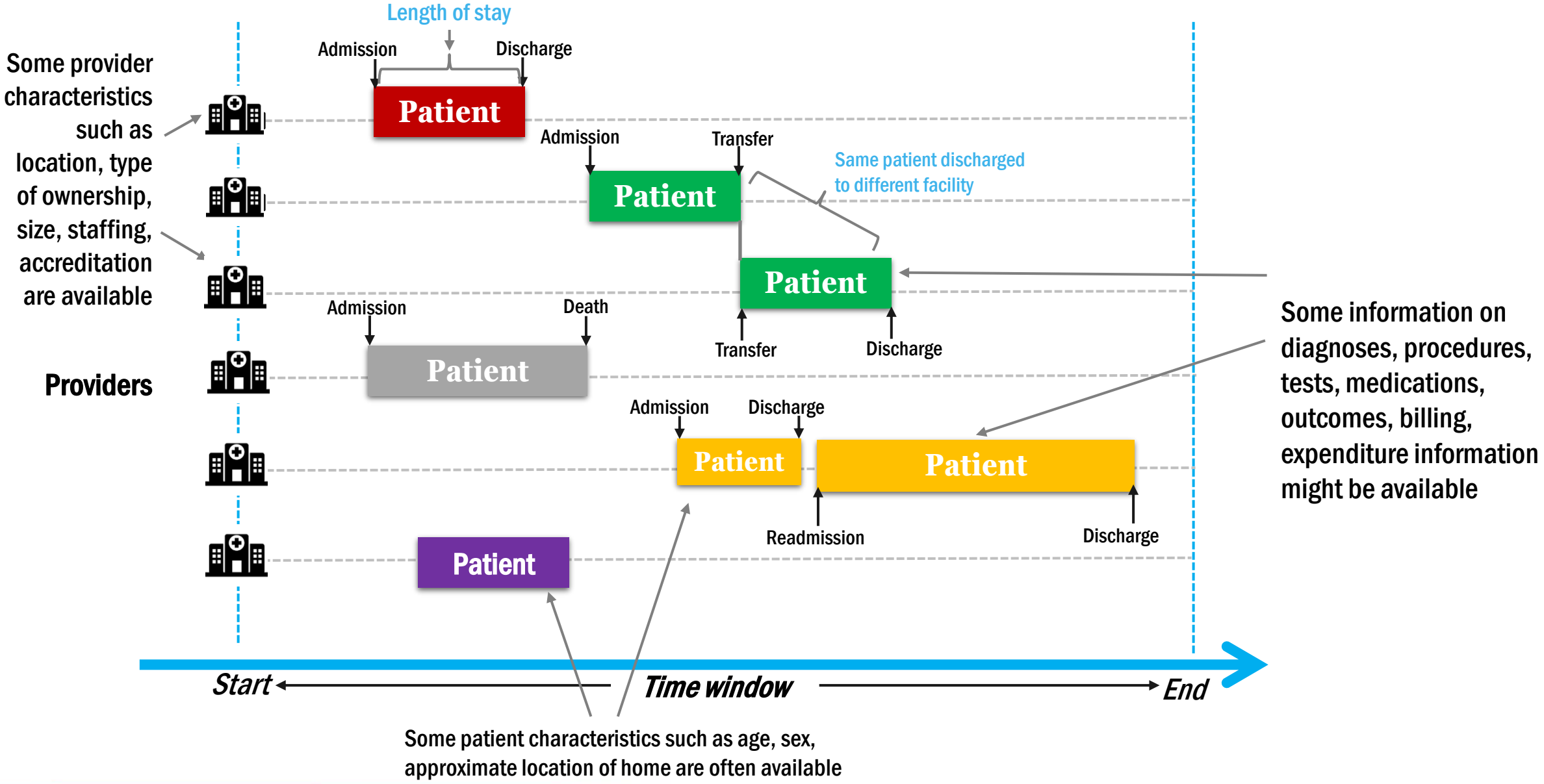
Health data are (rightfully) privacy-sensitive which can make them difficult to access and utilize without robust protection systems in place

Many developing countries lack capacity for conducting meaningful policy-relevant analytics, especially 'big data' analytics

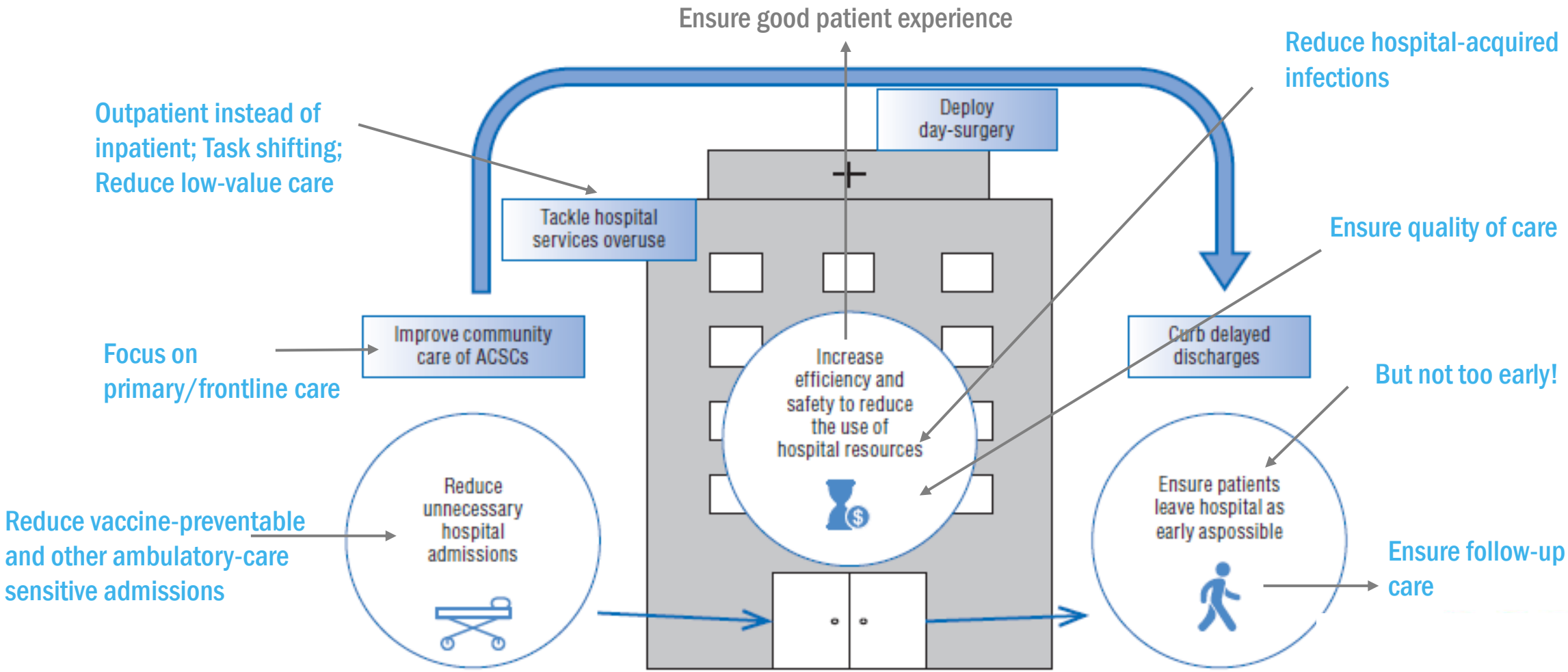
Too much focus on using claims data analytics for detecting/managing fraud as opposed to quality/improving health

Using claims data for informing policy-making is often seen through lens of **'risk'** rather than **'opportunity'**

Typical Nature of Claims Data



Claims Data Analysis Can Help Improve Health System Performance



Overall Objectives of the Session

- Better understand the nature and characteristics of claims data
- What are advantages/disadvantages as well as strengths/weaknesses

Provide a flavor of common metrics that can be routinely calculated from claims data

Introduction to ways in which analyses of claims data could inform policy-making

Examples of ways in which claims data are currently being utilized across countries

- View claims databases as a potentially rich resource that can be leveraged to complement other sources of information for helping inform policies in ways that can improve health system performance.

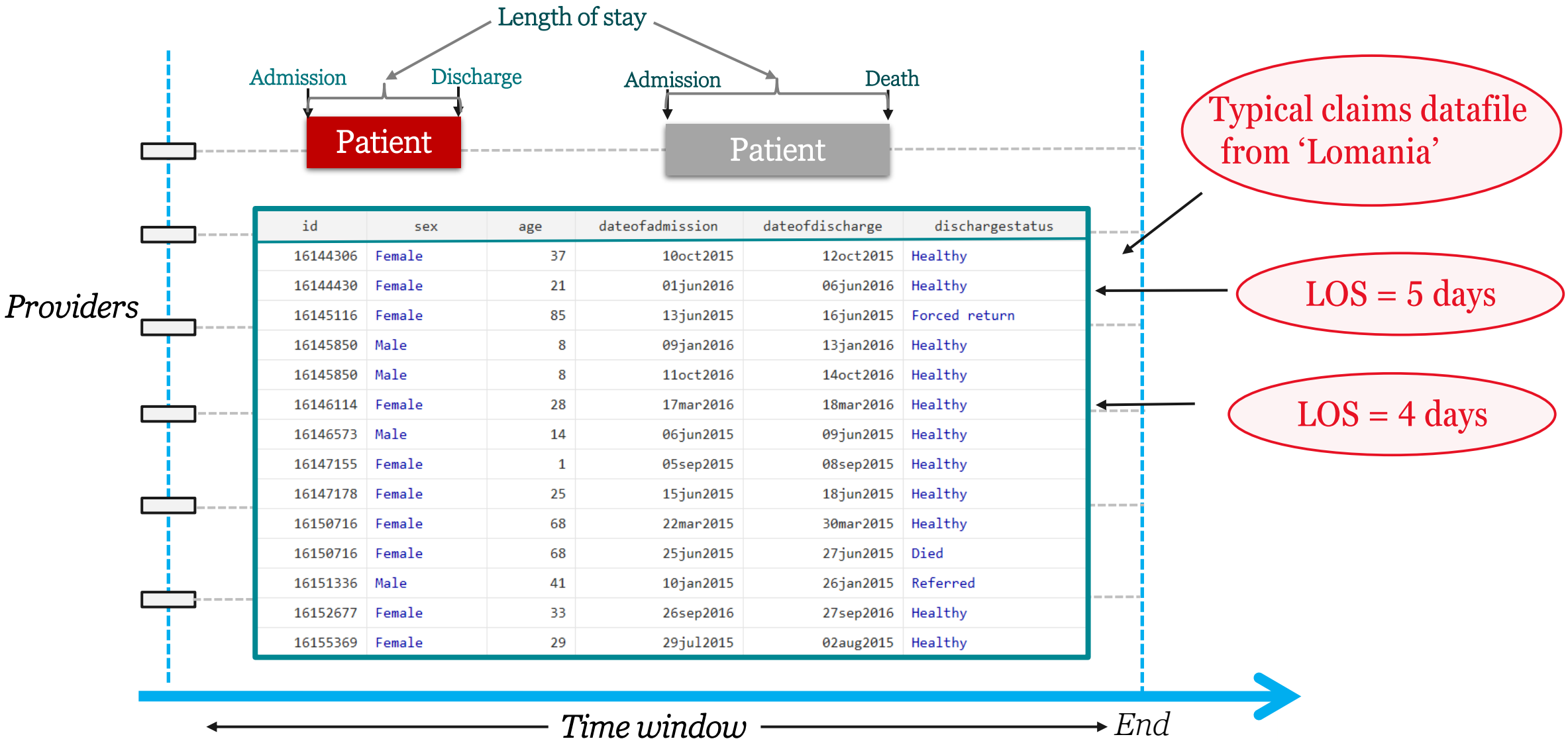
Claims Data Use Cases

- Length of stay and expenditure analysis
- Quality of primary health care: Ambulatory care sensitive conditions
- Quality of hospital care: Readmissions & case from India
- Estimating health costs of smoking
- Climate change & health: Extreme heat & hospitalization

Length Of Stay

Navneet Manchanda (Health Economist, WB)
World Bank, Global Practice on Health, Nutrition, and Population

What is Length Of Stay?



id	sex	age	dateofadmission	dateofdischarge	dischargestatus
16144306	Female	37	10oct2015	12oct2015	Healthy
16144430	Female	21	01jun2016	06jun2016	Healthy
16145116	Female	85	13jun2015	16jun2015	Forced return
16145850	Male	8	09jan2016	13jan2016	Healthy
16145850	Male	8	11oct2016	14oct2016	Healthy
16146114	Female	28	17mar2016	18mar2016	Healthy
16146573	Male	14	06jun2015	09jun2015	Healthy
16147155	Female	1	05sep2015	08sep2015	Healthy
16147178	Female	25	15jun2015	18jun2015	Healthy
16150716	Female	68	22mar2015	30mar2015	Healthy
16150716	Female	68	25jun2015	27jun2015	Died
16151336	Male	41	10jan2015	26jan2015	Referred
16152677	Female	33	26sep2016	27sep2016	Healthy
16155369	Female	29	29jul2015	02aug2015	Healthy

Typical claims datafile from 'Lomania'

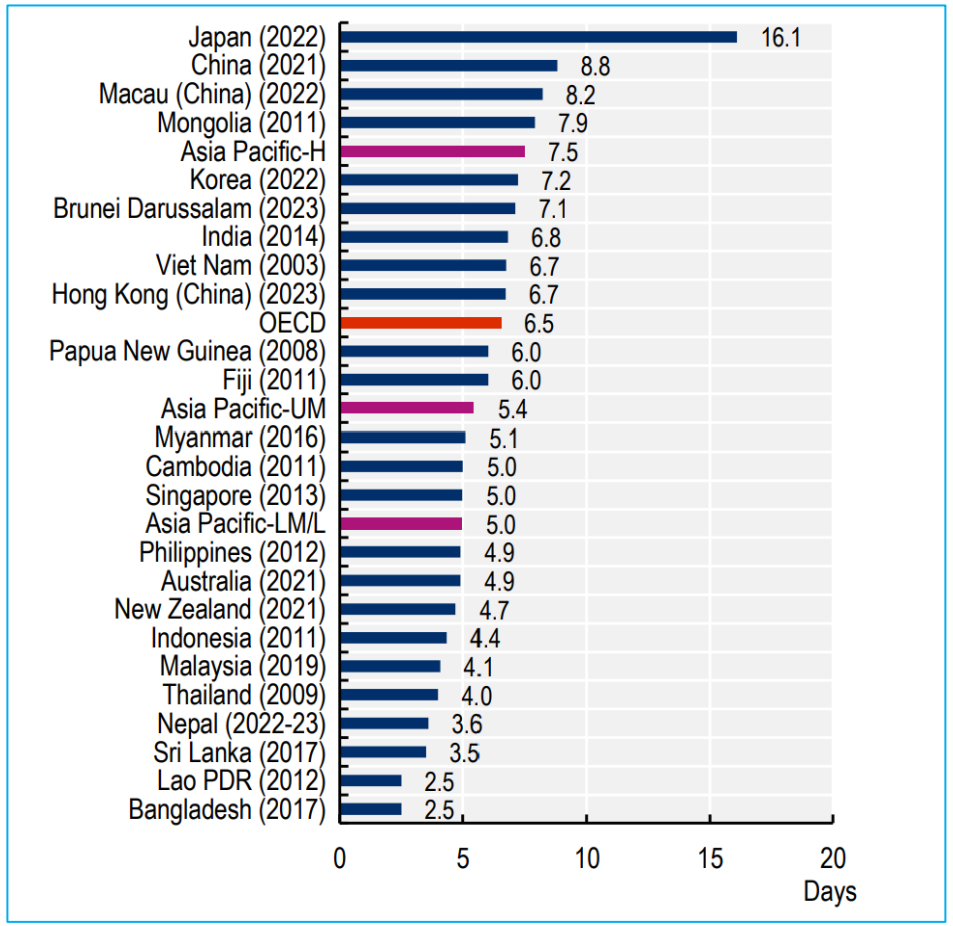
LOS = 5 days

LOS = 4 days

Length of Stay (LOS) = Date of Discharge-Date of Admission

Average Length Of Stay is a Commonly Reported Metric

Length of Stay (LOS) = Date of Discharge-Date of Admission



Large variations

- Patient profiles can influence LOS
- In Japan, "social admissions" – i.e., acute care beds devoted to long-term care for the elderly -- partly explains large number of beds and long average LOS.
- A short average LOS, coupled with the high admission rates in Sri Lanka suggests that inpatient services may be partly substituting for outpatient and primary care.
- LOS is influenced by how hospitals are paid: fee-for-service and per diem payments generally result in longer LOS, whereas case-based 'bundled' payments can result in lower LOS.

Source: Health at a Glance 2023.

Provider Payment Methods Can Influence LOS in Hospitals

Case Based (like DRGs)

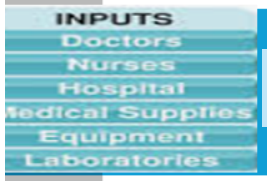
Providers are paid a fixed amount per admission depending on patient and clinical characteristics, regardless of the actual number of days that may be required and the actual amount of services that may be utilized per admission episode. This generally leads to a decline in LOS but may lead to increased number of hospital admissions and possible readmissions.

Fee For Service

Providers are paid for each individual service provided per episode of utilization; fees are usually fixed in advance for each service or group of services that are provided. Gives provider an incentive to increase number/volume of services, thus may lead to longer stay in hospital.

Per Diem

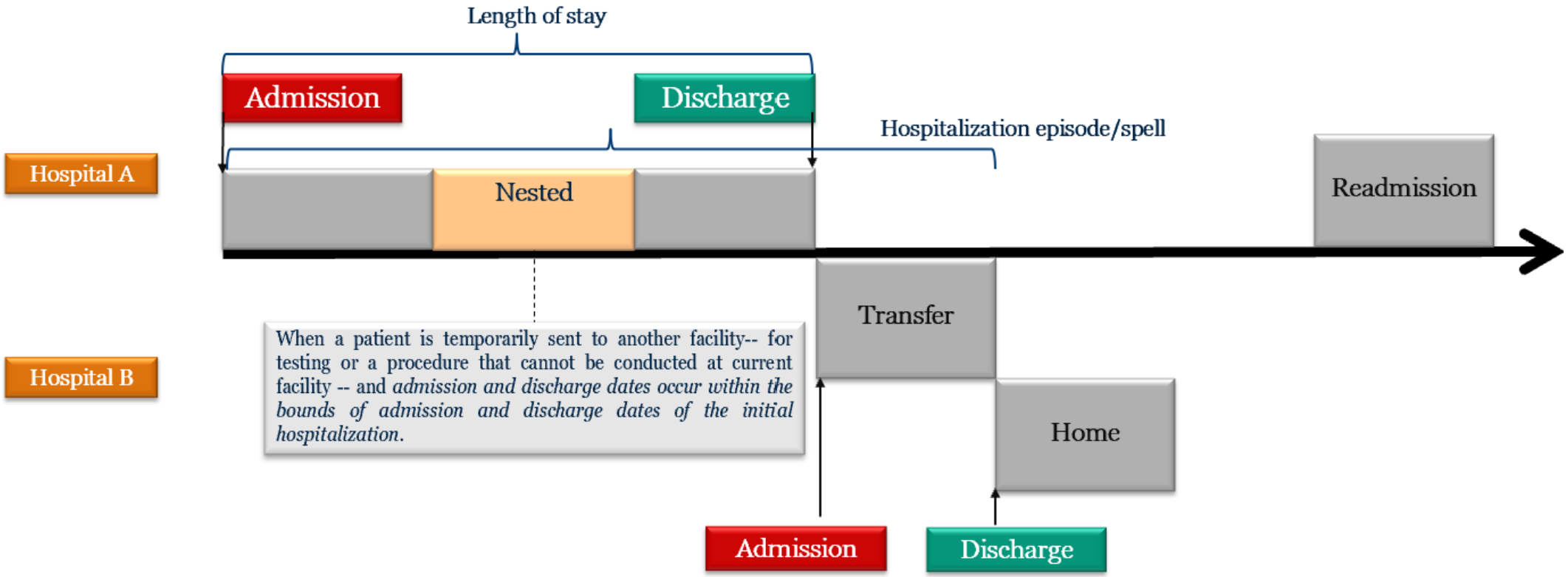
Providers are paid a fixed amount per day that an admitted patient stays in the facility; this type of provider payment mechanism is often used for long-term palliative and rehabilitative care. Incentive for provider is to increase the number of bed-days →excessive length of hospital stays



Line Items

Providers receive a fixed amount of resources to cover specific input expenses (e.g., for salaries, medicines, equipment, maintenance, etc.) to provide a stipulated set of health services over a certain period. Providers incentivized to underprovide services or increased referrals. No incentive to improve quality/efficiency.

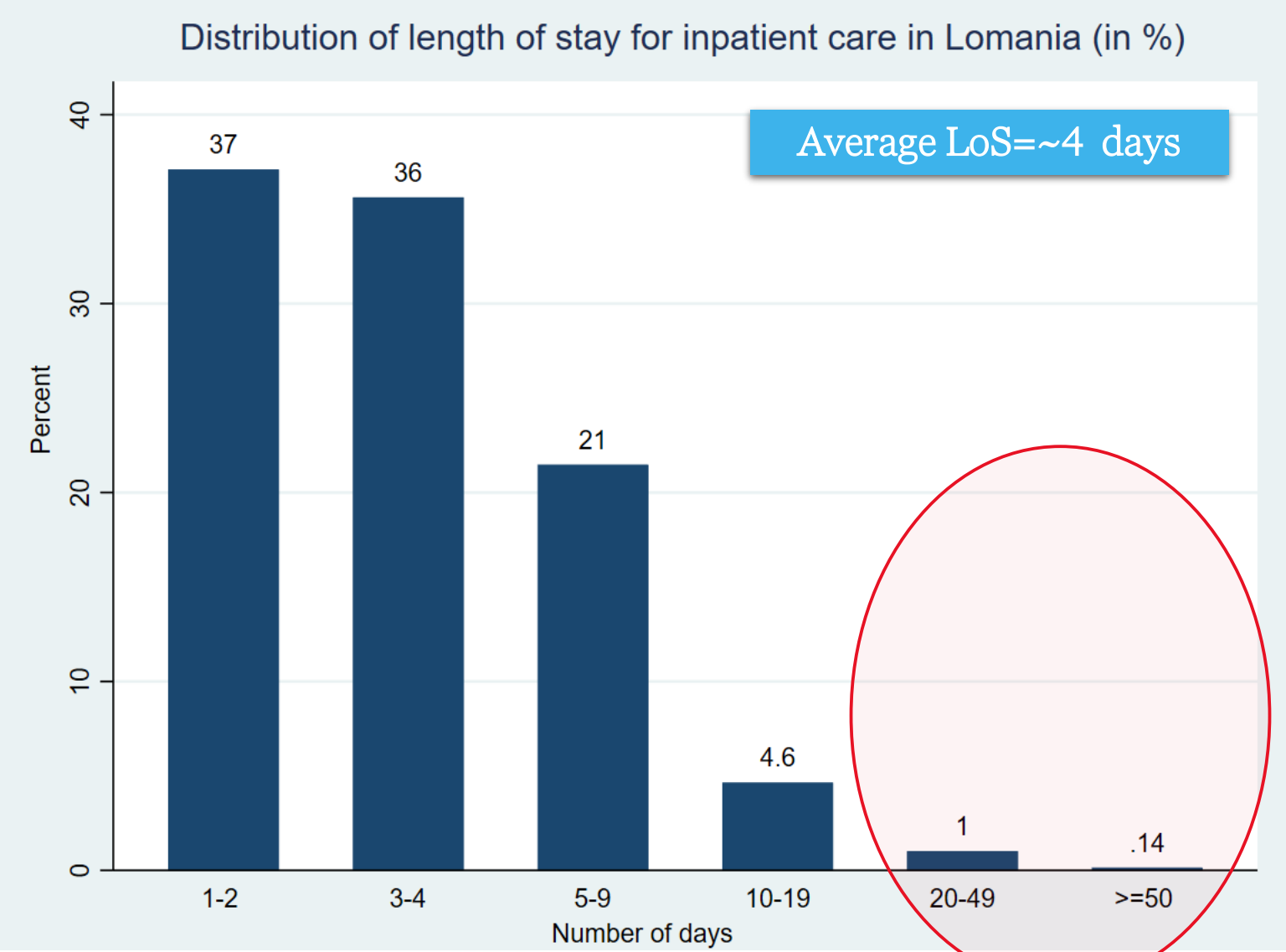
Length Of Stay: Some Additional Considerations



Length of Stay: Sometimes Different Definitions in Different Countries

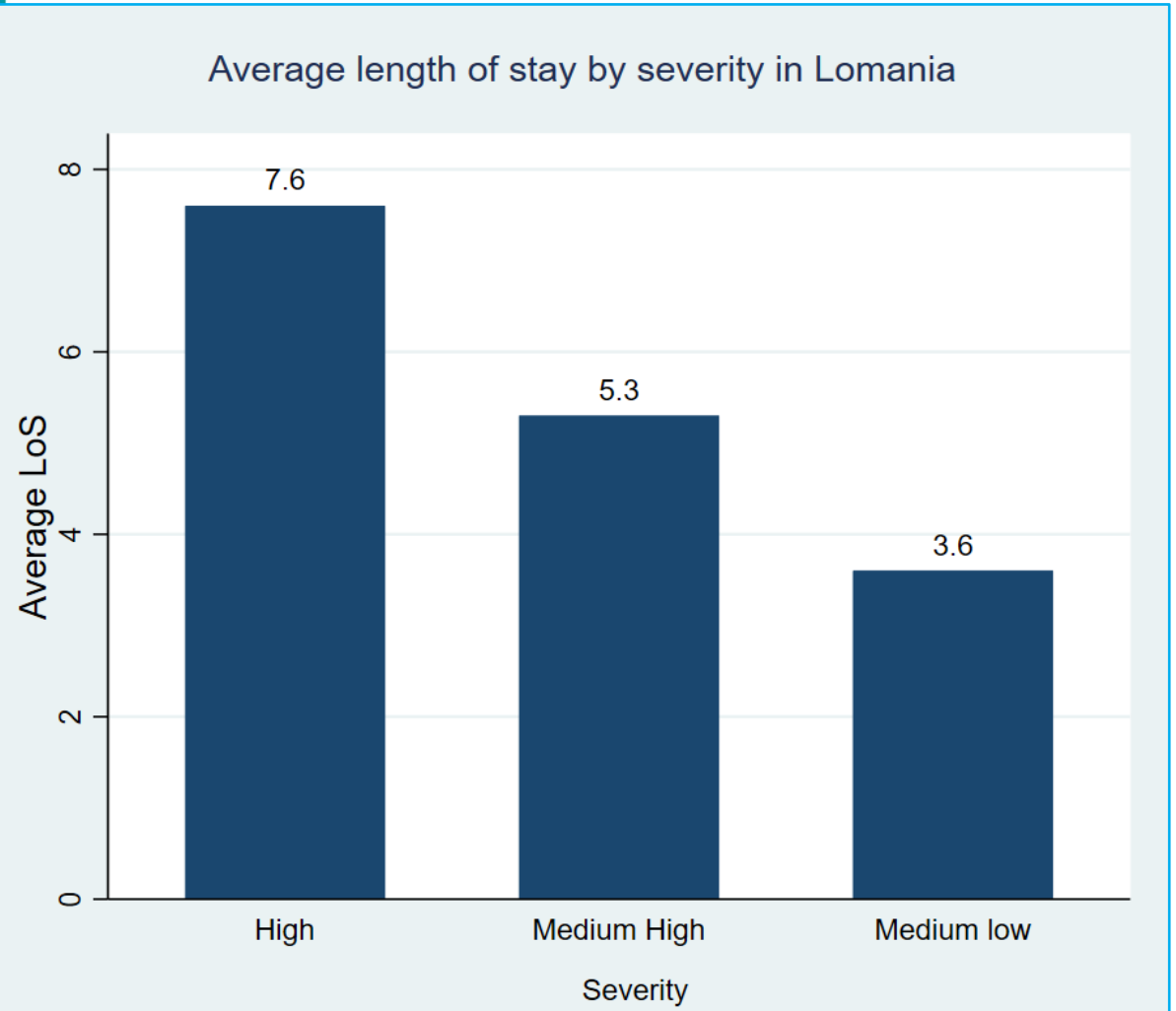
Germany	Ireland
Numerator: # of bed days Denominator: # of cases (admissions plus discharges including deaths divided by 2)	Numerator: # of bed days used Denominator: # of inpatients discharged (including deaths, excluding day cases)

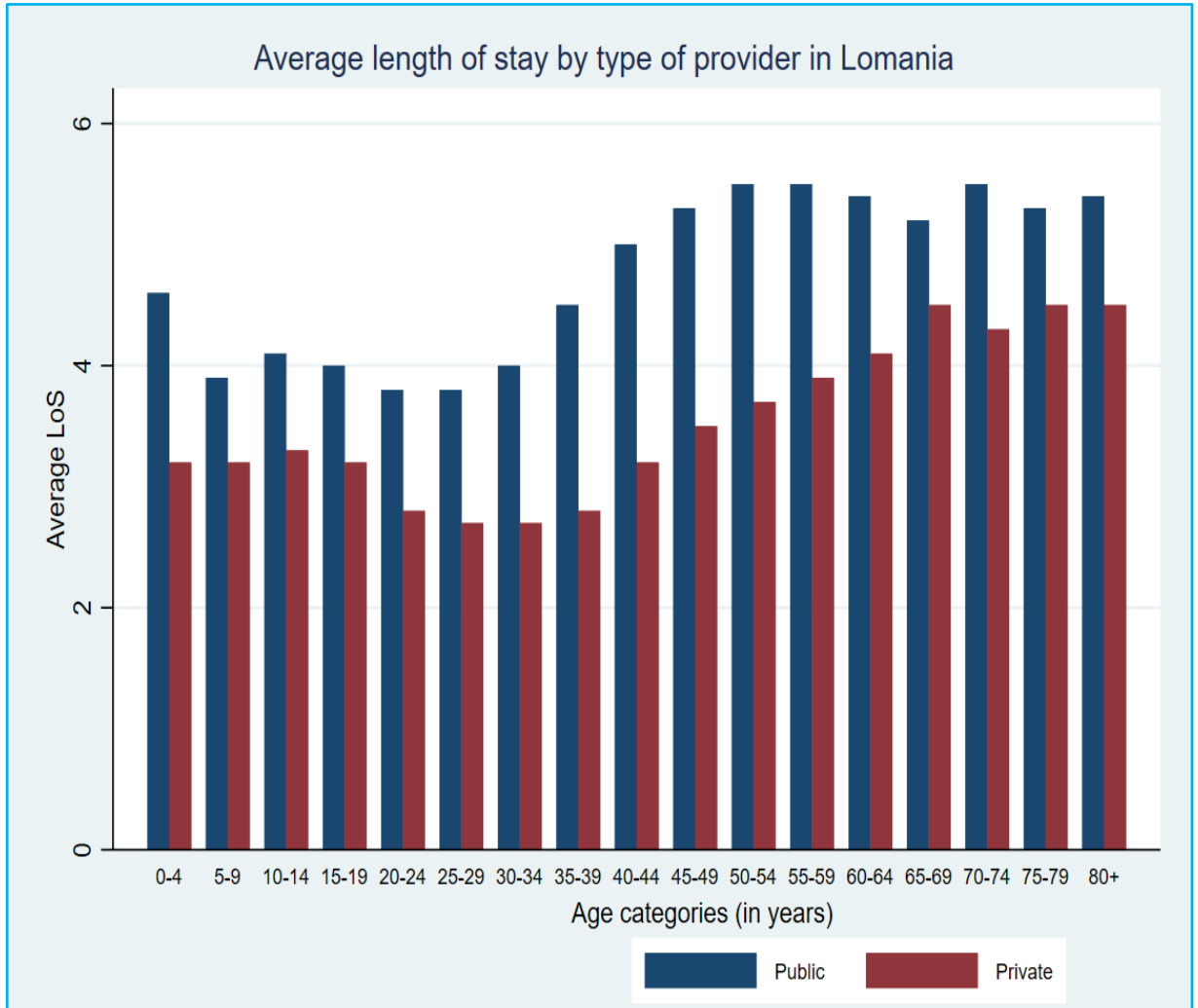
Long-term Inpatients in ‘Lomania’



Source: WB staff analysis using synthetic claims dataset

Using Claims Data to Visualize LOS

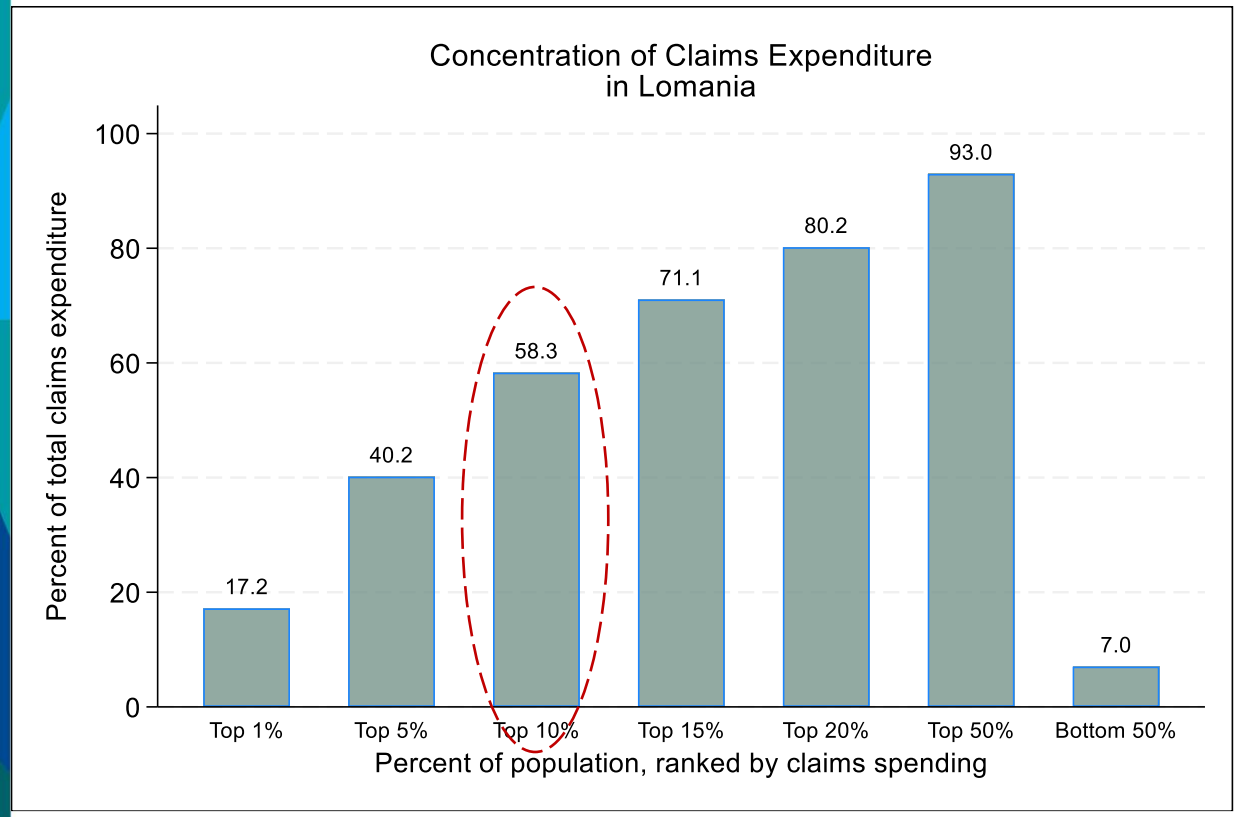


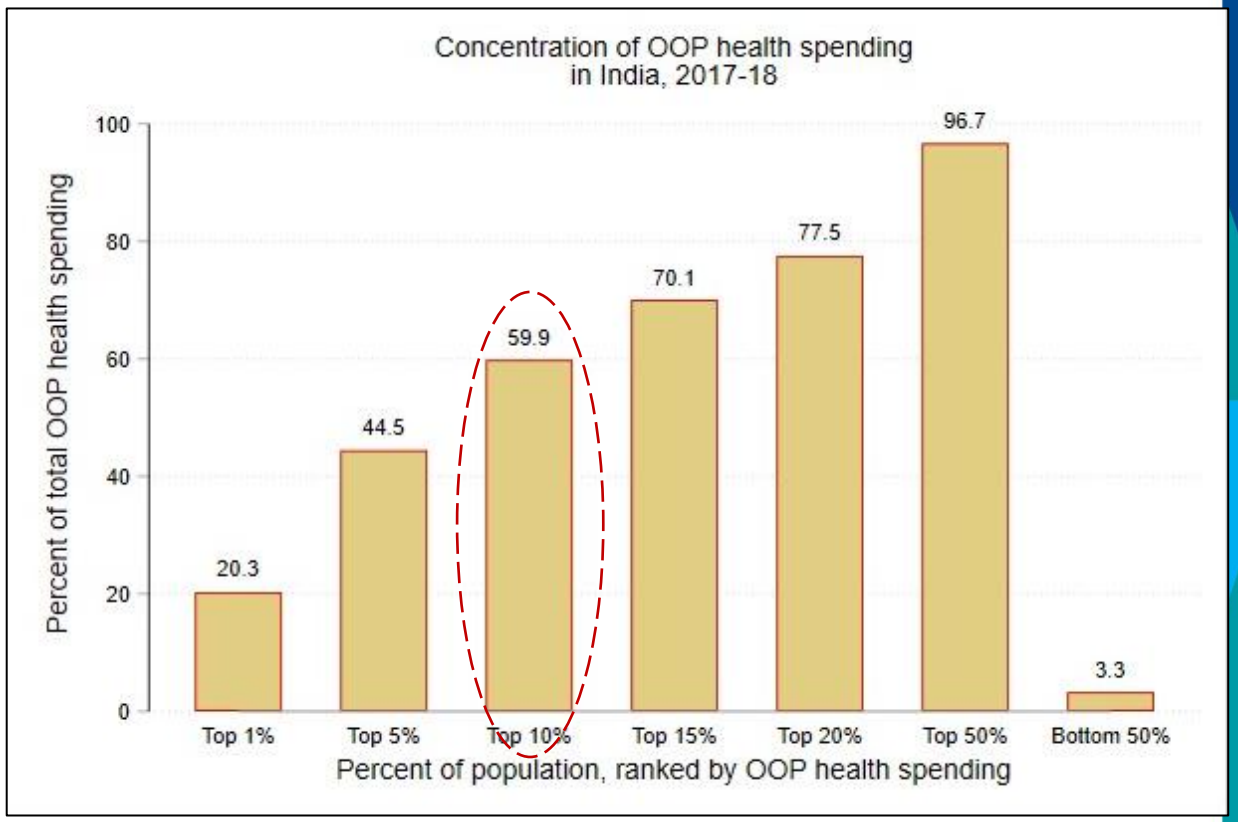


Source: WB staff analysis using synthetic claims dataset

The "10-60" Rule

Health Expenditures Tend to be Highly Concentrated: *10%* of the population driving about *60%* of expenditures





Sources: WB staff analysis using synthetic claims dataset representative of LMIC experiences; NSSO 2017/18.

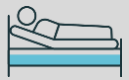
Who Are The "10%"?

Claims Analysis Can Help Identify Opportunities to Manage Costs and Improve Care Outcomes for High-Cost Users

Typical Characteristics of the "10%" High-Cost Users:

More likely to be elderly

More likely to be from vulnerable populations



More likely to have higher average number hospitalizations per year than non high-cost users

And more likely to stay longer in hospital than non high-cost users

Claims data can identify key drivers of expenditure.

- Targeted interventions using claims analysis can help reduce hospitalizations and manage cost challenges
- Not all expenditures among high-cost users can be "managed" or mitigated

Top reasons for hospital utilization for the "10%" highest cost users from "Lomania":

- Chronic kidney disease (12.3%)
- Medical surveillance and aftercare following completed treatment (12.2%)
- Care involving dialysis (3.0%)
- Heart failure (2.3%)
- Care involving rehabilitation procedures (2.1%)

Source: WB staff analysis using synthetic claims dataset representative of LMIC experiences.

Key Considerations

Current Scenario (especially in public facilities in many countries):

- Not enough hospital beds
- Overcrowding
- Hospital-acquired infections
- Staffing challenges
- Avoidable hospitalizations

Average LOS Can Be Key Performance Indicator

Efficiency

Longer LOS may indicate inefficiencies in resource allocation as beds, staff time, and medical care are tied up for extended periods

Patient Safety & Quality

Longer LOS may raise concerns about patient safety and quality of care provided. Some patients may be discharged too early, when staying in hospital longer could have improved their health outcomes or reduced chances of readmissions

Reimbursement Determination

Sometimes hospitals are paid based on LOS

Claims Analysis Can Help Identify Opportunities to Manage Costs and Improve Care Outcomes for High-Cost Users

Quality of Primary Health Care: Ambulatory Care Sensitive Conditions (ACSC)

Huong Lan Dao (Senior Health Specialist, WB)
World Bank, Global Practice on Health, Nutrition, and Population

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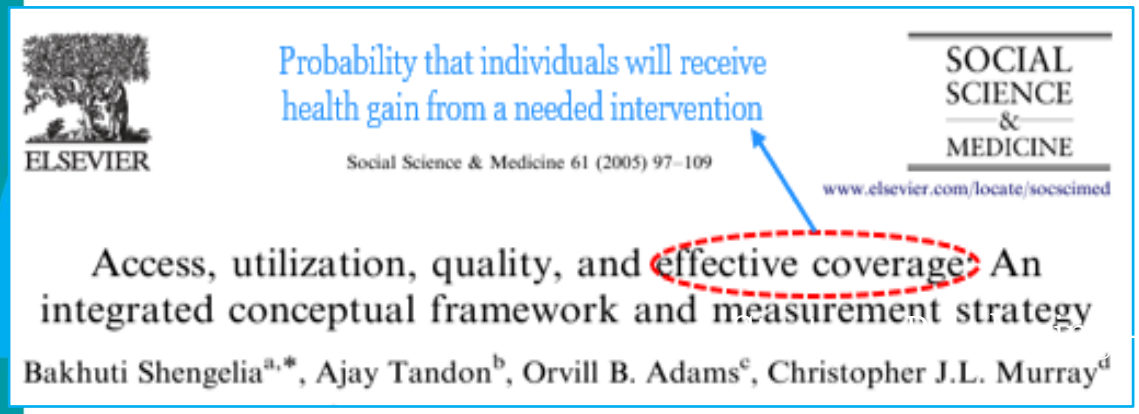
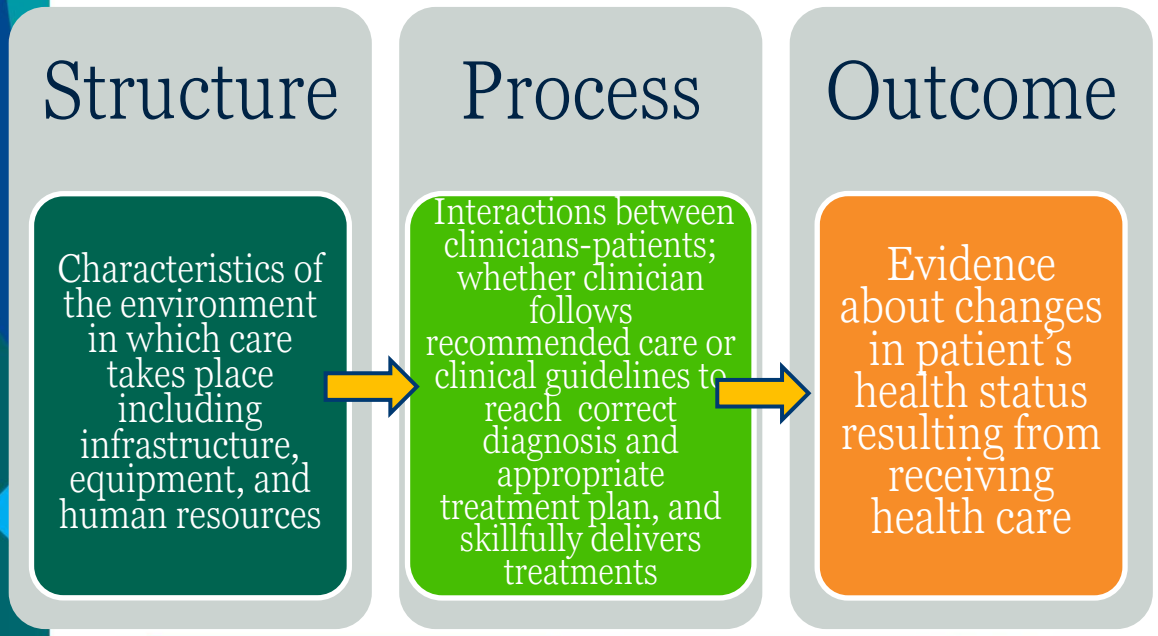
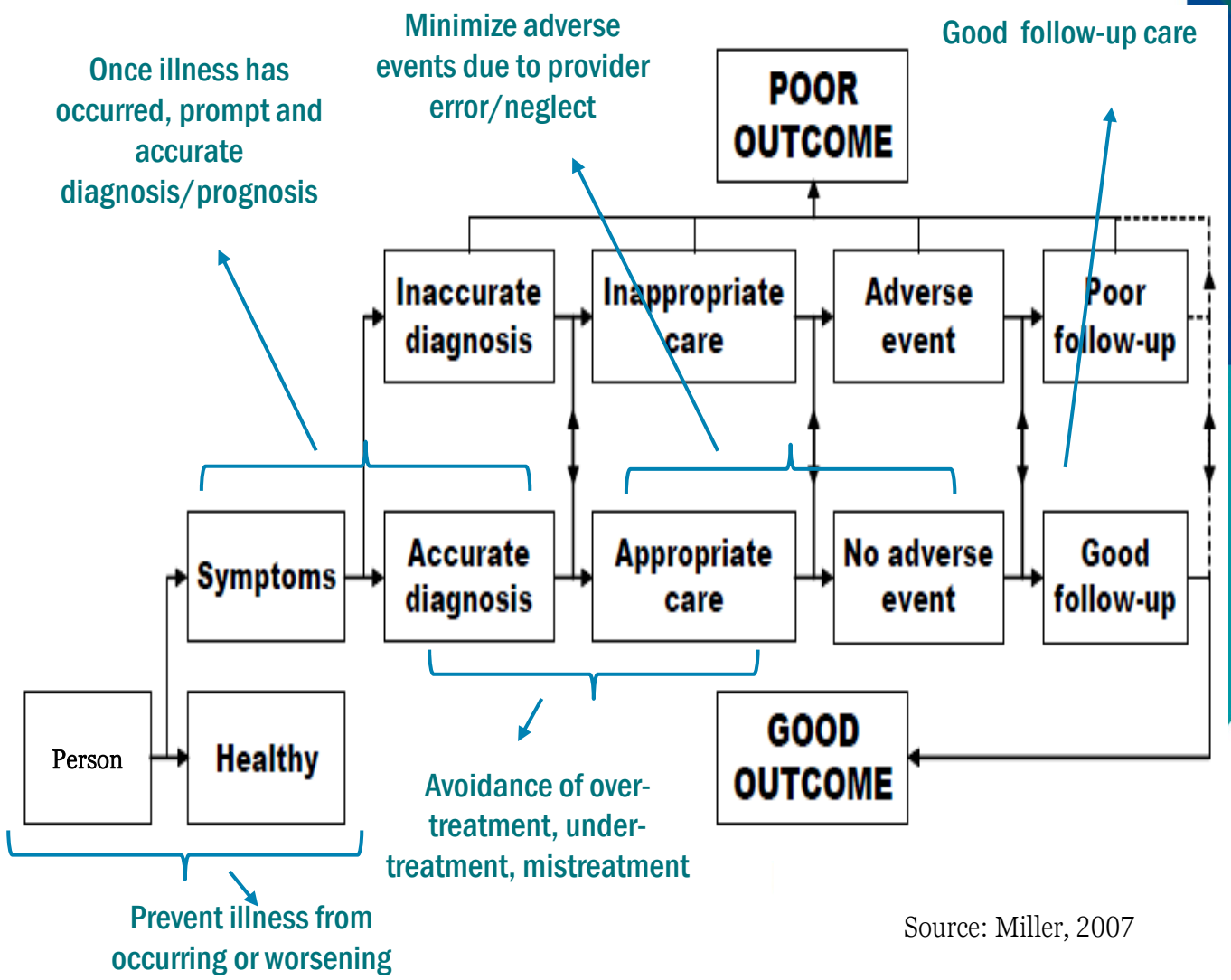
What is Quality?

Availability and utilization of competent care, effective interventions, together with a positive experience when users interact with the health system (Lancet Commission on High Quality Health Systems)





Source: Donabedian, 1966

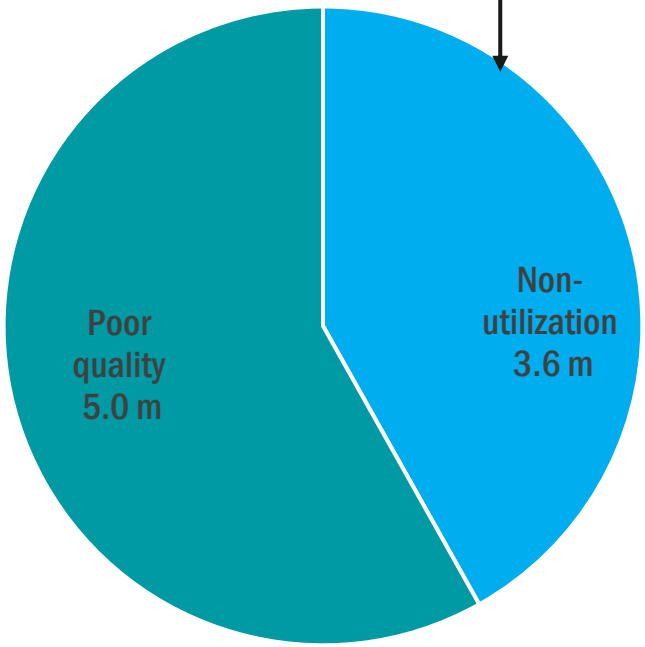


Source: Miller, 2007

Why Quality Matters? Quality has eclipsed access as driver of survival

As coverage rates have risen globally, commensurate gains in population health have often not been observed, focus of policy attention increasingly on effectiveness of coverage

Lancet Commission estimated that of 8.6 million deaths from treatable conditions, 60% are due to poor quality



Poor quality healthcare often results in harm; or can result in low-value interventions that are wasteful instead of being cost-effective

Across surveys, perceived lack of (clinical) quality and long waiting times are often most-cited reasons for people to bypass public health facilities and pay OOP to seek care at private facilities (where clinical quality is not necessarily better…)

Poor structural, process, and outcome quality due to under-leveraged and under-financed public coverage is key driver of OOP spending and financial hardship

Assessing Quality of Primary Health Care from Hospitalization Data: Ambulatory Care Sensitive Conditions

'...conditions for which **timely** and **effective ambulatory care** can help **reduce the risks of hospitalization** by preventing the onset of an illness or condition, controlling an acute episodic illness or condition, or managing a chronic disease or condition.' *Billings et al. (1993)*

Potentially Preventable Hospitalizations (PPHs)/Hospitalizations for Ambulatory Care Sensitive Conditions (ACSC) are hospitalizations due to ACSCs..... distinct from unnecessary admissions

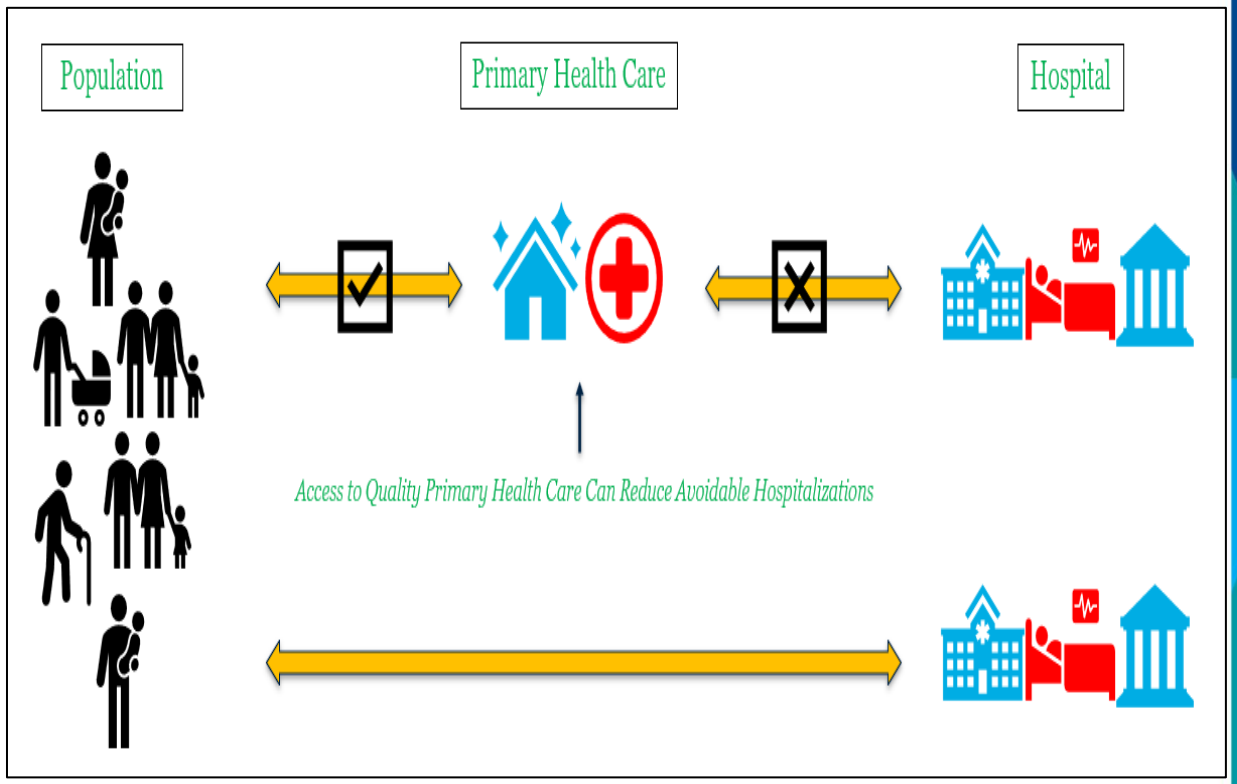
Hospitalizations for ACSCs are widely used in high-income counties as a routine statistical indicator of the quality and effectiveness of primary care system + access and equity

Why Monitor and Track ACSC Hospitalizations?

- ACSC hospitalization metrics can indirectly provide information on effectiveness of primary health care:
  - High ACSC hospitalization rates signal potential gaps in health promotion, disease prevention, primary health care management of ACSCs.
  - ACSC hospitalization rates are used as key performance indicator (KPI) for monitoring primary health care effectiveness and efficiency of health systems (used in Thailand, Australia, US, UK…)

- Effective frontline primary health care management of ACSCs can help free scarce hospital beds in resource-constrained settings.

- Preventing the need for hospitalization is better for patients:
  - Admissions can lead to hospital-acquired infections as well as loss of mobility and increased frailty from inactivity.
  - Admissions are costly to purchasing agencies and to patients and their families.



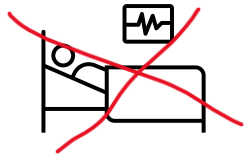
Primary Health Care To Avoid Need for Hospitalization

Prevention

- Prevention of risk factors
- Behavioral/lifestyle modifications
- Public health interventions

Screening

- Proactive population-based screening
- Early detection by families, in the community, during routine visits



Treatment

- Early initiation and compliance with treatment
- Adherence to treatment, often for decades/lifetime

Management

- Ongoing management and monitoring
- Adjustments based on co-morbidities and multi-morbidities

Examples of ACSCs

Vaccine-Preventable ACSCs	Acute ACSCs	Chronic ACSCs
Bacterial pneumonia	Dehydration	Atrial fibrillation and flutter
Influenza	Pediatric gastroenteritis	Angina
Diphtheria	Perforated appendix	Congestive heart failure
Whooping cough	ENT infections	Hypertension
Measles	Kidney/urinary tract infections	Asthma
Rubella	Perforated/bleeding ulcer	COPD
Acute hepatitis B	Cellulitis	Diabetes complications
Mumps	Dental conditions	Iron deficiency anemia
Rubella arthritis	Convulsions and epilepsy	Nutritional deficiencies

Early symptoms of urinary tract infections can be detected and treated in ambulatory settings; a failure to do so can lead to acute glomerulonephritis which will most likely require hospitalization

Acute episode may be dealt with at primary care without requiring unplanned/emergency hospital admissions

Avoid need for emergency care via improved primary care management

Steps: Defining ACSCs Is Key

There is scientific evidence that the cause of hospitalization is ambulatory care-sensitive.

There is clarity on the definition and coding of the diagnosis (using ICDs).

The health problem is important for public health (i.e. not a rare event)

Hospitalization is needed when the condition is present (the condition is not exclusively treated in ambulatory basis)

There is a consensus among experts and clinicians that hospitalization is potentially avoidable by effective and timely provision of ambulatory care for prevention or management to prevent complications. (DELPHI Method)

Minimal Data Requirement

- Primary & Secondary diagnostic ICD codes, procedure codes*
- Patient characteristics: age, sex
- Facility type (Level of facility, public vs private)
- Geographic identifiers (province, district).
- LOS
- Month of admission (for seasonality analysis)
- Total cost for the episode, total paid by the insurance

Typical Process of ACSC Development & NHS England Example

Start with global list from WHO and/or from comparable countries

↓

Expert consensus via representative clinical panel (e.g., using Delphi method)

↓

Adjustments based on local context, clinical guidelines, public health importance, etc.

↓

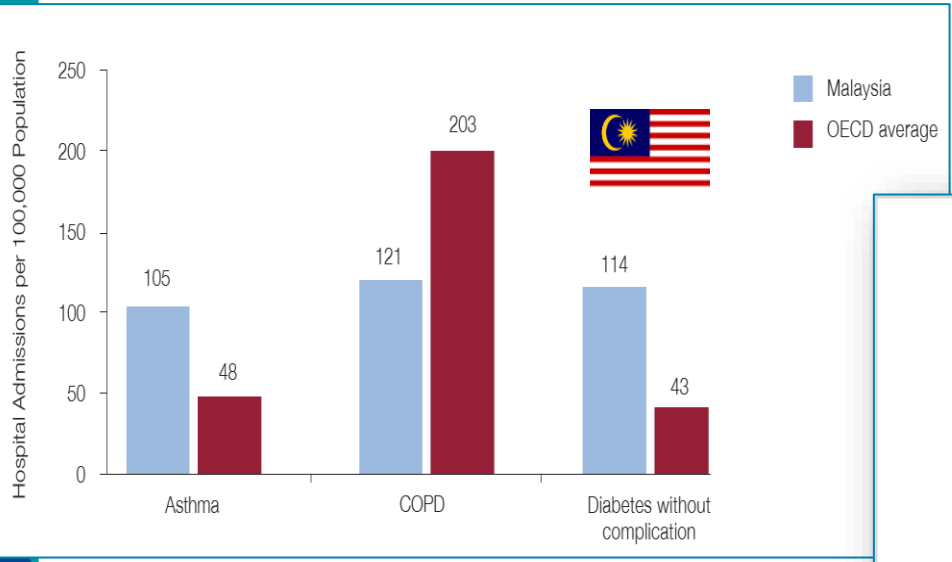
Estimation, assessment, interpretation, learning, revisions over time

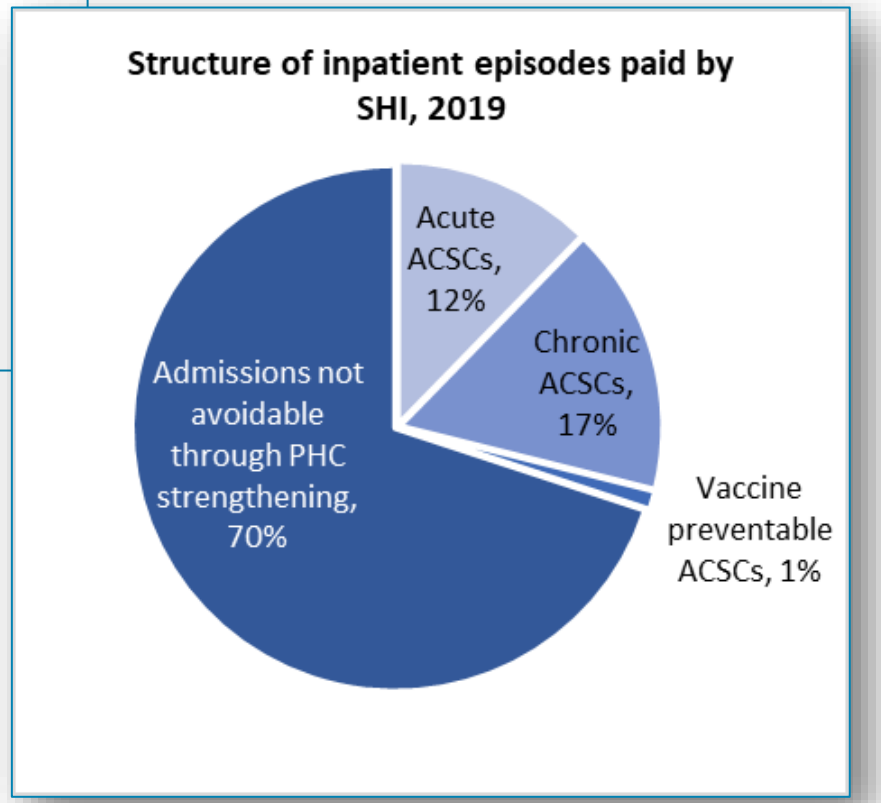
NHS Digital

Congestive heart failure	I110	Hypertensive heart disease with (congestive) heart failure	Principal diagnosis only; Exclude main operative procedures with OPCS4 codes of K0,K1,K2,K3,K4,K50,K52,K55,K56,K57, K60,K61,K66,K67,K68,K69,K71
	I50	Heart failure	
	J81	Pulmonary oedema	
Diabetes complications	E100-E108	Insulin-dependent diabetes mellitus	In any diagnosis field
	E110-E118	Non-insulin-dependent diabetes mellitus	
	E120-E128	Malnutrition-related diabetes mellitus	
	E130-E138	Other specified diabetes mellitus	
	E140-E148	Unspecified diabetes mellitus	
Chronic obstructive pulmonary disease	J20	Acute bronchitis	Principal diagnosis only; ICD-10: J20 only if there is a secondary diagnosis of J41, J42, J43, J44, J47
	J41	Simple and mucopurulent chronic bronchitis	
	J42	Unspecified chronic bronchitis	
	J43	Emphysema	
	J44	Other chronic obstructive pulmonary disease	
	J47	Bronchiectasis	
Angina	I20	Angina pectoris	Principal diagnosis only; Exclude cases with main operative procedure OPCS4 codes of A, B,C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, V, W, X0, X1, X2, X4, X5
	I240	Coronary thrombosis not resulting in myocardial infarction	
	I248	Other forms of acute ischaemic heart disease	
	I249	Acute ischaemic heart disease, unspecified	
Iron deficiency anaemia	D501	Sideropenic dysphagia	Principal diagnosis only
	D508	Other iron deficiency anaemias	
	D509	Iron deficiency anaemia, unspecified	
Hypertension	I10	Essential (primary) hypertension	Principal diagnosis only; Exclude cases with main operative procedure OPCS4 code of K0, K1, K2, K3, K4, K50, K52, K55, K56, K57, K60, K61, K66, K67, K68, K69, K71
	I119	Hypertensive heart disease without (congestive) heart failure	

Examples of Findings from ACSC Studies…

Reducing ACSC hospitalizations can reduce cost pressures on health systems given the generally lower unit costs of implementing frontline interventions





A study aimed to measure the avoidable hospitalization rate and the treatment cost per hospitalization time in large cities of eastern China looked at five ACSC: hypertension, diabetes, asthma, COPD, and Congestive heart failure between 2015-2018.

Condition	Number in 2018	Average cost per case
Hypertension	30,957	$1,307
Diabetes	41,975	$1,593
Asthma	3,060	$1,301
COPD	35,122	$2,068
CHF	14,258	$2,084

Approximately 30% of Vietnam's inpatient episodes in 2019 were potentially preventable through strengthened PHC and prevention

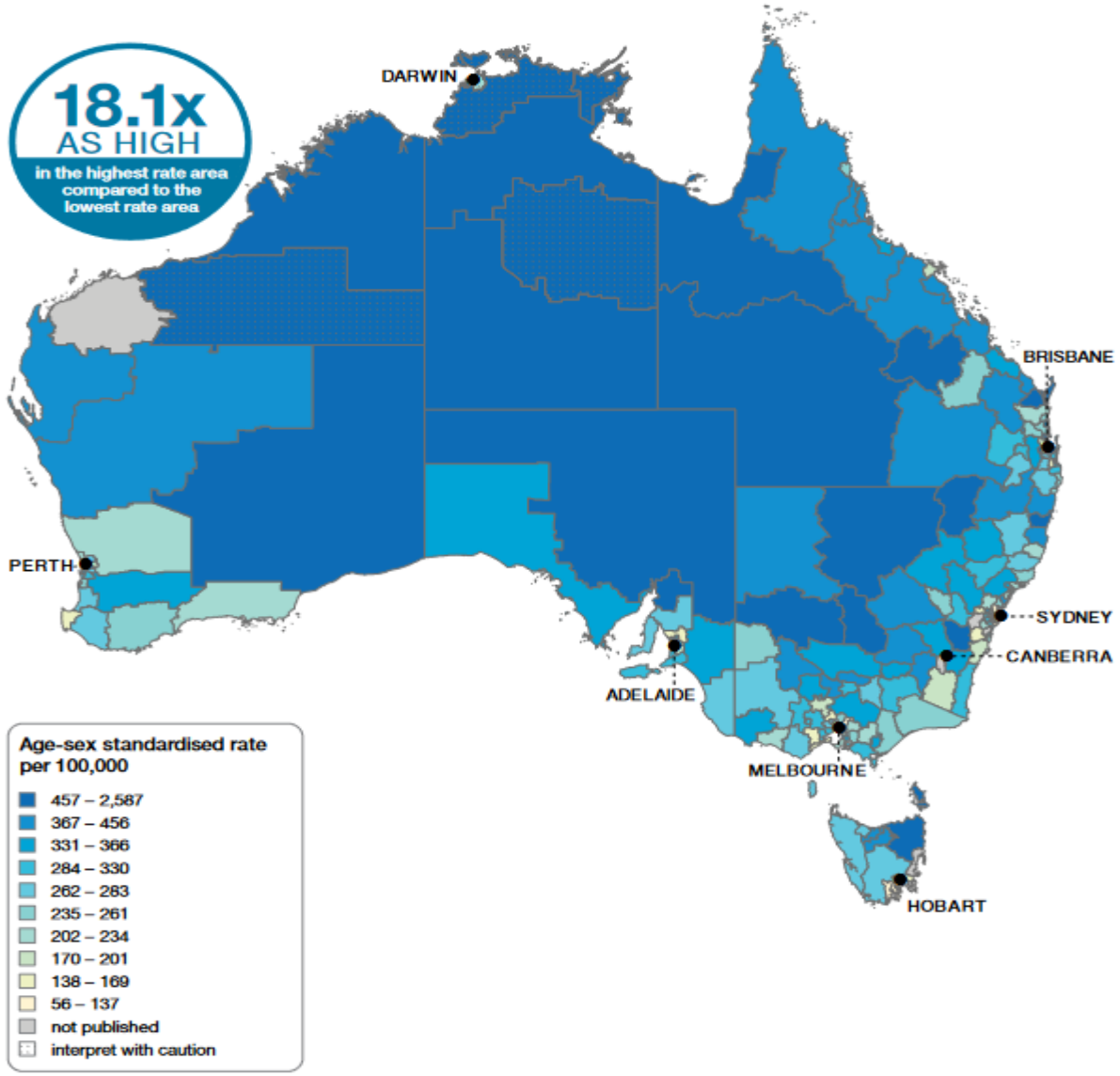
Use of Potentially Preventable Hospitalizations in Australia

- Australia examination of geographic inequalities in potentially preventable hospitalization rate for COPD

- More remote and poorer areas have higher potentially preventable hospitalization due to low access to effective PHC for COPD management.

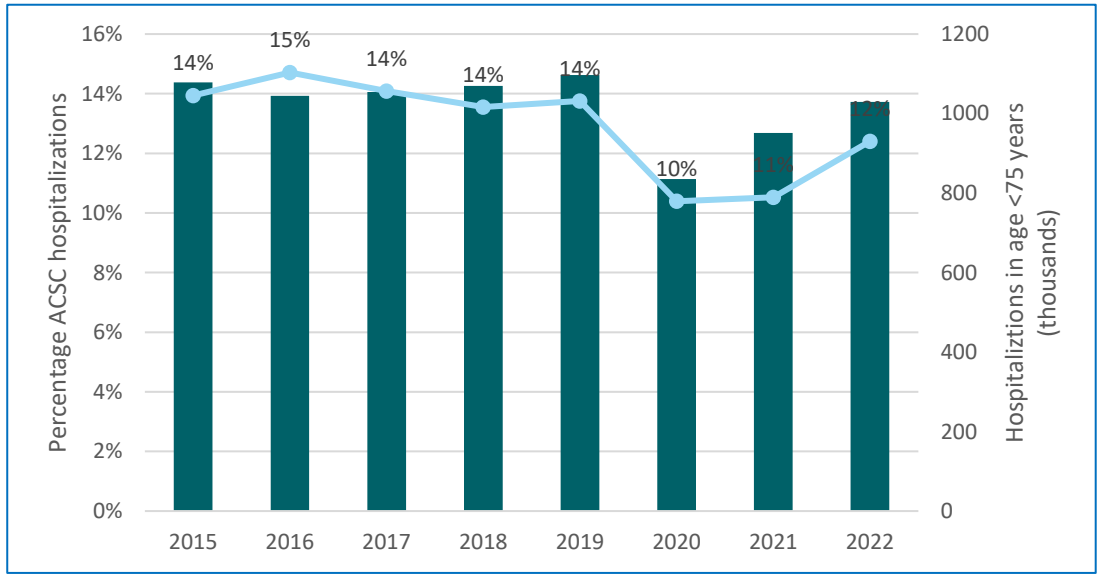
Source: Australian Commission on Safety and Quality in Healthcare. **The Fourth Atlas of Health Care Variation 2021.** https://www.safetyandquality.gov.au/sites/default/files/2021-04/fourth_atlas_2021_-_2._chronic_disease_and_infection.pdf

Number of potentially preventable COPD hospitalizations per 100,000 people of all ages, by area of patient residence, 2017-18

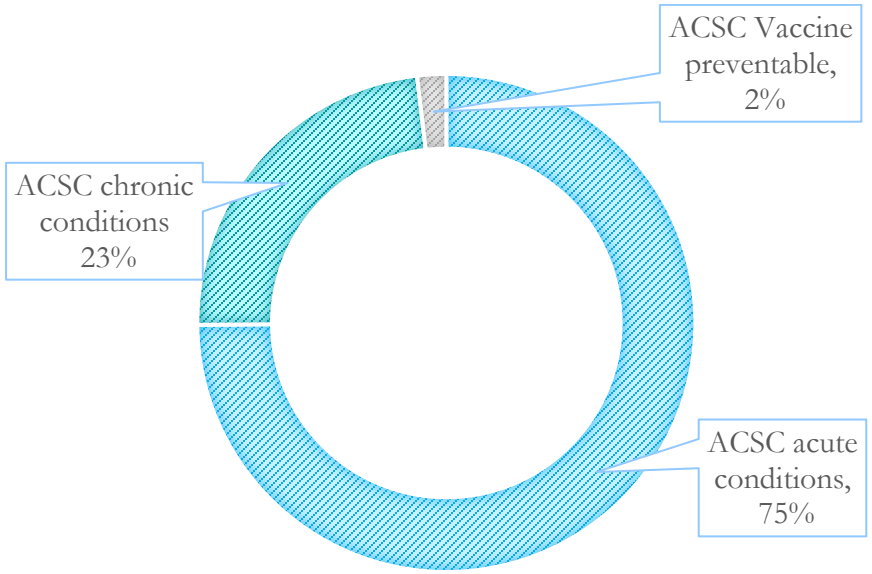


Results from ACSC Study from Ecuador

Between 2015 and 2022, 12-15% of all hospital discharges in population below 75 years of age were due to ambulatory care sensitive conditions (ACSC)



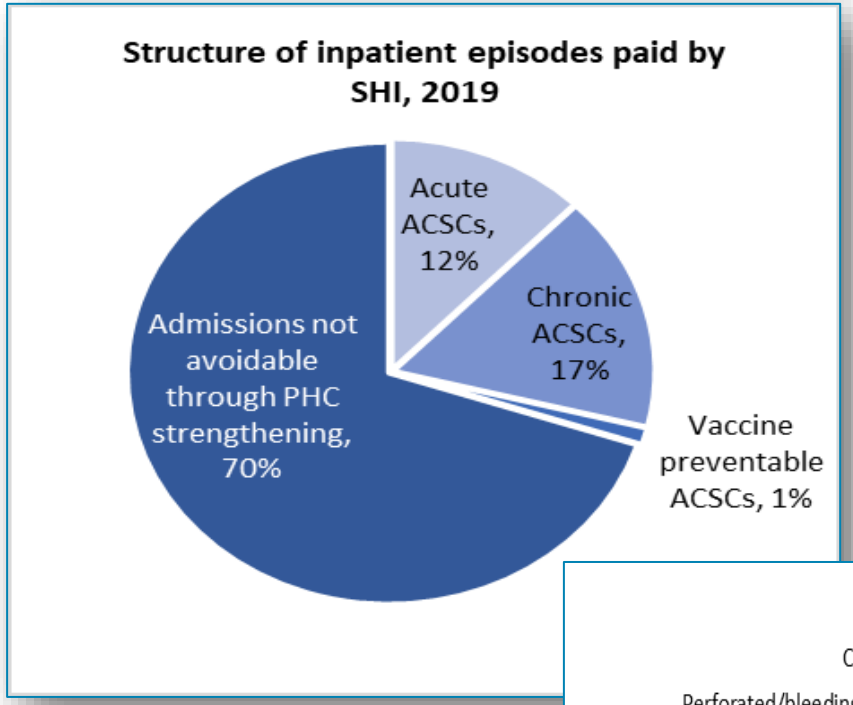
Furthermore, 75% of the ACSC related admissions are due to acute illnesses; 23% are due to chronic conditions



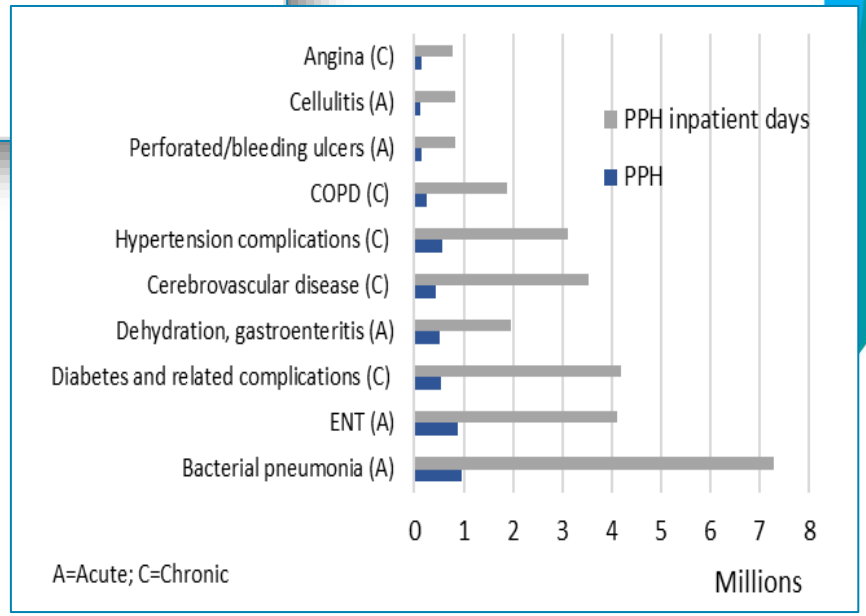
Source: Giovagnoli and Mohpal (2024). Note: Data includes all public, private and not for profit hospitals. Hospitals classified as psychiatric hospitals or addiction centers are excluded.

Results from ACSC Study from Viet Nam

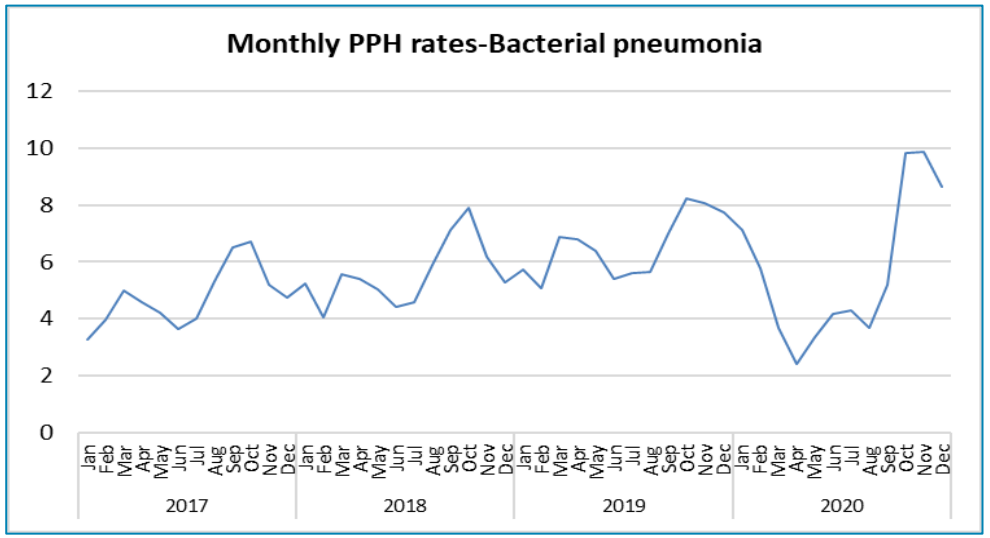
Approximately 30% of Vietnam's inpatient episodes in 2019 were potentially preventable through strengthened PHC and prevention

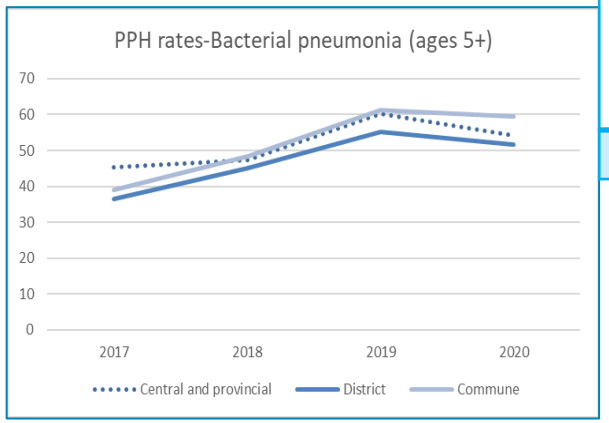


Top 10 ACSCs account for 82% of potentially preventable hospitalizations

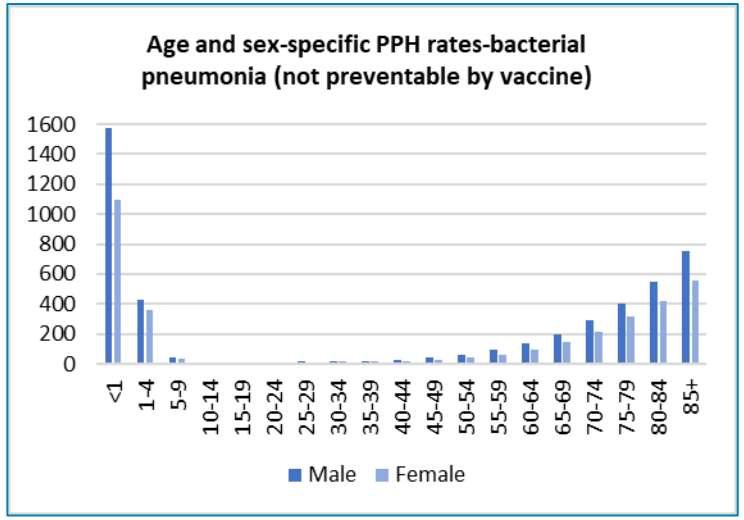


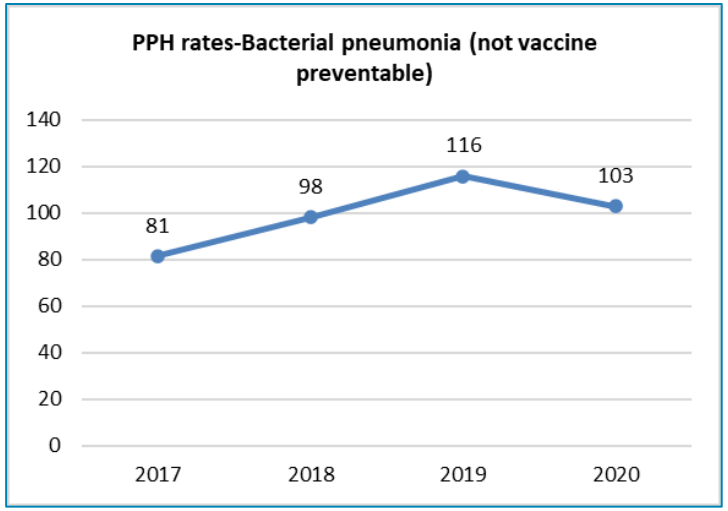
ACSC Dashboard Example: Bacterial Pneumonia in Viet Nam

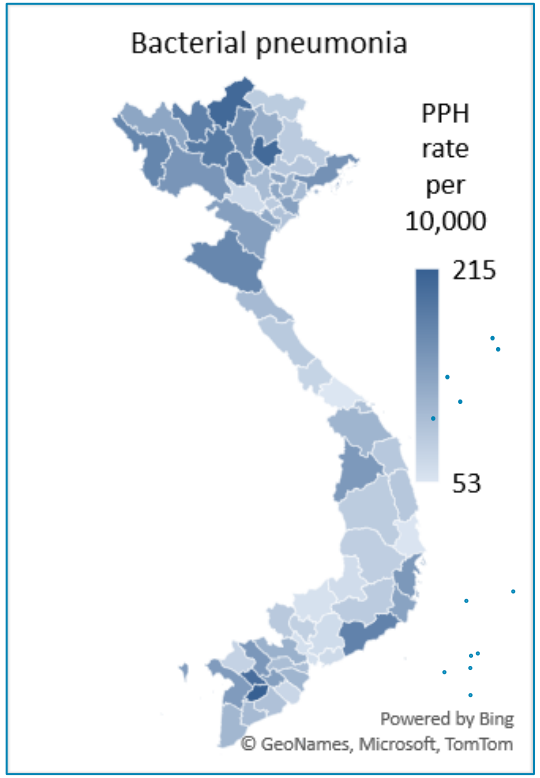




Total PPHs	Total inpatient days	Total SHI payments (billion VND)	Total patient payments (billion VND)
945,535	7,280,558	4557	445







ACSC Analysis Results Must Be Interpreted Carefully

- Hospitalizations for ACSCs are potentially preventable, but not all can be eliminated. Despite all efforts at prevention and management, some cases may still require hospitalization.
- Decades-long lags may exist between behavior and disease, such as tobacco smoking and COPD, so the ACSC outcomes today may be due to historical lack of programs and cannot be blamed on current provision of primary health care.
- ACSC hospitalizations may result from risk factors that are outside the scope of health sector interventions, such as air pollution. They may also be influenced by other factors such as insurance coverage that influence care seeking.
- Low ACSC rates may indicate effective primary healthcare services that prevent hospitalization, but they might also indicate unmet need for inpatient care services for vulnerable groups or regions. Also, reductions in ACSC may not necessarily reflect improved clinical outcomes.
- ACSC rates are a proxy indicator, *not* a direct measure of access to and quality of ambulatory care (or primary health care). Understanding why groups of people sought hospitalization for their condition and did not get ambulatory care services to avoid the hospitalization requires further investigation.
- Although some ACSCs are used in almost all health system contexts, others are specific to a country based on consultations with clinicians about which diseases are preventable or manageable with current PHC service delivery capacity.

Key Considerations

Before carrying out ACSC study, ask the following questions:

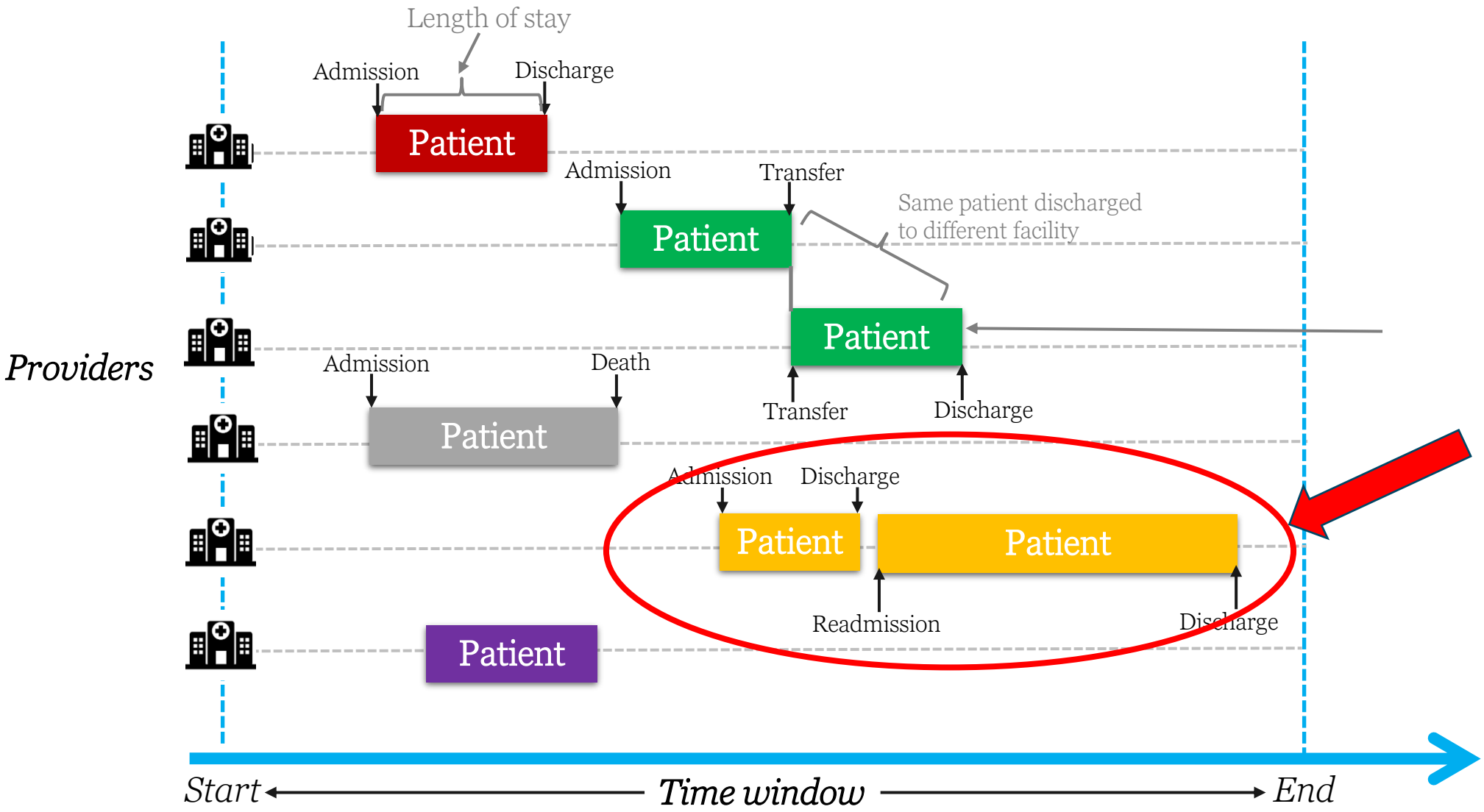
- Why do you need such studies and what they inform?
- What are the data requirement?
  - Big Data: large-scale hospitalization data increasingly collected and available
  - Minimal data requirements for ACSC methodology: diagnosis code, age, sex, and some utilization or charge data. More detailed data allows refinements.
- What are key steps involved?
  - Note: clinician consultations involving preventive and primary healthcare experts helps to identify the most preventable ACSCs and types of programs required.
- Can it be done routinely as a key performance indicator?
  - Can be used as a **key performance indicator** for identifying localities and groups in greatest need of interventions to prevent ACSC hospitalizations, and for holding localities or primary healthcare networks responsible for reducing hospitalizations for ACSCs.

Quality of Hospital Care: Readmissions & Application from India

Sheena Chhabra (Senior Health Specialist, WB)
World Bank, Global Practice on Health, Nutrition, and Population

WORLD BANK GROUP

What is a Readmission?



Why Analyze Readmissions Rates?

Unplanned hospital readmissions have been a focus of health researchers and policy-makers since 1970s

- Readmissions impose heavy burden on patients and their families, on the quality of health services and health systems in general (unnecessary care)

Readmissions are common, costly and avoidable. In the United States:

- 8.6% of all patients and 16.0% of Medicare patients were readmitted within 30 days (2016)
- Average cost of a readmission of those aged 65 was 5.3% higher than the cost of initial visit (2013)
- Studies have shown that 9% to 48% of all unplanned readmissions are avoidable

Many countries publicly report readmissions indicators as measure of quality

- CMS from the US publicly reports all-cause hospital readmission rates for pneumonia, congestive heart failure and acute myocardial infarctions
- Similarly, Australia, Canada, England, Denmark, Germany UK estimate and report condition specific readmission rates

What Counts as a Readmission Varies Across Countries

Australian Commission on Safety and Quality

- An avoidable hospital readmission occurs when a patient who has been discharged from hospital (index admission) is admitted again within a certain time interval, and
- The readmission is clinically related to the index admission
- The readmission has the potential to be avoided through improved clinical management and/or appropriate discharge planning in the index admission.
- Four conditions: acute myocardial infarction, knee replacements, hip replacements, and pediatric tonsillectomy and adenoidectomy. Time period varies

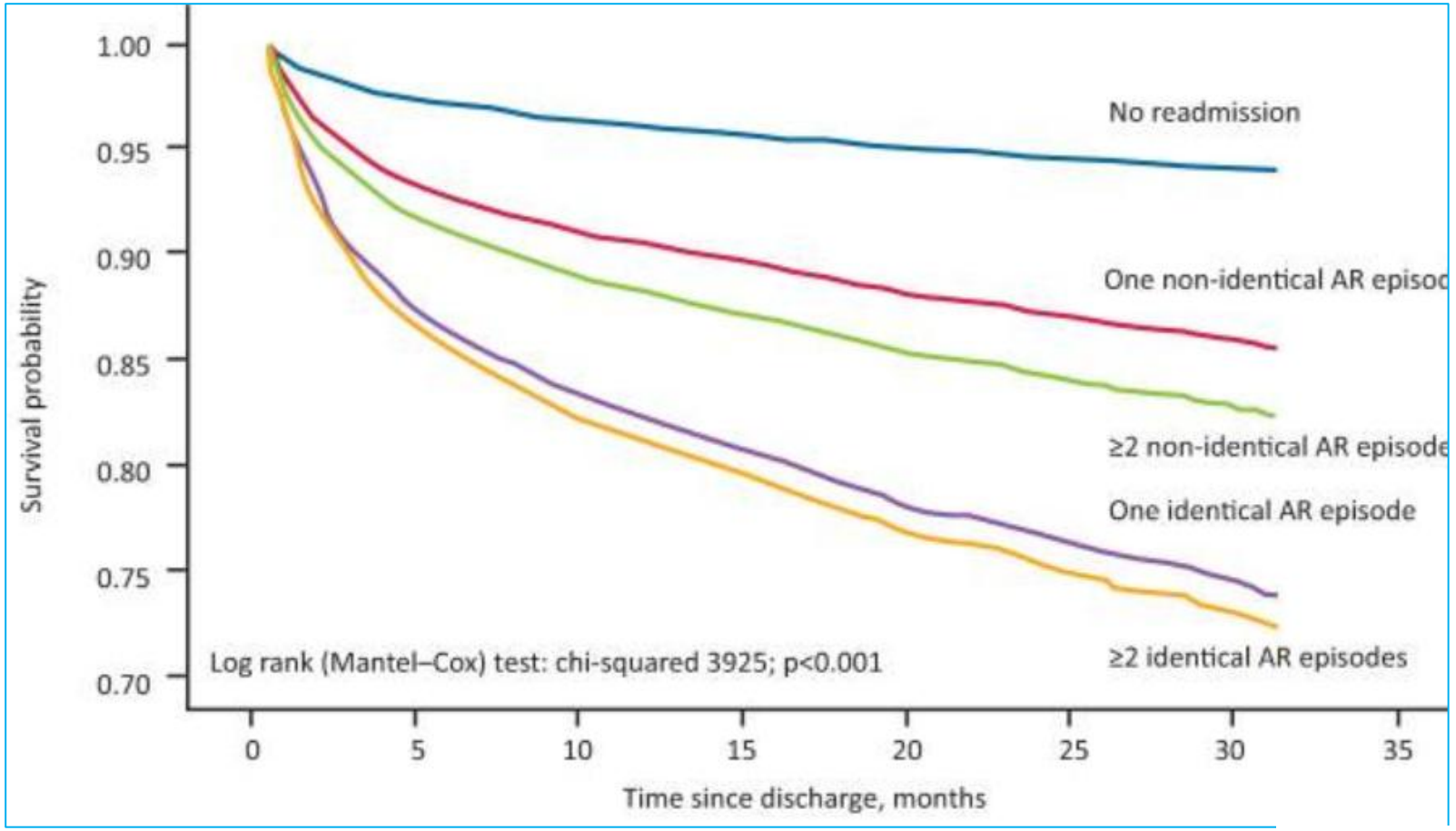
Center for Medicare and Medicaid Services, USA

- Capture unplanned readmissions that happen within 30 days of discharge from the index (i.e., initial) admission.
- The readmission measures include patients who are readmitted to the same hospital, or another applicable acute care hospital, no matter the principal diagnosis. The measures exclude some planned readmissions.
- Acute myocardial infarction (AMI), heart failure, pneumonia, chronic obstructive pulmonary disease (COPD), stroke, knee/hip replacement and coronary artery bypass graft (CABG)

National Health Service (NHS)

- Measures the percentage of emergency admissions to any hospital in England occurring within 30 days of the most recent discharge from hospital for selected medical and surgical specialties
- Admissions for cancer and obstetrics are excluded as they may be part of the patient's care plan.
- Four conditions: proximal femur, stroke, hysterectomy, primary hip replacement surgery

Readmissions Also Correlated with Higher Mortality

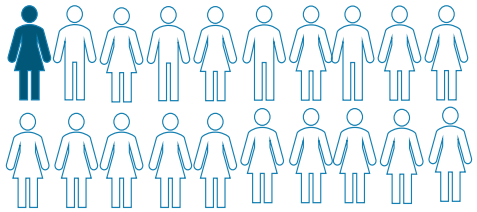


Source: Fry CH, Fluck D, Han TS. Frequent identical admission-readmission episodes are associated with increased mortality. Clin Med (Lond). 2021 Jul;21(4):e351-e356. doi: 10.7861/clinmed.2020-0930. PMID: 35192477; PMCID: PMC8313203

What Causes Readmissions?

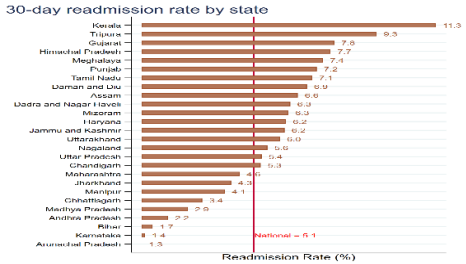
Fragmented care and coordination	• Treatment by multiple providers • Gaps in care • Lack of follow-up appointments
Discharge planning and follow-up	• Insufficient discharge planning • Poor post-discharge support • Medications management
Complex patient needs	• Age, multiple chronic conditions • Mental health issues • Lack of social support
What else?	• ? • ?

Example from India



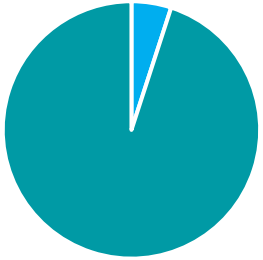
1 in 20

patients experience unplanned readmission within 30-days of discharge



11.4%

readmission rate in Neurology

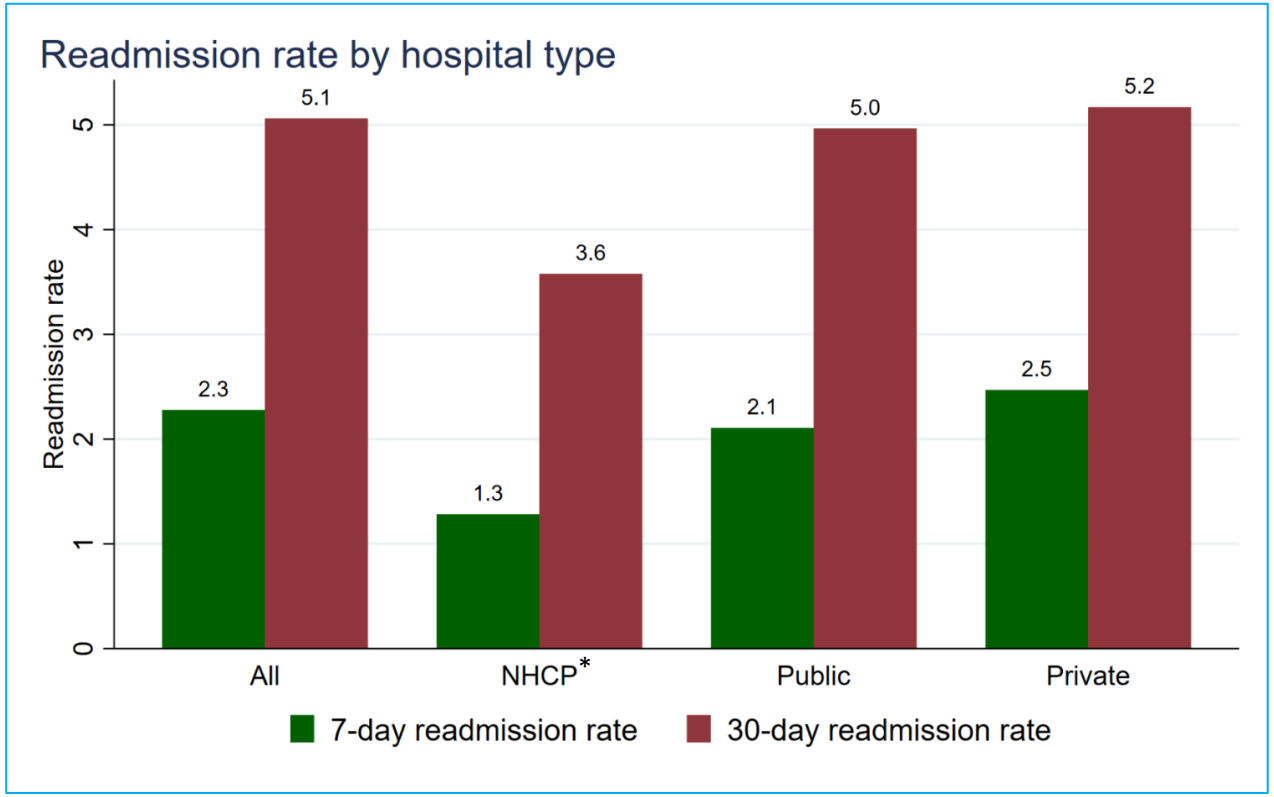


Readmission cases account for

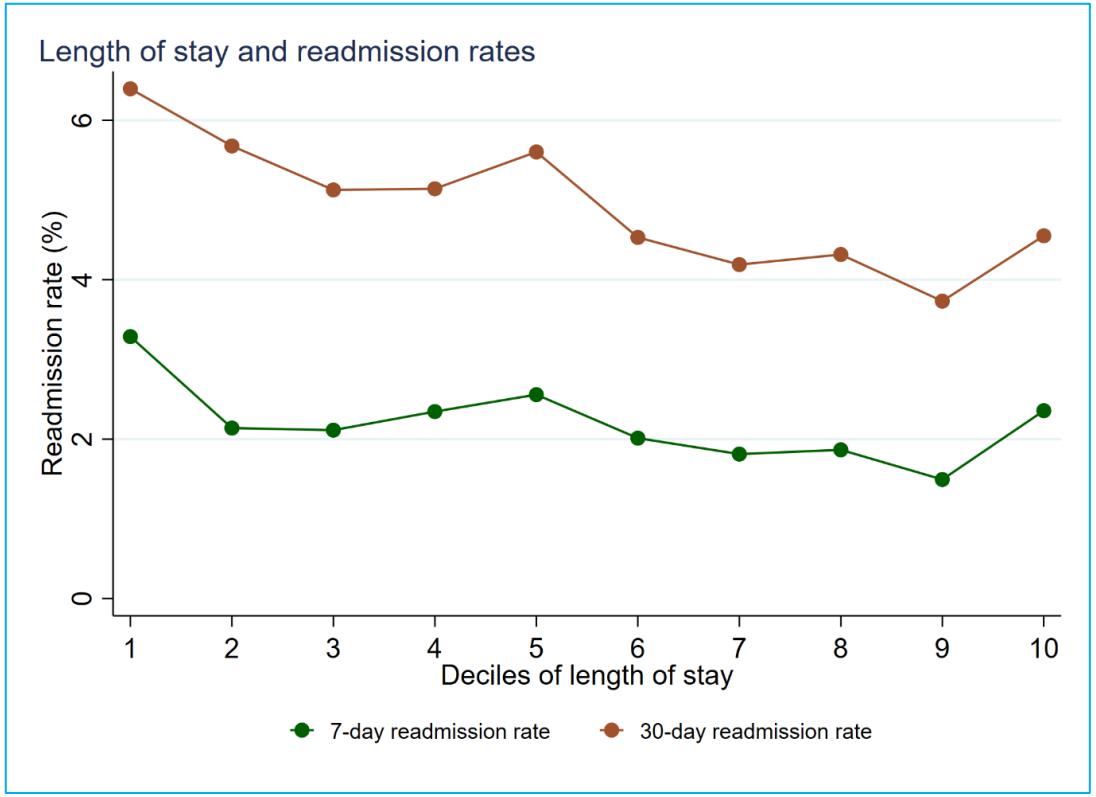
3.4 - 4.9%

of the total value of all claims

Variations in Readmission Rates



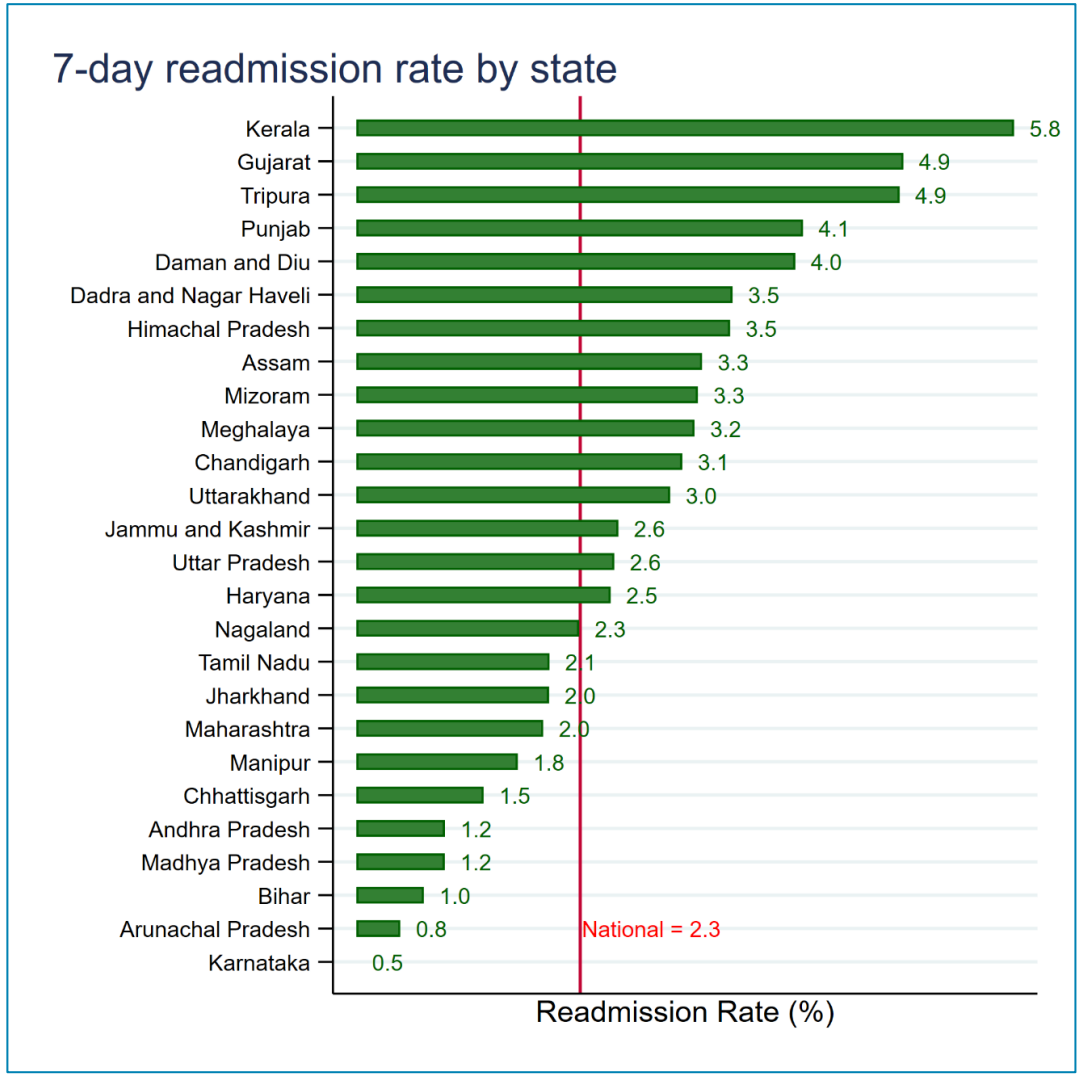
Readmission rates vary by type of hospital - Private hospitals have higher readmission rates than public hospitals

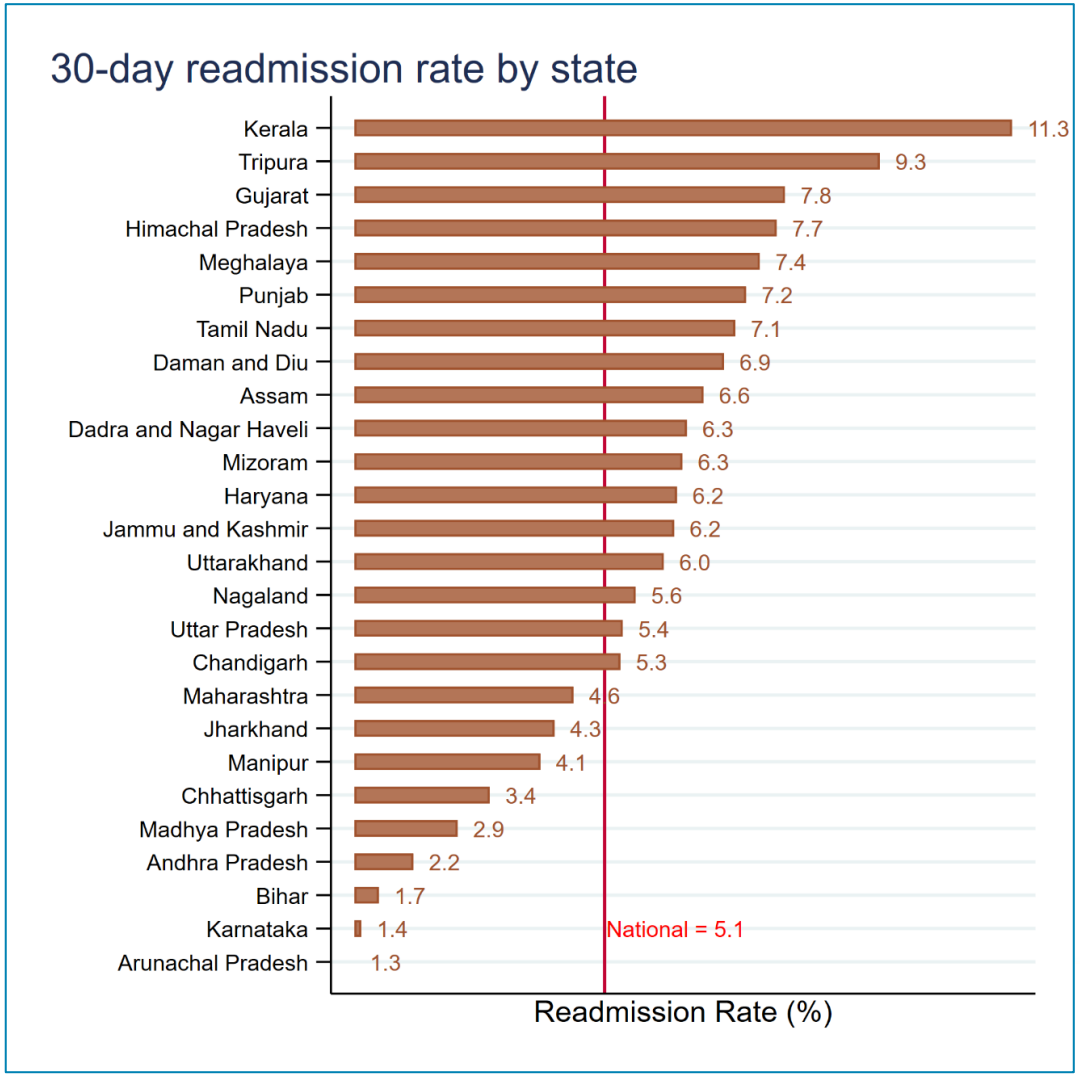


Readmission rates tend to <u>decrease</u> with length of stay

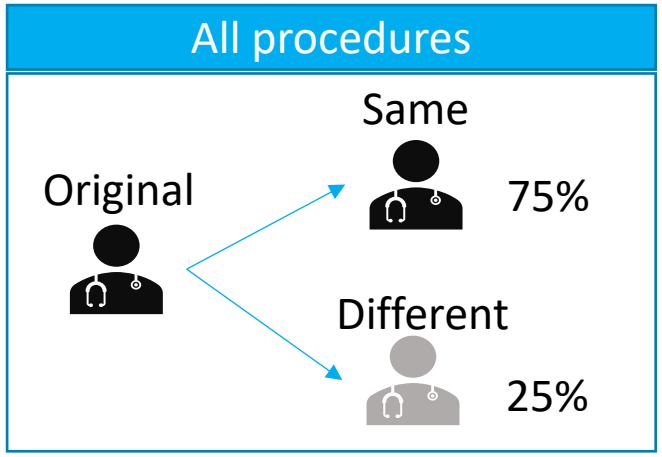
*NHCP: National Health Care Providers

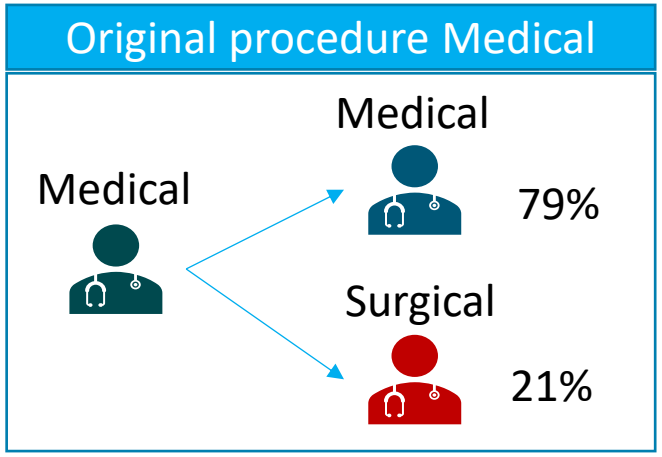
Enormous Variation in Readmission Rates by State

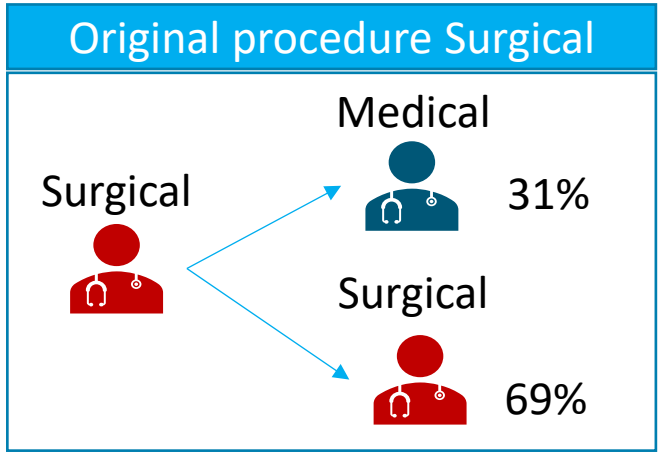


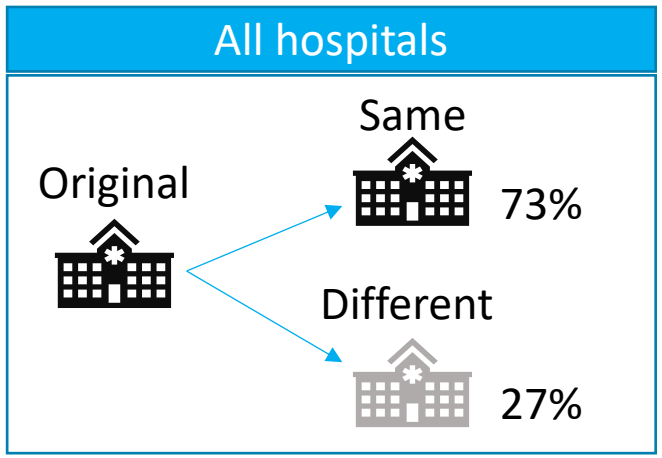


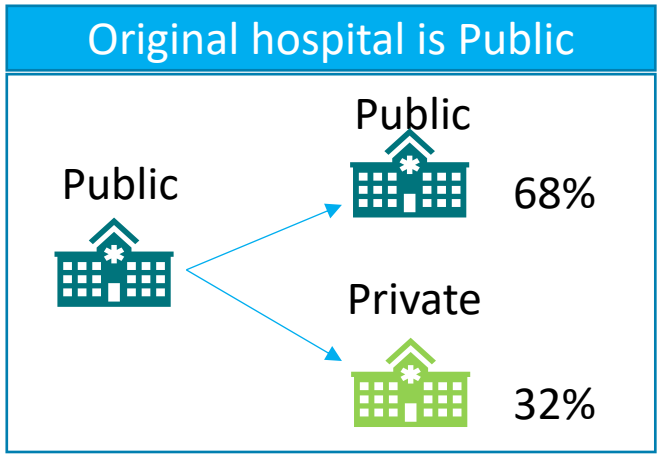
3 out of 4 Patients are Readmitted to Same Specialty
1 out of 4 Patients Switch Hospitals During Readmission

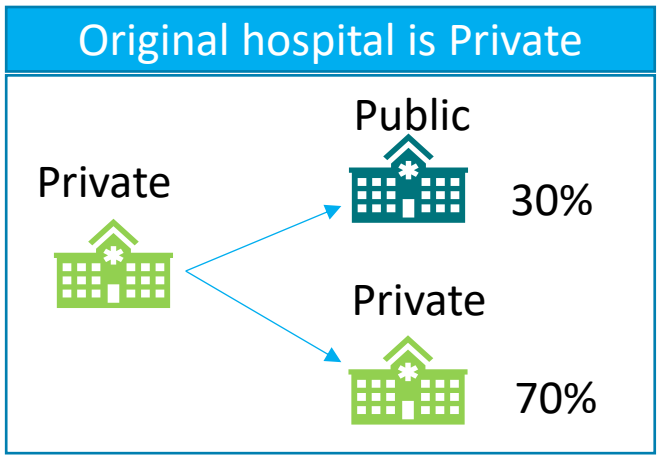




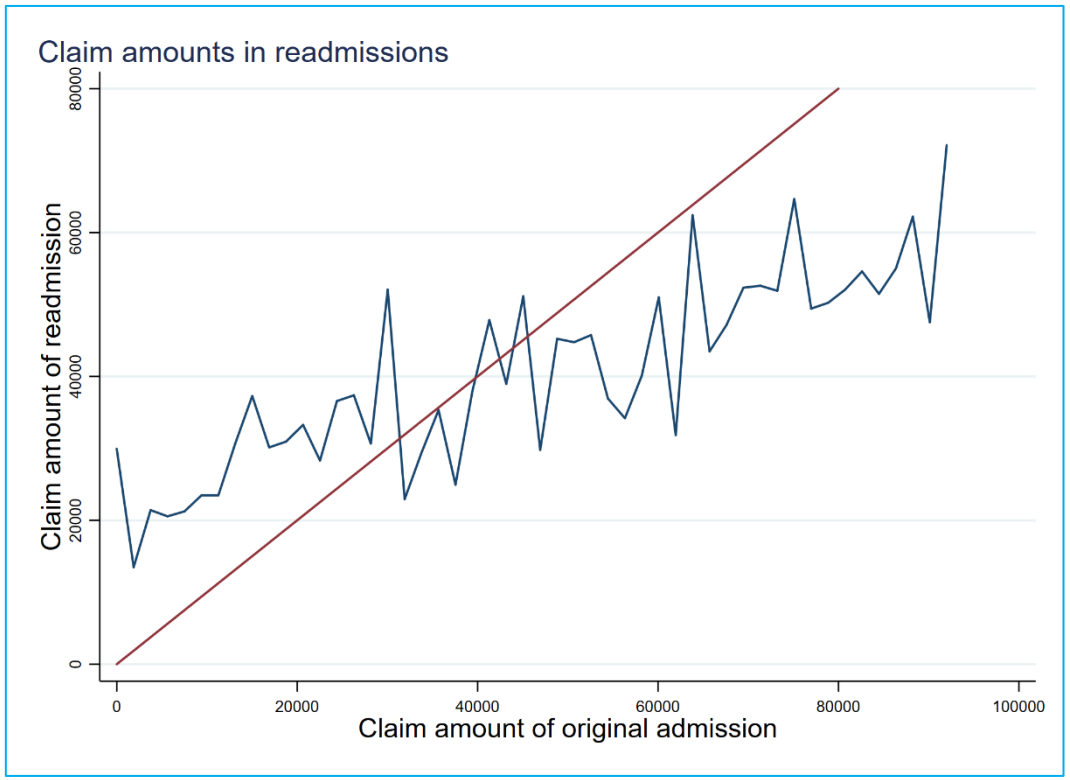


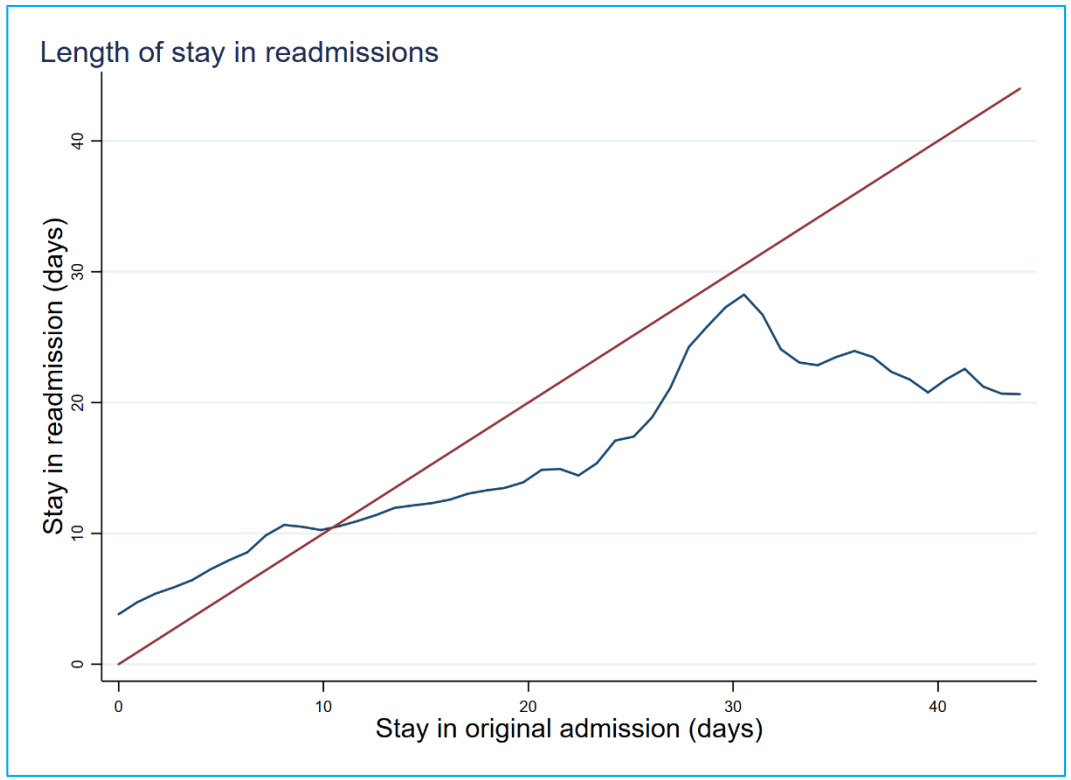






Readmissions Generate Higher Claim Amounts than Original Admission and the LOS Is Also Longer





Average claim amount of original admission = $158 (Rs.12,652)
Average claim amount of readmission = **$241 (Rs.19,295)**

Avg LOS in original admission = 6.6 days
Avg LOS in readmission = **7.5 days**

Some Key Considerations

Measurement:

Adjusting for case- and patient-mix

- Some hospitals could have higher readmission rates because they receive sicker patients
- Solution: Risk Standardized Readmission Rate (RSRR); look within conditions

Identifying "planned" and "unplanned" readmissions

- Example: *Chemotherapy* and *hemodialysis* require planned readmissions; *cataract surgeries* are performed over two sittings
- Need to carefully exclude "planned" readmissions
- Or work with tracer conditions

Some issues that are harder to address

- Instances where patients may not be readmitted but makes many ED or OP visits
- Patient dies after discharge (due to poor quality of care)

Interpretation:

Interpreting readmission rates across procedure types

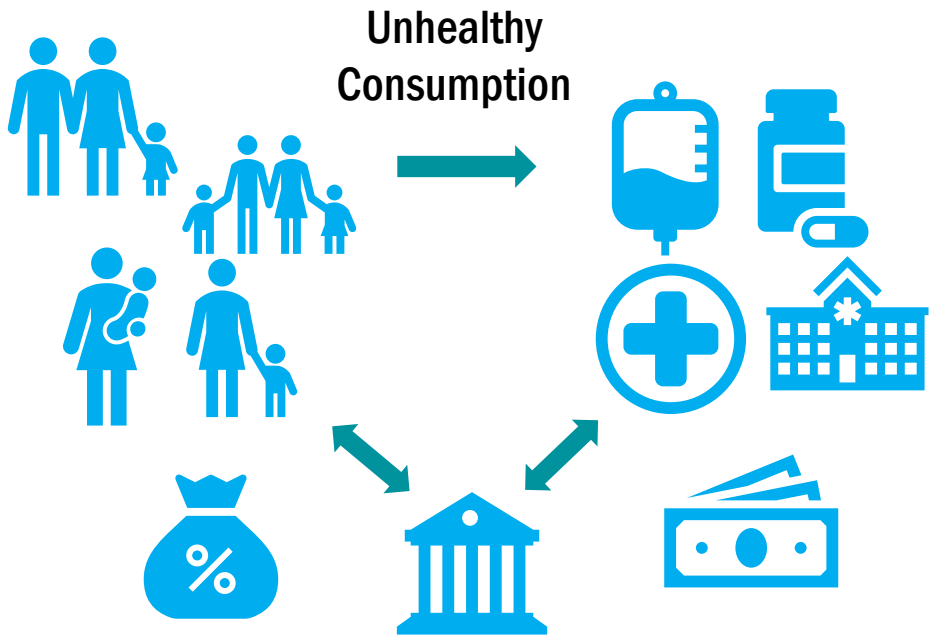
- Medical patients tend to get readmitted due to conditions related to the original diagnosis
- Surgical patients tend to get readmitted due to complications during surgery or post-op care
- Example: *gastroenteritis* vs. *fracture of the tibia*

Estimating Health Costs of Smoking

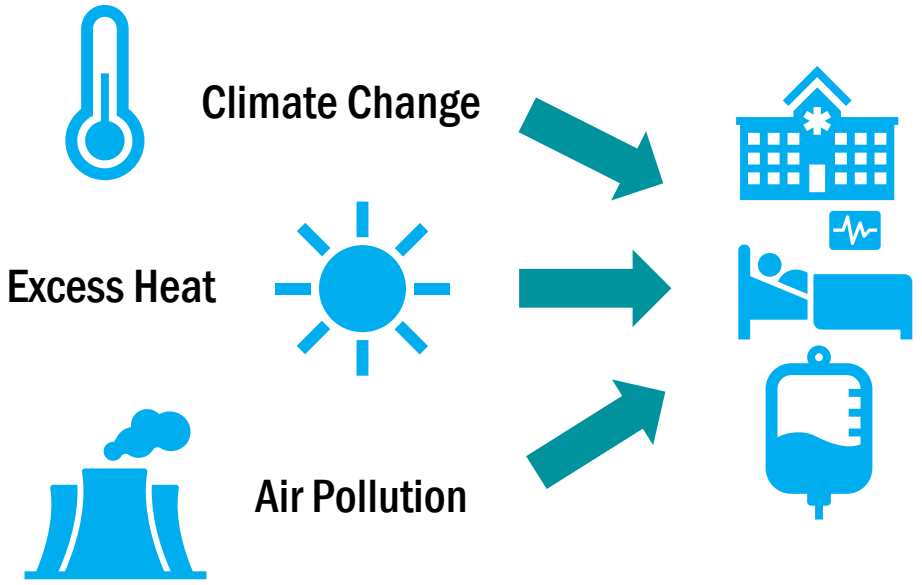
Hideki Higashi (Senior Health Economist) and **Pandu Harimurti** (Senior Health Specialist)
World Bank, Global Practice on Health, Nutrition, and Population

Examples of Claims Data Analytics: Risk Factors

Making the case for introducing/expanding health taxes



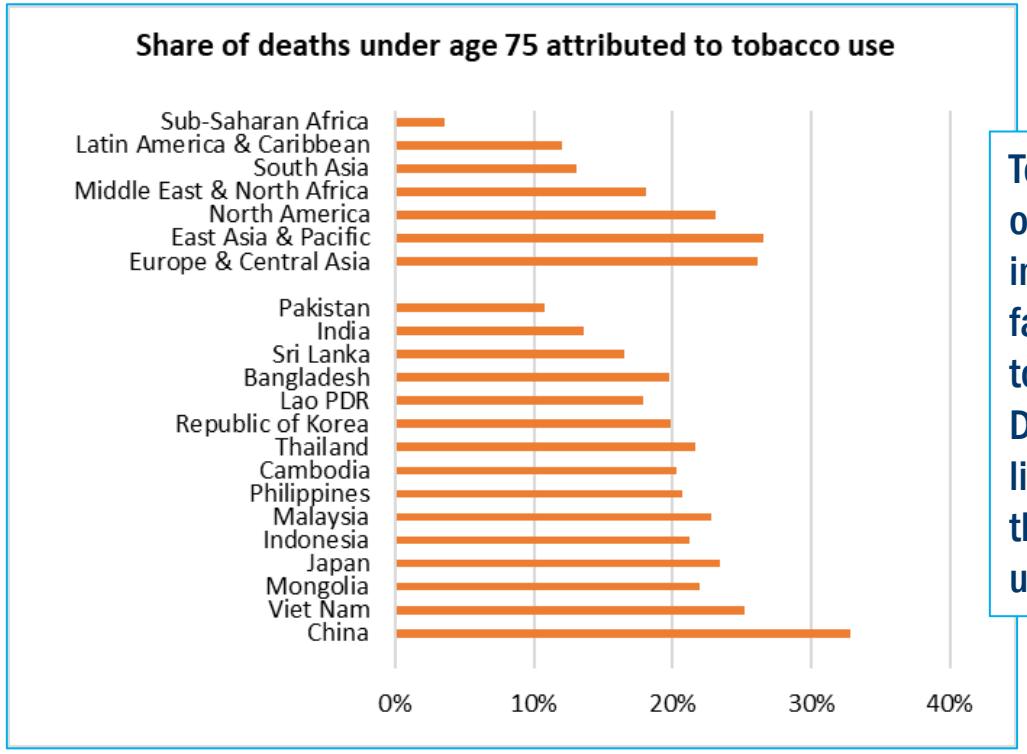
Risk multiplicative impact of climate change



Why Do We Care About Smoking?

Health burden from smoking

- Tobacco kills up to half of its users who don't quit.
- Tobacco kills more than 8 million people each year, including an estimated 1.3 million non-smokers who are exposed to second-hand smoke.



Tobacco use is one of the most important risk factors contributing to total deaths and Disability adjusted life years (DALYs) in the population under age 75.

Financial costs of smoking

- Higher out-of-pocket spending by households due to increased morbidity
- Higher indirect costs due to lower productivity and premature mortality
- Increasingly higher costs to the public health financing system

Smoking attributable diagnoses (ICD codes)

Share of disease burden attributable to smoking (Population Attributable Fraction or PAF)

→ *Share of hospitalizations & costs attributable to smoking*

Source: https://www.who.int/news-room/fact-sheets/detail/tobacco; IHME Global Burden of Disease Study-Results Tool.

Many Studies Estimated Direct & Indirect Costs of Tobacco Using Surveys Or Patient Records

Trend analysis of smoking-attributable hospitalizations in Thailand, 2007–2014

Roengrudee Patanavanich[1], Wichai Aekplakorn[1], Paibul Suriyawongpaisal[1]

Economic burden of lung cancer attributable to smoking in China in 2015

Ju-Fang Shi [1], Cheng-Cheng Liu [1], Jian-Song Ren [1], Mark Parascandola [2], Rong Zheng [3], Wei Tang [4], Hui-Yao Huang [1], Fang Li [5], Le Wang [1], Kai Su [5], Ni Li [1], Kai Zhang [6], Wan-Qing Chen [1], Ning Wu [4], Xiao-Nong Zou [7], Guo-Xiang Liu [8], Min Dai [1]

Healthcare Costs Attributable to Secondhand Smok Exposure Among Indian Adults

Rijo M. John PhD[1], Estelle P. Dauchy PhD[2]

[1]Rajagiri College of Social Sciences, Kochi, Kerala, India
[2]International Research, Campaign for Tobacco-Free Kids, Washington, DC, USA

Corresponding Author: Rijo M. John, PhD, Adjunct Professor, Rajagiri College of Social Scienc... Kochi 682104, Kerala, India. Telephone: +91-7742811617
E-mail: rmjohn@gmail.com

Direct and indirect costs of smoking in Vietnam

Pham Thi Hoang Anh [1], Le Thi Thu [1], Hana Ross [2, 3], Nguyen Quynh Anh [4], Bui Ngoc Linh [4], Nguyen Thac Minh [5]

Correspondence to Dr Pham Thi Hoang Anh, Postal address: HealthBridge Foundation of Canada, Rooms 202 & 203, Building E4, TrungTu Diplomatic Compound, No. 6 Dang Van Ngu street, Dong Da district, Hanoi 0084, Vietnam; phanh@healthbridge.org.vn

예방의학회지 제40권 제3호(2007년 5월)
J Prev Med Public Health 2007;40(3):227-232

Medical Expenditure of National Health Insurance Attributable to Smoking among the Korean Population

Sang-Yi Lee, Sun Ha Jee[1)2)3)], Ji Eun Yun[3)], Su-Young Kim[4)], Jakyung Lee[1)], Jonathan M Samet[5)], Il Soon Kim[6)]

Economic Costs of Diseases and Deaths Attributable to Tobacco Use in India, 2017–2018

Rijo M. John PhD[1], Praveen Sinha PGDM[2], Vineet Gill Munish PGDBM[2], Fikru T. Tullu PhD[2]

[1]Health Economist and Independent Researcher, Kerala, India; [2]World Health Organization India Country Office, New Delhi, India

Measuring Health Costs of Tobacco Use Using Health Insurance Claims

Economic costs of tobacco-attributable disease include three components:

1. Direct healthcare costs

Societal (health insurance, government, household) spending on medical care for diseases attributed to smoking. [HI claims data can be useful to estimate this component]

2. Productivity costs

Evaluate value of lost work days due to tobacco-attributed illness.[HI claims data can be used to estimate work days lost when seeking insured health care]

3. Mortality costs

Measure the present value of lifetime earnings of people who die during the year from tobacco-attributed illness [Other data are used for this calculation].

Estimating Direct Health Costs Using Health Insurance Claims Data

Step 1: Determine which diseases are attributed to smoking using the global evidence base (The Lancet, IHME, Surgeon general of the United States,…

Step 2: Identify these diseases in your country's health insurance claims data using ICD-10 codes (IHME lists the codes related to each disease)

Step 3: Extract relevant information on total cases, admissions, outpatient visits, length of stay and costs for each of these diseases from claims data

Step 4: Determine the share of these diseases that is attributable to tobacco use (population attributable fraction-PAF)

Step 5: Estimate the direct health costs attributed to smoking

Identify Tobacco-Attributed Diseases

Spatial, temporal, and demographic patterns in prevalence of smoking tobacco use and attributable disease burden in 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019

GBD 2019 Tobacco Collaborators † • Show footnotes

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Health Outcome	Age Group	Sex	Dose	Relative Risk
Tuberculosis	All Ages	Both	0 Cigarette-Equivalents	1·00 (1·00–1·00)
Tuberculosis	All Ages	Both	9 Cigarette-Equivalents	2·07 (1·60–2·55)
Tuberculosis	All Ages	Both	18 Cigarette-Equivalents	2·31 (1·81–2·92)
Tuberculosis	All Ages	Both	27 Cigarette-Equivalents	3·03 (2·31–3·97)
Tuberculosis	All Ages	Both	36 Cigarette-Equivalents	4·01 (2·49–5·99)
Lower respiratory infections	All Ages	Both	0 Cigarette-Equivalents	1·00 (1·00–1·00)
Lower respiratory infections	All Ages	Both	1.5 Cigarette-Equivalents	1·32 (1·00–1·79)

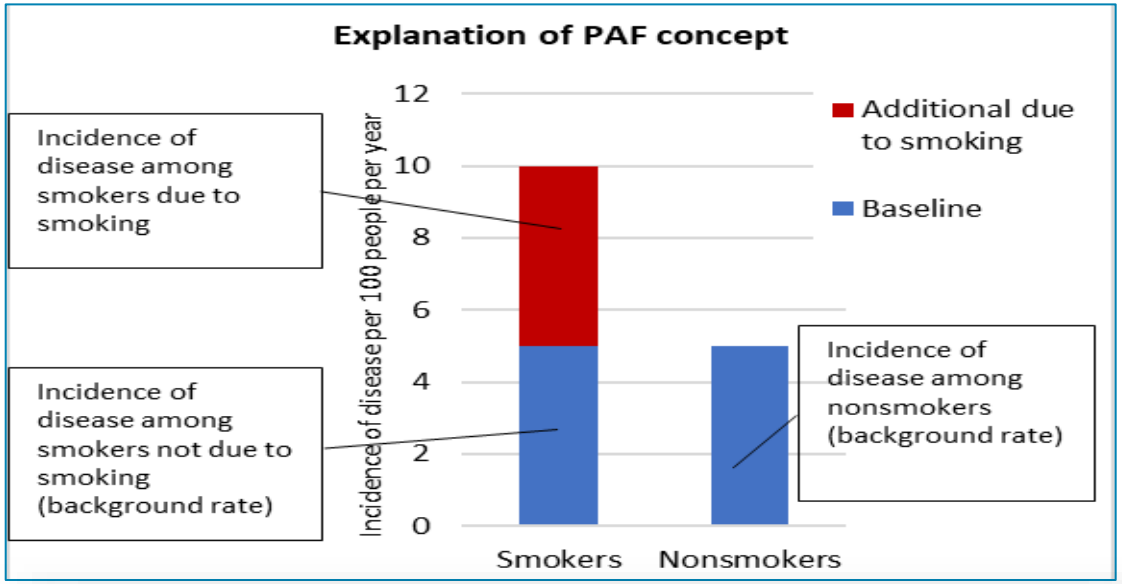
List of more than 30 diseases attributable to direct smoking and additional diseases attributable to secondhand smoke.

ICD10 diagnosis codes are available for each disease.

Understanding & Estimating Population Attributable Fraction (PAF)

- For each disease, sex and risk factor, the PAF is the ratio of:
  - Red area (disease among smokers due to smoking) divided by
  - Blue area (total disease among smokers and non-smokers, including cases attributed to risk factors other than smoking).

- Use of this method avoids overestimating the smoking-attributable burden.

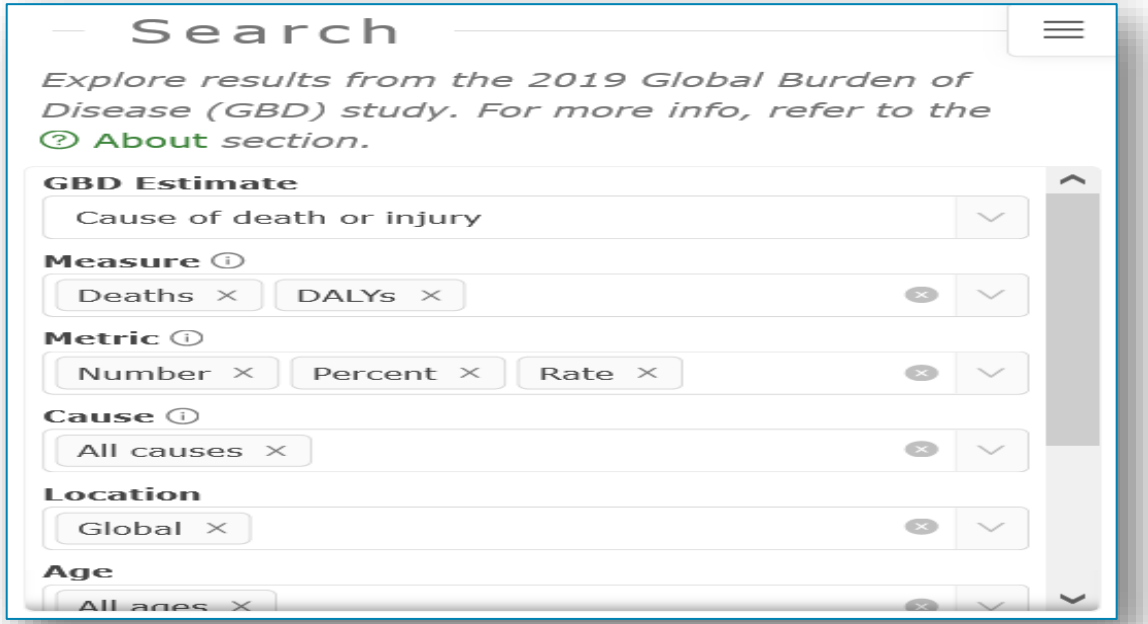


IHME estimates for each country:

1. total DALYs attributed to tobacco use for specific diseases (d).
2. total DALYs for the same diseases (d).

$$Proxy\ PAF_d = \frac{Total\ tobacco{-}attributed\ DALYs_d}{total\ DALYs_d}$$

Proxy PAF is calculated separately for each disease (d) and sex.
It can also be calculated for each age group.



Rosen L. An intuitive approach to understanding the attributable fraction of disease due to a risk factor: the case of smoking. international Journal of Environmental Research and Public Health. 2013

Calculation is Straightforward (Viet Nam Example)

Disease	PDx (list of ICD-10 codes)	Sex	Lung cancer DALYs attributed to smoking	Total lung cancer DALYs	Proxy PAF (4)/(5)	Total SHI payments by disease	SHI payments for diseases attributed to smoking (6)x(7)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lung cancer	C33, C34-C34.92, Z12.2, Z80.1-Z80.2, Z85.1-Z85.20	Male	360,521	496,426	0.726	32 million USD	23 million USD
Stroke	G45-G46.8, I60-I62, I62.9-I64, I64.1, I65-I69.998, Z82.3	Male	672,451	1,940,769	0.346	48 million USD	17 million USD
...							

Estimates of health costs attributed to smoking can inform policymakers and smokers about the hidden costs of smoking and spur action

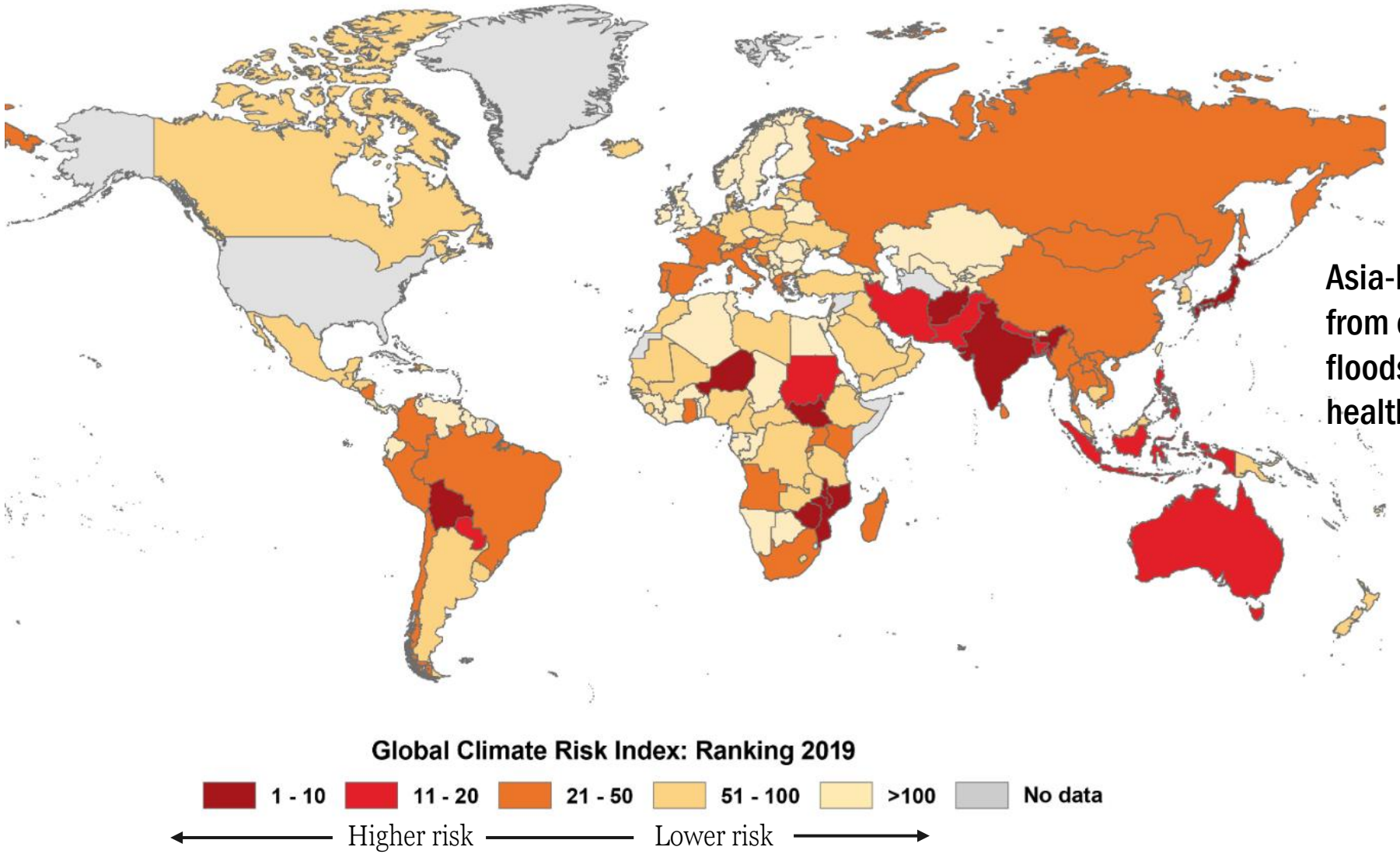
Conclusion

- Estimates of the health costs attributed to tobacco use can provide a strong impetus for action to strengthen tobacco control activities.
- Health insurance claims data is a readily available source of data that can be used to make up-to-date estimates of direct healthcare costs of tobacco use and monitor trends.
- Analysis of PM-JAY data could provide estimates to know the burden of smoking on this important government health financing scheme.
- These methods can easily be adapted to estimate direct healthcare costs of other risk factors to health, such as alcohol use, unsafe sanitation, or uncontrolled high blood pressure.

Climate Change & Health: Extreme Heat & Hospitalization

Jacopo Gabani (Health Economist, WB) & **Ajay Tandon** (Lead Economist, WB)
World Bank, Global Practice on Health, Nutrition, and Population

A Changing Climate

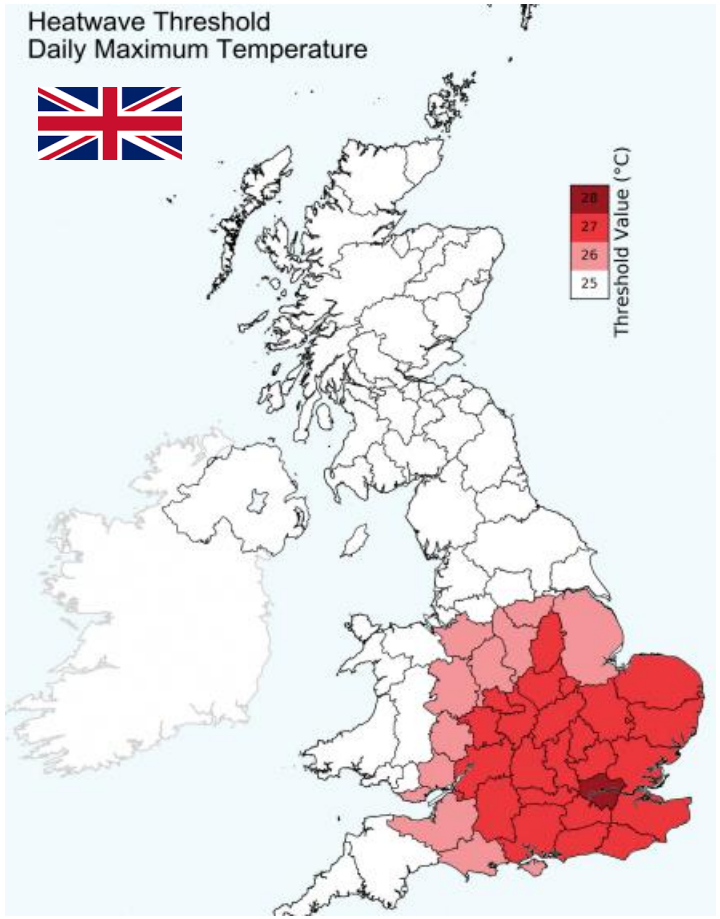


Asia-Pacific at high risk of impact from climate change – storms, floods, heatwaves – and from health effects of climate change

Source: Germanwatch

Different Definitions of Extreme Heat

Apparent Temperature (AT) = −2.653 + (0.994 × mean temperature) + 0.0153 × (dew point^2); Two or more consecutive days when the daily mean AT was above 90°F (32.2°C) and exceeded the 95th percentile of historical temperatures



The Intergovernmental Panel for Climate Change (IPCC) defines a heatwave as 'a period of abnormally hot weather, often defined with reference to a relative temperature threshold, lasting from two days to months'

France: Maximum temperature >30°C

Korea: Maximum temperature >33°C

The World Meteorological Organization (WMO) defines a heat wave as a period during which the daily maximum temperature exceeds for more than five consecutive days the maximum normal temperature by 9 degrees Fahrenheit (5 degrees Celsius), the normal period being defined as 1961–1990

A. Based on Departure from Normal (normally observed temperatures for that period)
- Heatwave: Departure from normal is 4.5°C to 6.4°C
- Severe Heatwave: Departure from normal is >6.4°C

B. Based on Actual Maximum Temperature
- Heatwave: When actual maximum temperature ≥ 45°C
- Severe Heatwave: When actual maximum temperature ≥47°C

Using Claims to Help Health Respond to Climate Change:
Heat and Healthcare Utilization Example from Indonesia

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RESEARCH ARTICLE

Health Economics WILEY

Temperature and non-communicable diseases: Evidence from Indonesia's primary health care system

Manuela Fritz[1,2]

[1]School of Business, Economics and Information Systems, University of Passau, Passau, Germany
[2]Department of Economics, Econometrics and Finance, University of Groningen, Groningen, The Netherlands

Correspondence
Manuela Fritz, School of Business, Economics and Information Systems, Chair of Development Economics, University of Passau, Passau 94032, Germany.
Email: manuela.fritz@uni-passau.de

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Abstract

Climate change induced rising temperatures will pose a detrimental threat to decent health in the coming decades. Especially at risk are individuals with chronic diseases, since heat can exacerbate a variety of health conditions. In this article, I examine the heat-morbidity relationship in the context of Indonesia, focusing on chronic, non-communicable diseases, namely diabetes, cardiovascular and respiratory diseases. Using a novel dataset from the Indonesian national health insurance scheme Jaminan Kesehatan Nasional/Badan Penyelenggara Jaminan Sosial (BPJS) and linking it with meteorological data on the daily-district level, I estimate the causal effect of high temperatures on the daily number of primary health care visits. The results show that on a hot day all-cause visits and visits with a diagnosis of diabetes and cardiovascular diseases increase by 8%, 25% and 14%, respectively. These increases are permanent and not offset by visit displacement or 'harvesting'. Visits related to respiratory diseases seem not to be affected by high temperatures. I use several climate change scenarios to predict the increase in visits and costs by the end of the century, which all forecast a substantial financial burden for the health care system. These results might have relevance for other middle-income countries with similar climatic conditions.

KEYWORDS
climate change, health, Indonesia, JKN/BPJS kesehatan, non-communicable diseases, temperature

JEL CLASSIFICATION
I10, I13, I18, Q50, Q51, Q54

How does daily mean temperature affect the number of daily all-cause and NCD-specific health visits, focusing on diabetes, cardiovascular diseases, and chronic respiratory diseases?

- Fourth-largest country in terms of population (~277 million) following India, China, USA.
- Single-payer social health insurance system with three-fourths of population covered under *Jaminan Kesehatan Nasional* (JKN) which is administered by BPJS.
- Decentralized to district level.
- Climate almost entirely tropical. Temperatures on land remain fairly constant, with coastal plains averaging 28°C (82 °F), inland and mountain areas averaging 26°C (79°F), and higher mountain regions, 23°C (73 °F)
- Main variable of Indonesia's climate is not so much temperature or air pressure, but rainfall.

Methods & Data

Weather data:

SA-OBS dataset (Version 2.0), gridded daily meteorological dataset for Southeast Asian region by Southeast Asian Climate Assessment & Dataset Project (SACA&D) which combines data from 3,914 meteorological stations throughout Southeast Asia

Daily rainfall, humidity, wind speed, air pollution (NASA data, satellite and observational based)

Mean temperature (°C)	26.76
Temperature bins (°C)	
<21°	0.01
21°–22.5°	0.02
22.5°–24°	0.06
24°–25.5°	0.14
25.5°–27°	0.25
27°–28.5°	0.32
28.5°–30°	0.18
>30°	0.02

Proportion of days in a year with temperature in specified range

ICD-10-codes for the respective visit categories:

E10-E14 for diabetes-related visits

- E10 Type 1 diabetes mellitus
- E11 Type 2 diabetes mellitus

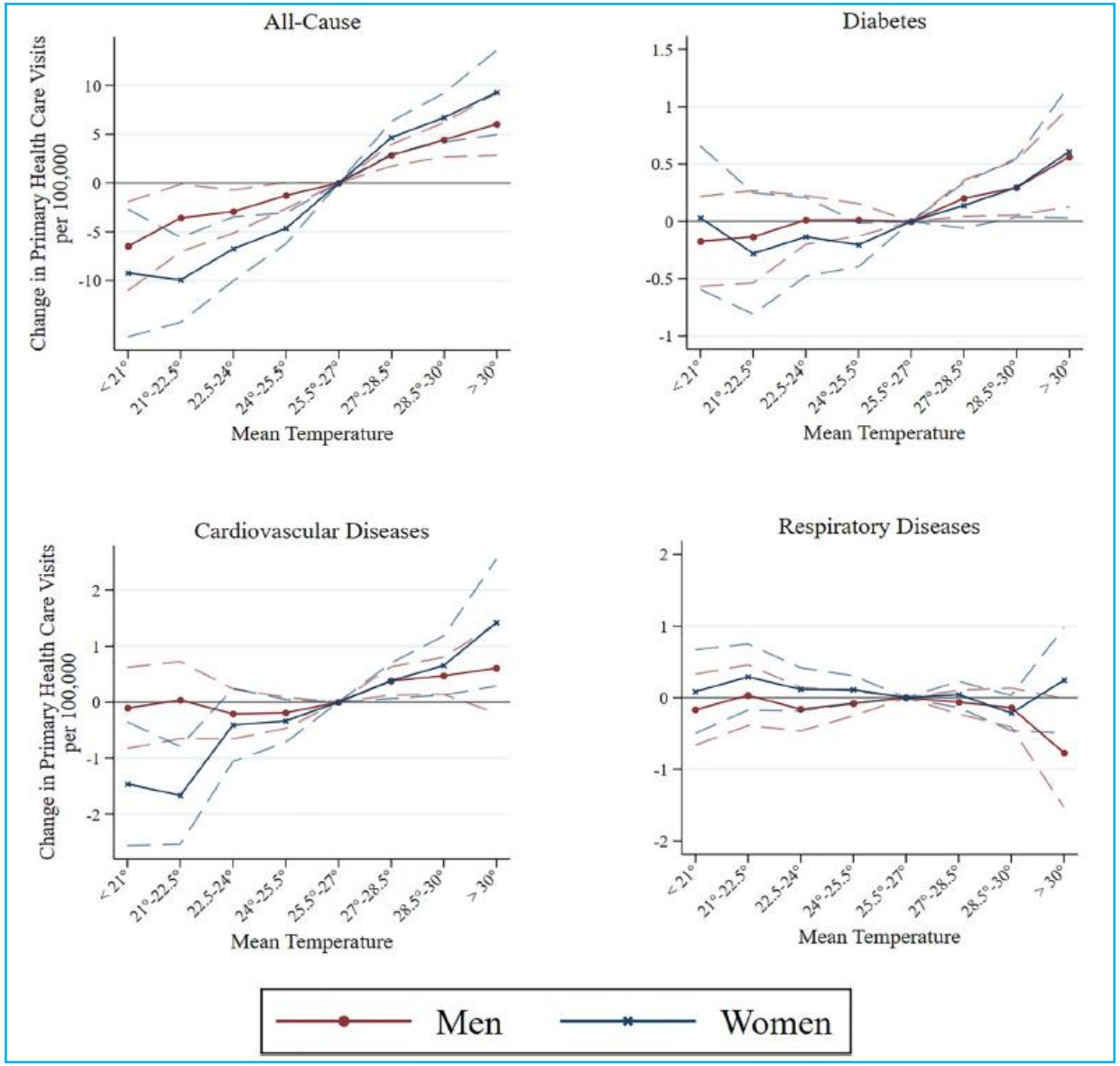
I00-I99 for cardiovascular diseases

- I10 Essential (primary) hypertension
- I46 Cardiac arrest
- I64 Stroke, not specified

J30-J99 for chronic respiratory diseases

- J45 Asthma
- J60-J70 Lung diseases due to external agents

Results



- Results confirm high temperatures increase the health burden at health facilities as heat-induced morbidity significantly increases health care usage.
- On days with mean temperature above 30°C, numbers of daily all-cause, diabetes, and cardiovascular disease visits increase by 8%, 25%, and 14%, respectively, compared to a reference day with mean temperature between 25.5-27°C.
- Even though Indonesia is a country where high temperatures prevail and residents are used to heat and high humidity, the heat-morbidity relationship is a factor in people's health care seeking behavior.

Policy Implications

- Establish links with local meteorological services to receive early information and warnings of impending heat.
- Individual early warning systems, for example, in the form of alerting weather apps, can provide timely information.
- This would allow for a timely response by physicians and general practitioners in the form of increased and disease-specialized staff during days with excessive temperatures.
- Individuals affected by a chronic disease should be sensitized to the risks of heat. Possible interventions could include the provision of educational material/coping information.

Audience Questions?

Closing Remarks

Results from ACSC Study from Ecuador

Further insights by analyzing deeper the distributions:

- **Among children**, nearly a third of ACSC hospitalizations due to acute gastroenteritis → strengthen prevention, healthy behaviors and primary care
- **Among women** aged 18-35 years, nearly half of all ACSC hospitalizations due to conditions related to pregnancy → strengthen antenatal care
- **Among adults** between 50-75 years, a quarter of ACSC hospitalizations due to diabetes → strengthen prevention and primary care

Distribution of ACSC by diagnosis, age and sex - 2019

Descripcion (CIE10)	H	M	H	M	H	M	H	M	H	M
	Menor de 18		18-35		36-50		50-75		Total	
Gastroenteritis infec	38.3	31.9	18.0	7.9	11.1	10.4	5.5	8.6	22.8	17.6
Diabetes mellitus	0.5	0.7	8.7	2.6	22.4	13.1	28.2	25.6	12.5	8.7
Infección de la piel	11.5	8.4	17.6	3.1	12.9	6.0	7.2	5.3	11.0	6.0
Neumonía bacteriana	13.2	10.4	4.5	1.2	4.0	2.0	4.4	4.7	8.5	5.7
Infección renal y de vias ur	4.9	18.5	7.9	17.1	9.0	25.8	10.6	19.5	7.5	19.3
Úlcera del aparato di	0.9	0.5	10.9	1.1	13.2	3.4	12.8	8.1	7.1	2.9
Enf. de las vías resp	9.1	6.4	2.2	0.8	2.2	2.1	5.0	4.8	6.3	4.1
Epilepsia	6.1	5.4	7.1	2.4	4.2	2.5	1.6	1.3	4.6	3.3
Infecciones de oídos,	7.1	5.6	4.5	1.6	1.8	1.7	0.7	0.8	4.2	3.0
Infecciones prevenible	1.1	0.8	11.1	1.3	5.9	1.9	2.3	1.2	3.1	1.1
Insuficiencia cardíac	0.3	0.1	1.7	0.5	3.5	1.8	7.8	6.5	3.1	2.0
Hipertensión	0.1	0.1	1.7	0.6	4.0	3.2	6.6	6.7	2.8	2.2
Insuf. cardíaca conge	0.0	0.0	0.6	0.1	3.6	1.1	5.8	3.4	2.3	1.0
Asma	3.9	3.4	1.1	0.7	0.7	1.4	0.4	1.1	2.2	1.9
Deficiencias nutricio	1.1	1.0	0.3	0.2	0.2	0.2	0.3	0.3	0.7	0.5
Enf.prev. con vacunac	0.7	0.6	1.4	0.2	0.8	0.2	0.3	0.1	0.7	0.3
Anemia	0.6	0.5	0.6	0.9	0.6	2.5	0.6	0.8	0.6	0.9
Enfermedades del emba		5.2		49.5		10.7		0.0		15.8
Enf. cerebrovasculare		0.7		8.3		10.3		1.3		3.9