

2023

1. Introduction
2. Methodology
3. Results
4. Discussion
5. Conclusion

Thanks for listening - any questions?

A. Lee et al.
Ng Jie Hui, Nurul Nazha, Jeyarajoo Raj, Dee Lynn, Aarti Harsh, May King Cheong, Anne Joseph, Joon Kim Yoo, Lee Hui Yi, Lee Hui Hui, Yvonne Lim, Michael Sapiro, Sri Sri, Tan Han Ling, Lee Jia Yi, Mar Najiya Farhana, David DANBY, Ang Min Yee, Paula Kinta Ma Vitor Almeida, Natthakulchai Jantanasri, Caroline Kim Yoo, Kim Seonja Park, Liang JIANG, Tao Du, Michael Koo, Stephen Chang, Yip Tin Oi, Sherrin Yuen Ka Tung, Yvonne Wan Ho, Kim Li (Korea), Nathan Lee, Chai Yan Hong, Anandaram Chinnai, Tiffney Ng, Jay Ross, Lee, Krishna Kumar, Sangeetha Sankaran, David Skyles, Lee Yvonne Lee, Susanto Setiawan

Acoustics and noise of electric vehicles in Singapore

Preliminary findings



Methodology

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Results

1. Introduction
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Epidemiology and costs of chronic wounds in Singapore

Preliminary findings

Nicholas Graves, PhD



Health Services &
Systems Research



Part 1. Why do we need to know

Part 2. What do we know now
epidemiology
economic costs

Part 3. How to make improvements to services



Part 1. Why do we need to know

Part 2. What do we know now

Chronic wounds

venous leg
diabetic foot
arterial insufficiency
pressure injury

Associated with pain, depression, anxiety, embarrassment, functional impairment and reduced quality of life for both patients and caregivers.

Extra costs for inpatient and outpatient health services and the broader economy



Likely a major health problem

The prevalence and incidence of chronic wounds: a literature review

Wound Care 2014

Modelling the direct health care costs of chronic wounds in Australia

Wound Care 2014



1% of the total national health expenditure



1-2% of the total NHS expenditure



1% of EU health budgets



1-2% of the health expenditure in Sweden and the rest of Europe



Graves N & Zheng H

The prevalence and incidence of chronic wounds: a literature review

The prevalence and incidence of chronic wounds: a literature review

Nicholas Graves & Henry Zheng

Graves N & Zheng H

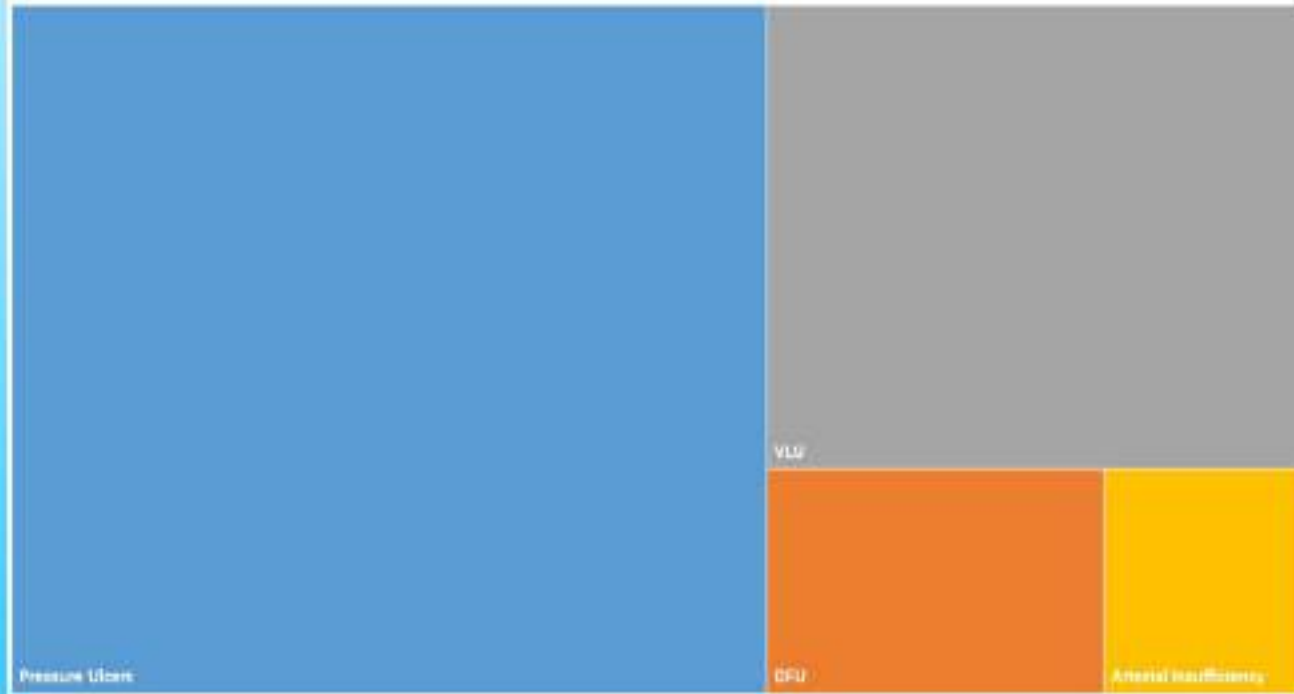
Modelling the direct health care costs of chronic wounds in Australia

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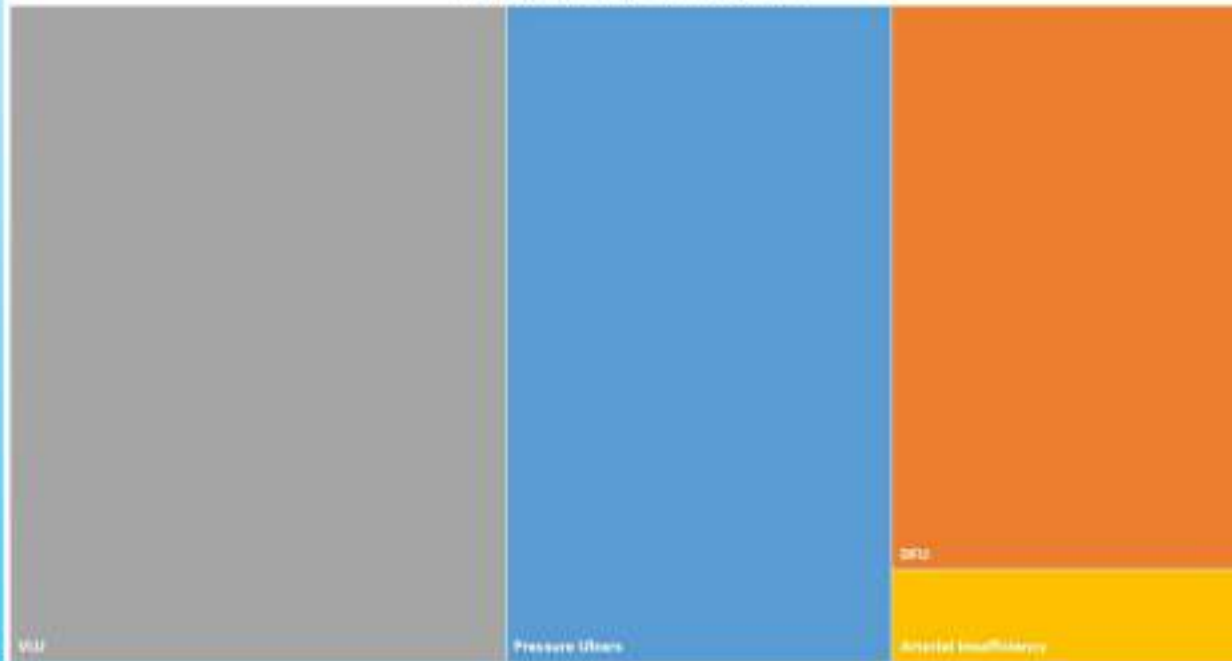
ALL HOSPITALS

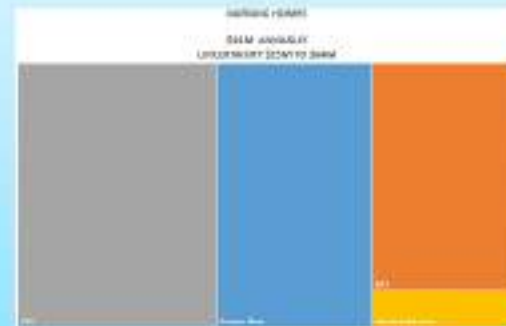
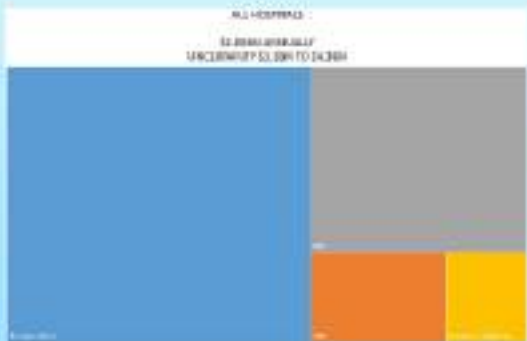
\$2.85BN ANNUALLY
UNCERTAINTY \$1.2BN TO \$4.3BN



NURSING HOMES

\$44M ANNUALLY
UNCERTAINTY \$25M TO \$64M





2% of the total national health expenditure





2% of the total national health expenditure



2-3% of the total NHS expenditure



2% of EU health budgets



2-4% of the health spending in Scandinavian countries

a or insights





Initial data are important to:

- raise awareness among decision makers

- inform appropriate investments to reduce the problem

Some research questions

how many people have a chronic wound

what resources are used treating them

what factors affect outcomes

The Singapore Wound Registry



World's first major wound care registry based on Asian data in a tropical climate.

A national partnership between all 3 healthcare clusters in Singapore – National University Health System, National Healthcare Group and SingHealth.



Captures systematic key anonymized information from patients and clinics that serve to inform healthcare providers on opportunities to deliver and improve the quality of wound care.

"WCIT is a huge programme focused on an area of unmet need. It will provide a range of key learnings and innovations that will ensure patients with wounds who live in the tropics receive the best possible care of a globally leading standard."

- Professor Keith Harding CHC, FRCGS, FRCR, FRCRCS, MRW
Senior Clinical Research Director, NUSHS, Singapore



a* Skin Research Institute of Singapore

For more information, please contact:
Skin Research Institute of Singapore (SIRIS)
Agency for Science, Technology & Research
11 Marshall Road, #11-01 Singapore 130025
E-mail: arwin_prajapati@skin.nus.edu.sg

WOUND CARE INNOVATION FOR THE TROPICS

Transforming & Enabling New Approaches in Wound Healing



a* Skin Research Institute of Singapore



Wound Care Innovation for the Tropics

Data available:

Some research questions

how many people have a chronic wound

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Data available:

MoH national data

SGH Pressure Injury

TTSH Pressure Injury

NUH Peripheral arterial disease

NUH registry

TTSH registry

St Luke's data

Part 1. Why do we need to know

Part 2. What do we know now

epidemiology

economic costs

Part 3. How to make improvements to serv

Open access

Original research

BMJ Open Incidence of chronic wounds in Singapore, a multiethnic Asian country, between 2000 and 2017: a retrospective cohort study using a nationwide claims database

Orlinda Q Goh^{1,2,3,4}, Ganga Ganesan,¹ Nicholas Graves,⁵ Yi Zhen Ng,⁶ Keith Harding,⁸ Kevin Bryan Tan^{1,2}

Retrospective cohort study using national claims data (MoH)

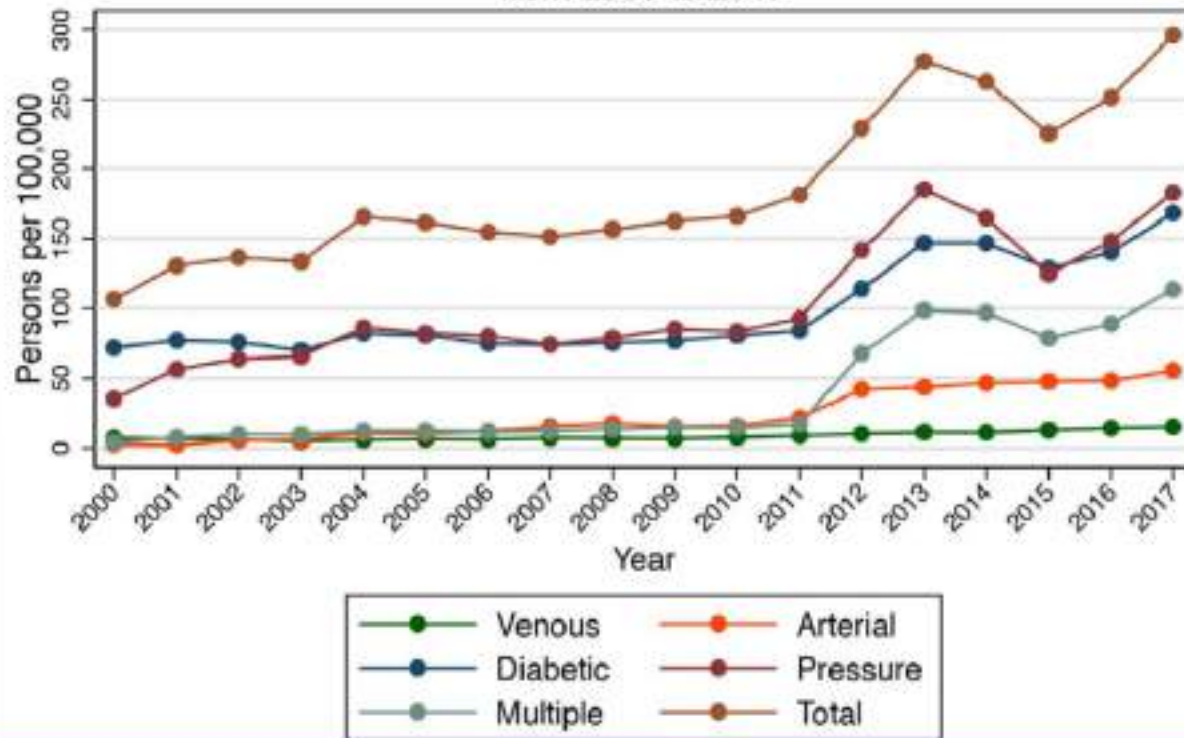
Between 2000 and 2017, 124 023 wound-related claims among 86 631 pts identified

age = 75; male = 51%; Chinese (70%) Malay (15%) Indian (9%)



2017 crude incidence = 296/100,000

Crude incidence rate of wounds
from 2000 to 2017



2017 crude incidence = 296/100,000

venous leg = 15

arterial = 56

diabetic foot = 168

pressure injury = 183

In 2017 alone

16,872 Singaporeans acquired a new chronic wound

855 new venous leg

3192 new arterial sufficiency ulcers

9576 diabetic foot

10431 pressure injuries



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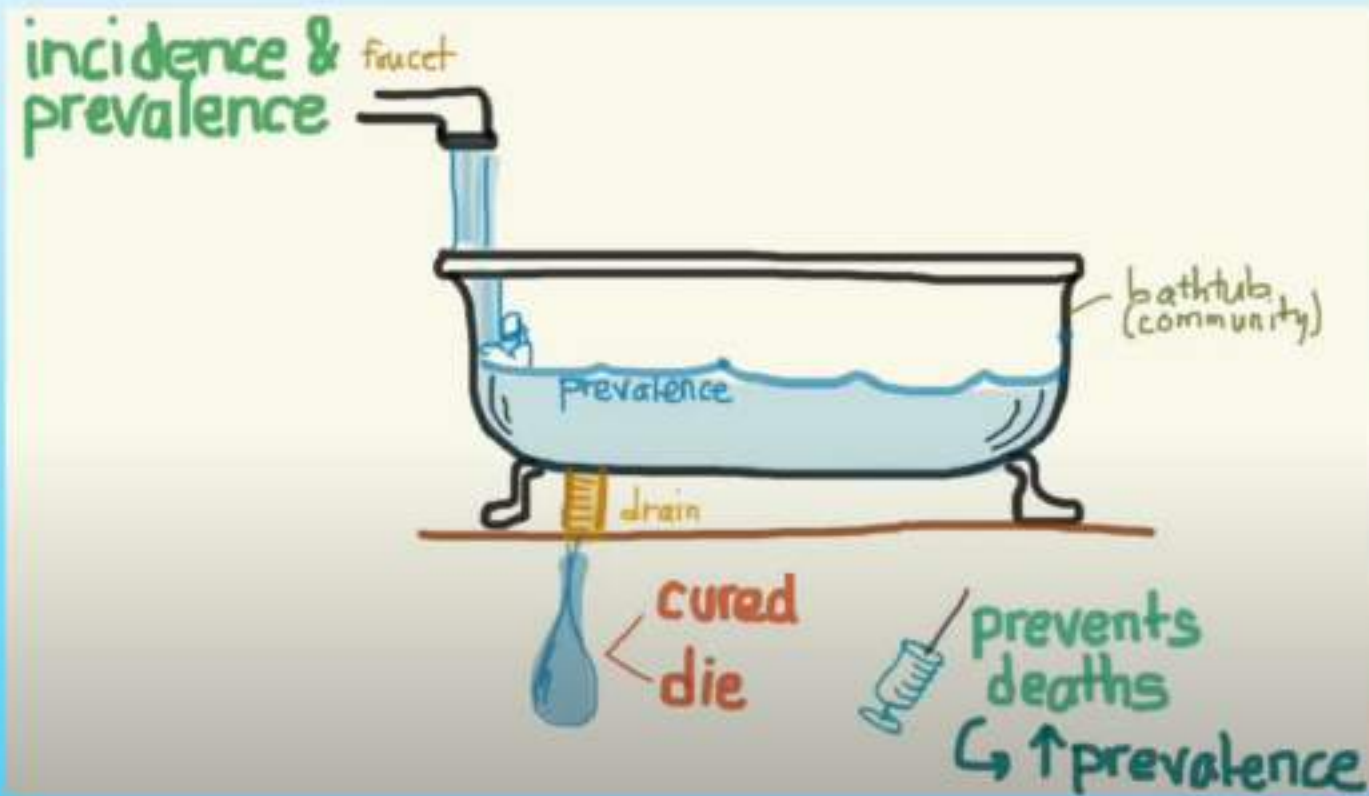
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9576 diabetic foot

10431 pressure injuries



INCIDENTS IN A HEALTH CARE UNIT



INCIDENCE DATA MIGHT NOT SHOW THE ENTIRE COST BURDEN

2017 age standardized rates greatest in >80's

4277/100,000

venous leg = 92

arterial = 478

diabetic foot = 1791

pressure injury = 3647

COMPARED WITH THE CHINESE, INDIANS HAD THREEFOLD THE RATES FOR VENOUS AND ARTERIAL AND DOUBLE THE RATE FOR DIABETIC WOUNDS.

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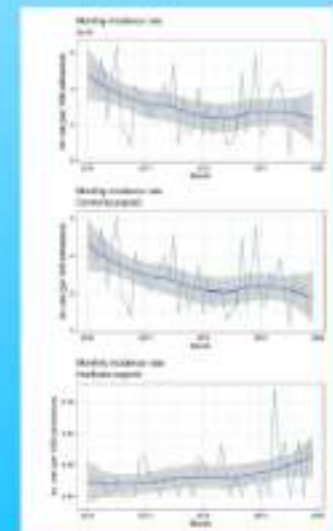
Pressure injuries among admissions to a hospital in the tropics

Nicholas Graves^{1,2,3} | Raju Maiti¹ | Fazila Abu Bakar Aloweni⁴ |
Ang Shin Yuh⁴ | Zhiwen Joseph Lo^{5,6} | Keith Harding^{2,7}

Existing nursing led data set for SGH, Jan 2016 - Dec 2019.

Incidence rates for Stage 3 or 4 (n=1143)

Declined from 4.05 to 3.4 per 1000 admissions



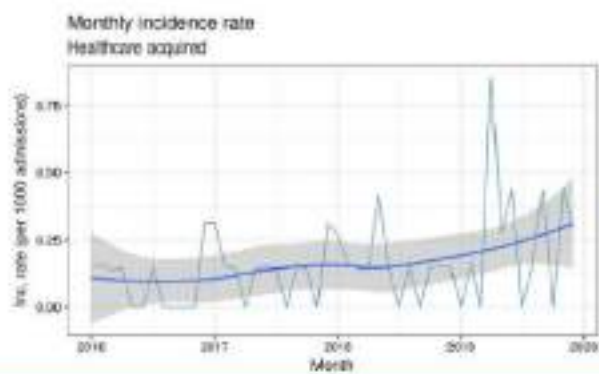
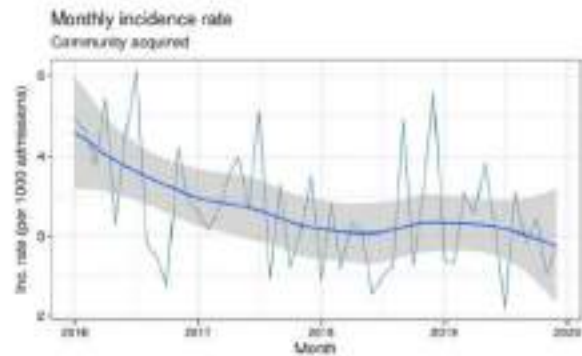
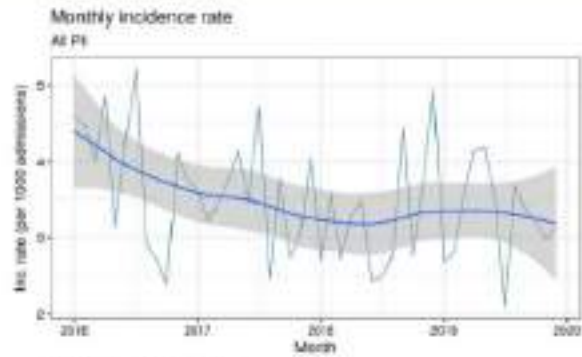


TABLE 2 Sources of Pressure Injury for those that were community acquired, number of cases, and percentage

	Community acquired (%)	Healthcare acquired (%)
Admitted from home	867 (77)	11 (85)
From inter hospital transfer	89 (8)	1 (7.7)
Nursing home	174 (15)	1 (7.7)
Total	1130 (100)	13 (100)

Stage 3 & 4 Pressure Injuries

3 to 4 patients per 1000 admissions

community acquired with 75% in admission from the patients' home.

hospital stays were between 12 and 15 days on average, compared to 4-6 days

Stage 3 and 4 injuries arise in a home environment and are managed in acute hospital at high cost.

Might be worth implementing screening & prevention programmes

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The epidemiology and costs of healthcare acquired pressure injury arising in the tropics.

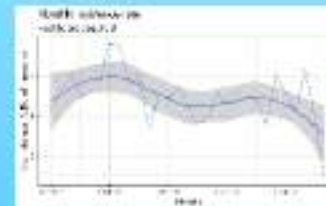
Nick Graves, Raju Maiti, Fazila, Yi Zhen, Shin, Priya Bishnoi, Tse Tec Chong, David Carmody,
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Existing nursing led data set for SGH, Jan 2016 - May 2018

Only healthcare acquired

Incidence rates for Stage 1 or 2 (n=1032)

Declined from 5 to 4 per 1000 admissions

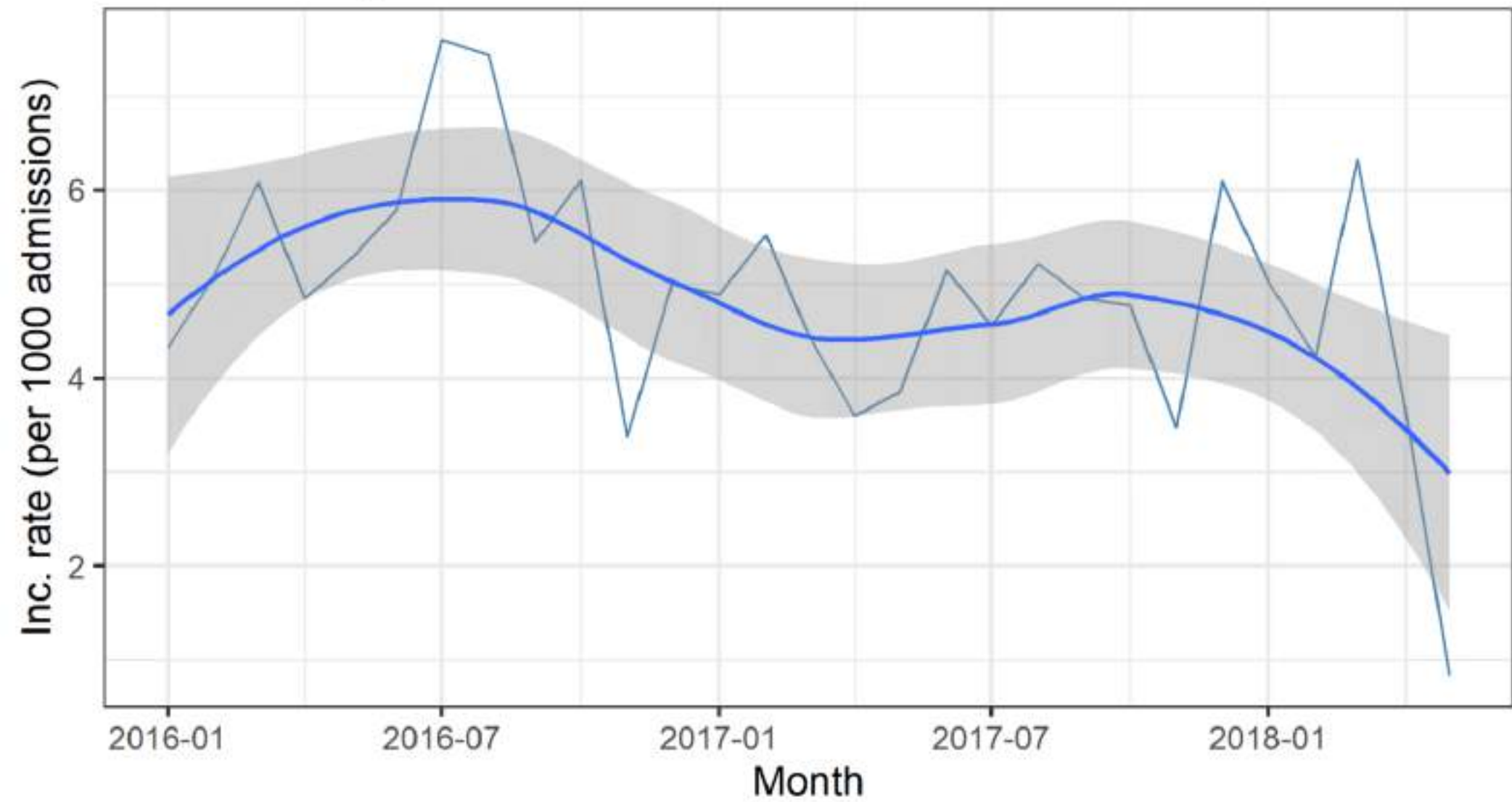


Costs arising by prolonged LoS

	Cases (n=1032)	Controls (n=8158)
Age (mean ± sd)	89.09 ± 14.33 Min = 17 Max = 102	73.25 ± 14.75 Min = 24 Max = 106
Gender (n, %)		
Male	549 (53.2)	5897 (45.18)
Female	483 (46.8)	4891 (44.82)

Monthly incidence rate

Healthcare acquired



The epidemiology and costs of healthcare acquired pressure injury arising in the tropics.

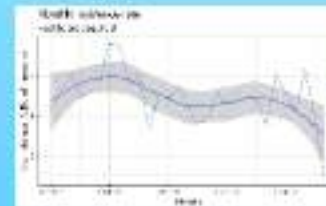
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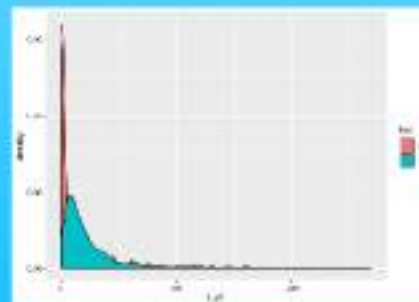
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Costs arising by prolonged LoS

	Cases (n=1032)	Controls (n=8588)
Age (mean \pm sd)	69.09 \pm 14.37 Min = 17 Max = 102	72.25 \pm 14.75 Min = 24 Max = 106
Gender (n %)		
Male	549 (53.2)	3897 (45.38)
Female	483 (46.8)	4691 (54.62)
Race (n %)		
Chinese	773 (74.90)	6686 (77.92)
Indian	81 (7.85)	685 (7.98)
Malay	132 (12.79)	756 (8.81)
Others	46 (4.46)	454 (5.29)
Braden Score (n %)		
No risk	42 (4.07)	4194 (48.84)
At risk	396 (38.37)	3441 (40.07)
Moderate risk	324 (31.40)	540 (6.29)
High risk	225 (21.80)	335 (3.90)
Very high risk	45 (4.36)	78 (0.91)
Length of hospital stay (mean \pm sd)	48.72 (58.03) Min=2 Max=535	35.53 (64.02) Min=1 Max=507

often used methods

1. crude comparison
2. linear regression
3. generalized linear model, gamma link
4. state based model



Length of hospital stay (mean \pm sd)

48.72 (28.03)

53.53 (34.02)

Min=2

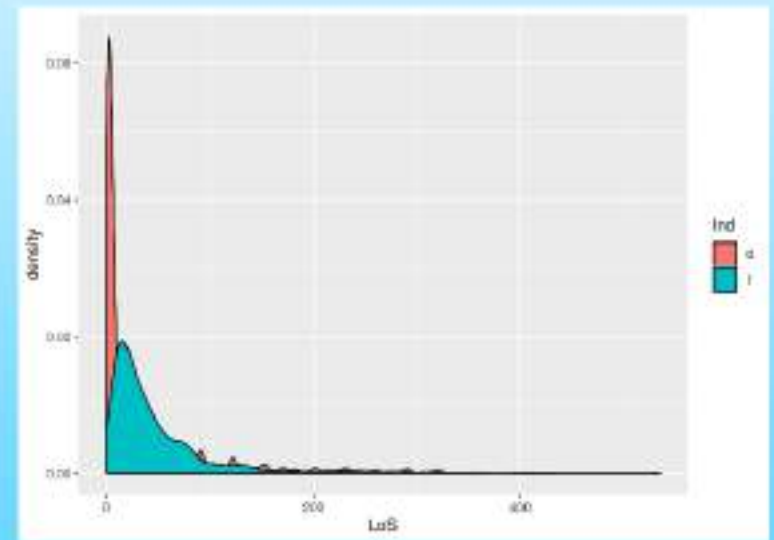
Min=1

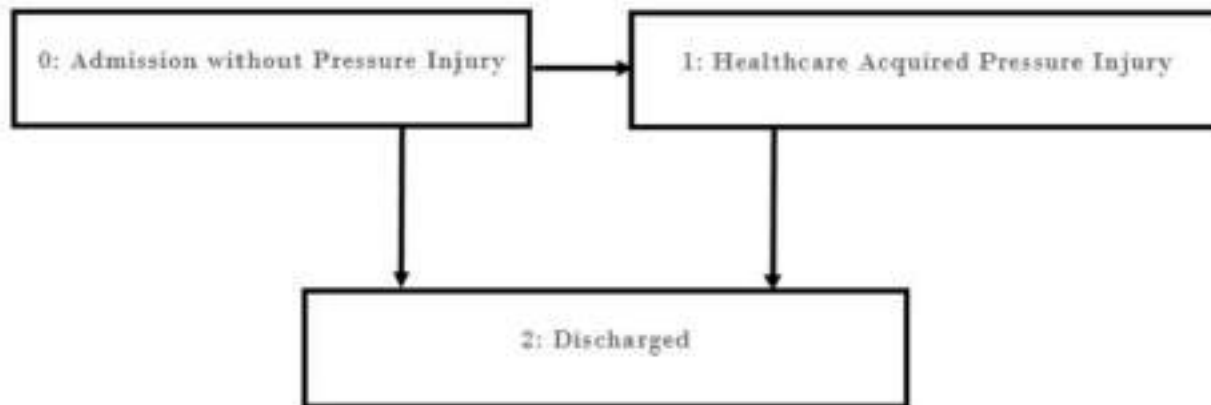
Max=535

Max=507

often used methods

1. crude comparison
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Extra days should only be attributed to PI after the PI has begun

Failing to account for timing of events includes days prior to PI in the comparison

This can only bias the result upwards

	LoS outcome censored at 60 days
Excess LoS for PI (95% CI)	1.22 (0.19, 2.23)
Adjusted Hazard Ratio (95% CI)	0.29 (0.20, 0.51)

crude comparison = 18 days

linear regression = 10 days

generalized linear model, gamma link = 11 days

Failing to account for timing of events includes days prior to PI in the

This can only bias the result upwards

	LoS outcome censored at 60 days
Excess LoS for PI (95% CI)	1.22 (0.19, 2.23)
Adjusted Hazard Ratio (95% CI)	0.29 (0.26, 0.31)

crude comparison = 18 days

linear regression = 16 days

generalized linear model, gamma link = 11 days



Data available:

MoH national data

SGH Pressure Injury

TTSH Pressure Injury

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St Luke's data

NUH Data (2014 to 2017)

Wound categorisation	Cases (N= 7998)	Patients (N=4208)
VLU	250	168
NIU	3778	1722
PI	1907	1266
Mixed wounds	127	150
Total	6062	3356

demographic & clinical characteristics to explain variation in cost outcomes.

Inpatient costs

1. Total length of stay
2. Inpatient bill

Outpatient costs

3. Number of outpatient visits
4. Number of ED visits
5. Outpatient bill

VLU Analysis

Inpatient costs

Length of stay (mean = 5 days, median = 9 days)
longer for females, heart disease, hyperlipidaemia & smokers

Inpatient bill (median \$4,831, IQR 6,432)
larger for heart disease, ESRF

Outpatient costs

Outpatient costs

Outpatient visits (median = 10, IQR = 20)
more for females, hypertension, obesity

ED visits (median = 1, IQR = 1)
more for males, non-chinese, heart disease, smokers

Outpatient bill (median = 2372, IQR = 4347)
larger for females, hypertension, obesity

Some research questions

how many people have a chronic wound

what resources are used treating them

what factors affect outcomes



Some research questions

how many people have a chronic wound

what resources are used treating them

what factors affect outcomes

Can model at a national level the burden of chronic wounds by VLU, DFU, PI, Arterial

Estimate how many bed days and other resources are used up

Demonstrate the potential cost savings and health benefits of

prevention

better therapies that improve healing & alleviate symptoms

Open access

Original research

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Part 1. Why do we need to know

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Must respond to scarcity of resources, and show the best value

Invest in the best services

Compression therapy for venous leg ulcers

Interventions to reduce risk of Pressure Injury

proton beam therapy



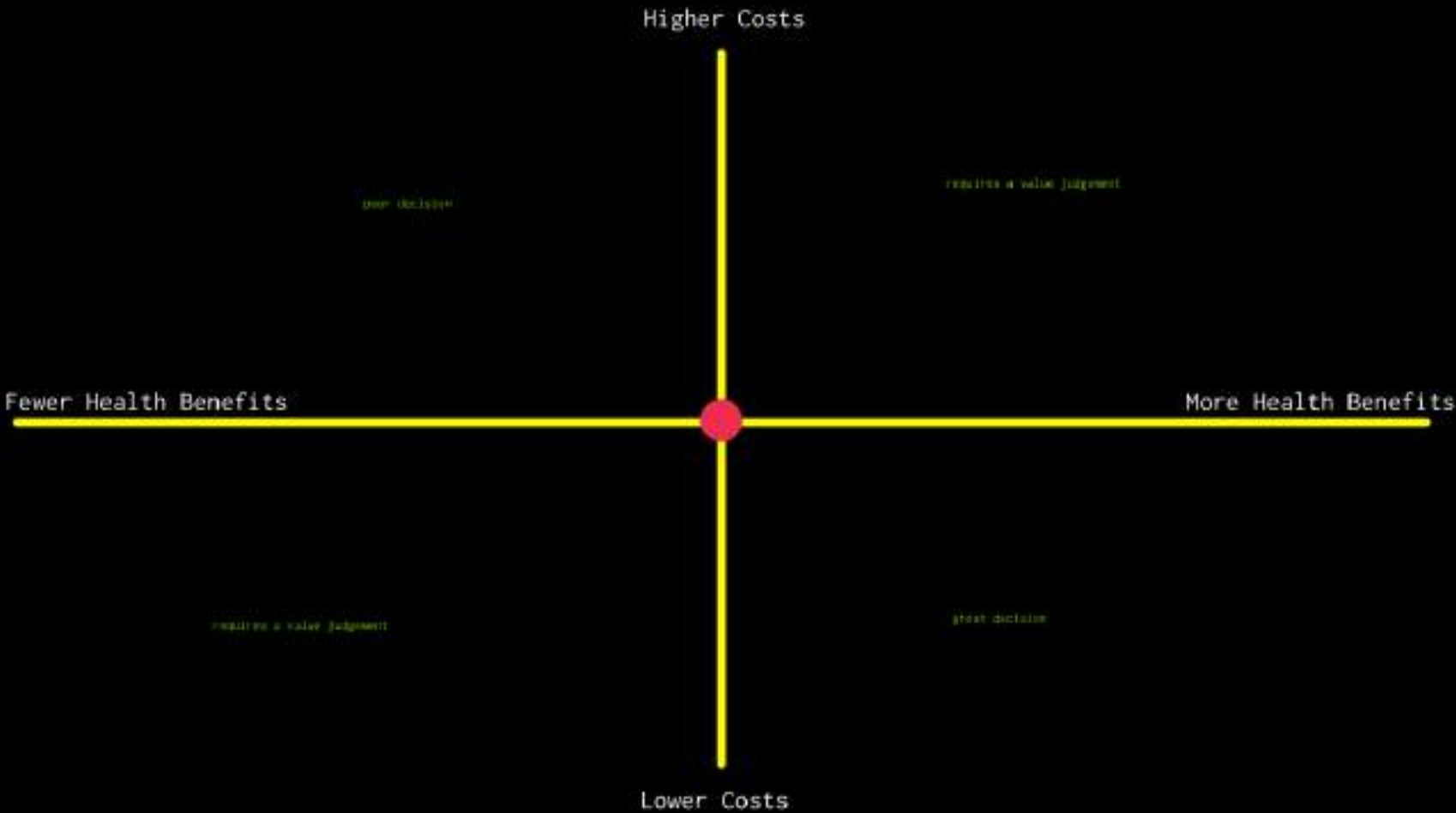
Must respond to scarcity of resources, and show the best value

Invest in the best services

palliative oncology

primary prevention of diabetes

robotic orthopaedic surgery



Higher Costs

poor decision

Fewer Health Benefits



More Health Benefits

great decision

Lower Costs

Higher Costs

requires a value judgement

More Health Benefits

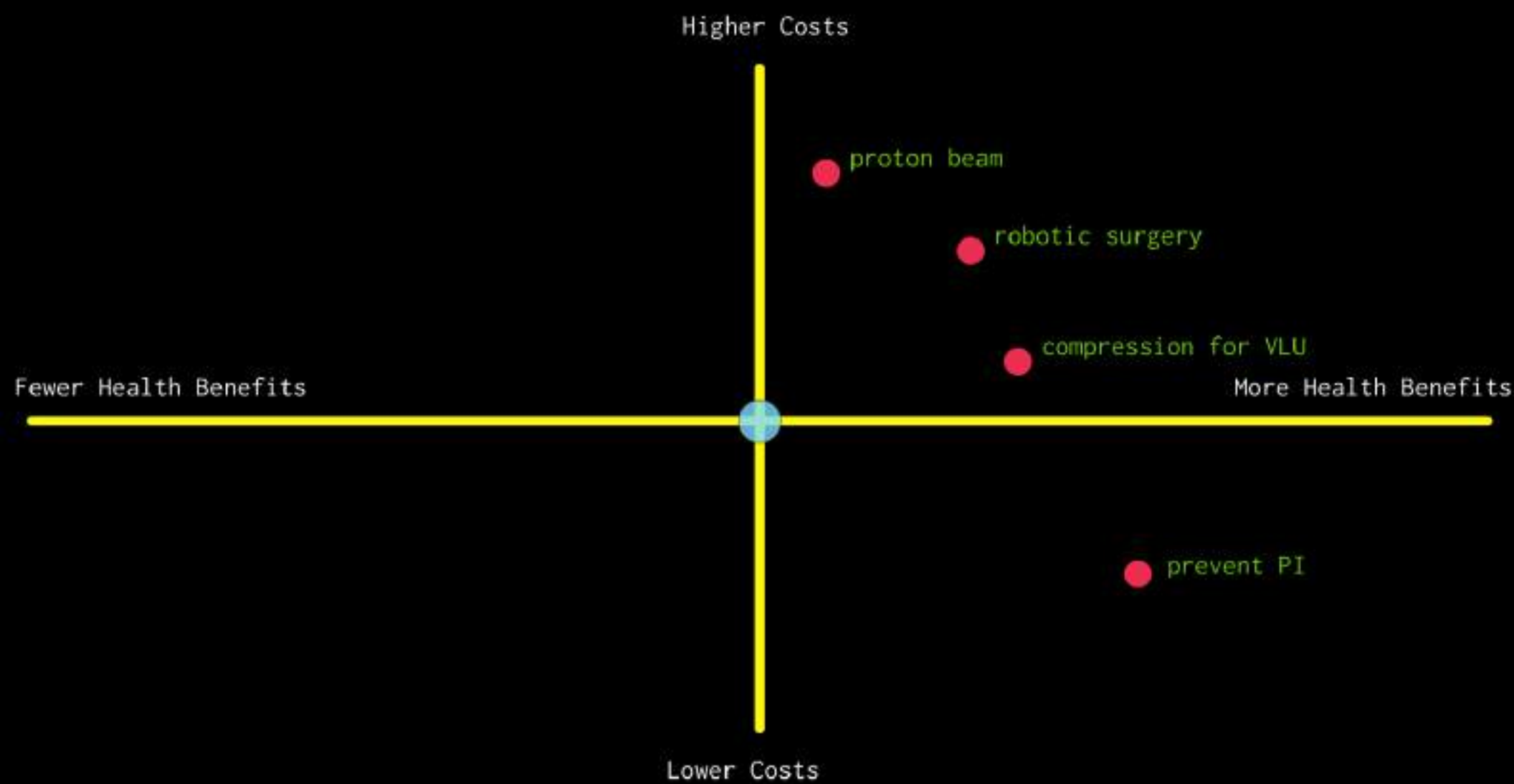


Fewer Health Benefits

requires a value judgement

Lower Costs





A team effort

Raju Maiti; Nuraini Nazeha; Jessamine Goh; Zee Upton; Keith Harding; Wong Wing Cheong; Annie Joseph; Jason Kow Tian Jyh; NG Yi Zhen; Ho Pei; Sophie Coral Whitelaw; Daphne SH TAN; Tan Wan Ling; Lee Jia Yi; Nur Nabila Farhana; David CARMODY; Ang Shin Yuh; Fazila Binte Abu Bakar Aloweni; Nanthakumahrie Gunasegaran; Corrina Kee Pei Yin; Amilia Foo Ai Jun; CHONG Tze Tec; Manfred Mak Yaoquan; Charyl Yap Jia Qi; Shereen Soon Xue Yun; Vanessa Khoo Bao Xian; Lo Zhiwen; Meghan Lim; Chan Yam Meng; Norulhuda Othman; Esther Ng; Tay Peck Ling; Orlanda Goh; Ganga Ganesan; Kelvin Bryan Tan; Yvonne Lau; Kavitha Sanmugam.

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