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THE BOON WURRUNG PEOPLE OF THE KULIN NATIONS
AS THE TRADITIONAL CUSTODIANS OF THE LAND ON
WHICH OUR OFFICE IS LOCATED. WE PAY OUR
RESPECT TO ELDERS PAST AND PRESENT, AND EXTEND
THAT RESPECT TO ALL FIRST NATIONS PEOPLE.



Admission screening testing of patients and staff N95 respirators are cost-effective in reducing COVID-19 hospital-acquired infections

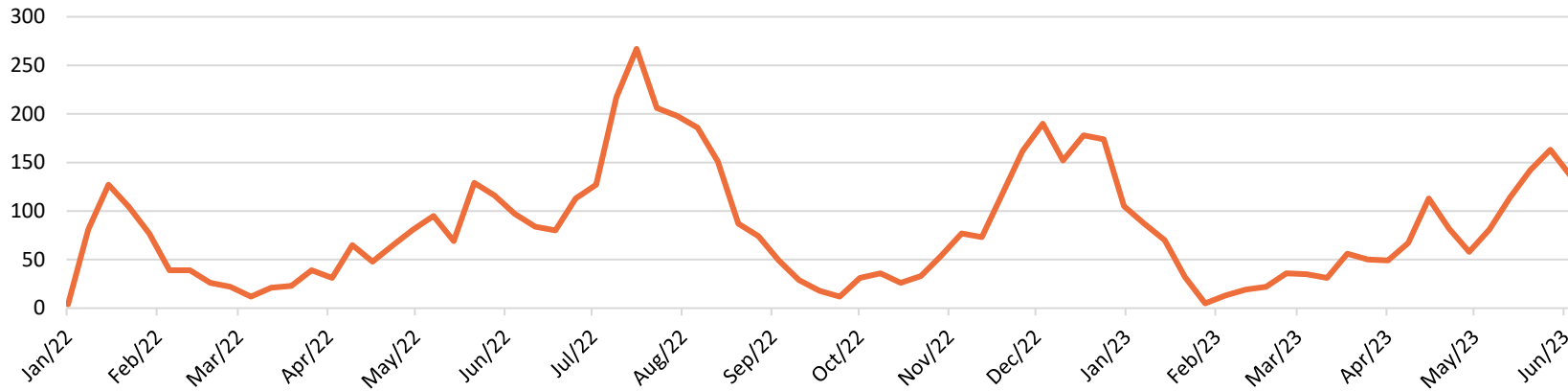
Fenella McAndrew

Burnet Institute

Melbourne, Australia

Reported COVID-19 hospital-acquired infections (HAIs)

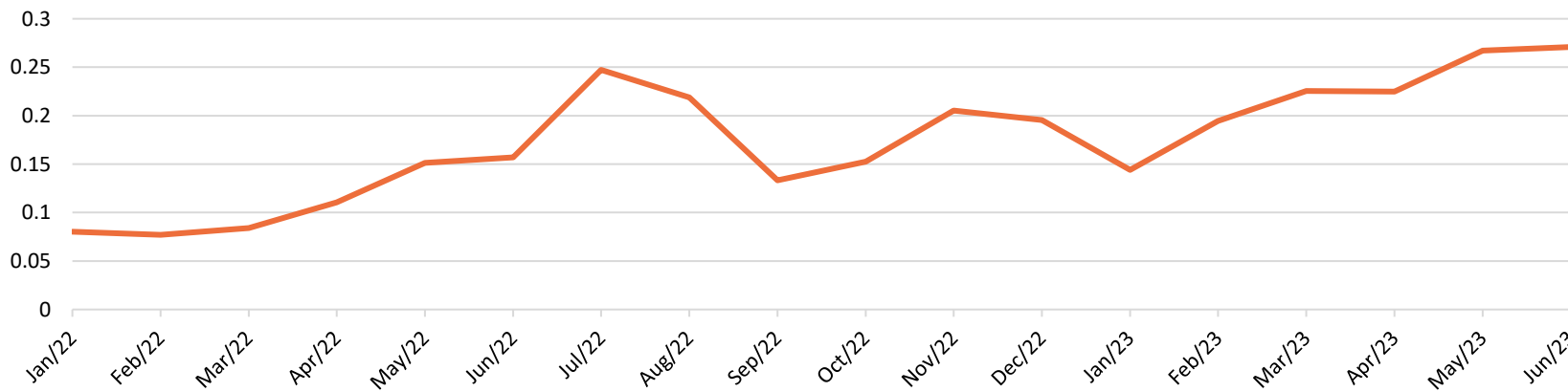
Weekly hospital-acquired infections; January 2022 to July 2023



4853

HAI average per annum

Hospital-acquired infections as a proportion of hospitalised COVID-19 cases



Suggests that at one time, 25% of people in hospital with COVID-19 caught it while in hospital

Background & Context

The prevention and reduction of healthcare-associated infections is a major priority in Australia and globally due to the increased vulnerability of patients.



COVID-19 outbreaks in acute care settings can:

- Have severe consequences for patients due to their underlying health conditions or vulnerabilities.
- Be costly due to additional patient bed days and the need to replace isolating staff.



In Australia, between January 2020 and March 2024, there were **over 1.1M hospitalisations** involving a COVID-19 diagnosis.

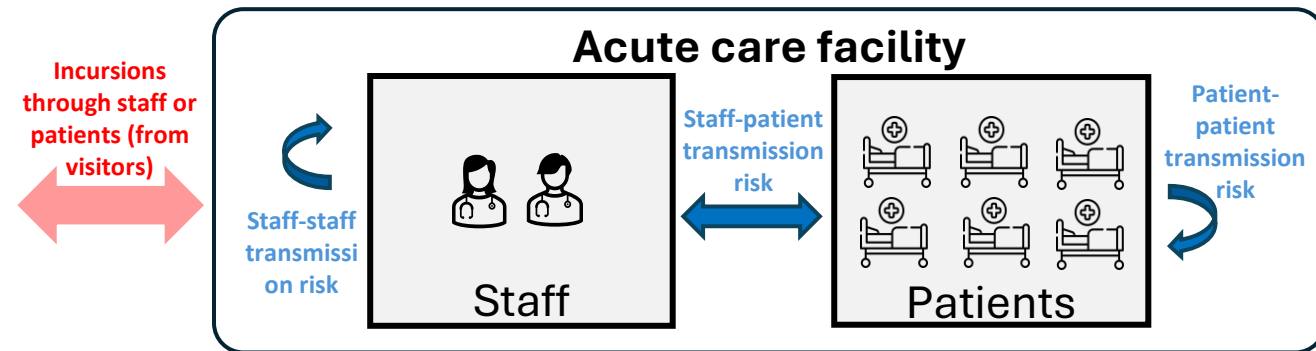


High COVID-19 prevalence can increase hospital-acquired infections, worsening hospital demand and staff shortages.

Aim: To use modelling to assess the cost-effectiveness of clinical staff N95 respirators and admission screening testing of patients to reduce COVID-19 hospital-acquired infections.

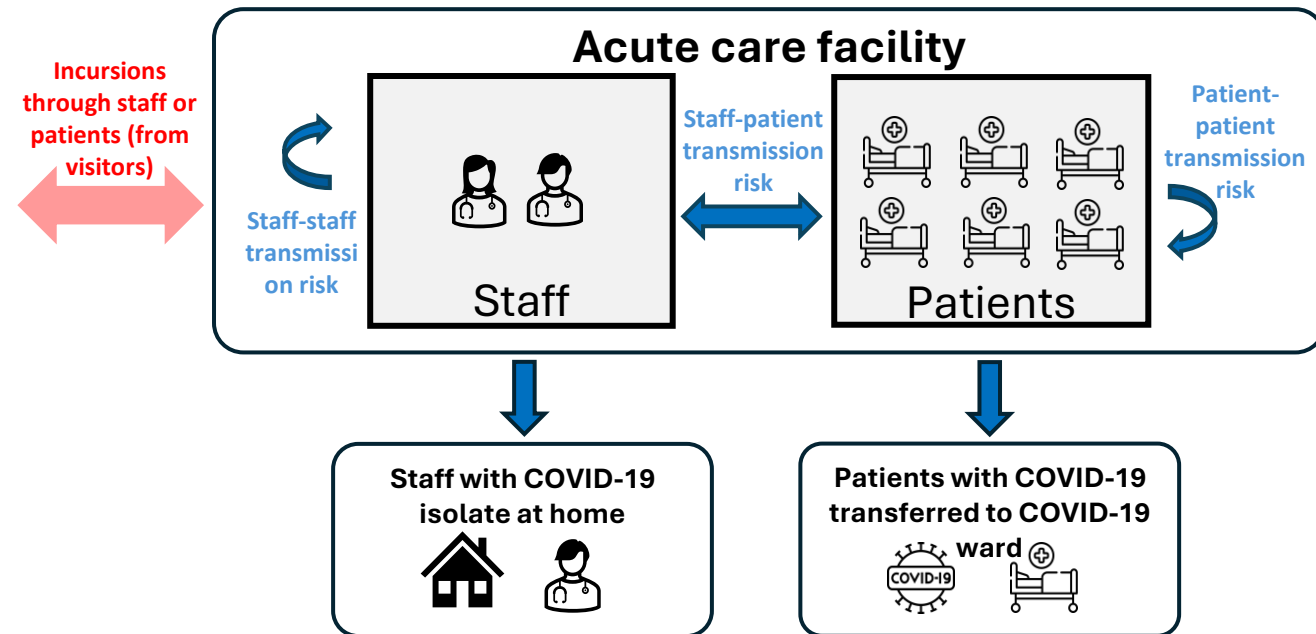
Covasim acute care outbreak model

An agent-based model, *Covasim*, was calibrated to data on 178 outbreaks in acute care settings in Victoria, Australia between October 2021 and July 2023.



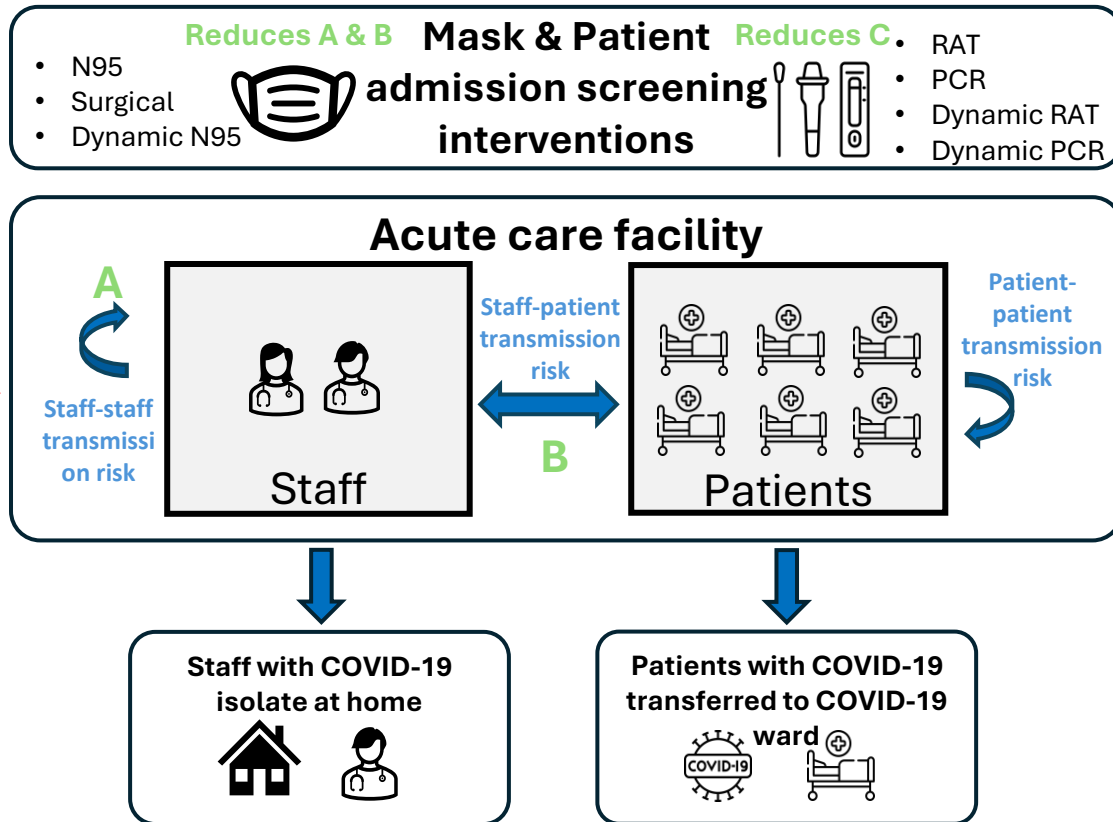
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Combinations of the following scenarios were tested:

Admission screening of patients:

1. with PCR (current practice);
2. with RATs; or
3. with dynamic PCR; or
4. none, i.e. symptomatic testing only.

Staff mask use:

1. N95s (current practice);
2. surgical masks only; or
3. dynamic mask policy.

Total costs were calculated in 2023 AUD\$

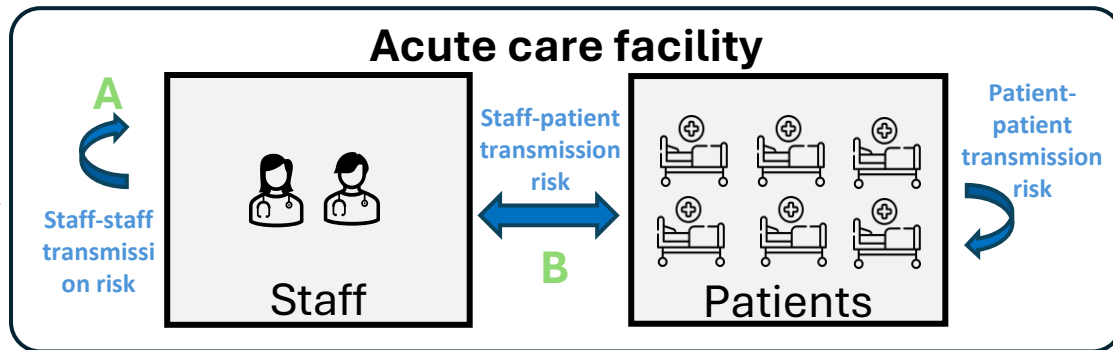
Costs included:

- interventions (i.e., masks, tests),
- additional patient bed days for patients with COVID-19,
- staff replacement during isolation

Reduces A & B Mask & Patient admission screening interventions **Reduces C**

- N95
- Surgical
- Dynamic N95

- RAT
- PCR
- Dynamic RAT
- Dynamic PCR



Staff with COVID-19 isolate at home

Patients with COVID-19 transferred to COVID-19 ward

Dynamic mask and testing policies

With COVID-19 fatigue, it might be difficult to have staff agree to always wear masks and patient to always test on admission

- Interventions only during periods of high community transmission (e.g., during a wave)
- From June 2022 to June 2023, Victoria was estimated to be in a wave 63.4% of the time, accounting for 76.8% of hospital-acquired infections
- Dynamic scenarios assumed the intervention costs for 63.4% of the time but intervention benefits for 76.8% of simulated incursions.

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CASES

based on how many incursions took place during a wave with interventions in place



COSTS

based on the proportion of the time spent during a wave with interventions in place

Intervention efficacy

Mask efficacy

- Mask scenarios impact on staff-staff and staff-patient contacts (not patient-patient contacts).
- When staff move from N95 to surgical or no masks, the relative increase in transmission risk between contacts was estimated as:

	N95	Surgical	None
Staff-staff contacts	1	X3.20	X11.9
Staff-patient contacts	1	X1.79	X3.45

Test efficacy

- PCRs have higher sensitivity for both symptomatic and asymptomatic case detection than RATs
- RATs have a further reduced sensitivity for asymptomatic case detection

	PCR	RAT
Symptomatic	87%	77.3%
Asymptomatic	87%	58%

Cost inputs

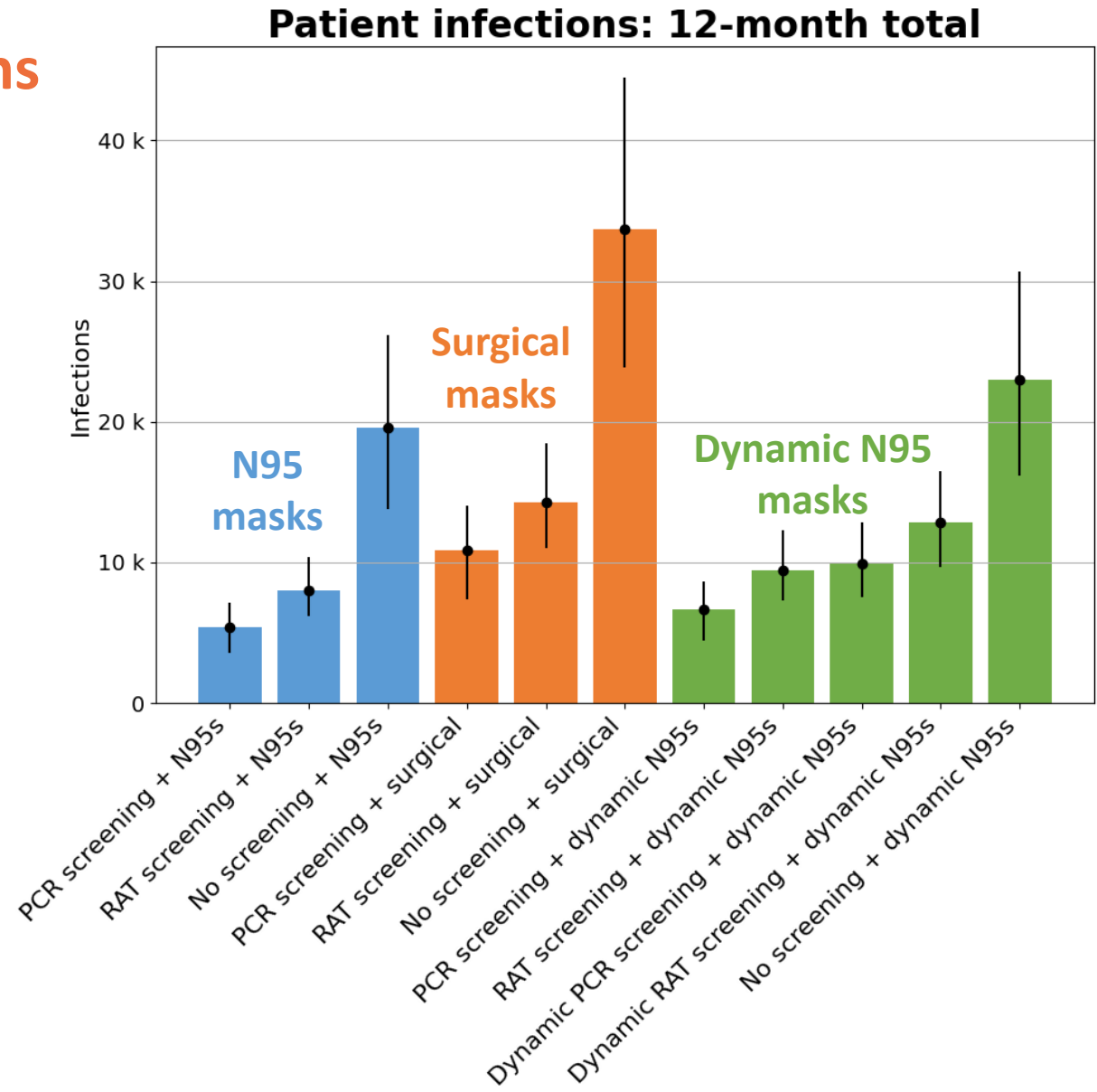
Cost component	Cost (AUD)
N95 masks (statewide annual cost)	\$18.9M
Surgical masks (statewide annual cost)	\$4.9M
PCR admission screening testing of patients (statewide annual cost)	\$23.6M
RAT admission screening testing of patients (statewide annual cost)	\$1.2M
Patient bed costs (mean cost per infection)	\$1595/day
Staff (mean cost per infection)	\$308/day

Source: Victoria Department of Health

Results

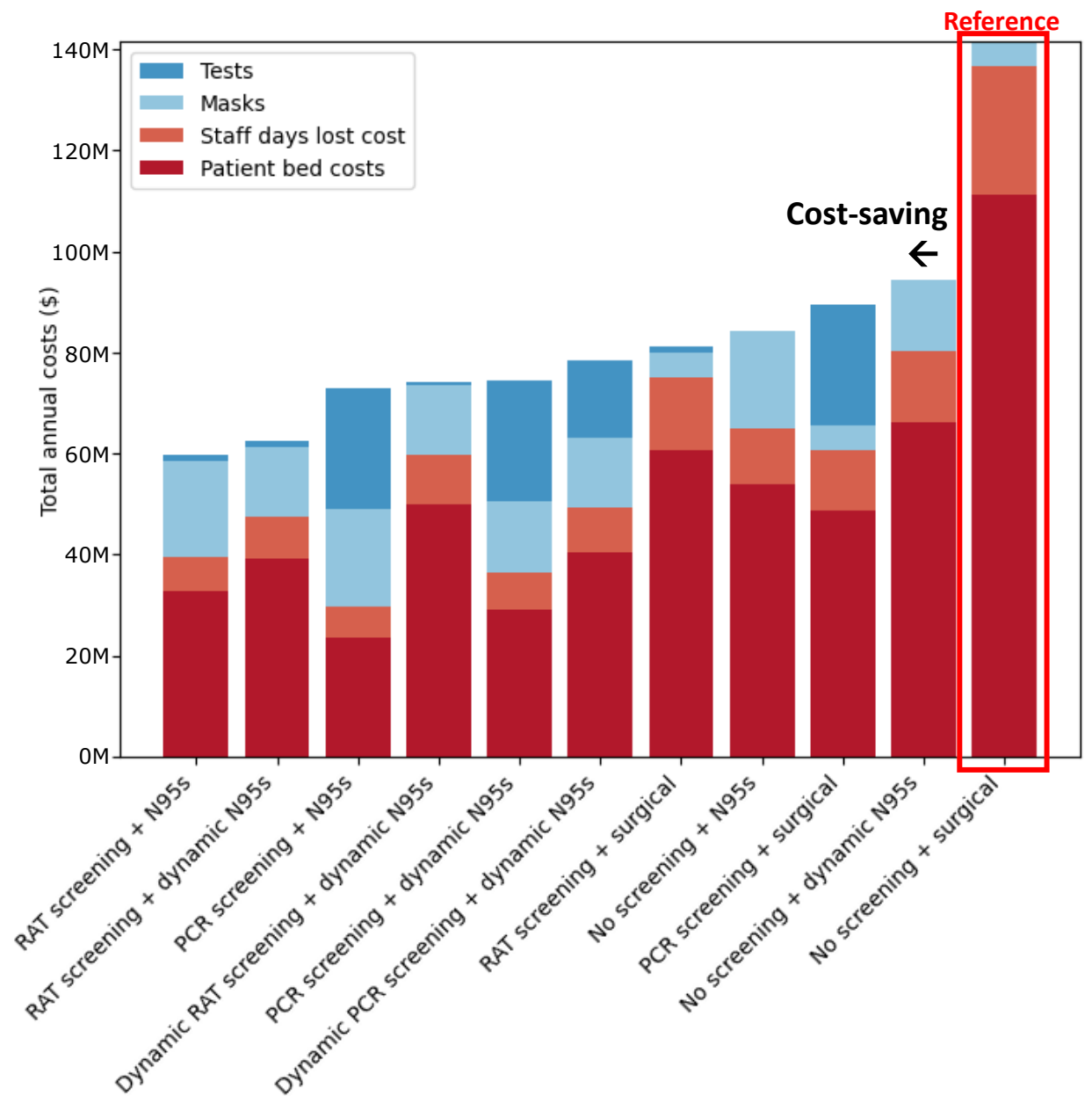
Intervention effectiveness over 12-months

- Equivalent proportional impact on staff infections and patient deaths, noting the following:
 - There are less staff per facility (1 staff member to 3 patients),
 - Patients have 90-day mortality rate of 18.9%.
- All scenarios with PCR screening have the best health outcomes.
- No screening at all results in the worst outcomes, regardless of mask type.
- No screening coupled with surgical masks has the worst health outcomes of the scenarios tested.



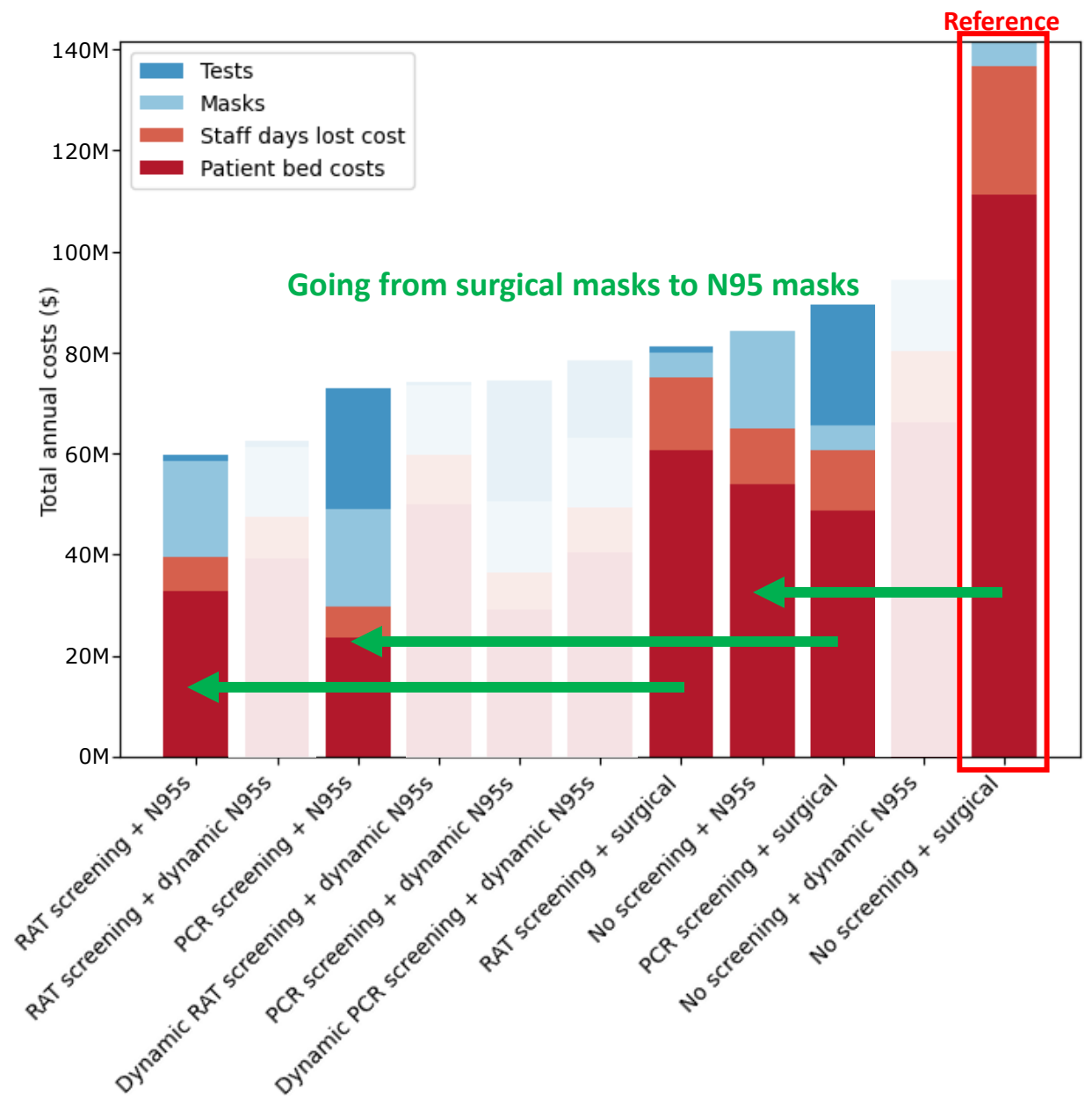
Total cost of different scenarios

- Compared to the reference (no screening and surgical masks), all scenarios are cost-saving with health gains.



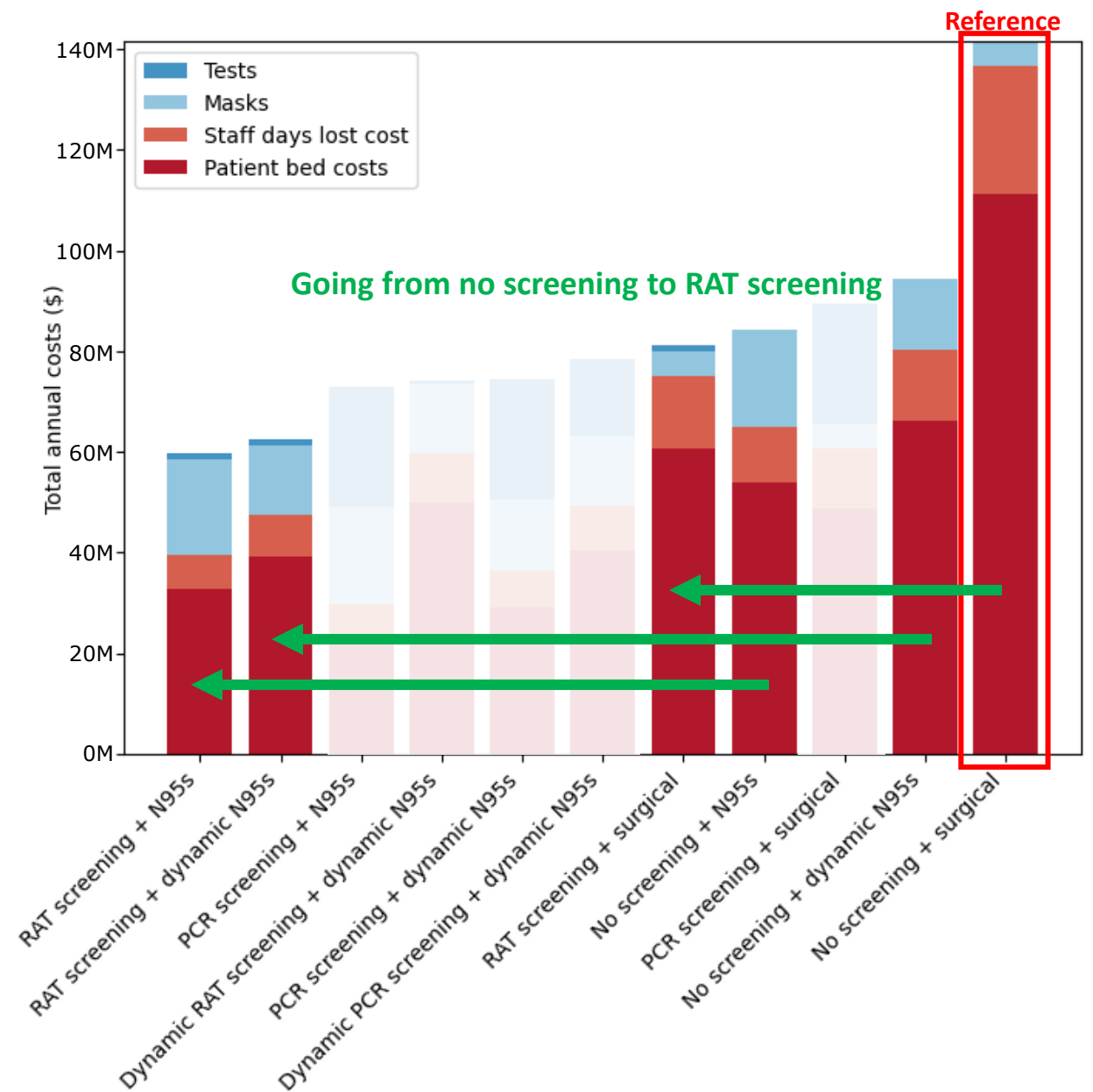
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- N95s were cost saving with health gains compared to surgical masks, regardless of screening testing (PCR, RAT, none).



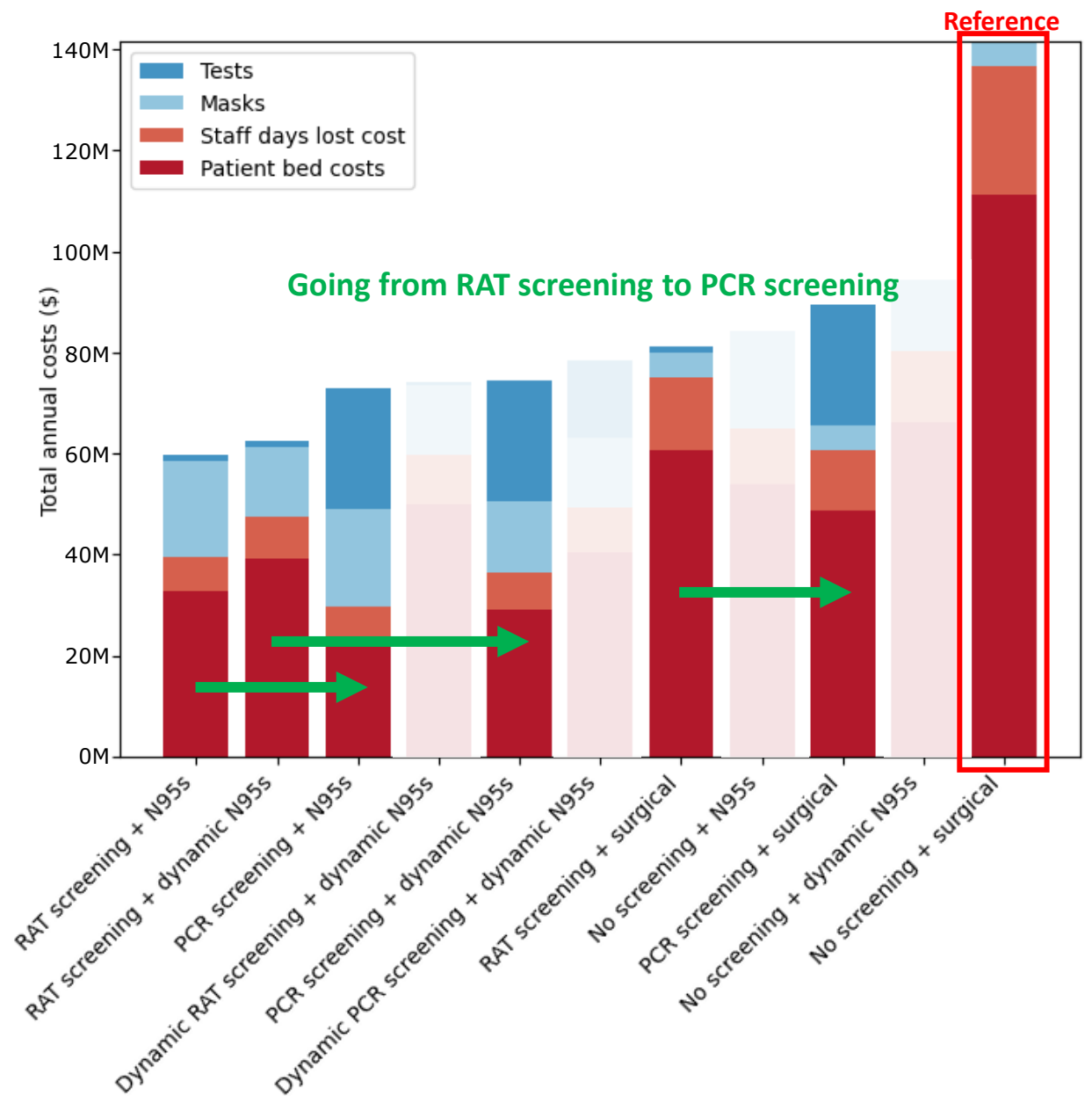
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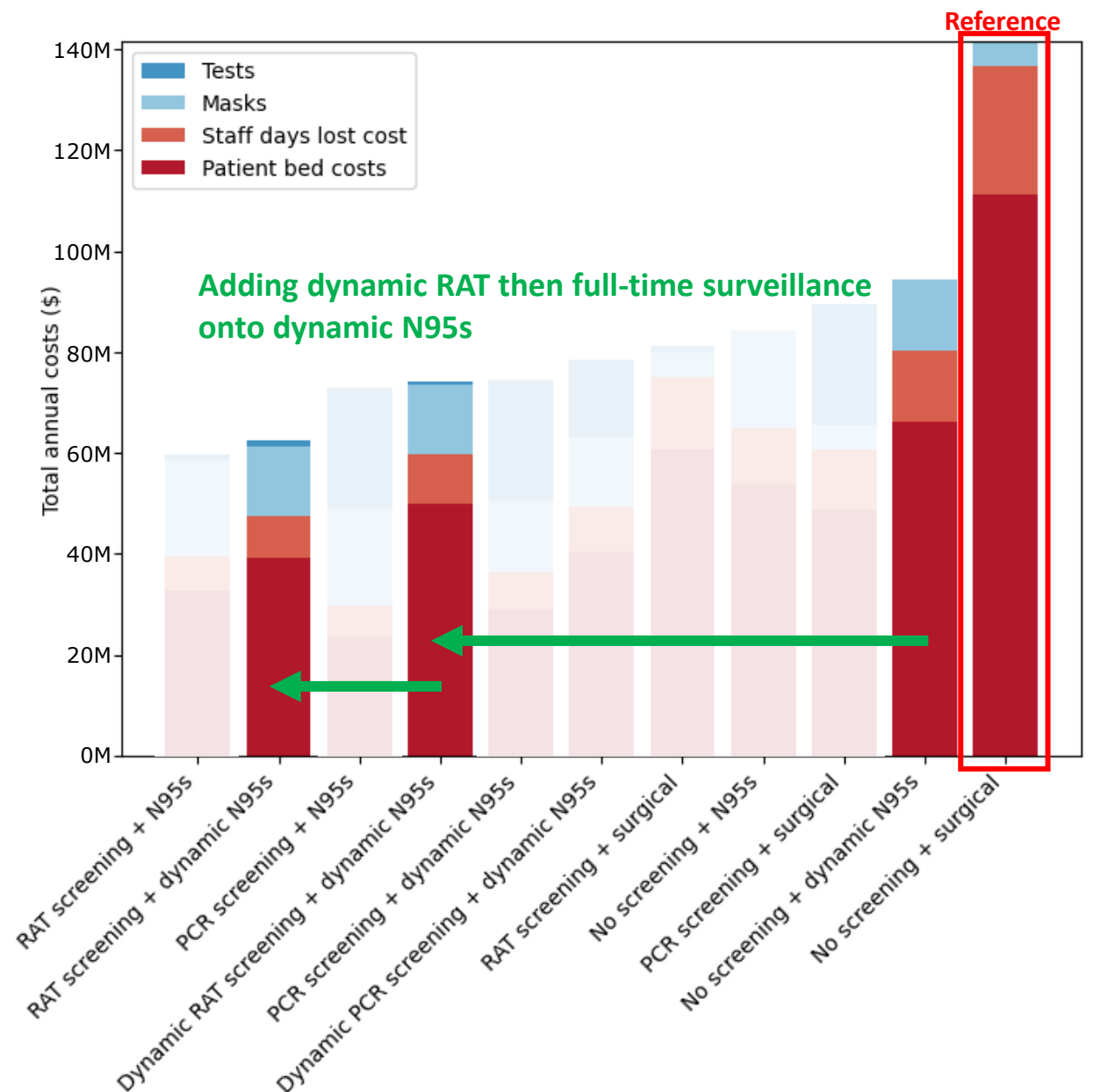
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- Admission screening testing with PCR was more expensive but more effective than RATs.

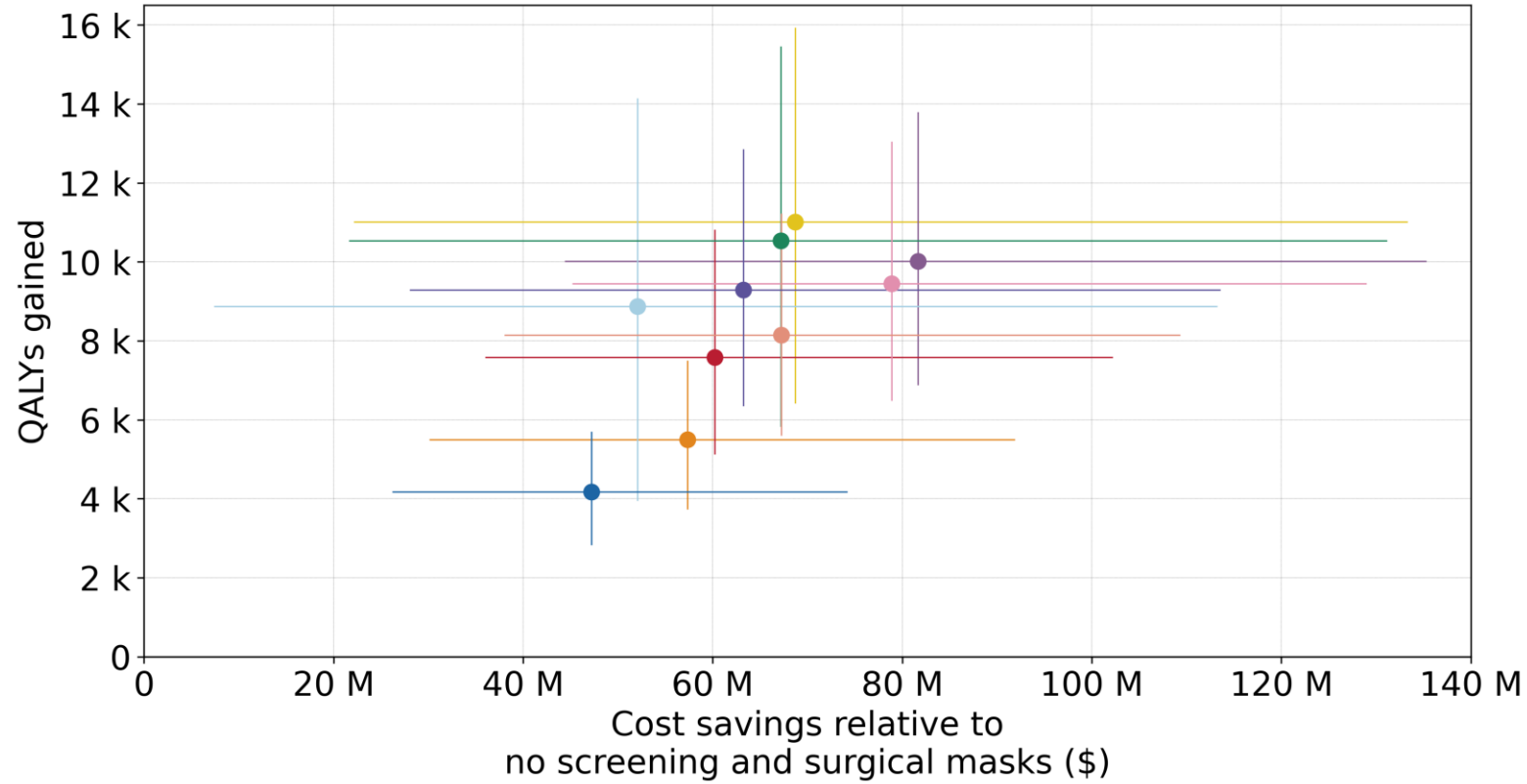


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- RAT screening was cost-saving with health gains compared to no screening, regardless of masks (N95, surgical, dynamic N95).
- Admission screening testing with PCR was more expensive but more effective than RATs.
- With dynamic N95 masks in place:
 - Dynamic RATs were cost-saving with health gains compared to no surveillance.
 - Full time RATs were cost-saving with health gains compared to dynamic RATs.

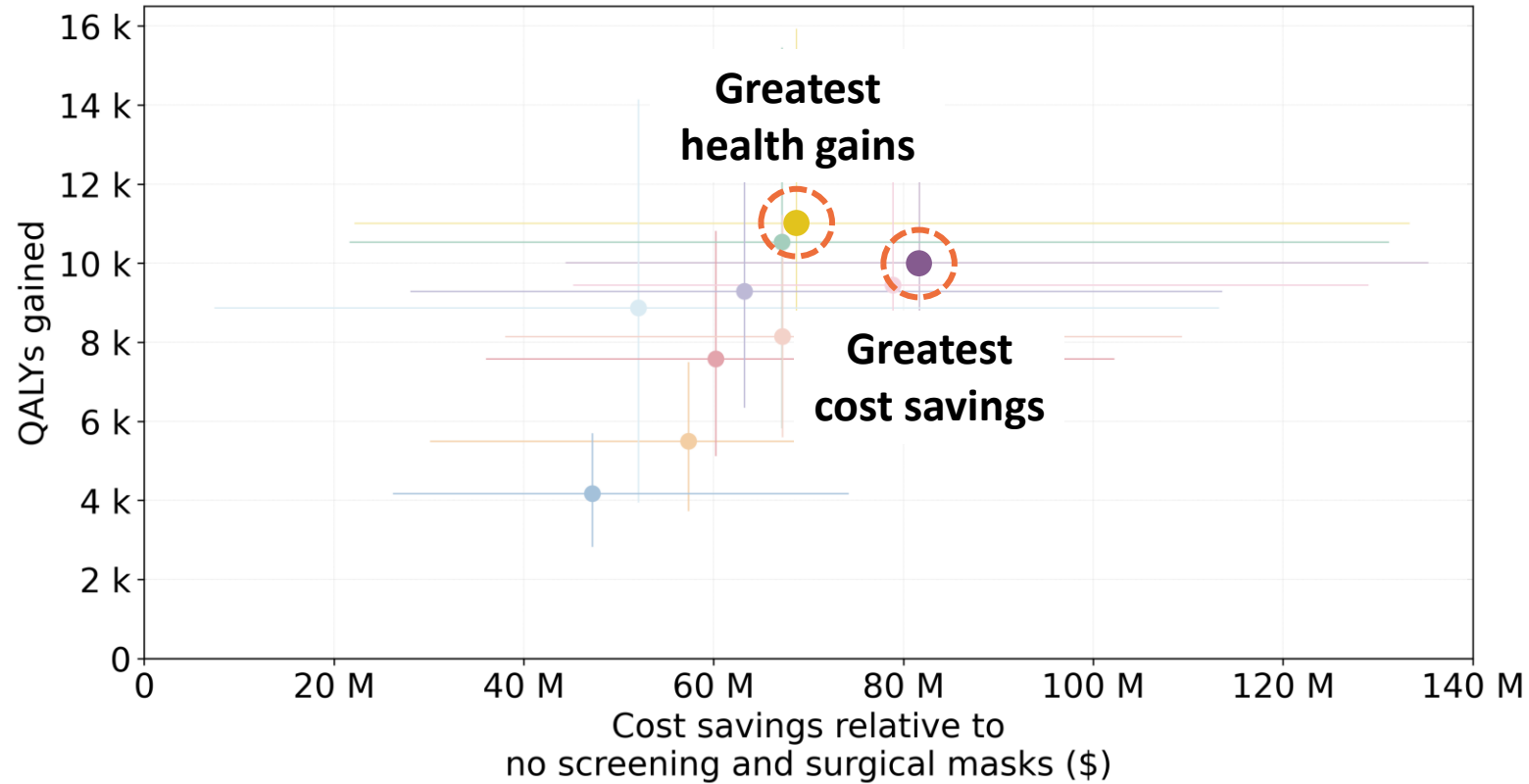


Cost-effectiveness plane



- PCR screening + N95s
- RAT screening + N95s
- No screening + N95s
- PCR screening + surgical
- RAT screening + surgical
- PCR screening + dynamic N95s
- RAT screening + dynamic N95s
- No screening + dynamic N95s
- Dynamic RAT screening + dynamic N95s
- Dynamic PCR screening + dynamic N95s

Cost-effectiveness plane



- PCR screening + N95s
- RAT screening + N95s
- No screening + N95s
- PCR screening + surgical
- RAT screening + surgical
- PCR screening + dynamic N95s
- RAT screening + dynamic N95s
- No screening + dynamic N95s
- Dynamic RAT screening + dynamic N95s
- Dynamic PCR screening + dynamic N95s

Results summary: difference compared to no N95s or surveillance testing

Patient admission screening testing	Staff masks	Difference in costs (intervention + bed days + staff absent)	Difference in COVID-19 deaths
None	Surgical	Reference	Reference
PCR	N95	\$-62.6M (\$-133.3M, \$-22.1M)	-1,684 (-2,478, -998)
RATs	N95	\$-78.4M (\$-135.3M, \$-44.4M)	-1,543 (-2,146, -1,070)
None	N95	\$-54.7M (\$-91.9M, \$-30.1M)	-854 (-1,167, -580)
PCR	Surgical	\$-49.7M (\$-113.3M, \$-7.4M)	-1,402 (-2,201, -613)
RATs	Surgical	\$-57.6M (\$-102.2M, \$-36.0M)	-1,176 (-1,683, -797)
PCR	Dynamic	\$-61.3M (\$-131.2M, \$-21.6M)	-1,626 (-2,404, -906)
RATs	Dynamic	\$-76.3M (\$-129.0M, \$-45.2M)	-1,456 (-2,030, -1,007)
None	Dynamic	\$-45.3M (\$-74.2M, \$-26.2M)	-645 (-887, -439)
Dynamic RATs	Dynamic	\$-64.8M (\$-109.3M, \$-38.0M)	-1,256 (-1,746, -871)
Dynamic PCR	Dynamic	\$-58.6M (\$-113.6M, \$-28.0M)	-1,419 (-2,000, -987)

Summary & Conclusions

Summary of work

- Using data from the Victorian Department of Health we were able to create a model that reflects an average acute care facility in Victoria, Australia.
- We used our model to test a variety of staff mask and patient admission screening scenarios.
- Using annual cost estimates and our agent-based model, we were able to generate and compare outcomes on the relative cost effectiveness of mask and testing strategies in acute care facilities.

Study Outcomes

This study found that **staff use of N95 masks in acute care settings** could save state-wide per annum

\$54.7M-78.4M and
854-1,543 deaths

Staff N95 usage and patient admission screening testing with RATs was the most cost-effective combination.

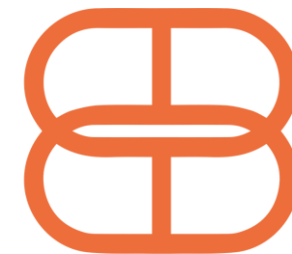
Increasing mask or testing usage can improve outcomes and be cost effective compared to no masks or testing at all.



Department of
Health



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University



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reach for the many

Thank you

Fenella McAndrew
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Suman Majumdar
Nick Scott



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