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Impacts of Antimicrobial Stewardship Program (ASP) on Healthcare Utilization and Patient Safety

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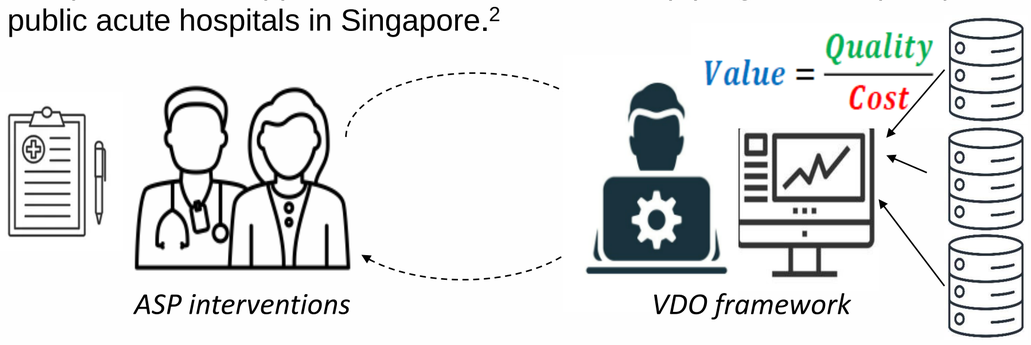
Context and Problem

Antimicrobial resistance (AMR) is **one of the top ten threats** to global health (MOH, 2019).[1] In 2009, the Ministry of Health (MOH) in Singapore appointed the National Antimicrobial Taskforce (NAT) to address the problem of AMR in public hospitals.[2]

One of the 5 core strategies identified in the National Strategic Action Plan on AMR published in 2017 was the optimisation of antimicrobial use and funding was provided to support antimicrobial stewardship programmes (ASP) in all public acute hospitals in Singapore.[2]



ASP interventions *VDO framework*

Prospective audit and feedback

National University Hospital (NUH) in Singapore initiated ASP in 2009 to reduce inappropriate prescribing of broad-spectrum antimicrobial agents without compromising patient safety.

Retrospective analysis and report

Value Driven Outcomes (VDO) office in NUH strives to ensure the best quality of care at affordable cost, by systematic monthly monitoring of quality and cost.

The ASP team, in collaboration with VDO office, monitors the effect of accepting ASP interventions by comparing the clinical outcomes in patients with accepted versus rejected ASP interventions.

Methodology and Data

Inclusion criteria:
Adults, in-patient, with ASP interventions in NUH
(1st Mar 2022 – 7th Feb 2023)

Whether the intervention is clinically relevant?

ASP Interventions:
1) De-escalation of antibiotic
2) Discontinuation of unnecessary antibiotics
3) IV to PO switch
4) Stop concurrent antibiotic

861 patients with 1,005 ASP interventions

Categorize patients by whether the intervention is accepted by clinicians
(For patients with multiple interventions, they are categorized into accepted group if >50% of the interventions are accepted).

$$\textit{Percentage of accepted ASP interventions} = \frac{\textit{No. of ASP intv. that were accepted within 48hrs } x\ 100\%}{\textit{Total no. of ASP intv. during hospital admission}}$$

Accepted (n=626, 72.7%) **Rejected (n=235, 27.2%)**

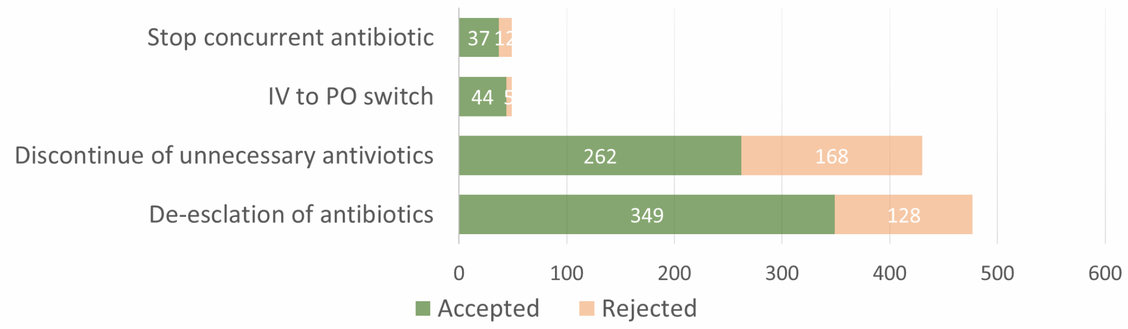
Patient demographics and outcomes including duration of carbapenem prescription, length of stay between ASP intervention and discharge from hospital (LOS), in-hospital mortality, 30-day mortality, 30-day readmission and hospitalization costs were obtained from the electronic medical records.

The effects of ASP acceptance on patient outcomes were estimated by multivariate linear regressions and logistic regressions, controlling for age, gender and Charlson Comorbidity Index (CCI).

Robustness check was conducted by controlling for infection types, including urinary tract infection, pneumonia, sepsis and bacteremia. Statistical analysis was performed using STATA.

Results and Discussion

I) Types of interventions and acceptance rate



II) Baseline comparison by accepted/rejected groups

Patients' demographics and comorbidities were similar in Accepted and Rejected groups.

Table 2. Patient demographics

Demographic	Accepted (n=626)	Rejected (n=235)	p-value
Age (years)	67.29	68.78	p=0.191
Gender (Male)	0.54	0.55	p=0.728
Charlson Comorbidity Index	5.67	6.06	p=0.068

III) Clinical impact of ASP and healthcare utilization

Duration of carbapenem prescription was significantly **shorter** (-1.09 days, P=0.001) in the Accepted group compared with the Rejected group.

We observed **a shorter LOS** of 2 days in the Accepted group (P=0.082).

There was an observed reduction in hospitalization costs of -$4,915 in the Accepted group as compared to the Rejected group (P=0.264).

Table 3. ASP acceptance and healthcare utilization

Variable	Coefficient	P-value	95% Conf. Interval
Duration of carbapenem prescription	**-1.095**	**0.001**	-1.750 to -0.440
Length of stay (since ASP intv.)	-2.092	0.082	-4.450 to 0.265
Hospitalization costs	-$4915.49	0.264	-13554.48 to 3723.50

IV) Acceptance of ASP and safety

Acceptance of ASP interventions was **not** associated with

- in-hospital mortality (P=0.869)
- 30-day mortality (P=0.658)
- 30-day readmission (P=0.739)

Results were consistent and robust after controlling for the infection types.

Table 4. ASP acceptance and safety

Variable	Odds Ratio	P-value	95% Conf. Interval
In-hospital mortality	0.968	0.896	0.591 to 1.583
30-day mortality (since ASP intv.)	1.116	0.658	0.686 to 1.817
30-day readmission	0.929	0.739	0.604 to 1.430

V) Acceptance of ASP and long-term antibiotic resistance

The number of incidences of antibiotic resistance for VRE/CPE/CDIFF was numerically fewer in the accepted group. However, the number of cases does not yet meet the minimum number to detect any statistical significance.

Conclusion

Prospective audit and feedback showed that the ASP initiative in NUH is beneficial for patients.

Acceptance of ASP interventions is significantly associated with a shorter duration of carbapenem prescription. We have also observed a shorter LOS and reduced hospitalization costs numerically but statistically insignificant. Patient outcomes, including mortality and readmission, were not affected by the ASP interventions.

We have also measured the long-term antibiotic resistance but the case number did yet meet the power to detect any statistical significance.

References

1. World Health Organization. Ten threats to global health in 2019. (Accessed on Sept 26, 2023)
2. National Strategic Action Plan on Antimicrobial Resistance, Singapore. Published 1 November 2017

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