DOI:10.1071/AH20071_AC

Australian Health Review 2021, 45, 59–65

Evaluating the economic effects of genomic sequencing of pathogens to prioritise hospital patients competing for isolation beds

Thomas M. Elliott[1,6] MH Econ, Health Economist

Nicole Hare[1] MB Inf, Masters Student

Krispin Hajkowicz[2,3] FRACP, Director of Infectious Diseases Unit

Trish Hurst[2] B. Nurs, Clinical Nurse Consultant

Michelle Doidge[2] B. Nurs, Clinical Nurse Consultant

Patrick N. Harris[3] FRACP, FRCPA, PhD, Staff Specialist

Louisa G. Gordon[1,4,5] PhD, Associate Professor

[1]QIMR Berghofer Medical Research Institute, 300 Herston Road, Herston, Brisbane, Qld 4006, Australia. Email: n.k.hare@hotmail.com; louisa.gordon@qimrberghofer.edu.au

[2]Infectious Diseases Unit, Royal Brisbane and Womens' Hospital, Herston, Brisbane, Qld 4029, Australia. Email: Krispin.Hajkowicz@health.qld.gov.au; Trish.Hurst@health.qld.gov.au; Michelle.Doidge@health.qld.gov.au

[3]The University of Queensland, Centre for Clinical Research, Herston, Brisbane, Qld 4006, Australia. Email: p.harris@uq.edu.au

[4]The University of Queensland, School of Public Health, Brisbane, Qld 4006, Australia.

[5]Queensland University of Technology, School of Nursing, Kelvin Grove, Brisbane, Qld 4059, Australia.

[6]Corresponding author. Email: thomas.elliott@qimrberghofer.edu.au

Supplementary Material

Text 1: Surveillance program for MROs

Pathogen screening of: patients transferred from another hospital, patients who had travelled overseas and, patients admitted to the adult intensive care unit, burns unit, renal dialysis unit,

haematology, oncology, transplant units and neonatal intensive care units (1). Weekly and bi-weekly screening occurred in several wards along with extensive contact tracing.

Table 1: CHEERS Statement Checklist

Manuscript "Evaluating the use of genomic sequencing of pathogens to prioritise hospital patients competing for isolation beds"

Section/item	Item no.	Recommendation	Reported on page no./line no.
Title and abstract			
Title	1	Identify the study as an economic evaluation, or use more specific terms such as ''cost-effectiveness analysis'' and describe the interventions compared.	Page 1
Abstract	2	Provide a structured summary of objectives, perspective, setting, methods (including study design and inputs), results (including base-case and uncertainty analyses), and conclusions	Page 1, line 4
Introduction			
Background and objectives	3	Provide an explicit statement of the broader context for the study. Present the study question and its relevance for health policy or practice decisions.	Page 4, line 13
Methods			
Target population and subgroups	4	Describe characteristics of the base-case population and subgroups analyzed including why they were chosen.	Page 7, line 12
Setting and location	5	State relevant aspects of the system(s) in which the decision(s) need(s) to be made	Page 5, line 15
Study perspective	6	Describe the perspective of the study and relate this to the costs being evaluated.	Page 8, line 12
Comparators	7	Describe the interventions or strategies being compared and state why they were chosen.	Page 5, line 21
Time horizon	8	State the time horizon(s) over which costs and consequences are being evaluated and say why appropriate.	Page 4, line 22
Discount rate	9	Report the choice of discount rate(s) used for costs and outcomes and say why appropriate.	N/A
Choice of health outcomes	10	Describe what outcomes were used as the measure(s) of benefit in the evaluation and their relevance for the type of analysis performed.	N/A
Measurement of effectiveness	11a	Single study–based estimates: Describe fully the design features of the single effectiveness study and why the single study was a sufficient source of clinical effectiveness data.	N/A
	11b	Synthesis-based estimates: Describe fully the methods used for the identification of included studies and synthesis of clinical effectiveness data.	Page 7, line 12
Measurement and valuation of preference-based outcomes	12	If applicable, describe the population and methods used to elicit preferences for outcomes.	N/A
Estimating resources and costs	13a	Single study–based economic evaluation: Describe approaches used to estimate resource use associated with the alternative interventions. Describe primary or secondary research methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	N/A
	13b	Model-based economic evaluation: Describe approaches and data sources used to estimate resource use associated with model health states. Describe primary or secondary research	Page 7, line 12

		methods for valuing each resource item in terms of its unit cost. Describe any adjustments made to approximate to opportunity costs.	
Currency, price date, and conversion	14	Report the dates of the estimated resource quantities and unit costs Describe methods for adjusting estimated unit costs to the year of reported costs if necessary. Describe methods for converting costs into a common currency base and the exchange rate.	Page 8, line 12
Choice of model	15	Describe and give reasons for the specific type of decision-analytic model used. Providing a figure to show model structure is strongly recommended.	Page 7, line 1. Supplementary Figure 1
Assumptions	16	Describe all structural or other assumptions underpinning the decision-analytic model.	Page 7, line 11
Analytic methods	17	Describe all analytic methods supporting the evaluation. This could include methods for dealing with skewed, missing, or censored data; extrapolation methods; methods for pooling data; approaches to validate or make adjustments (e.g., half-cycle corrections) to a model; and methods for handling population heterogeneity and uncertainty.	Page 8, line 17
Results			
Study parameters	18	Report the values, ranges, references, and if used, probability distributions for all parameters. Report reasons or sources for distributions used to represent uncertainty where appropriate. Providing a table to show the input values is strongly recommended.	Page 16, Table 1
Incremental costs and outcomes	19	For each intervention, report mean values for the main categories of estimated costs and outcomes of interest, as well as mean differences between the comparator groups. If applicable, report incremental cost-effectiveness ratios.	Page 9, line 15 & Page 17, Table 2
Characterizing uncertainty	20a	Single study–based economic evaluation: Describe the effects of sampling uncertainty for estimated incremental cost, incremental effectiveness, and incremental cost-effectiveness, together with the impact of methodological assumptions (such as discount rate, study perspective).	N/A
	20b	Model-based economic evaluation: Describe the effects on the results of uncertainty for all input parameters, and uncertainty related to the structure of the model and assumptions.	Page 10, line 10 & Figure 2
Characterizing heterogeneity	21	If applicable, report differences in costs, outcomes, or cost effectiveness that can be explained by variations between subgroups of patients with different baseline characteristics or other observed variability in effects that are not reducible by more information.	N/A
Discussion			
Study findings, limitations, generalizability and current knowledge	22	Summarize key study findings and describe how they support the conclusions reached. Discuss limitations and the generalizability of the findings and how the findings fit with current knowledge.	Page 10-12
Other			
Source of funding	23	Describe how the study was funded and the role of the funder in the identification, design, conduct, and reporting of the analysis. Describe other nonmonetary sources of support.	Title page
Conflicts of interest	24	Describe any potential for conflict of interest among study contributors in accordance with journal policy. In the absence of a journal policy, we recommend authors comply with International Committee of Medical Journal Editors' recommendations.	Title page

N/A – not applicable

Table 2: Model scenarios included within the AnyLogic ® model to represent real-life isolation protocol amendments.

Scenario	Description	Isolation Policy
1	Current Practice	1st priority isolation: CDI. 2nd priority isolation: nmMRSA, mMRSA, UK-EMRSA15, VRE, *E. coli*
2	Intervention	1st priority isolation: CDI. 2nd priority isolation: mMRSA, UK-EMRSA15, VRE, *E. coli* Not isolated: nmMRSA
3	Current Practice + Influenza	1st priority isolation: CDI, Influenza 2nd priority isolation: nmMRSA, mMRSA, UK-EMRSA15, VRE, *E. coli*
4	Intervention + Influenza	1st priority isolation: CDI, Influenza 2nd priority isolation: mMRSA, UK-EMRSA15, VRE, *E. coli* Not isolated: nmMRSA

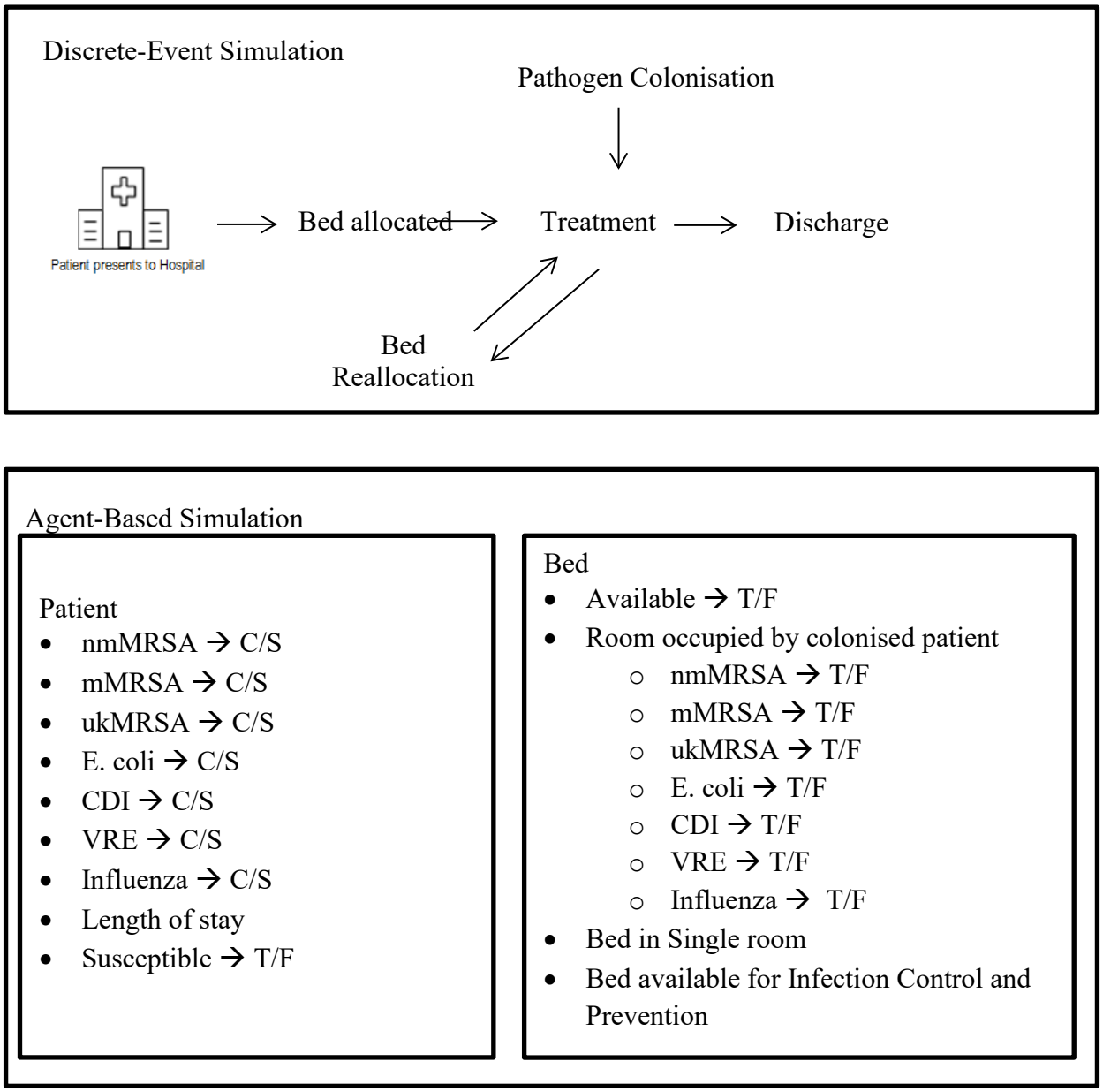
Abbreviations: nmMRSA = non-multi-resistant methicillin-resistant *Staphylococcus aureus*; mMRSA = multiresistant methicillin-resistant *Staphylococcus aureus*; UK-EMRSA15 = Epidemic methicillin-resistant *Staphylococcus aureus* types 15; E. coli = *Escherichia coli*; CDI = *Clostridioides difficile* infection; VRE = Vancomycin-resistant *enterococci*

Table 3: Transmission probabilities derived from MRO incidence data used in AnyLogic ® model colonization event generation.

Month	**nmMRSA**	**mMRSA**	**UK-EMRSA15**	**E. coli**	**VRE**	**CDI**	**Influenza**
January	0.00106	0.00014	0.00003	0.00061	0.00051	0.00044	0.00066
February	0.00105	0.00011	0.00007	0.00042	0.00039	0.00046	0.00188
March	0.00114	0.00006	0.00009	0.00028	0.00025	0.00031	0.00515
April	0.00116	0.00006	0.00003	0.00025	0.00025	0.00028	0.00450
May	0.00098	0.00003	0.00003	0.00009	0.00021	0.00037	0.00198
June	0.00070	0.00000	0.00003	0.00005	0.00013	0.00023	0.00058
July	0.00061	0.00007	0.00004	0.00007	0.00014	0.00014	0.00078
August	0.00079	0.00003	0.00003	0.00043	0.00034	0.00037	0.00051
September	0.00082	0.00003	0.00003	0.00046	0.00052	0.00033	0.00059
October	0.00118	0.00016	0.00006	0.00050	0.00062	0.00031	0.00054
November	0.00111	0.00019	0.00013	0.00057	0.00044	0.00035	0.00040
December	0.00116	0.00023	0.00007	0.00043	0.00050	0.00050	0.00049

Abbreviations: nmMRSA = non-multi-resistant methicillin-resistant *Staphylococcus aureus*; mMRSA = multiresistant methicillin-resistant *Staphylococcus aureus*; UK-EMRSA15 = Epidemic methicillin-resistant *Staphylococcus aureus* types 15; E. coli = *Escherichia coli*; CDI = *Clostridioides difficile* infection; VRE = Vancomycin-resistant *enterococci*

Figure 1: Discrete-event simulation and agent-based simulation components of the Hybrid model.



Note: C/S = colonised/susceptible; T/F = true/false; nmMRSA = non-multi-resistant methicillin-resistant *Staphylococcus aureus*; mMRSA = multi-resistant methicillin-resistant *Staphylococcus aureus*; ukMRSA = United kingdom methicillin-resistant Staphylococcus aureus; E. coli = *Escherichia coli*; CDI = *Clostridioides difficile* Infection; VRE = Vancomycin-resistant *enterococci*

Reference

1. Infection Monitoring and Prevention Service. Royal Brisbane and Women's Hospital: Multi Resistant Organisms, Management. Metro North hospital and Health service2018.