

On study design for policy analysis using patient flow simulations

Boris Sobolev

University of British Columbia, Canada

Supported by grants from CIHR, MSFHR and CRC

Healthcare intervention study

- intervention – management and policy alternatives
- implemented at the level of organization
- comparing clusters of individual patients
- hospital-level comparisons document hospital performance
- individual-level comparisons document patient results

Cluster-randomised design

- clusters of individuals rather than individuals are randomized to different intervention groups
- responses vary more across clusters than within
- intraclass correlation to measure similarity of responses within clusters
- implications for sample-size calculations

Policy analysis using simulations

- individual-level data to study variation in outcomes
- each run represents one hospital – cluster of patients
- runs randomised across intervention groups

How many runs?

- DOE: to estimate main effects
- intervention study: to test for differences
- inflated sample for patient-level comparison

Design of a simulation experiment

- booked admissions vs. wait-list booking
- intervention by method of scheduling clinic and surgery
- additional four 2-level factors
- 64 runs per group to detect 15% difference in proportion
- 760 cases per run to detect 15% difference in event rate
- 256 runs – a full factorial 2^6 experiment with 4 replicates

Understanding booked admissions

- 6 eighteen-week cycles of theater time allocation
- 3 surgeons alternating duties
- 15K emergency and 196K inpatients cases
- 211K elective referrals, 70% medium surgical priority
- % runs with no cancellations among high-priority cases
- weekly surgery rate among elective cases

Hospital-level comparisons

	Hospitals with no cancellations*	
	Percentage	Odds ratio†
Wait-list booking	89	1.0
Advance booking	74	0.4 (0.2, 0.7)

*High surgical priority

†Adjusted for initial queue size at clinic appointment, and for size of elective and urgent queues at registration, method of scheduling appointment, and OR slot allocation

Patient-level comparisons

	Access to surgery from wait lists	
	Surgery rate*	Rate ratio†
Wait-list booking	38	1.0
Advance booking	46	1.21 (1.18, 1.24)

* per 100 pts-week, medium surgical priority

†Adjusted for initial queue size at clinic appointment, and for size of elective and urgent queues at registration, method of scheduling appointment, OR slot allocation, and correlation between waits

Summary

- cluster-randomised intervention study
- hospital- and patient-level comparisons
- inflated sample for patient-level comparison to account for *within-cluster* correlation

Main idea

- cluster-randomised intervention study

Presentation outline

- hospital- and patient-level comparisons
- design of simulation experiment for patient flow
- booked admissions vs. wait-list booking

How many runs?

- DOE: to estimate main effects
- intervention study: to test for differences
- cluster design: to account for correlation r
- inflated sample for patient-level comparison

$$IF = 1 + r(m-1)$$