Using discrete event simulation to redesign care in the outpatient setting

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Background

Discrete-event simulation (DES) models the operation of a system as a discrete sequence of events in time. Each event, or process step, occurs at a particular time, dependent or independent or other process steps, and has a known and accepted rate of variation. It is an ideal methodology to design efficient systems. This study reports on the use of DES modeling to aid the system redesign of a large-volume uro-gynaecology assessment clinic. It was envisaged that a more rapid assessment of women to identify those who would benefit from a physiotherapy pathway as opposed to surgical pathway, would lead to more patients seen overall and with reduced waiting times

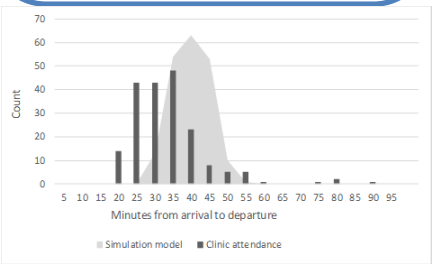
Objectives

The aim is to validate DES used to design a urogynaecology outpatient clinic flow by comparing the patient journey times predicted by the DES model, to those of women who attended the clinic.

Results

ANALYSIS OF PATIENT JOURNEY TIMES

The total patient journey time was measured from arrival at the reception desk until exiting the clinic area, and included registration, patient completion of self-assessment tool, clinical assessment by physiotherapist and doctor pair including relevant patient information video and medication provision and finally nurse checkout. The median patient journey time was 30 minutes (IQR: 25-35); compared to the DES predicted median time of 37 minutes (34-40). The distribution of arrival times for women arriving in the clinic, and as predicted by the model, are shown in Figure 1. There were no differences between total patient journey times comparing clinic 1 (31 minutes; IQR: 27-35) with clinic 2 (28 minutes; IQR: 24-36)



Methods

A DES model of the gynaecology outpatients department at Mater Hospital was created using FlexSim modelling (FlexSim Software Products Inc; Orem, Utah, USA). The floor plans of the clinic were inputted, patient and staff travel pathways described, and the triangular distributions of time for each step were inputted. The number of gynaecologists, physios, nurses, admin staff and rooms, as well as the arrival time intervals was then manipulated through twenty 3-month DES experiments to identify the appointment scheduling, staffing and room numbers associated with the least patient delay at each step in their journey.

Data pertaining to approximately 200 female patients with prolapse / incontinence symptoms, who attended two large-volume assessment clinics, have been used in this analysis.

The median and inter-quartile ranges of time from patient arrival at reception to time patient left the outpatient department have been analysed using Mann-Whitney *U* test, and compared visually using cumulative histograms to the DES predicted arrival-departure times.

Results

REDESIGN OF CLINICAL PROCESSES

A MDT comprising gynaecologists, physiotherapists, nursing, pharmacy and administration met to design a new model of care for large-volume assessment of women with uro-gynaecological symptoms.

The FIGO assessment scoring system for women with pelvic floor dysfunction is a patient-centric validated tool for appraisal of symptoms and signs of prolapse and incontinence. The key elements of this tool were contextualised and incorporated into an assessment tool for use by both patients and clinicians

TRIAGE	DISCHARGE PHYSIO	DISCHAGE GYNAE
Abnormal symptoms or investigations Already worked up ☐ pain if PU ☐ haematuria ☐ PMB ✓ UDs done ☐ abnormal urine ☐ abnormal USS ✓ normal physio ☐ Y → refer direct GOPD ☐ N → continue	# F2F contacts_____ # phone contacts _____ # groups _____ # 1on1 _____ 1st contact date_____ last contact date_____ Pessary ☐ Y ☐ N Size _____ Type _____ Self-manage ☐ Y ☐ N Last review date_____	☐ pessary ☐ ant repair ☐ post repair ☐ perineorrhaphy ☐ sacrospinous colposcpy ☐ abdo sacrocolpopexy ☐ hysterectomy ☐ mid-urethral sling ☐ ☐ other_____ 1st contact date_____ last contact date_____
0 ☐ Above hymen *"feel nothing"*	0 ☐ Above hymen *"feel nothing"*	0 ☐ Above hymen *"feel nothing"*
1 ☐ At hymen *"feel something when wipe or wash"*	1 ☐ At hymen *"feel something when wipe or wash"*	1 ☐ At hymen *"feel something when wipe or wash"*
2 ☐ Below hymen *"feel lump size of plum or golf ball"*	2 ☐ Below hymen *"feel lump size of plum or golf ball"*	2 ☐ Below hymen *"feel lump size of plum or golf ball"*
3 ☐ Compete eversion *"feel lump size of orange"*	3 ☐ Compete eversion *"feel lump size of orange"*	3 ☐ Compete eversion *"feel lump size of orange"*
0 ☐ 0 symptoms	0 ☐ 0 symptoms	0 ☐ 0 symptoms
1 ☐ 1-2 symptoms	1 ☐ 1-2 symptoms	1 ☐ 1-2 symptoms
2 ☐ 3-5 symptoms	2 ☐ 3-5 symptoms	2 ☐ 3-5 symptoms
3 ☐ 6 symptoms	3 ☐ 6 symptoms	3 ☐ 6 symptoms
0 ☐ 1 ☐ 2 ☐ 3 ☐ bother	0 ☐ 1 ☐ 2 ☐ 3 ☐ bother	0 ☐ 1 ☐ 2 ☐ 3 ☐ bother
SUM ABOVE FOR TOTAL score =	**SUM ABOVE FOR TOTAL score =**	**SUM ABOVE FOR TOTAL score =**
☐ ≥ 6 ☐ E2 cream prescribed UD referral ☐ Y ☐ N ☐ physio referral ☐ For GOPD referral and AO instructions completed below ☐ 4 or 5 decide ☐ ≤ 3 ☐ E2 cream prescribed UD referral ☐ Y ☐ N Ok for Physio pessary insert ☐ Y ☐ N ☐ Urgency only → Continence referral ☐ Y ☐ N → Ditropan prescribed ☐ Y ☐ N ☐ Dominant prolapse ☐ Dominant incontinence	Score improved AND Satisfied with improvement ☐ Y → ☐ discharged ☐ letter to GP and GOPD ☐ email to admingynae@mater.org.au ☐ N → ☐ UD referral actioned ☐ discharged to continence clinic ☐ UD referral actioned ☐ discharged to gynae clinic ☐ letter to GP and GOPD ☐ email to admingynae@mater.org.au → ☐ AO instructions completed below	NOTES Name: _____ Designation: _____ Signature:_____ Date: _____

Conclusion

System redesign in an outpatient clinic environment using DES resulted in a highly efficient assessment and triage of a large volume of patients, it identified early those might require surgical intervention, was associated with a positive healthcare experience, and has helped reduced outpatient wait times. DES is an effective tool to aid redesign of clinic processes and can accurately predict patient journey times

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