Understanding optimal resource allocations to deliver a sustainable IV infliximab infusion service through digital innovation

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Objectives

To determine the resource allocation required to deliver a robust, sustainable IV infliximab infusion service and demonstrate resource utilisation impact.

Methods

A bespoke discrete-event simulation model was utilised using Lean Six Sigma methodology for efficiency/inefficiency determination. Principles of pathway mapping, time, staffing, and resource requirements were identified. Simulations were run using a game-based learning approach to determine the impact of changes.

Parameters assessed were patient numbers (350, 400, 450), infusion chairs (5, 6, 7), number of nurses available (2, 3, 4), hours open (6, 7, 8) and days open (3, 4, 5). Simulations were run for a 12-month period.

The model assumed that there were no patients in the waiting list and that there was no delay to treatment.

A ratio of annual total time required to deliver service versus infusion chair capacity time was used to assess delivery of service (1 being optimal). Delays to appointments (>3 days) were also determined.

Results

- A total of 243 simulations were performed. Ratios calculated against patient volumes were 0.38–1.19 (350 pts), 0.44–1.36 (400 pts) and 0.49–1.53 (450 pts). Delays to appointments were assessed as 0.0–10.8%, 0.0–13.9% and 0.0–16.9% for 350, 400 and 450 patients respectively.
- Direct nurse/patient resource utilisation ranged from 14–61% (350 pts), 16–62% (400 pts) and 18–67% (450 pts) across the scenarios modelled with chair utilisation ranges being 32–83%, 37–91% and 42–91% for the corresponding patient cohorts.
- Optimal deployment of resources was determined to be 3 nurses, 5 chairs, 7 hrs/day and 3 days/week for 350 pts and 2 nurses, 5 chairs, 6 hrs/day and 4 days/week for 400 pts. Either 2 nurses, 5 chairs, 7 hrs/day and 4 days/week or 2 nurses, 6 chairs, 6 hrs/day for 4 days/week was optimal for 450 pts.

Table 1. Examples of nurse resource allocation

Direct	Indirect
Preparation of infusion	Patient documentation
Administration of infusion	Blood sampling
Monitoring of infusion	Dose adjustments
Termination of infusion	Prescription
Discharge	

Table 2. Resource impact on nurse and chair utilisation for a 350-patient service

Patients	350	350	350	350	350	350	350	350	350	350	350
Chairs	7	7	7	7	5	7	5	5	5	5	5
Nurses	4	3	2	4	2	4	3	3	2	3	4
Hours open/day	8	8	8	6	7	6	8	7	6	6	6
Days open	5	5	5	5	4	3	3	3	3	3	3
Direct nurse utilisation (%)	14	19	28	19	39	30	23	35	46	31	23
Direct chair utilisation (%)	32	32	32	43	63	69	56	83	73	73	73
Ratio	0.38	0.38	0.38	0.51	0.77	0.85	0.89	1.02	1.19	1.19	1.19

Figure 1. Overview of resources to deliver optimal service delivery to a 350/400-patient cohort

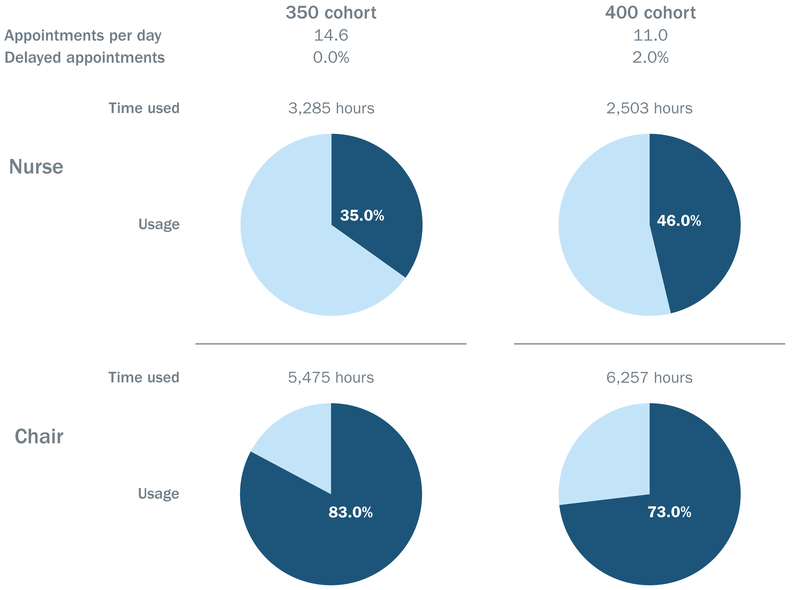


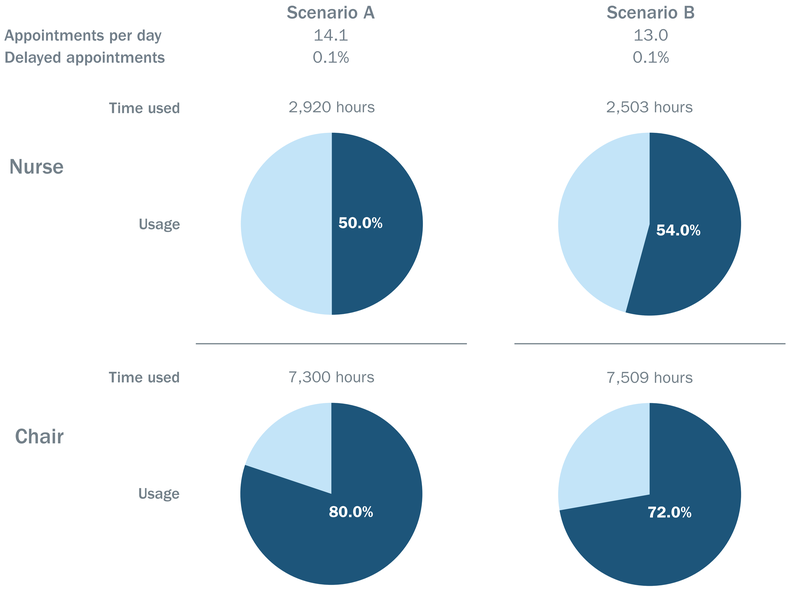
Table 3. Resource impact on nurse and chair utilisation for a 400-patient service

Patients	400	400	400	400	400	400	400	400	400	400	400
Chairs	7	7	7	5	5	5	6	5	5	5	5
Nurses	4	3	2	2	3	2	3	2	2	3	4
Hours open/day	8	8	8	7	6	6	6	7	6	6	6
Days open	5	5	5	5	5	4	3	3	3	3	3
Direct nurse utilisation (%)	16	26	32	37	28	46	36	57	46	31	23
Direct chair utilisation (%)	37	44	37	59	68	73	72	91	73	73	73
Ratio	0.44	0.44	0.44	0.70	0.82	1.02	1.14	1.17	1.36	1.36	1.36

Table 4. Resource impact on nurse and chair utilisation for a 450-patient service

Patients	450	450	450	450	450	450	450	450	450	450	450
Chairs	7	7	7	5	5	6	5	5	5	5	5
Nurses	4	3	2	2	2	2	2	3	2	3	4
Hours open/day	8	8	8	8	8	6	7	7	6	6	6
Days open	3	5	5	5	4	4	4	3	3	3	3
Direct nurse utilisation (%)	18	24	36	36	44	54	50	38	46	31	23
Direct chair utilisation (%)	42	42	42	58	70	72	80	91	73	73	73
Ratio	0.49	0.49	0.49	0.69	0.86	0.96	0.99	1.32	1.53	1.53	1.53

Figure 2. Overview of resources to deliver optimal service delivery to a 450-patient cohort



Conclusions

Both macro (COVID) and/or micro (staffing and funding) factors may impact on service delivery. Appropriate resource allocation can overcome challenges and allow for continued administration for suitable patients. Further work is required to understand resource requirements to reduce waiting lists.

Disclosures of interest E Carmona, I Rickard, J Tumelty and S Keady are employees of Biogen and I Rickard, J Tumelty and S Keady hold stock in Biogen. Biogen International GmbH funded this study.
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