

The Art of the Adjacent Possible

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What is the adjacent possible?

In any system that is evolving over time—whether it's a biological system or a cultural one—at any given point in that evolution, there are a finite set of ways that the system can be changed, and a much larger set of changes that can't be made. Think of the pieces of a chessboard halfway through a game of chess: there are a finite set of moves that are possible at that moment of the game, given the rules of chess, and a much larger set that can't be made. The set of moves that you can make define **the adjacent possible** at that moment in the game. If you think of it in terms of technology, there's simply no way to invent a microwave oven in 1650, however smart you might be. But somehow, in the middle of the 20th century, the idea of a microwave oven became imaginable, became part of **the adjacent possible**.

-Steven Johnson

The Little's Law definition

☰ Little's law

🌐 15 languages ▾

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In mathematical [queueing theory](#), **Little's law** (also **result**, **theorem**, **lemma**, or **formula**^{[1][2]}) is a theorem by [John Little](#) which states that the long-term average number of customers (L) in a [stationary](#) system is equal to the long-term average effective arrival rate (λ) multiplied by the average time that a customer spends in the system (W). Expressed algebraically the law is

$$L = \lambda W.$$

The relationship is not influenced by the arrival process distribution, the service distribution, the service order, or practically anything else. In most queueing systems, service time is the [bottleneck](#) that creates the queue.^[3]

The Little's Law formula

$$\lambda \times W = L$$

“How many?”
(the long-term
average effective
arrival rate)

“How long?”
(the average
time that a
patient spends in
the system)

“How full?”
(the long-term
average number
of patients in a
stationary
system)

The Little's Law formula 'translation'

How many? \times How long? = How full?

The Little's Law arithmetic

(e.g. downstream General Medicine)

$$10.6 \times 9.6 = 102.6$$

Average admissions per day

Average length of stay

Average occupied beds per day

The Little's Law numbers

	Specialty's actual numbers
How many?	10.6 admissions
How long?	9.6 days
How full?	102.6 occupied beds

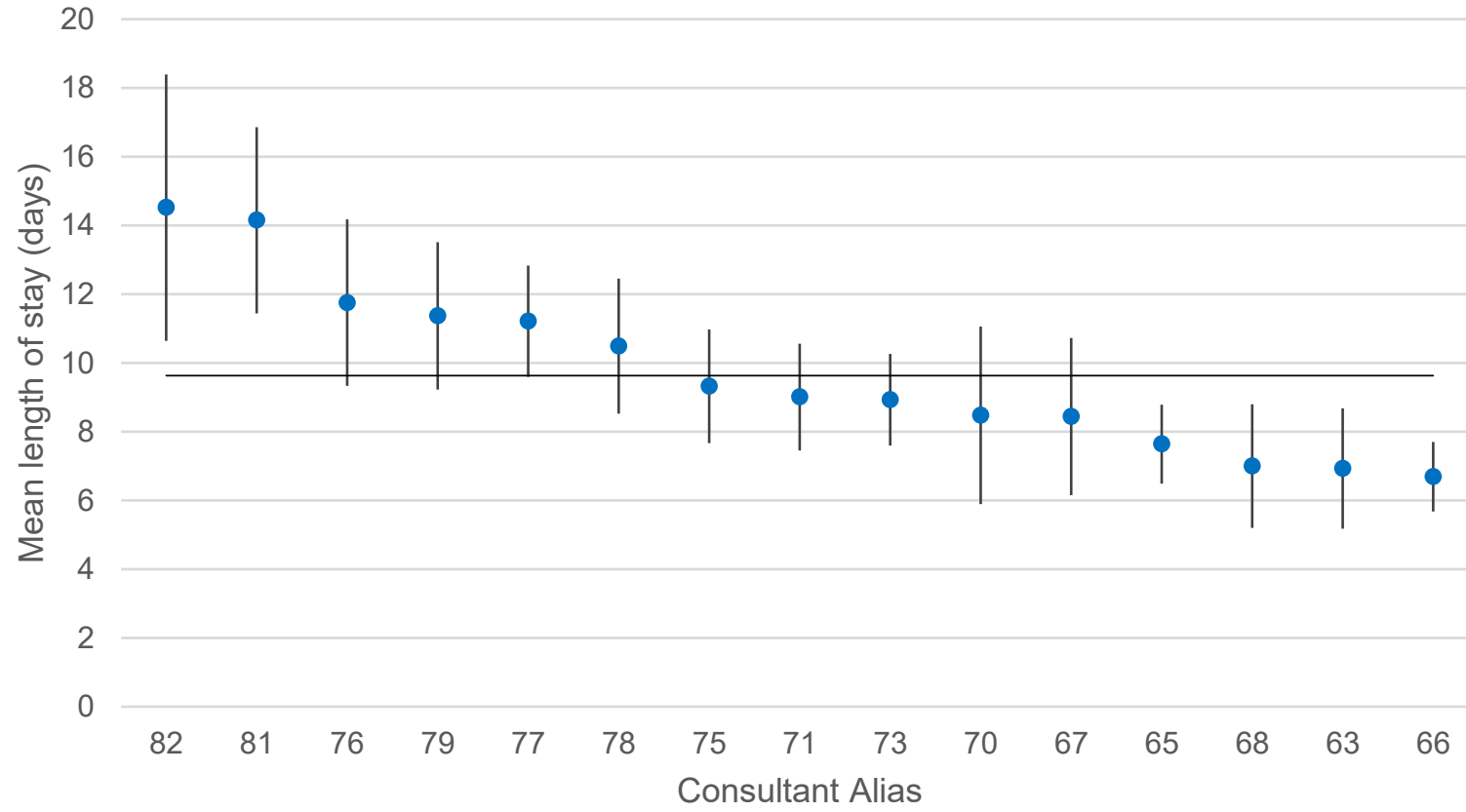
The crude league table

HIGH_LOW (All) ▾

CONSULTANT ▾	NO. OF DISCHARGES	MEAN LENGTH OF STAY (DAYS)
CONS_63	165	6.93
CONS_65	353	7.64
CONS_66	231	6.70
CONS_67	184	8.44
CONS_68	115	7.01
CONS_70	140	8.48
CONS_71	187	9.01
CONS_73	297	8.93
CONS_75	298	9.32
CONS_76	209	11.76
CONS_77	238	11.21
CONS_78	315	10.49
CONS_79	187	11.37
CONS_81	210	14.15
CONS_82	117	14.52
Grand Total	3246	9.64

The caterpillar plot

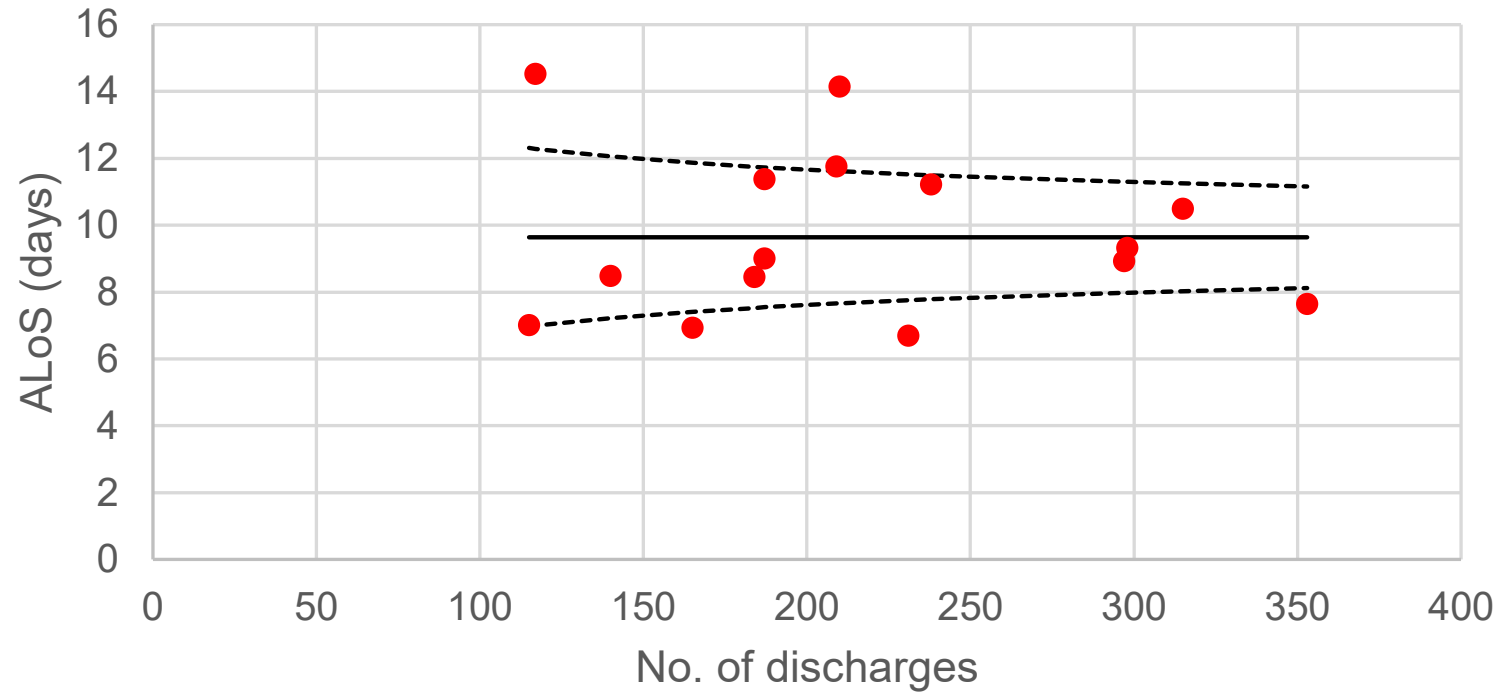
(95% confidence intervals)



The funnel plot

(95% control limits)

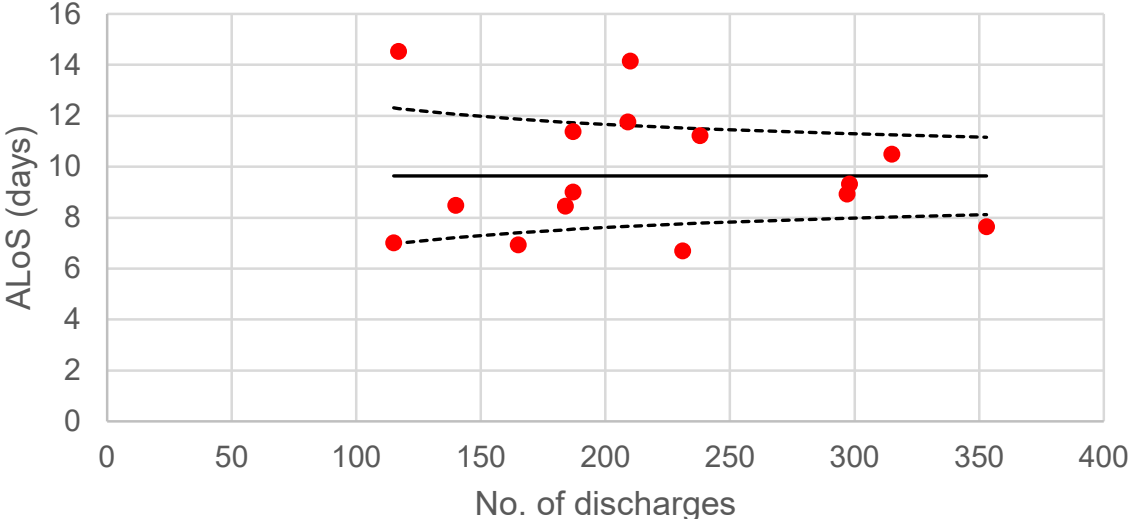
15 General Medicine consultants
Overall ALoS = 9.6 days



A bit of funnel plot juxtaposition

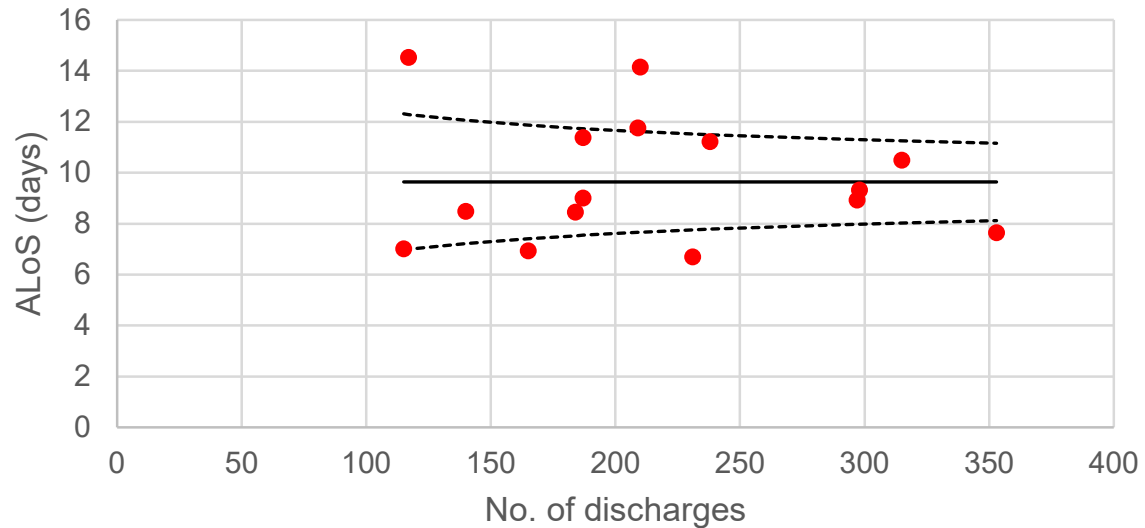
(still using 95% control limits)

15 General Medicine consultants
Overall ALoS = 9.6 days

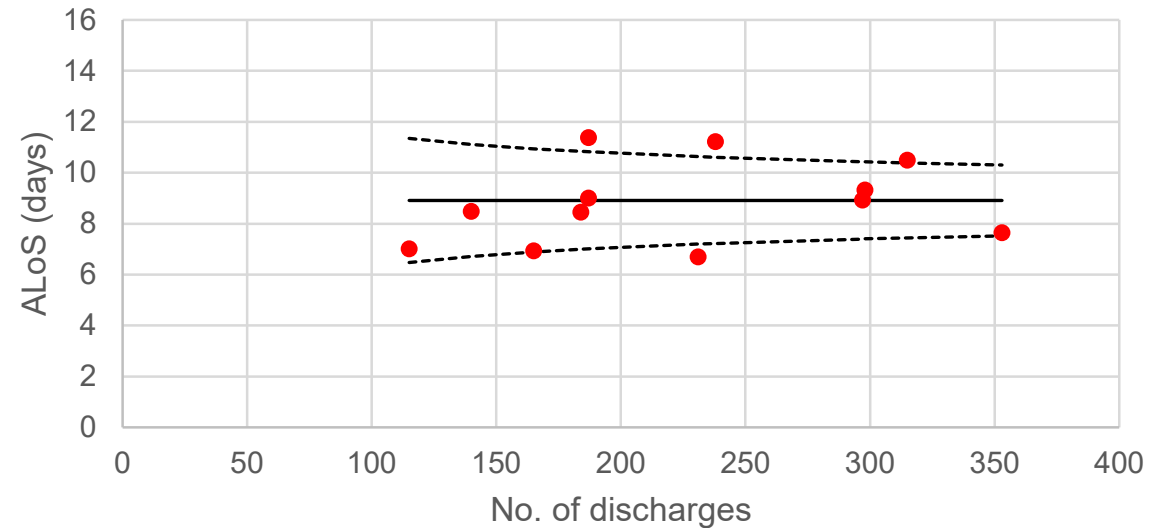


A bit of funnel plot juxtaposition (still using 95% control limits)

15 General Medicine consultants
Overall ALoS = 9.6 days



12 General Medicine consultants
Overall ALoS = 8.9 days



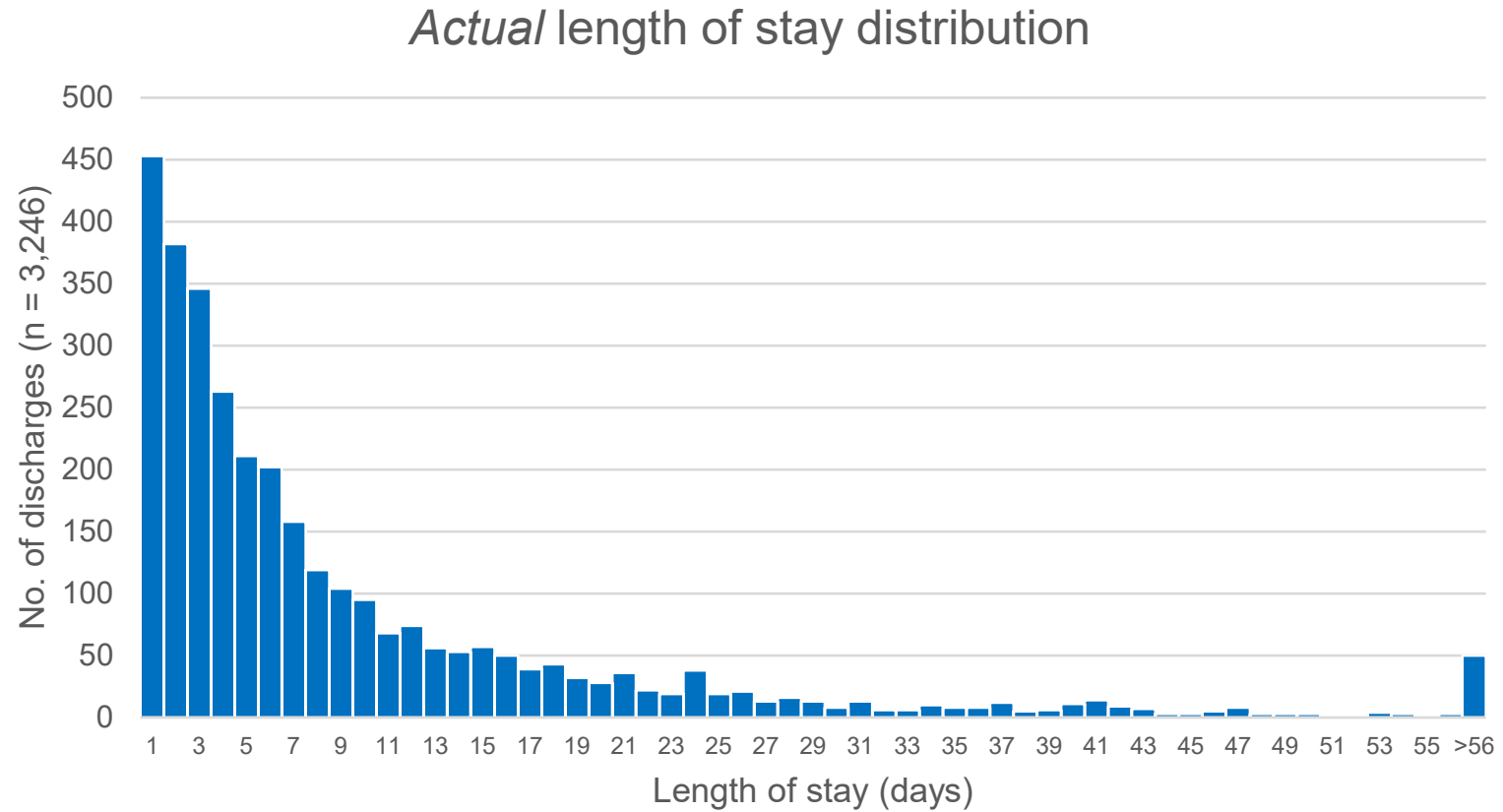
The Little's Law numbers

	Specialty's actual numbers	The adjacent possible numbers
How many?	10.6 admissions	10.6 admissions
How long?	9.6 days	8.9 days
How full?	102.6 occupied beds	94.8 occupied beds

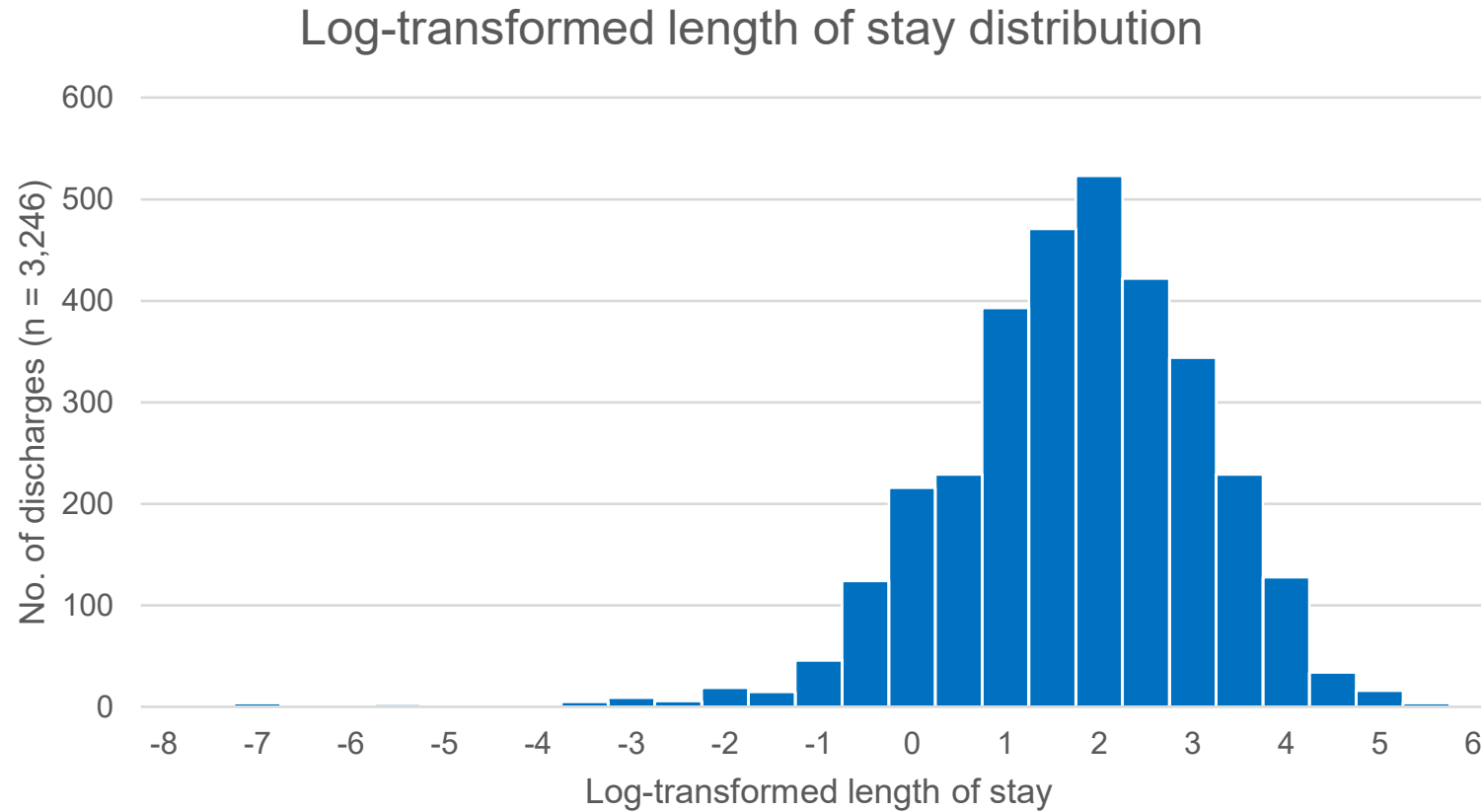
Four issues that emerge from this

1. The comparability of consultant casemix complexity
2. Balancing measures (e.g. 30-day mortality, 30-day readmission rates)
3. The shape of the underlying length of stay distribution
4. The long and the short of it: the difference between the **LONG ALoS** distribution and the **SHORT ALoS** distribution

The *actual* length of stay distribution

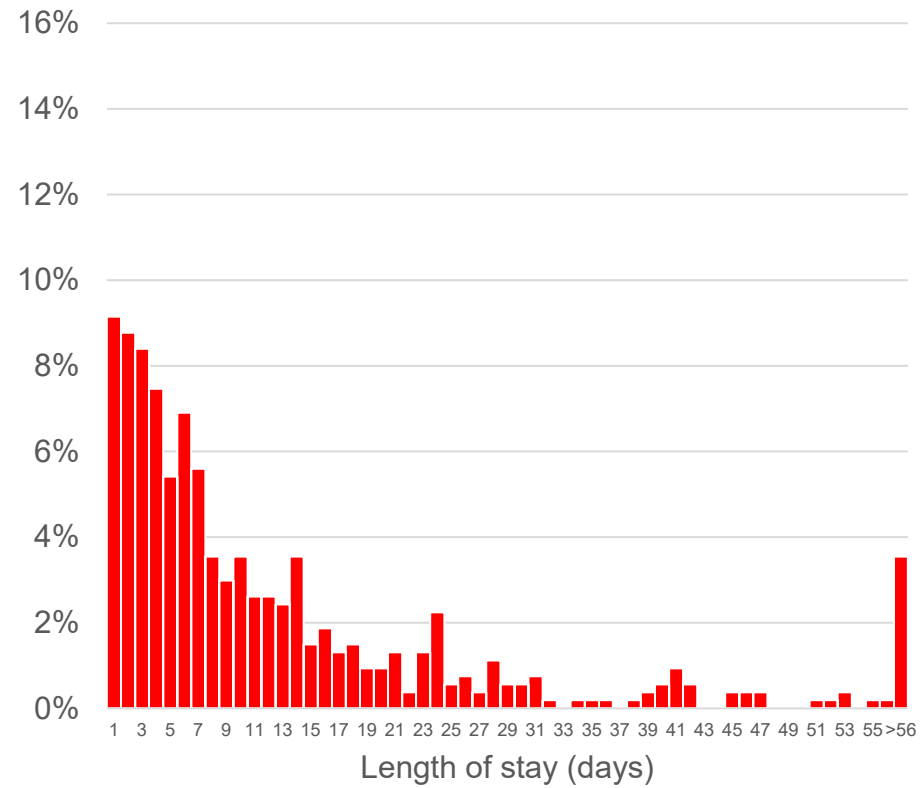


The *log-transformed* length of stay distribution



The long and the short of it

The three 'Long ALoS' consultants
Overall ALoS = 13.3 days



The other twelve consultants
Overall ALoS = 8.9 days

