

Supplementary Material to: Koh JJE, Tan YZ, Oh HC, et al. Factors associated with persistent high healthcare service utilisers in eastern Singapore in 2020–2022: A population health analysis. *Ann Acad Med Singap* 2025;54. DOI: <https://doi.org/10.47102/annals-acadmedsg.202543>

In our effort to study the factors associated with persistent high utilisers (PHUs) among patients in Changi General Hospital (CGH) from 2020 to 2022 in the main study, the annual expenditure threshold (AET) of healthcare services offered by CGH would need to be derived to classify the patients into PHUs or non-PHUs. The AET was obtained using Dataset 1 (DS1) by identifying the minimum annual expenditure (Table S2, column A) incurred in CGH, rounded to the nearest hundred dollars so that all residents with annual gross bills incurred in CGH greater than or equal to the AET in each year of 2017, 2018 and 2019 were PHUs. This is equivalent to deriving an AET value that will yield an equal number of (1) residents in DS1 with annual healthcare expenditure in CGH greater or equal to AET (Table S2, column A) for 3 consecutive years (2017–2019 (Table S2, column B) and (2) residents in group 1 of DS1 with annual healthcare expenditure in CGH greater or equal to AET (Table S2, column A) of the same 3 years (Table S2, column C).

This value was found to be SGD3700/year. With the AET, patients by years in this study were classified into high utilisers (HUs) if their annual expenditure was at least SGD3700 that year and non-HUs otherwise. PHUs were defined as patients who were HUs for 3 consecutive years over the study period. All other patients were defined as non-PHUs.

The novelty of utilising DS1 allows us to identify residents who are not only PHUs of CGH in the main study but also PHUs when considering all healthcare costs offered by private and public hospitals, primary care and intermediate-long-term care providers in Singapore.

Table S2. Determination of AET in Dataset 1.

Column A: Total cost spent in CGH (SGD)	Column B: No. of residents spending above SGD value in Column A per year in CGH for 3 consecutive years	Column C: No. of PHUs	Column D: Ratio of C/B
1000	14,095	6786	0.481
...	...	...	...
2000	7125	5522	0.775
...	...	...	...
3000	4499	4355	0.968
3100	4337	4241	0.978
3200	4183	4121	0.985
3300	4024	3992	0.992
3400	3881	3863	0.995
3500	3717	3713	0.999
3600	3596	3594	0.999
3700	3476	3476	1.000

AET: annual expenditure threshold; CGH: Changi General Hospital; PHUs: persistent high utilisers; SGD: Singapore dollars

Note: Intermediate values between 1000 and 2000 and 3000 (in SGD100 intervals) are omitted as they are not relevant for presentation.

Comparison between DS1 with data in the main study

Compared to DS1, which has records of Singapore healthcare services utilised by residents till 31 December 2019, data in the main study contain records of CGH healthcare services utilised by CGH patients till 31 December 2022.

The records from the main study exhibit a higher level of granularity and data resolution compared to DS1. Since it was obtained within an institution in Singapore, it captured detailed variables such as the discharge specialities for inpatient admissions, the specific nature of outpatient visits, the sources of referral for the emergency department and a comprehensive breakdown of the billing by service type. The increased data resolution allows deeper insights to identify and examine subtle patterns that may not have been observable in DS1.