Supplementary Methods

Operational Definitions of the Derived Indicators

Three binary indicators were derived from each patient care report. A primary psychiatric or substance-use diagnosis was a field field International Classification of Diseases 10th Revision (ICD-10) code in chapter F (F00–F99) recorded as the primary (first-listed) diagnosis; a primary respiratory diagnosis was a chapter J code (J00–J99) in the same position; and 24-hour recontact flagged any call occurring within 24 hours of the same patient's preceding call, identified through the national identification number. The two diagnosis indicators were defined on the first-listed diagnosis and the recontact indicator on call timing; a patient was classified positive for an indicator if it appeared in at least one of their calls.

Ever-positive Coding and Patient-level Prevalence

Each patient was classified positive for a binary predictor if the corresponding indicator appeared in at least one of their calls. Because higher-volume patients have more calls, they have proportionally more opportunities to be classified positive on every binary predictor, independent of any per-encounter difference. This mechanism inflates patient-level prevalences relative to call-level proportions across all indicators, not only those structurally tied to call frequency. The call-level comparisons (Table 1) and the patient-clustered call-level model (Table S2) is therefore the safeguard that distinguishes genuine per-encounter associations (e.g., respiratory diagnosis, home location, which persist) from those arising largely through accumulation (e.g. the triage code, which becomes null).

Rationale for the Two Volume-Entangled Sensitivity Models

The yellow-or-red triage code and 24-hour recontact are mechanically tied to call volume: under ever-positive coding, a patient-level "at least one call" flag approaches certainty as the number of calls rises. To separate per-encounter signal from accumulation, two complementary models were estimated. Table S1 omits both volume-entangled predictors and re-fits the seven remaining clinical and social predictors at the patient level. Table S2 uses the call as the unit of analysis with standard errors clustered by patient, testing whether each characteristic retains an independent association at the level of the individual encounter.

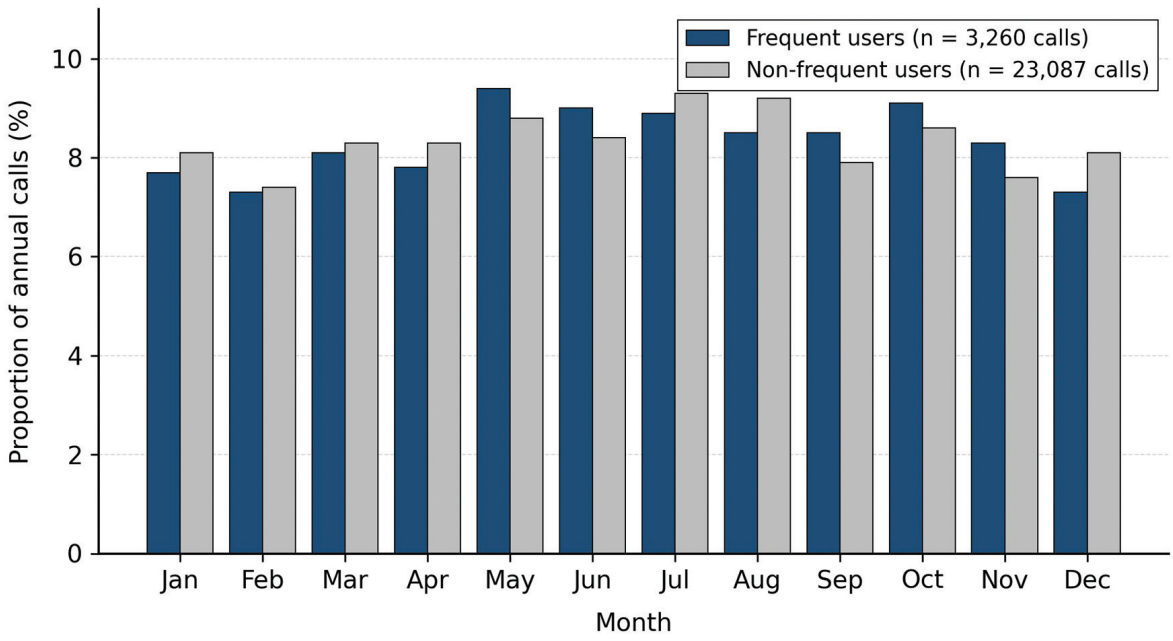


Figure S1. Monthly distribution of calls by frequent-user status, 2025

Within-group percentages (each group sums to 100%). Monthly distributions did not differ between frequent-user and non-frequent-user calls (Pearson chi-square p=0.37)

Table S1. Sensitivity model excluding the two volume-entangled predictors (n=18,653; 430 frequent users)			
Predictor	**AOR**	**95% CI**	**p**
Psychiatric/substance-use dx (F)	6.74	5.19-8.75	<0.001
Respiratory dx (J)	6.50	5.08-8.31	<0.001
Home incident location	4.66	3.44-6.31	<0.001
Retiree insurance	4.41	3.45-5.65	<0.001
Urban incident area	2.21	1.54-3.15	<0.001
Male sex	1.70	1.37-2.11	<0.001
Age ≥65 years	1.52	1.18-1.94	<0.001
AOR: Adjusted odds ratio, CI: Confidence interval, yellow/red triage code and 24-hour recontact, both mechanically inflated by call volume because a patient-level "≥1 call" flag becomes near-certain at high call counts, were removed. The seven remaining clinical and social predictors retained their direction, significance, and approximate magnitude (respiratory essentially unchanged; psychiatric attenuated only modestly from 7.99 to 6.74), indicating the core phenotype does not depend on the volume-driven indicators. Nagelkerke pseudo-R^2 =0.232			

Table S2. Call-level model: odds of a call originating from a frequent user (n=26,347 calls; cluster-robust standard errors)			
Predictor	**OR**	**95% CI**	**p**
Yellow or red triage code	0.98	0.86-1.11	0.71
24-hour recontact	4.59	3.60-5.85	<0.001
Psychiatric/substance-use dx (F)	1.49	1.16-1.91	0.002
Respiratory dx (J)	2.10	1.69-2.61	<0.001
Home incident location	1.77	1.49-2.10	<0.001
Retiree insurance	0.99	0.83-1.19	0.93
Urban incident area	2.10	1.58-2.81	<0.001
Male sex	1.66	1.32-2.08	<0.001
Age ≥65 years	2.12	1.66-2.70	<0.001
OR: Odds ratio, CI: Confidence interval, each call is the unit of analysis; the outcome is whether the call was made by a frequent user. Standard errors are clustered by patient to account for repeated calls. This model tests whether call-varying characteristics retain an independent association at the level of the individual encounter. The near-null triage estimate (OR: 0.98) confirms that the large patient-level triage association (Table 2) reflects call frequency rather than per-encounter acuity; 24-hour recontact, by contrast, retains the strongest call-level association (OR: 4.59), a genuine per-encounter signal that nonetheless rises with repeated contact. Respiratory diagnosis and home location also remain independently associated (OR: 2.10 and 1.77), identifying them as genuine encounter characteristics; the psychiatric estimate is modest (OR: 1.49), consistent with a real but limited per-encounter signal alongside accumulation across calls. Patient-stable attributes (insurance, sex, age) are constant across a patient's calls and are therefore not subject to the accumulation effect; the patient-level model (Table 2) is the appropriate basis for these			

Table S3. Primary ICD-10-chapter distribution, frequent vs non-frequent calls			
ICD-10 chapter	**FU (n=3,260), n (%)**	**NFU (n=23,087), n (%)**	**p**
Symptoms/signs ill-defined (R00-R99)	1,521 (46.7)	9,225 (40.0)	<0.001
External causes (V01-Y98)	141 (4.3)	3,991 (17.3)	<0.001
Circulatory (I00-I99)	208 (6.4)	1,827 (7.9)	0.002
Mental & behavioural (F00-F99)	263 (8.1)	1,765 (7.6)	0.397
Injury & poisoning (S00-T98)	62 (1.9)	1,648 (7.1)	<0.001
Respiratory (J00-J99)	309 (9.5)	993 (4.3)	<0.001
Musculoskeletal (M00-M99)	117 (3.6)	965 (4.2)	0.112
Factors influencing health status (Z00-Z99)	182 (5.6)	601 (2.6)	<0.001
Nervous system (G00-G99)	144 (4.4)	482 (2.1)	<0.001
Digestive (K00-K93)	77 (2.4)	379 (1.6)	0.003
Genitourinary (N00-N99)	55 (1.7)	391 (1.7)	0.979
Infectious & parasitic (A00-B99)	35 (1.1)	303 (1.3)	0.257
Endocrine/metabolic (E00-E90)	65 (2.0)	148 (0.6)	<0.001
Skin (L00-L99)	9 (0.3)	126 (0.5)	0.043
Pregnancy/childbirth (O00-O99)	9 (0.3)	111 (0.5)	0.104
Neoplasms (C00-D48)	32 (1.0)	50 (0.2)	<0.001
Eye (H00-H59)	2 (0.1)	37 (0.2)	0.225
Blood & immune (D50-D89)	20 (0.6)	8 (0.0)	<0.001
Ear (H60-H95)	1 (0.0)	17 (0.1)	0.717
Congenital (Q00-Q99)	3 (0.1)	5 (0.0)	0.066
Perinatal (P00-P96)	2 (0.1)	5 (0.0)	0.211
ICD-10: International Classification of Diseases 10th Revision, FU: Frequent users, NFU: Non-frequent users. Each call assigned to the chapter of its primary (first-listed) diagnosis; 13 calls (3 frequent-user, 10 non-frequent-user) without a classifiable primary diagnosis are not shown. Chi-square/Fisher exact			