

# Getting To Know The Super-user: Experience From A Large Urban Hospital System



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## Summary of findings

- A large portion of super-users utilize at high rates over prolonged periods of time
- Super-users differ markedly from non-super user ER and hospital patients
- Neighborhood doesn't seem to play a factor in super-utilization for this cohort of super-users
- We recommend including factors that determine medical complexity to identify high risk cohorts

## Introduction

- We approach research practically
- Questions are directed to impact selection of complex patients for intervention and structure of population health decision making
- Literature has failed to include the complexity of this population: frequency of visits, cost thresholds do not include the social and medical factors resulting in utilization
- We describe risk and long-term use to identify needier patients and indicate the role of geographic location

## Methods

### Data

**Patient data:** We obtained data from a large urban hospital system that covers 3 consecutive years of visits by patients who have had at least one ER visit during that time. Data reflects ER visits and inpatient hospitalizations only. All demographic, visit, and diagnostic information was obtained from the hospital system's files. Patient addresses were geocoded to enable linkage with Census Data.

**Census data:** American Community Survey data 5-year estimates for 2014 were obtained from FactFinder at the Census Tract level.

### Population of interest

Unless otherwise noted, we used the following Camden Coalition derived definition of super-users:

(1) at least 10 ER visits OR 4 hospital visits in a 12-month period;

(2) at least 2 chronic conditions, both of which cannot be mental health or substance abuse;

(3) not seeking care for oncological, obstetric, or surgical reasons

### Statistical methods

For bivariate comparisons, the t-test was used for continuous variables and the chi2 test for categorical. Standard multivariate logistic regression and multilevel logistic regression (random intercept only) were used where noted.

Stata® version 14.2<sup>1</sup> was used for all statistical analyses and ArcGIS® for Desktop 10.4 was used to create geographic representations.

The study was approved by the Baylor College of Medicine Institutional Review Board.

## Longitudinal look at Super Users

### Background

- There is a paucity of longitudinal data describing behavior of frequent users outside of a year (typically) during which high utilization is documented.
- All the literature focuses on frequent users of the ED.
- Studies suggest that only a small proportion of frequent users remain in the frequent use category.<sup>2, 3, 4, 5</sup> emphasizing regression in utilization after less than a year.<sup>6, 7</sup>
- It is not clear how longitudinal utilization varies depending on definition of super-user.
- It is not clear how "longitudinal" super-users differ from "discrete" super-users.
- Patients who use outside of a discrete period should potentially be prioritized for intervention.
- We look at three years of continuing utilization for super-users.
- We marked one year (2014) as the index year and considered utilization in two flagging years – 2013 and 2015 -- to track use before and after for patients fitting super-user criteria.
- We then compared super-users who used for more than one year against those who used only for a single year.

### Results

**Table 1: Longitudinal behavior of Super-Users (SUs), with SUs defined based on Camden Coalition derived definition (2013-2015).<sup>a</sup>**

	2013	2014	2015
Total patients (n) <sup>b</sup>	84,456	105,594	97,276
SUs (%)	1.08	1.26	1.49
SUs who qualified as SUs in addition to index year 2014 (%)	27.1	100	32.7
SUs who had ≥5 ER or ≥2 inpatient hospitalizations outside of index year 2014	47.8	100	50.8

<sup>a</sup> See Methods for definition

<sup>b</sup> Patients who have had at least 1 ER visit during the described time-period

**Table 2: Risk factors for long-term SUs compared to single-year SUs – bivariate comparisons and logistic regression results (2013-2015).**

	Bivariate comparisons		Logistic regression results OR (95% CI)
	SUs who qualified only in index year (n=695)	SUs who met SU criteria in at least one other year (n=634)	
Age (mean, SD)	52.6 (13.0)	50.7 (12.4)	.99 (0.98, 1.00)*
Gender (%)			
Female	35.3	40.9	-
Male	64.8	59.2	0.79 (0.62, 1.00)
Race (%)			
White	16.1	12.2	-
Black	42.6	36.0	1.21 (0.84, 1.73)
Latino	39.3	49.2	2.16 (1.48, 3.18)**
Other	2.0	2.7	2.09 (0.94, 4.64)
Insurance status (%)			
Homeless care	6.8	7.6	1.08 (0.67, 1.74)
Indigent care	42.0	39.4	0.76 (0.59, 0.98)*
Medicaid	31.8	39.8	-
Medicare	17.6	12.8	0.77 (0.54, 1.11)
Commercial	1.9	0.5	0.22 (0.06, 0.79)*
Charlson comorbidity index (mean, SD)	5.2 (3.1)	5.9 (3.3)	1.09 (1.05, 1.13)**
Mental health condition (%)	48.6	55.1	1.24 (1.07, 1.74)*
Substance abuse disorder (%)	34.8	44.5	1.90 (1.47, 2.46)**

\*p<0.05 \*\*p<0.0001

## Lessons learned and next steps

- Applying stringent criteria allows for the selection of the most vulnerable and needy patients.
- A high proportion of SUs has high rates of utilization before and after an index year.
- While some "regression to the mean" is present, this complex group of patients shows a higher degree of longitudinal high use compared to groups reported in the literature.
- Multi-year super-use is associated with several risk factors: Latino ethnicity (although is exclusively coded), insurance status, severity of illness, and presence of mental health and substance abuse disorders.
- Simply using utilization thresholds fails to identify high risk cohorts.
- Patients on Medicaid, with higher number of chronic conditions and a greater burden of mental health and substance abuse disorders are more likely to use long-term and should be prioritized for intervention

## Risk Factors for Super Utilization

### Background

- Majority of literature that characterizes risk factors for SUs focuses on ED frequent users
- For those users, several characteristics and risk factors are consistently highlighted in primary research. They are more likely to:
  - suffer from mental health conditions and substance abuse disorders,<sup>3, 5</sup>
  - be insured by Medicaid,<sup>4, 8</sup>
  - be homeless,<sup>3, 9</sup>
  - be poor,<sup>10</sup>
  - have a bimodal age distribution with peaks in the group aged 25 to 44 years and older than 65 years.<sup>11</sup>
- It is not clear whether these risk factors apply when considering a more complex population and to what extent chronic, mental health, and substance abuse contribute when considered together.
- We look at a single cross-sectional year to arrive at a sample of super-users using our intervention-based definition (see Methods) and a comparator group of patients with at least one ER visit.
- We compare them across a host of individual characteristics chosen based on prior literature and our experience both in bivariate comparisons and using logistic regression.

### Results

**Table 3. Comparing super-users to non-super-users in cross-section on individual characteristics – results of bivariate comparison and logistic regression results (2015).**

	Bivariate Comparisons*		Logistic regression results OR (95% CI)
	Non Super Users (n=85,393)	Super Users (n=1,060)	
<b>Individual characteristics</b>			
Age (mean, SD)	43.5 (15.1)	51.5 (12.8)	0.99 (0.98, 1.00)†
Gender (%)			
Female	52.0	37.6	-
Male	48.0	62.4	1.58 (1.36, 1.82)†
Race (%)			
White	11.3	15.2	-
Black	34.0	37.6	0.72 (0.58, 0.89)†
Latino	51.2	45.1	1.04 (0.83, 1.29)
Other	3.5	2.2	0.76 (0.47, 1.24)
Insurance status (%)			
Homeless care	3.2	6.7	0.97 (0.71, 1.33)
Indigent care	72.8	41.2	0.47 (0.40, 0.55)†
Medicaid	11.0	35.6	-
Medicare	7.8	15.2	0.45 (0.36, 0.56)†
Commercial	5.2	1.3	0.36 (0.21, 0.62)†
Charlson comorbidity index (mean, SD)	0.83 (1.9)	5.1 (2.9)	(not included)
<b>Chronic conditions (%)</b>			
MI	2.7	24.6	1.54 (1.27, 1.87)†
CHF	5.2	46.9	2.06 (1.72, 2.47)†
Peripheral Vascular Disease	1.7	17.1	1.67 (1.34, 2.08)†
Cerebrovascular Disease	2.8	14.9	1.12 (0.88, 1.42)
Dementia	0.6	4.2	1.83 (1.22, 2.73)†
COPD	4.4	43.6	3.01 (2.57, 3.54)†
Rheumatologic conditions	1.0	4.9	3.37 (2.37, 4.79)†
Peptic Ulcer Disease	0.7	4.8	1.75 (1.29, 2.53)†
Liver Disease (mild)	4.2	30.4	2.44 (2.02, 2.94)†
Diabetes without complications	16.4	63.3	2.96 (2.50, 3.50)†
Diabetes with complications	3.1	36.2	1.93 (1.59, 2.35)†
Paralysis	0.9	5.9	2.42 (1.72, 3.40)†
Chronic Kidney Disease	4.2	49.1	4.03 (3.36, 4.83)†
Liver Disease (moderate/severe)	0.9	10.6	1.55 (1.16, 2.07)†
HIV/AIDS	1.6	7.5	2.45 (1.83, 3.27)†
Mental health condition (%)	15.5	51.6	3.21 (2.76, 3.73)†
Substance abuse disorder (%)	10.3	42.5	2.38 (2.02, 2.80)†

\*statistically significant differences were found between SU and non-SU patients on all individual characteristics at the p<0.0001 level; standard t-test and chi2 tests were used as appropriate; neighborhood variations were not assessed using statistical techniques given non-independence  
†p<0.005 \*\*p<0.0001

## Lessons learned and next steps

- SUs differ dramatically from non-SUs: The burden of chronic disease, mental health conditions, and substance abuse among SUs is astounding
- These result reinforce that utilizing stringent criteria selects the most vulnerable and needy patients
- We highlight the medical aspects of super-use, but important social factors remain to be studied
- We observe that all insurance types are protective against super-use when compared to Medicaid, but few other proxies of social impacts are available
- Interaction between chronic conditions, mental health and substance abuse disorders, and social factors should be studied

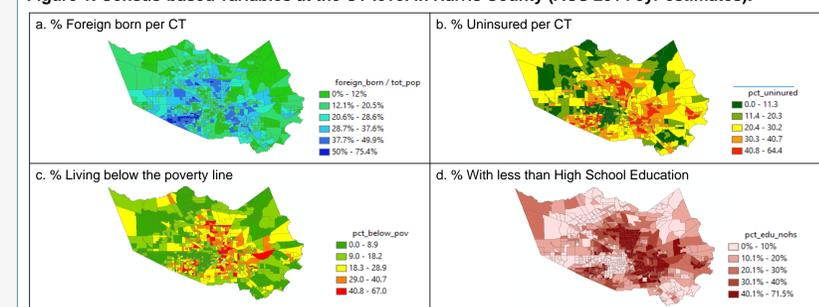
## Geographic context of Super Users

### Background

- There have been few reports documenting the relationship between geographic factors and super-utilization.
- Existing reports focus on availability of resources – hospital-based versus outpatient – and whether it predicts unnecessary use of the emergency department.<sup>12</sup>
- Here we look more broadly at whether socioeconomic and diversity indicators have an effect on super-use. Furthering our knowledge on geographic predictors of super-utilization would allow us to target the phenomenon on a neighborhood level.
- Houston is a diverse, yet highly segregated city along socio-economic lines. We hypothesized that measures of disparity and lower SES would positively predict super-use, while a measure like density of foreign-born individuals would be protective against super use (consistent with prior reports and more broadly with the "immigrant paradox").
- We surveyed the Houston geography to visualize distribution of our neighborhood predictors and subsequently build a multi-level logistic regression to see whether neighborhood-level factors would predict super-utilization.

### Results

**Figure 1. Census-based variables at the CT level in Harris County (ACS 2014 5yr estimates).**



**Table 4. Comparing super-users to non-super-users in cross-section on neighborhood characteristics – results of bivariate comparisons and multilevel modeling (2015).**

MLM Model 1 – Only neighborhood characteristics entered into the model

MLM Model 2 – Both neighborhood and individual characteristics entered (individual characteristics not shown)

	Non Super Users (n=85,393)	Super Users (n=1,060)	MLM Model 1 OR (95% CI)	MLM Model 2 OR (95% CI)
<b>Neighborhood characteristics</b>				
Neighborhood poverty rate			1.00 (1.00, 1.01)	1.00 (0.99, 1.01)
0-10%				
10.1-20%	9.6	7.5		
20.1-30%	22.1	21.9		
30.1-40%	27.6	29.7		
40.1-60%	23.7	22.0		
60.1-71.5%	17.0	19.0		
Gini index (mean, SD)	0.43 (0.06)	0.43 (0.06)	7.19 (2.00, 25.79)	2.19 (0.54, 8.93)
Neighborhood rate of uninsured			1.00 (0.98, 1.01)	1.00 (0.98, 1.01)
0-10%				
10.1-20%	2.7	1.5		
20.1-30%	12.6	15.3		
30.1-40%	30.7	32.3		
40.1-60%	34.0	34.0		
60.1-71.5%	20.1	17.0		
Neighborhood educational levels - % with less than a HS diploma or GED			3.77 (1.77, 8.02)	1.31 (0.57, 3.00)
0-10%				
10.1-20%	10.3	10.6		
20.1-30%	15.2	15.1		
30.1-40%	20.8	20.6		
40.1-60%	21.3	19.7		
60.1-71.5%	32.4	34.1		
Neighborhood foreign born rate			0.24 (0.11, 0.49)	0.78 (0.34, 1.80)
0-10%				
10.1-20%	13.0	15.5		
20.1-30%	21.8	26.2		
30.1-40%	22.4	20.5		
40.1-60%	24.7	23.2		
60.1-71.5%	18.2	14.6		

## Lessons learned and next steps

- Neighborhood factors do not appear to differ in bivariate comparisons (statistical tests were not conducted due to violation of independence). Neighborhood factors are significant predictors of SU in a neighborhood-factor-only model, but stop being significant predictors once individual risk factors are added.
- We hypothesized that neighborhood would have a significant effect on super-utilization. We did not find this to be the case. This is likely due to the fact that we only considered data from a single urban hospital system. The homogeneity of the population served by this system likely obliterated neighborhood-level differences one would expect from SU and non-SU patients.
- Importantly missing from our model are access measures, like distance to ERs, hospitals, and outpatient services.

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