Incorporating Alternative Care Site Characteristics Into Estimates of Substitutable ED Visits

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Background: Several recent efforts to improve health care value have focused on reducing emergency department (ED) visits that potentially could be treated in alternative care sites (ie, primary care offices, retail clinics, and urgent care centers). Estimates of the number of these visits may depend on assumptions regarding the operating hours and functional capabilities of alternative care sites. However, methods to account for the variability in these characteristics have not been developed.

Objective: To develop methods to incorporate the variability in alternative care site characteristics into estimates of ED visit "substitutability."

Research Design, Subjects, and Measures: Our approach uses the range of hours and capabilities among alternative care sites to estimate lower and upper bounds of ED visit substitutability. We constructed "basic" and "extended" criteria that captured the plausible degree of variation in each site's hours and capabilities. To illustrate our approach, we analyzed data from 22,697 ED visits by adults in the 2011 National Hospital Ambulatory Medical Care Survey, defining a visit as substitutable if it was treat-and-release and met both the operating hours and functional capabilities criteria.

Results: Use of the combined basic hours/basic capabilities criteria and extended hours/extended capabilities generated lower and upper bounds of estimates. Our criteria classified 5.5%–27.1%, 7.6%–20.4%, and 10.6%–46.0% of visits as substitutable in primary care offices, retail clinics, and urgent care centers, respectively.

Conclusions: Alternative care sites vary widely in operating hours and functional capabilities. Methods such as ours may help incorporate this variability into estimates of ED visit substitutability.

Key Words: Emergency Department Utilization, acute unscheduled care delivery, health services research

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Several policies have recently been implemented to divert low-acuity emergency department (ED) visits to alternative care sites such as primary care offices, retail clinics, and urgent care centers.[1–5] These efforts have been fueled by federal legislation promoting value-based payment and delivery reforms that incentivize shifting care to lower-cost settings.[6,7] Estimating the impact of these interventions requires the use of valid methods to identify ED visits that are "substitutable."

However, previous studies that have attempted to identify substitutable ED visits may have important methodological limitations. Most notably, many have assumed that lack of acuity is the only criterion for substitutability,[8] even though alternative care sites may be closed when patients seek care or may lack the resources to deliver equivalent care.[9] Moreover, the few studies that have accounted for hours and capabilities assumed a single profile for each site,[10] even though site characteristics vary substantially. For example, some primary care offices are open on weekdays and only perform basic point-of-care tests, while others are open on weekends and can perform a variety of tests on-site.[11,12] If substitutability depends on ED visit timing and resource utilization, estimates of this construct will inherently depend on assumptions regarding the hours and capabilities of alternative care sites. Given the variability in these characteristics among sites, presenting a range of estimates may be more justifiable than presenting a point estimate based on an assumption of homogeneity.

In this study, we developed a new method to incorporate the variability in hours and capabilities among alternative care sites into estimates of ED visit substitutability. Our approach uses the plausible range of hours and capabilities in each site to generate lower and upper bounds of estimates. We demonstrate one potential application of our approach using data from a nationally representative sample of ED visits.

METHODS

Construction of Functional Capabilities Criteria

To characterize the range of functional capabilities among alternative care sites, we searched the available literature using Pubmed, examined relevant websites, engaged in discussions with experts, and reviewed claims from retail clinics and urgent care centers. Our literature review identified a survey on functional capabilities of urgent care centers and 2 national surveys of functional capabilities of primary care offices.[5,12,13] For retail clinics and urgent care centers, we searched the website of a major retail clinic chain,[14] and communicated with and examined reports from national associations of retail clinics (the Convenient Care Association) and urgent care centers (the Urgent Care Association of America, personal communication, 2016).[15] We also searched for specific Current Procedure Terminology codes in retail clinic and urgent care claims contained in the 2014 Truven MarketScan Commercial Claims and Encounters Database, a convenience sample of claims from over 47 million individuals aged 0–64 with employer-sponsored insurance.[16]

We found evidence of substantial variation in functional capabilities within similar sites. Therefore, we developed 2 sets of criteria that captured the plausible degree of variation among sites: "basic" and "extended" criteria. If an intervention was performed at all members of a particular alternative care site, it was included in both the basic and extended capabilities criteria; if it was performed by some but not all members, it was included only in the extended capabilities criteria; and if it was not performed by any members, it was not included in either the basic or extended capabilities criteria.

Specific functional capabilities we considered included diagnostic tests, imaging tests, procedures, and medications coded in a national sample of ED visits, the 2011 National Hospital Ambulatory Medical Care Survey (NHAMCS). For diagnostic tests, we defined functional capability as the ability to perform a test on-site and obtain immediate results, similar to an ED (eg, point-of-care testing).[17,18] For imaging tests, procedures, and medications, we defined functional capability as the ability to perform imaging, perform procedures, or administer medications on-site (a complete list of medications is included in Appendix 1, Supplementary Digital Content 1, http://links.lww.com/MLR/B385).

For certain interventions, there was no direct evidence to inform decisions, while for others, the nature of the intervention coded in NHAMCS was unclear. For example, NHAMCS includes a variable for "cardiac monitoring," which may imply telemetry or basic cardiorespiratory monitoring. For these interventions, we used a consensus-based approach in which 2 primary authors (N.S.T. and K.-P.C., both ED physicians) rated each intervention individually and resolved disagreements via discussion. Draft capabilities by site were reviewed by the remainder of the authors (including 3 ED physicians), and disagreements were also resolved via discussion. A detailed discussion of decisions is included in Appendix 2, Supplementary Digital Content 1 (http://links.lww.com/MLR/B385).

Construction of Operating Hours Criteria

Using a similar approach, we constructed basic and extended criteria to capture the plausible degree of variation in the operating hours of alternative care sites. According to a nationally representative survey of a nationally representative study, 40% of individuals with a usual source of care visit a primary care office with evening or weekend hours.[11] Therefore, we defined basic operating hours for primary care offices as 8 AM–5 PM on weekdays, and extended hours as 8 AM–8 PM on weekdays and 9 AM–5 PM on Saturdays. According to the Convenient Care Association, most retail clinics are open for up to 12 hours a day on weekdays and up to 8 hours a day on weekends, although some retail clinics are closed on weekends.[15] Therefore, we defined basic operating hours for retail clinics as 8 AM–8 PM on weekdays, and extended operating hours as 8 AM–8 PM on weekdays and 8 AM–5 PM on weekends. According to the Urgent Care Association of America, most urgent care centers are open 7 days a week for up to 12–16 hours a day, although some urgent care centers are closed on weekends (Urgent Care Association of America, personal communication, 2016). As such, we defined basic operating hours for urgent care centers as 8 AM–8 PM on weekdays, and extended operating hours as 7 AM–11 PM on weekdays and weekends. As our data sources did not reveal the exact operating hours of alternative care sites, we used consensus to define the criteria for operating hours.

Example Application of Criteria

Our criteria can be used to estimate upper and lower bounds of ED visit substitutability in a variety of situations. To illustrate 1 example, we conducted an analysis in which we defined substitutability as a function of visit timing, resource utilization, and disposition, following similar approaches in previous literature.[10] Data were derived from ED visits by adults age 19 or older in the 2011 NHAMCS.[19] Among 23,995 such visits, we excluded 1,298 visits (5.4%) with missing information for disposition and visit timing (day of the week, arrival time, length of stay), leaving a sample of 22,697 visits. In NHAMCS, arrival time and length of stay are expressed in minutes; we calculated discharge time in minutes by adding these 2 quantities.

To be classified as substitutable in this analysis, visits were required to meet 3 conditions: (1) the arrival and discharge time occurred between a site's operating hours; (2) the resources utilized during the visit were within a site's functional capabilities; and (3) the visit was treat-and-release (ie, disposition other than hospital admission, observation then admission, observation then discharge, transfer to psychiatric hospital, transfer to other hospital, died in ED, or dead on arrival). To estimate the lower bound of substitutability, we calculated the proportion of visits that met all of these conditions when using the basic criteria for hours and capabilities. To estimate the upper bound, we performed the same analysis but used the extended criteria for hours and capabilities.

We adjusted for the complex design of the NHAMCS using survey weights and design-based variance estimators. We used SAS version 9.4 (Cary, NC) to conduct analyses.

The Institutional Review Board of the University of Chicago determined that this study was not human subject research.

RESULTS

Table 1 displays the basic and extended criteria for operating hours and functional capabilities, while Table 2 displays the characteristics of the 22,697 ED visits included in the example analysis. The sample represented 99.0 million visits by adults aged 19 or above in 2011. The majority of visits were from females, non-Hispanic whites, and individuals who lived in urban areas. Public insurance programs such as Medicare, Medicaid, and the Children's Health Insurance Program were the primary expected source of payment for 43.1% of visits.

Table 3 displays the proportion of ED visits by adults that met the basic and extended criteria for operating hours, as well as the proportion that met the basic and extended criteria for functional capabilities. Estimates varied widely when using the basic and extended criteria, suggesting that the plausible range of hours and capabilities may be large among alternative care sites.

Table 4 displays the proportion of visits that met our definition of substitutability. Among ED visits in our sample, 81.5% were treat-and-release. When we additionally required that visits meet the basic operating hours and functional capabilities criteria, 5.5% [95% confidence interval (CI), 4.9%–6.0%] of visits were substitutable in primary care offices, compared with 27.1% (95% CI, 25.7%–28.4%) when we additionally required that visits meet the extended operating hours and functional capabilities criteria. For retail clinics, the corresponding estimates were 7.6% (95% CI, 6.9%–8.3%) and 20.4% (95% CI, 19.3%–21.6%), while for urgent care centers, these estimates were 10.6% (95% CI, 9.7%–11.5%) and 46.0% (95% CI, 44.1%–48.0%).

TABLE 1. Definition of Basic and Extended Operating Hours and Functional Capabilities for Alternative Care Sites

	Primary Care Office		Retail Clinic		Urgent Care Center	
	Basic	Extended	Basic	Extended	Basic	Extended
Operating hours						
Monday–Friday*	8 AM–5 PM	8 AM–8 PM	8 AM–8 PM	8 AM–8 PM	8 AM–8 PM	7 AM–11 PM
Saturday*	Closed	9 AM–5 PM	Closed	9 AM–5 PM	Closed	7 AM–11 PM
Sunday*	Closed	Closed	Closed	9 AM–5 PM	Closed	7 AM–11 PM
Diagnostic tests						
Glucose	Y	Y	Y	Y	Y	Y
Pregnancy test	Y	Y	Y	Y	Y	Y
Influenza test	Y	Y	Y	Y	Y	Y
Urine test	Y	Y	Y	Y	Y	Y
CBC, electrolytes, BUN/creatinine	N	Y	N	Y	N	Y
Coagulation tests	N	Y	N	Y	N	Y
HIV test	N	Y	N	Y	N	Y
Toxicology screen	N	N	N	N	N	N
Cardiac enzymes	N	N	N	N	N	N
LFTs	N	N	N	N	N	N
Arterial blood gas	N	N	N	N	N	N
Blood alcohol level	N	N	N	N	N	N
Blood culture and wound culture	N	Y	N	N	N	Y
EKG	N	Y	N	Y	Y	Y
Other blood tests	N	Y	N	Y	N	Y
Other lab tests	N	Y	N	Y	N	Y
Imaging tests						
X-ray	N	Y	N	Y	Y	Y
CT, MRI, US	N	Y	N	N	N	Y
Other imaging	N	N	N	N	N	N
Procedures						
Splinting*	N	Y	N	Y	N	Y
Casting*	N	Y	N	N	N	Y
Nebulizer therapy*	N	Y	N	Y	Y	Y
IV fluids or medications*	N	Y	N	N	N	Y
Suturing*	N	Y	N	N	N	Y
Incision and drainage*	N	Y	N	N	N	Y
Foreign body removal*	N	Y	N	Y	N	Y
Bladder catheterization*	N	Y	N	N	N	Y
Cardiac monitoring*	N	N	N	N	N	N
Other procedure*	N	Y	N	Y	N	Y
CPR, endotracheal intubation, central line placement	N	N	N	N	N	N
Medications						
ED-only medications*	N	N	N	N	N	N

*Criteria for which a consensus-based approach was used for one or more of the alternative care sites.

BUN indicates blood urea nitrogen; CBC, complete blood count; CPR, cardiopulmonary resuscitation; CT, computed tomography; ED, emergency department; EKG, electrocardiogram; HIV, human immunodeficiency; IV, intravenous; LFTs, liver function tests; MRI, magnetic resonance imaging; N, no; US, ultrasound; Y, yes.

TABLE 2. Characteristics of ED Visits in Sample

Characteristics	Category	Unweighted Observations	Weighted Visits (Thousands)	Weighted% (95% CI)
Age (y)	19–34	7878	34,899	35.3 (34.1%–36.4%)
	35–50	6113	26,852	27.1 (26.2%–28.1)
	51–64	4182	17,686	17.9 (17.0%–18.7%)
	65+	4524	19,554	19.8 (18.5%–21.1%)
Sex	Female	12,746	56,233	56.8 (55.8%–57.8%)
Imputed race or ethnicity	Non-Hispanic white	14,267	62,417	63.1 (59.3%–66.8%)
	Non-Hispanic black	4590	21,812	22.0 (18.3%–25.8%)
	Hispanic	2837	11,773	11.9 (10.0%–13.8%)
	Non-Hispanic other	1003	2988	3.0 (2.1%–4.0%)
Urban or rural residence	Urban	19,682	83,605	84.5 (75.9%–93.0%)
Insurance coverage	Private insurance	6465	28,162	28.5 (26.6%–30.2%)
	Medicare	5395	23,713	24.0 (22.4%–25.5%)
	Medicaid or CHIP	4519	18,889	19.1 (17.3%–20.9%)
	Worker's compensation	275	1202	1.2 (1.0%–1.4%)
	Self-pay	3624	16,505	16.7 (15.2%–18.1%)
	No charge/charity	362	1905	1.9 (0.8%–3.0%)
	Other	641	2949	3.0 (1.8%–4.2%)
	Missing	312	1403	1.4 (1.0%–1.8%)
	Unknown	1104	4264	4.3 (2.7%–5.9%)
Census region	Northeast	4782	18,289	18.5 (14.9%–22.1%)
	Midwest	5708	22,626	22.9 (18.5%–27.2%)
	South	6956	38,455	38.8 (33.6%–44.1%)
	West	5251	19,622	19.8 (15.7%–23.9%)

Sample includes 22,697 ED visits by adults aged 19 or older. Weighted percentages may not add up to 100% due to rounding error.
CI indicates confidence interval; CHIP, Children's Health Insurance Program; ED, emergency department.

In Appendix 3 (Supplementary Digital Content 1 http://links.lww.com/MLR/B385) we report estimates when using the extended hours/basic capabilities criteria and the basic hours/extended capabilities criteria. In Appendix 4 (Supplementary Digital Content 1, http://links.lww.com/MLR/B385) we present results from a sensitivity analysis in which we decreased the operating hours in both the basic and extended criteria.

DISCUSSION

Operating hours and functional capabilities of alternative care sites vary substantially, complicating efforts to estimate the proportion of ED visits that potentially could be treated in these sites. In this study, we developed a method that accounts for this variability by estimating lower and upper bounds of substitutability. Our approach of providing a range of estimates may be more justifiable than providing a point estimate based on a single profile of hours and capabilities. Indeed, such an estimate not only masks potentially important heterogeneity, but also requires the use of somewhat arbitrary assumptions given the lack of detailed data on the characteristics of a "typical" alternative care site.

On the basis of these considerations, we believe that many existing algorithms for identifying substitutable ED visits—particularly the New York University algorithm—should be used with caution. In this algorithm, discharge diagnosis is used to assign ED visits a probability of being treatable in primary care offices. These probabilities were based on a large-scale chart review in the 1990s that accounted for whether resources utilized in the ED were available in primary care offices. However, documentation regarding the algorithm's development suggests that primary

TABLE 3. Proportion of ED Visits Meeting Operating Hours and Functional Capabilities Criteria

Criteria	Site	Basic Criteria			Extended Criteria		
		Unweighted Observations	Weighted Visits (Thousands)	Weighted% (95% CI)	Unweighted Observations	Weighted Visits (Thousands)	Weighted% (95% CI)
Operating hours	Primary care office	5148	22,605	22.8 (22.0%–23.7%)	8854	38,682	39.1 (38.0%–40.1%)
	Retail clinic	7972	34,856	35.2 (34.2%–36.2%)	9728	42,506	42.9 (41.8%–44.1%)
	Urgent care center	7972	34,856	35.2 (34.2%–36.2%)	15,462	67,783	68.5 (67.1%–69.8%)
Functional capabilities	Primary care office	4402	18,338	18.5 (17.1%–19.9%)	15,484	68,362	69.1 (66.7%–71.4%)
	Retail clinic	4402	18,338	18.5 (17.1%–19.9%)	9676	41,440	41.9 (40.0%–43.7%)
	Urgent care center	6121	26,166	26.4 (24.7%–28.2%)	15,484	68,362	69.1 (66.7%–71.4%)

CI indicates confidence interval; ED, emergency department.

TABLE 4. Lower and Upper Bounds of Estimates of ED Visit Substitutability

	Basic Operating Hours, Basic Functional Capabilities (Lower Bound)	Extended Operating Hours, Extended Functional Capabilities (Upper Bound)
Primary care offices		
Unweighted observations	1279	6075
Weighted visits (thousands)	5434	26,797
Weighted% (95% CI)*	5.5 (4.9%–6.0%)	27.1 (25.7%–28.4%)
Retail clinics		
Unweighted observations	1772	4734
Weighted visits (thousands)	7502	20,241
Weighted% (95% CI)*	7.6 (6.9%–8.3%)	20.4 (19.3%–21.6%)
Urgent care centers		
Unweighted observations	2456	10,263
Weighted visits (thousands)	10,510	45,583
Weighted% (95% CI)*	10.6 (9.7%–11.5%)	46.0 (44.1%–48.0%)

*The values in the rows labeled "weighted% (95% CI)" represent the percentage of ED visits that were treat-and-release and met both the operating hours and functional capabilities criteria. A total of 81.5% of ED visits in our sample were considered treat-and-release.

CI indicates confidence interval; ED, emergency department.

care offices were assumed to have the same set of functional capabilities.[20]

Our study has limitations. First, although we thoroughly searched available evidence, including claims from retail clinics and urgent care centers, we sometimes used a consensus-based approach. In most cases, however, changing any particular element would only affect a small proportion of ED visits. In the future, our criteria could be updated as additional data on site characteristics become available.

Second, we do not claim that estimates from our example analysis necessarily represent the "true" proportion of ED visits that are substitutable. In particular, our definition does not account for potentially important factors such as patients' willingness to visit alternative sites, geographic proximity to these sites, and perceptions regarding whether ED care is required.[3,21,22] Furthermore, we were unable to determine whether resources utilized during ED visits were appropriate or whether patients would have been able to obtain appointments at alternative care sites even if they were open.

Finally, our functional capabilities criteria are specifically designed for the NHAMCS. However, these criteria could readily be adapted to other datasets, such as administrative claims containing procedure codes.

CONCLUSIONS

Alternative care sites vary widely in operating hours and functional capabilities. Methods such as ours may help incorporate this variability into estimates of ED visit substitutability.

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