Original Investigation

Travel Times for Screening Mammography: Impact of Geographic Expansion by a Large Academic Health System

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Rationale and Objectives: This study aims to assess the impact of off-campus facility expansion by a large academic health system on patient travel times for screening mammography.

Materials and Methods: Screening mammograms performed from 2013 to 2015 and associated patient demographics were identified using the NYU Langone Medical Center Enterprise Data Warehouse. During this time, the system's number of mammography facilities increased from 6 to 19, reflecting expansion beyond Manhattan throughout the New York metropolitan region. Geocoding software was used to estimate driving times from patients' homes to imaging facilities.

Results: For 147,566 screening mammograms, the mean estimated patient travel time was 19.9 ± 15.2 minutes. With facility expansion, travel times declined significantly ($P < 0.001$) from 26.8 ± 18.9 to 18.5 ± 13.3 minutes (non-Manhattan residents: from 31.4 ± 20.3 to 18.7 ± 13.6). This decline occurred consistently across subgroups of patient age, race, ethnicity, payer status, and rurality, leading to decreased variation in travel times between such subgroups. However, travel times to pre-expansion facilities remained stable (initial: 26.8 ± 18.9 minutes, final: 26.7 ± 18.6 minutes). Among women undergoing mammography before and after expansion, travel times were shorter for the postexpansion mammogram in only 6.3%, but this rate varied significantly (all $P < 0.05$) by certain demographic factors (higher in younger and non-Hispanic patients) and was as high as 18.2%–18.9% of patients residing in regions with the most active expansion.

Conclusions: Health system mammography facility geographic expansion can improve average patient travel burden and reduce travel time variation among sociodemographic populations. Nonetheless, existing patients strongly tend to return to established facilities despite potentially shorter travel time locations, suggesting strong site loyalty. Variation in travel times likely relates to various factors other than facility proximity.

Key Words: Mammography; imaging facility; patient access; disparities.

INTRODUCTION

Screening mammography is associated with reduced breast cancer mortality in randomized controlled trials among women aged 40–74 years (1). Despite intense efforts by numerous stakeholders to promote breast cancer screening, screening rates in the United States remain suboptimal, ranging from 51.4% to 72.8% in one study (2). Reasons for inadequate screening have been the focus of extensive prior investigation and are complex and multifactorial (1–4). Nonetheless, screening rates vary by a range of patient-level factors, including race and ethnicity (3,5), education (6), income level (6), health-care insurance (4), and place of residence (7). Awareness of such variation has relevance for targeted interventions intended to improve screening compliance, particularly among vulnerable populations.

One factor potentially impacting screening mammography utilization that has received considerable attention is the time for patients to travel to an imaging facility (8–13). The perceived burden associated with such travel relates not only to the availability of mammography facilities within a given region but also to the expense and time required for travel (11), logistical barriers such as the need for a robust transportation system to travel greater differences (13), and psychosocial, cultural, or other personal characteristics influencing patients' willingness to travel (8,14). Of note, the travel burden for screening mammography has the potential to more strongly impact certain vulnerable groups (9,11,12). Thus, the greater travel burden faced by some populations may

Acad Radiol 2017; ■:■■–■■

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http://dx.doi.org/10.1016/j.acra.2017.03.010

contribute to and exacerbate previously noted disparities in screening compliance.

The focus of the present study is a large urban tertiary care academic medical system. Although located in Manhattan, the health system cares for a large number of patients throughout the entire New York metropolitan region. In recent years, the health system has incorporated an array of offsite mammography facilities throughout its served communities, including elsewhere in Manhattan as well as in Queens, Staten Island, and Long Island. This expansion provides an opportunity to explore the influence of facility geographic expansion on patients' travel times for mammography, including how any such influence varies among patient groups.

The aim of the present study was to assess the impact of off-campus community expansion by a large academic medical system on patient travel times for screening mammography.

MATERIALS AND METHODS

This retrospective study was Health Insurance Portability and Accountability Act compliant and was approved by the institutional review board, which provided a waiver of the requirement for written informed consent.

An automated search was conducted of the NYU Langone Medical Center Enterprise Data Warehouse for screening mammograms performed on adult patients for a 3-year period from January 2013 (corresponding with the first month of complete data availability) to December 2015, yielding 148,845 examinations. The following measures were recorded for all identified screening mammograms: patient age, race, ethnicity, payer status, and address, as well as date and performing facility of the examination. The typical driving travel time in minutes between the patient's address of residence and the facility address was estimated using the *placement* geocoding package in the R programming environment (www.r-project.org); a total of 36 examinations were excluded due to inability of the package to compute a driving time. An additional 1243 examinations were excluded due to a computed driving time of over 180 minutes, consistent with the threshold used for exclusion in earlier investigations of screening mammography driving times beyond which patients were considered as unlikely to have driven to the examination (8,13). Using 2010 U.S. Census data, included patients were classified as living in an urban or rural region (15).

Travel times for the entire population were assessed using standard summary statistics. The mean and standard deviation of travel times were then determined for cohorts stratified by patient age (classified as ≤39, 40–49, 50–59, 60–69, 70–79, and ≥80 years), race (Asian, African American, white, and other/unknown), ethnicity (Hispanic, non-Hispanic, and other/unknown), payer status (private insurance, managed care, Medicare, Medicaid, self-pay, and other/unknown), rurality of the patient's residence (urban, rural, and other/unknown), place of the patient's residence (Manhattan vs other), and performing facility (pre-expansion or postexpansion site). In addition, the travel times of the entire cohort and of all of these subgroups were determined for six serial 6-month periods during the 3-year study window. Screening mammography was offered during the first 6-month period at six facilities (three in Manhattan, one in Queens, and two in Long Island). During the final 6-month period, screening mammography was offered at 19 facilities (4 in Manhattan, 2 in Queens, 2 in Staten Island, and 11 in Long Island) (Fig 1). For each time period, the differential between the minimum and maximum travel times among subgroups was computed.

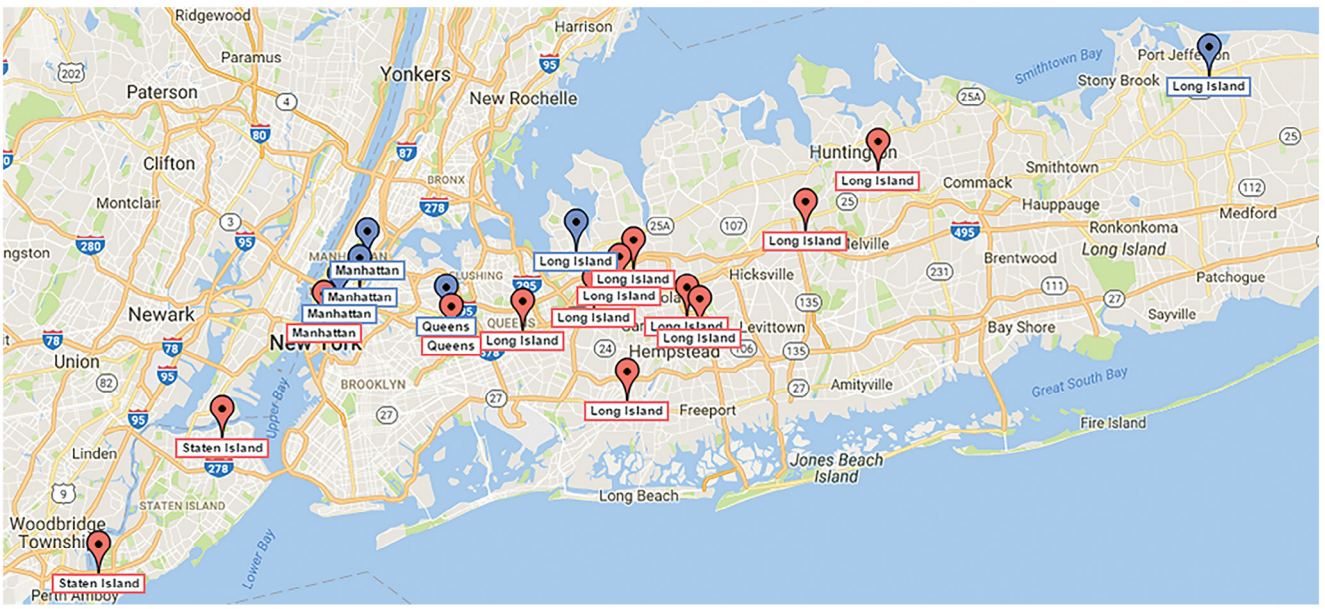

Figure 1. Map showing locations of mammography facilities at the start (blue) and finish (red) of the study interval. The figure was prepared using www.EasyMapMaker.com. (Color version of figure is available online.)