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Travel by public transit to mammography facilities in 6 US urban areas

S Graham[a], **B Lewis**[a], **B Flanagan**[a], **M Watson**[b], and **L Peipins**[b]

[a]Agency for Toxic Substances and Disease Registry, Atlanta GA, 30341, USA

[b]Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, Atlanta, GA, 30341, USA

Abstract

We examined lack of private vehicle access and 30 minutes or longer public transportation travel time to mammography facilities for women 40 years of age or older in the urban areas of Boston, Philadelphia, San Antonio, San Diego, Denver, and Seattle to identify transit marginalized populations - women for whom these travel characteristics may jointly present a barrier to clinic access. This ecological study used sex and race/ethnicity data from the 2010 US Census and household vehicle availability data from the American Community Survey 2008–2012, all at Census tract level. Using the public transportation option on Google Trip Planner we obtained the travel time from the centroid of each census tract to all local mammography facilities to determine the nearest mammography facility in each urban area. Median travel times by public transportation to the nearest facility for women with no household access to a private vehicle were obtained by ranking travel time by population group across all U.S. census tracts in each urban area and across the entire study area. The overall median travel times for each urban area for women without household access to a private vehicle ranged from a low of 15 minutes in Boston and Philadelphia to 27 minutes in San Diego. The numbers and percentages of transit marginalized women were then calculated for all urban areas by population group. While black women were less likely to have private vehicle access, and both Hispanic and black women were more likely to be transit marginalized, this outcome varied by urban area. White women constituted the largest number of transit marginalized. Our results indicate that mammography facilities are favorably located for the large majority of women, although there are still substantial numbers for whom travel may likely present a barrier to mammography facility access.

1. Introduction

Recent analyses of national data show that more than one-quarter of US women report not having received recommended screening mammography, indicating a mammography rate that is below the U.S. Department of Health and Human Services' Healthy People 2020

Corresponding Author: Shannon Graham, MS, 4770 Buford Highway NE, Mailstop F09, Atlanta, GA 30341-3717, Phone (770) 488-3851, SGraham@cdc.gov.

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target of 81.1% (Coleman King et al., 2012; US Department of Health and Human Services, 2011; US Preventive Services Task Force, 2009). Well-documented factors affecting adherence to mammography include poverty, low education levels, and absence of health insurance (Henry et al., 2013; Sabatino et al., 2008). These and similar studies have found that mammography screening among Asians was significantly lower than among whites or blacks (Coleman King et al., 2012), that Hispanics have lower screening percentages than non-Hispanics and that more recent immigrants (residence < 10 years) have considerably lower screening rates than US-born or long-term residents (Abraído-Lanza et al., 2005; Coleman King et al., 2012; Otero-Sabogal et al., 2004). However, many of these studies also show an attenuation of the effect of cultural factors such as ethnicity, health literacy and acculturation after accounting for structural factors such as access to health care, education, income, and availability of health insurance (Abraído-Lanza et al., 2005; Garcia et al., 2012; Jerome-D'Emilia, 2014).

Residential segregation by population group and poverty (Logan and Stults, 2011) as well as recent changes in these patterns (Kneebone and Garr, 2010) suggests that a geographical focus on access to healthcare could be particularly useful in understanding disparities. Geographic proximity to health care services such as mammography is strongly influenced by population density, and therefore, spatial access as measured by travel distance or service density, has been well examined for rural vs. urban areas (Doescher and Jackson, 2009; Engelman et al., 2002; Henry et al., 2013; Hyndman et al., 2000; Onega et al., 2011). In urban areas however, public transportation infrastructure and residential segregation patterns, rather than distance alone, may exert a stronger influence on access to services. An important component of the urban transportation infrastructure is its public transportation network. The lack of access to a private vehicle exerts limitations on travel time such as wait times and scheduling that are not experienced by those with a private vehicle. Thus, for those who most often depend on public transportation - low income, ethnic and minority urban residents – extended travel time may pose a barrier to mammography. In addition, there is likely to be a limit to the time that is acceptable for travel that can be especially salient for screening mammography which, by definition, is not urgent or emergency care.

Disadvantages in travel time to mammography facilities by automobile for low income and minority residents have been reported for Chicago, IL (Zenk et al., 2006), as well as in Atlanta, GA, where non-Hispanic black residents were found to have longer travel times to mammography facilities by public transportation (Peipins et al., 2011). A national study of car-based travel time to breast imaging facilities in the contiguous US found that Black and Asian women had the shortest median time to facilities and that rural women had the longest (Onega 2014). Conversely, in their examination of both individual-level factors and geographic factors for mammography use among Utah women, Henry and colleagues reported that travel time did not predict screening adherence (Henry et al, 2014). The inconsistencies in findings stem from differences in methodology and geographic scope. In addition, most studies focused on private transportation. Thus, there has been limited research on travel barriers to mammography facilities by public transportation in urban areas where it is assumed that women have adequate access.

1.1 Aims of the study

Using an ecologic approach, we examine public transportation travel time barriers to mammography facilities for women without access to a private vehicle and for women with especially long public transit times in six urban areas. For convenience of reporting we have defined these co-occurring characteristics as 'transit marginalization'. Specifically we describe the extent of travel time barriers to mammography facilities by public transportation within and across the 6 urban areas; the relative disadvantage with respect to travel time experienced by racial or ethnic groups, and the relative advantage of inner city vs. suburbs with respect to travel time. Thus in addition to numbers and percentages of women without access to a private vehicle, we calculated percentages of those with greater than 30 minutes travel time by population group for each of the six urban areas, for the urban areas combined and finally, by central city vs. remaining urban area for the six urban areas separately and combined. Our ecologic approach was based on aggregate data from the US census and American Community Survey (ACS) at the tract level and point-level mammography facility location data.

2. Methods

2.1 Urban public transportation setting

We chose six U.S. urban areas to represent different geographic regions (New England, Mid-Atlantic, South Central, Intermountain West, Southwest and Northwest) and racial/ethnic composition as well as a variety of transportation modes. We used systems that were available in their entirety via Google Maps for Transit. These areas included Boston, Philadelphia, San Antonio, Denver, San Diego, and Seattle. Urban areas differed in their mix of public transportation modes and frequency of public transportation use (Table 1). Boston and Philadelphia, with comprehensive public transit systems, including heavy rail, had considerably more annual public transportation trips as well as annual trips per person. Annual trips per person ranged from 98 in Boston to 29 in San Antonio. Bus ridership was also highest in Boston and Philadelphia. San Diego had the most extensive light rail system and San Antonio had only a bus system. Seattle was the most diverse in modes of transportation including ferry boat and trolley.

2.2 Definition of Urbanized Area

The 2010 US Census Urbanized Area boundaries were used to delineate the terminal extent of each of our six study areas. Census Urbanized Areas represent densely developed areas comprising residential and non-residential urban land uses with a population of 50,000 or more people (US Census Bureau, 2010). Urbanized area (we'll use the term 'urban area' hereafter) criteria include population density at the census block level, and do not always align with the census tract boundaries. Therefore, we used the following selection method to determine tracts to be included in the defined urban area. Centroids for each tract were obtained using ArcGIS 10.2 to identify the arithmetic mean center of the tract. Each centroid was evaluated as to its position within or without the Census Urbanized Area, and if within, it was included as part of our study area. We also mapped the central city boundaries within the urban areas using the delimited municipality-defined boundary of the city. In most instances, the central city boundaries fell within the census urban areas but in a few instances, tracts falling within the central city did not meet the population density requirement to be designated as a census urban area.

2.3 Data Sources and categorization of variables

We used U.S. Census 2010 Summary File 1 to obtain data for women 40 years of age and older by population group for each census tract in each urban area (US Census Bureau, 2010). Currently, the United States Preventive Services Task Force (USPSTF) recommends biennial mammography screening for women 50 years to 74 years and decisions by physicians to refer for screening at an earlier age can be made on an individual basis (US Preventive Services Task Force, 2009). Population group categories analyzed for this study included Hispanic, white (non-Hispanic), black (non-Hispanic) and Asian (non-Hispanic). A small 'other' population (other race, etc.) was not included in the analyses. The U.S. Census Bureau American Community Survey (ACS) data for 2008–2012 includes a variable regarding the household availability of a private vehicle (*How many automobiles, vans, and trucks of one-ton capacity or less are kept at home for use by members of this household?*). In this ecological study, we used ACS tract estimates for those who answered "None" to this variable and multiplied this estimate to population counts for women 40 years or older to represent populations most likely to depend on public transportation. Thus our analyses were restricted to women with no access to a private vehicle. Vehicle access data at the census tract level were used to limit sampling error associated with the variable at the block group level. We obtained data on certified mammography facilities in the six urban areas from the Food and Drug Administration's (FDA) certification and inspection records of U.S. mammography facilities for 2012 (US Food and Drug Administration, 2012). All facilities in the US are inspected annually for accreditation, and data from these reports include facility street addresses and the number of mammography machines in each facility. Addresses from the annual inspection database were geocoded to the street level of precision using ESRI's 2012 StreetMap Premium Advanced database (ESRI ArcGIS, 2012).

2.4 Analysis

The latitude/longitude locations for each tract centroid were entered into the Google Maps search engine using the public transportation option. Google Maps for Transit creates travel itineraries based on the least amount of travel time by all modes that are provided by the transit agency, as well as walking to and from stations. The shortest travel time from the centroid of each census tract to the nearest mammography facility by public transportation was obtained through repeated calls to the Google Maps Web page using the SAS FILENAME URL method in SAS version 9.3 (Zdeb, 2009). This allowed multiple routes from each tract to each facility to be calculated so as to identify the facility having the shortest travel time from each tract. As most facilities are closed on weekends, and optimal travel times exclude rush hours, a standard trip start time of 11:00 am on weekdays was used for all searches. For <1% of the searches, Google was unable to calculate transit directions from the centroid to a facility. These tracts were removed from our analysis.

Population-weighted median travel times to the nearest mammography facility were calculated for each urban area for the study population as a whole and within each urban area individually. The percentage of households with no vehicle access from the Census'

ACS data in each tract was assigned to all women in each tract. This percentage was applied to the number of women in each demographic subgroup to calculate the number and percentage of women 40 years of age and older without access to a private vehicle. For example, if 10% of households had no vehicle access we classified 10% of white, Hispanic, black, and Asian women as having no vehicle access. We then summed the number of women in each population group across all tracts in an urban area as well as for each component of the urban area (e.g., central city versus non-central). For all census tracts, we calculated the proportion of transit time that was less than 30 minutes or 30 minutes and greater. A 30-minute travel time has been suggested as a standard for accessible travel time to health care (Onega et al., 2011; Mao & Nekorchuk 2013; Bosanac et al., 1976). For ease of reporting we have defined women with the joint characteristics of no vehicle access and transit times that were 30 minutes or greater as 'transit marginalized'. We mapped the census tracts with a total number of transit marginalized women for each of the urban areas. We also described the racial/ethnic population composition within each central city and the remaining urban areas as well as the corresponding number and percent of transit marginalized women. We calculated bi-annual mammography capacity for each urban area by multiplying the number of machines in each facility by 12,000 (the maximum number of potential mammograms per machine = 6,000 per year × 2 years) (US Government Accountability Office, 2006), and then dividing by the population of women 40 years of age and older. A ratio of 1.0 or higher indicates adequate mammography capacity at the urban level.

3. Results

3.1 Six-City total population

Table 2 describes population characteristics of the 6 urban areas examined in our study. Population group percentages varied significantly among the six urban areas. Whites accounted for a majority of the population in all but San Antonio and San Diego. Hispanics made up the majority population of San Antonio and the combined minority populations in San Diego exceeded that of whites. Hispanics were the second largest population group in Boston (11%) and Denver (24%), while blacks were the second largest population group in Philadelphia. Seattle had the largest Asian population (13%). The racial/ethnic percentages of our total study resemble those of the nation as a whole (whites 65% compared with 64% nationally; Hispanics 17% compared with 16% nationally; blacks 11% versus 12% nationally; and Asians 7% versus 5% nationally) (Humes et al., 2011). Philadelphia had the largest population in both the defined urban area and the central city. San Antonio's central city population, composing 82% of its urban area, is the only city structured as such, with the other central cities containing a minority of the urban population. Because the study area included the central city and variously-sized outlying areas, population density (persons per square mile) varied from 1,918 in Boston to 3,558 in San Diego.

All urban areas had at least 10% of the population living below the poverty level, with the highest proportion of those living below the poverty level in San Antonio (17%). Boston and Philadelphia had the highest proportions of women with no private vehicle (13% and 14%, respectively), while the other urban areas had smaller proportions of women with no private vehicle, ranging from 6% in San Diego to 8.5% in San Antonio. In all urban areas, poverty and household vehicle access were strongly correlated. Therefore, we used household access to a private vehicle instead of poverty level for our analysis as a direct measure of spatial accessibility. The overall median travel time by public transportation for each urban area for women with no private vehicle ranged from 15 minutes in both Boston and Philadelphia to 27 minutes in San Diego—almost twice the time of the two east coast urban areas. Finally, all six urban areas had adequate mammography capacity as defined by a ratio of 1.0 or greater.

3.2 Women with no private vehicle access and transit marginalized women by population group

Table 3 presents the number and percentage of women age 40 or older with no vehicle access and those who are transit marginalized across the study population by population group. Our study population included more than four million women; nearly two-thirds white, with Hispanics being the second largest group. Approximately 10% (433,120) of all women in the study area did not have vehicle access, but percentages varied by population group. An estimated twenty-two percent of blacks had no vehicle access; while less than 8% of whites had no vehicle access, an almost three-fold difference. Hispanic (12%) and Asian (10%) percentages without vehicle access more resembled that of whites.

Combining the characteristic of travel time of 30 minutes or longer with that of no vehicle access presents a different demographic picture than vehicle access alone. All told, less than 2% (approximately 82,370) of all women in the six urban areas were transit marginalized meaning that the vast majority of women (98%) either had access to a private vehicle or had < 30 minute travel time. There are however substantial percentage differences between population groups. Among transit marginalized women, only Hispanics were overrepresented relative to their proportion of the entire study population (21% v. 1.7%). Numbering nearly 52,000, whites nonetheless constituted the majority of transit marginalized women. As a percentage of women without vehicle access, nearly a quarter of whites and nearly a fifth of Hispanics and Asians were transit marginalized. These three populations (whites, Hispanic, and Asian women) were each more highly transit marginalized than were black women as measured either as percentage of no vehicle access or as percentage of total population.

3.3 Geographic pattern of transit marginalized by urban area and region

Figure 1 displays the number of transit marginalized women per census tract for each of our six urban areas both within and outside of its central city. Figure 2 provides, by urban area and population group, the percentage of women without vehicle access and the percentage of women who were transit marginalized. Across the six urban areas black and Hispanic women were always more likely to be without access to a vehicle than were white or Asian women; the differential of black or Hispanic to white in this measure being substantially higher in the Eastern urban areas. However, the transition to transit marginalized populations presents a less conclusive picture, with whites, Hispanics, and blacks each highest in two urban areas. In all six urban areas however, the presence of public transit reduces the percentage of women without access to a mammography clinic.

Because of the clear dichotomy in median travel times and percentage of transit marginalized women between eastern urban areas with more developed transit systems and the other urban areas, we created East and West regions for comparison (Boston and Philadelphia vs. San Antonio, Denver, San Diego, and Seattle)(Table 4). We found that the East region provided better clinic access for all populations but whites, whose transit marginalized percentages were virtually the same in the East and West (Table 4). In the East, blacks fared best (1.3%), whites fared worst (1.9%)—a dynamic driven by the preponderance of blacks having a lower transit time burden in the central city and greater numbers of transit marginalized whites in the urban area beyond the central city. In the West, however, with less robust transit systems and higher private vehicle dependency, whites fared best (1.9%) and blacks fared worst (2.8 %) a result of higher household automobile access of whites relative to other population groups. Overall, Hispanic percentages fell between those of blacks and whites in both the East and West, though numerically they constituted a larger transit marginalized population than did blacks in the west. Asians composed the third largest population of transit marginalized in the West. Generally speaking, Asian percentages of transit marginalized women (1.9% overall) resembled those of whites. Percentages and numbers of transit marginalized women in all central cities and outer urban areas by population group can be found in Supplemental Table 1.

4. Discussion

Our focus on access to mammography facilities in urban areas highlights race and ethnic disadvantages for women who are public transit dependent, but also shows that the vast majority of women in the six urban areas examined either had access to a private vehicle or had travel times of < 30 minutes. With approximately 1.9% of all women in the study having the dual liabilities of no vehicle access while incurring more than 30 minute travel time, Hispanics at 2.3% were overrepresented. In terms of absolute numbers however, whites constituted the largest population of transit marginalized. Women in the Eastern urban areas of Boston and Philadelphia, with well-developed train systems, had, at 15 minutes, the shortest median travel time to the nearest mammography facility. It is typically those urban landscapes where private automobile use is highest that offer the fewest public transportation options. This results in higher percentages of women who are transit marginalized—especially for areas outside the central city (McKenzie, 2013; Tomer, 2011). Thus we found that in transitioning from no vehicle access alone to the added burden of longer trips, the demographic picture of black transit inequity changed to a multi-faceted one of higher transit marginalization of whites in the east, and of both Hispanics and blacks in the west.

This study of access to mammography as measured by travel time was not directly linked with health outcomes or utilization of services. Nevertheless, the results of this ecologic study show a Western U.S. disadvantage for Hispanics in travel time to mammography facilities that corresponds with the relatively lower mammography rates for Hispanics as compared with whites and blacks reported from national data (Coleman King et al., 2012). This travel time disadvantage is seen primarily in urban areas with majority or substantial Hispanic populations that also have lower levels of central city public transportation. Although Hispanics are less segregated that other population groups overall, many live in isolated enclaves that are less favorably situated with respect to public transportation (Holzer and Stoll, 2007; Tomer, 2011). However, it should be recognized that transportation barriers are but one component of access. A myriad of factors at the individual, community, or system level affect receipt of mammography services. Affordability, accommodation or ease of access, and acceptability or degree of comfort with mammography services also are important components in the overall concept of access (Penchansky and Thomas, 1981). More specifically, factors such as acculturation or language barriers have been posited as contributing to lower Hispanic screening percentages as compared with other population groups (Nonzee et al., 2015; Abraído-Lanza et al., 2005; Jerome-D'Emilia, 2014; Otero-Sabogal et al., 2004; Rosales and Gonzalez, 2013).

Our study also found that black women, relative to other populations, had a travel time advantage across our study area owing largely to contribution of Philadelphia's substantial central city black population. Typically, those inhabiting the central city would have a travel advantage if taking public transportation (Glaeser et al., 2008; Tomer, 2011). Historically, blacks have resided in the central cities and in this study the east coast urban areas with more comprehensive transit systems provide that advantage. However, we found a disadvantage for blacks and Hispanics compared with whites in the western region as well as for blacks and Hispanics outside the central city in the eastern region. Several studies have found a travel time disadvantage for blacks compared with whites in urban areas (Peipins et al., 2011; Zenk et al., 2006) while a national study found a travel time advantage for blacks compared with whites (Onega et al., 2014). Also, longer median travel times have been described for other urban areas when different methods were used (Peipins et al, 2011). Our study differed in its focus solely on women with no access to a private vehicle and those who had longer travel times.

Finally, we found mammography capacity to be more than adequate for all urban areas. However, mammography capacity has been declining over the past decade which has seen an increase in the number of women living in poor capacity areas, particularly in the South (Eberth et al., 2014) and a decrease in mammography capacity for poorer counties and those with a higher percentage of uninsured residents (Elkin et al., 2013).

4.1 Limitations

We chose to measure access to mammography facilities by transit time rather than other GIS-based methods such as density measures, distance, or a gravity model (Lian et al., 2012). Although a transit time measure does not account for competing services (e.g. taxi), this limitation may not be as relevant for a population whose travel options may be restricted by dependence on public transportation. Seasonality and inclement weather can also serve as a barrier to mammography screening (Onitilo et al., 2013) yet was not included in our analysis. Thus, our method captures transit time to the nearest facility thereby providing a 'best case' scenario for those who rely on public transportation. Other choices would result in longer travel times and perhaps a greater travel burden. In addition, by defining vehicle access as no vehicle access vs. any vehicle access we may have underestimated travel burden inasmuch as some women in one vehicle households may have limited access to that vehicle. Another limitation is we chose vehicle access rather than income as the most relevant variable for examining public transportation barriers and the margin of error for the variable describing private vehicle access at the census block group level was unacceptably high. Due to this limitation in the data, we used percentage of no vehicle access at the census tract level. Recognizing that vehicle access is not evenly distributed across tracts, we are likely to have overestimated the percentage of vehicle access for some population groups and underestimated it for others. However, the bias associated with assigning the same vehicle access to all race and ethnic groups in a tract may be attenuated because of racial and ethnic segregation in US cities. Thus, inasmuch as most U.S. urban areas exhibit high degrees of racial and ethnic segregation (Logan 2011) and census tract boundaries are drawn to include homogeneous populations, the bias of differential vehicle access by population group may be reduced. Finally, we measured travel time to the nearest facility from a single-point centroid of the census tract area and assumed all women live equidistant from this start point within the tract. In the urban setting where the geographic areas are small (mean census tract area ranges from 1.2 mi^2 in Boston to 2.4 mi^2 in Denver), there would likely be minimal distance between the population-weighted centroid and other points within a tract. Nevertheless, travel times for individuals within each tract will vary dependent upon the size of each individual tract.

5.0 Conclusions

Almost 98% of women in these 6 urban areas did not face significant travel time barriers as defined in our study. They either had access to a private vehicle or had a 30 minute or less travel time by public transportation. Nevertheless, for almost 2% of women having these joint characteristics, inadequate public transportation availability and long travel times can compound travel barriers. Although a small percentage, they comprise a large number of women across the 6 large urban areas. Across all urban areas, Hispanics had the highest percentage (2.3%) of transit marginalized women 40 years or older. The two Eastern urban areas, with their more comprehensive public transit networks, are better positioned to provide transport to mammography locations to those without vehicle access – especially within their central cities. However, because these are larger urban areas, they also have larger numbers of transit marginalized women—particularly whites outside the central city.

Access to adequate public transportation remains a challenge for a small proportion of women in many urban areas in the US. Expanding transportation options in terms of more comprehensive public transit systems or increasing access to mobile mammography units may help reduce potential travel related barriers to mammography clinic access by ameliorating the impact of unequal geographic distribution of mammography services. Nevertheless, public transit barriers are one component of the complex and interrelated factors that facilitate or hinder adherence to mammography. Screening adherence is influenced by individual characteristics such as language barriers, family support, level of comfort with providers, and limited knowledge about cancer or about resources available for screening, (Nonzee et al., 2015). Additional research on temporal barriers could include questions on the maximum travel time that women would be willing to undertake as well as understanding the role that wait times or delays have on receipt of mammography.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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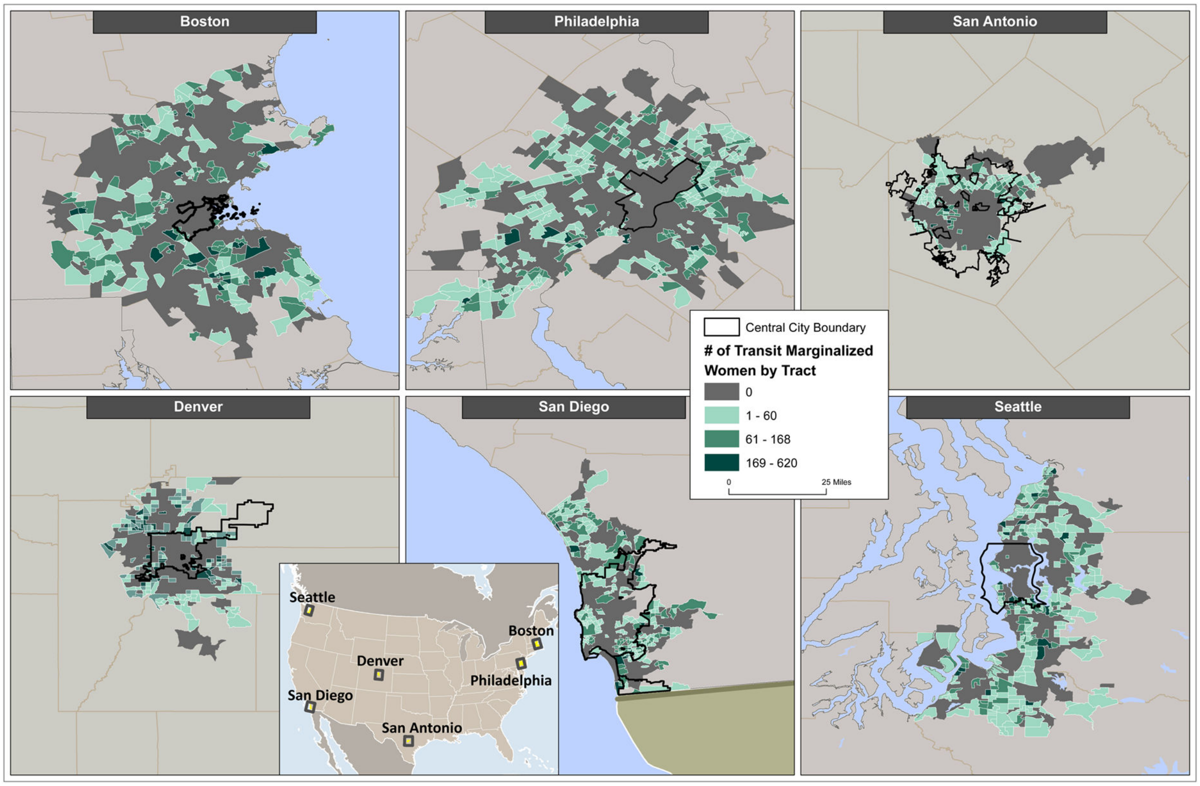
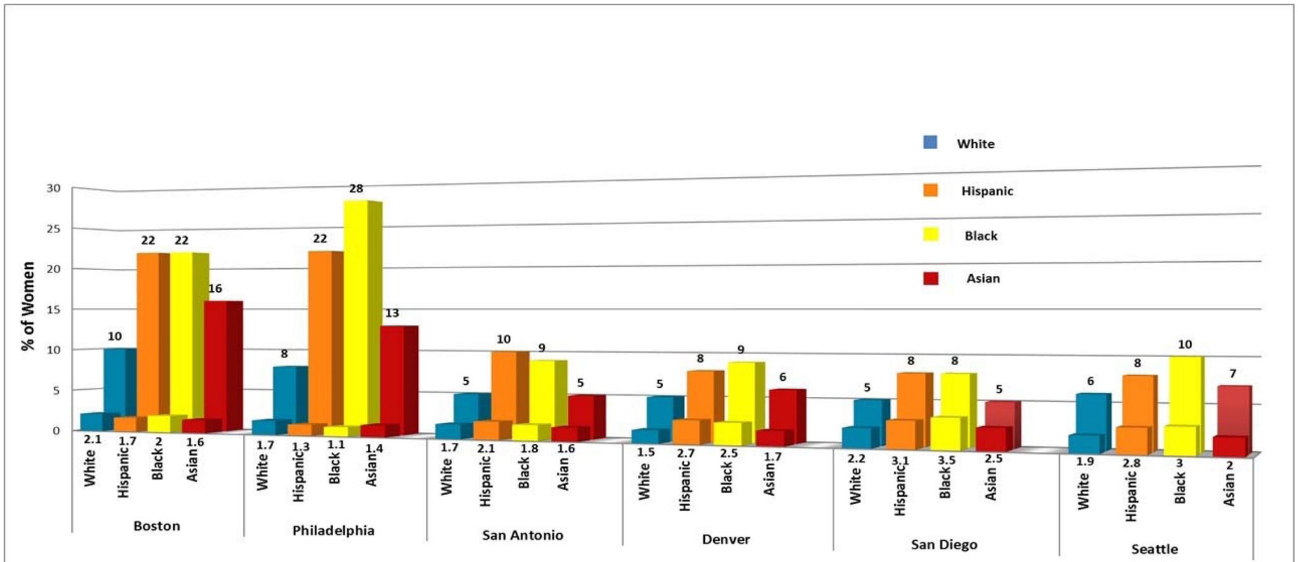


Figure 1.
Number of transit marginalized women by tract for each urban area



	Boston				Philadelphia				San Antonio				Denver				San Diego				Seattle			
	White	Hispanic	Black	Asian	White	Hispanic	Black	Asian	White	Hispanic	Black	Asian	White	Hispanic	Black	Asian	White	Hispanic	Black	Asian	White	Hispanic	Black	Asian
% No Vehicle Household*	10	22	22	16	8	22	28	13	5	10	9	5	5	8	9	6	5	8	8	5	6	8	10	7
% Transit Marginalized **	2.1	1.7	2.0	1.6	1.7	1.3	1.1	1.4	1.7	2.1	1.8	1.6	1.5	2.7	2.5	1.7	2.2	3.1	3.5	2.5	1.9	2.8	3.0	2.0

* back column of graph

** front column of graph

Figure 2.

Percent of women with no household vehicle access and percent transit marginalized by city and population group

Table 1

Modes of transportation and usage of six urban areas

	Boston	Philadelphia	San Antonio	Denver	San Diego	Seattle
Annual Trips (thousands)[1]	393,559	336,958	45,210	87,838	86,547	176,037
% BUS	30.1%	47.2%	97.3%	67.9%	58.5%	66.2%
% RAIL	68.7%	50.7%	0.0%	27.4%	40.8%	8.2%
% FERRY BOAT	0.3%	0.0%	0.0%	0.0%	0.0%	9.2%
% TROLLEY	0.4%	1.6%	0.0%	0.0%	0.0%	13.3%
% OTHER	0.5%	0.5%	2.8%	4.7%	0.7%	3.1%
Annual Trips/Person	98	64	29	39	32	58
Heavy Rail Annual Ridership (thousands)[1]	166,673	98,438	0	0	0	0
Heavy Rail Track Mileage[1]	38.0	36.7	0	0	0	0
Light Rail Annual Ridership (thousands) [1]	72,274	32,795	0	23,774	34,449	11,434
Light Rail Track Mileage	25.2[2]	40.1[3]	0	47.0[4]	56.2[5]	16.9[6]
Bus Annual Ridership (thousands) [1]	113,783	161,848	44,164	62,470	31,207	98,583

[1] APTA Ridership Report - Q4 2013 Report" (pdf). American Public Transportation Association (APTA) (via: http://www.apta.com/resources/statistics/Pages/RidershipArchives.aspx). February 26, 2014. Retrieved 2014-10-13

[2] About the T - Financials - Appendix: Statistical Profile" (pdf). Massachusetts Bay Transportation Authority. 2007. Retrieved 2014-10-13

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[4] RTD - Facts & Figures". Regional Transportation District. May 24, 2013. Retrieved 2014-10-13

[5] San Diego Trolley Fact Sheet" (pdf). San Diego Metropolitan Transit System (via: http://www.sdmts.com/Trolley/TrolleyFactSheet.asp). February 2011. Retrieved 2014-10-13; San Diego Vintage Trolley - Route and Fares". San Diego Vintage Trolley, Inc. 2013. Retrieved 2014-10-13

[6] Schedules – SoundTransit". SoundTransit. 2013. Retrieved 2014-10-13; South Lake Union Streetcar (SLU)". Seattle Streetcar. Retrieved 2014-10-13

Table 2

Population characteristics of 6 urban areas

	Boston	Philadelphia	San Antonio	Denver	San Diego	Seattle
Total Population (Metropolitan Area)[1]	4,034,026	5,273,944	1,582,254	2,245,877	2,727,909	3,016,910
% White[1]	71%	63%	30%	63%	48%	66%
% Hispanic[1]	11%	8.2%	59%	24%	33%	9.4%
% Black[1]	8.2%	22%	7.1%	5.9%	4.9%	6.0%
% Asian[1]	7.4%	5.3%	2.3%	3.8%	11%	13%
% Other[1]	2.6%	2.1%	1.9%	2.8%	3.8%	6.5%
Total Population (Central City alone)	640,602	1,520,826	1,294,860	602,950	1,232,946	611,317
Population Density (sq. mile)	1,918	2,207	2,400	3,373	3,558	2,632
% Households below 100% Poverty[2]	10%	12%	17%	13%	13%	10%
# of Women 40 and Older (Metro Area)[1]	930,247	1,346,851	342,378	499,152	611,721	700,054
% Women 40 and Older with No Household Vehicle Access[2]	13%	14%	8.5%	6.2%	6.0%	6.8%
Median Travel Time (minutes) No Household Vehicle Access	15	15	24	23	27	22
# of Mammography Facilities[3]	204	199	56	77	90	100
# of Census Tracts in Metro Area	892	1,324	354	542	581	624
Mean Area of Census Tracts (sq. mile)	2.4	1.8	1.8	1.2	1.3	1.8
2-Year Mammography Capacity[*]	2.63	1.77	1.96	1.84	1.77	1.71

[1] 2010 U.S. Census Bureau;

[2] 2008–2012 American Community Survey;

[3] 2012 Food and Drug Administration

[*] 2-year capacity calculated as (# machines * 12,000)/# Women 40+ years

Table 3

Number and percentages of women 40 years of age and older with no household vehicle access and transit marginalized by race and ethnicity across all metro areas

	All Race/Ethnicity	White	Hispanic	Black	Asian
All Women 40+ Years	4,292,269 (100%)	2,777,611 (65%)	736,604 (17%)	466,522 (11%)	311,532 (7.3%)
No Vehicle Access *	433,120 (10%)	209,613 (7.5%)	88,124 (12%)	104,643 (22%)	30,740 (10%)
% No Vehicle Access of all No Vehicle Access *	100%	48%	20%	24%	7.1%
Transit Marginalized	82,370 (1.9%)	51,546 (1.9%)	17,305 (2.3%)	7,755 (1.7%)	5,764 (1.9%)
% Transit Marginalized of all No Vehicle Access *	19%	25%	20%	7.4%	19%
% Transit Marginalized of all women Transit					
Marginalized	100%	63%	21%	9.4%	7.0%

* No household access to a private vehicle

Table 4

Number and percent transit marginalized by region and population group

	All Metros		Eastern Metros		Western Metros	
	N	%	N	%	N	%
Total Metro	**4,288,957**	**1.9%**	**2,226,714**	**1.7%**	**2,062,243**	**2.1%**
White	2,776,137	1.9%	1,560,108	1.9%	1,216,029	1.9%
Hispanic	735,349	2.4%	182,011	1.5%	553,338	2.6%
Black	466,064	1.7%	350,479	1.3%	115,585	2.8%
Asian	311,407	1.9%	134,116	1.5%	177,291	2.1%
Central City	**1,243,182**	**1.5%**	**469,556**	**0.4%**	**773,626**	**2.1%**
White	551,355	1.2%	188,282	0.5%	363,073	1.5%
Hispanic	348,225	2.3%	61,214	0.2%	287,011	2.8%
Black	243,600	0.9%	189,202	0.4%	54,398	2.8%
Asian	100,002	1.4%	30,858	0.5%	69,144	1.9%
Outside Central	**3,045,775**	**2.1%**	**1,757,158**	**2.1%**	**1,288,617**	**2.2%**
White	2,224,782	2.0%	1,371,826	2.0%	852,956	2.0%
Hispanic	387,124	2.4%	120,797	2.1%	266,327	2.5%
Black	222,464	2.5%	161,277	2.4%	61,187	2.7%
Asian	211,405	2.0%	103,258	1.8%	108,147	2.3%