Immigration and Geographic Access to Prenatal Clinics in Brooklyn, NY: A Geographic Information Systems Analysis

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We compared levels of geographic access to prenatal clinics in Brooklyn, NY, between immigrant and US-born mothers and among immigrant groups by country of birth. We used birth data to characterize the spatial distribution of mothers and kernel estimation to measure clinic density within a 2-mile radius of each mother. Results showed that geographic access to clinics differs substantially by country of birth. Certain groups (e.g., Pakistani, Bangladeshi) have relatively poor geographic access despite a high need for prenatal care. (*Am J Public Health*. 2005;95:638–640. doi: 10.2105/AJPH.2003.033985)

Accessible and effective prenatal care is critically important for improving reproductive health outcomes in the United States. In the past 2 decades, efforts have been made to enhance access to prenatal care by expanding Medicaid coverage for pregnant women and by providing prenatal services for low-income women. These efforts have significantly increased the proportion of pregnant women who receive early and regular prenatal care, although the proportion remains below the target specified in *Healthy People 2010: Understanding and Improving Health*.[1,2]

A major challenge in improving prenatal care is to respond to shifting patterns of ethnic diversity in the population that result from immigration. Women from different ethnic backgrounds have not only diverse needs, expectations, and resources but also different residential location patterns that affect their geographic access to prenatal care. Geographic access describes distance, transportation, and mobility factors that influence people's ability to use services when and where they are needed. Distance is a critical factor in the use of health and prenatal care services, affecting both the choice of service providers and the intensity of utilization.[3–5] Travel time, cost, and effort increase with distance, creating barriers to service use.[6–11] We analyzed how the uneven residential location patterns of immigrant women are related to their geographic access to prenatal care clinics provided by public and voluntary agencies in Brooklyn, NY.

METHODS

The data consisted of birth records for the year 2000 for mothers whose residential address was Brooklyn, NY (roughly 39 000 mothers). Brooklyn has a large and diverse immigrant population: 52% of the mothers in our data set were born outside the United States. Mothers' residential locations were recorded at the census tract level. Census tracts are small areas that represent well the detailed locational patterns of immigrant groups. Immigrant groups were defined according to country of birth. To assess differences among immigrant groups in prenatal care need, we examined several indicators: low-birthweight percentage; percentage of mothers whose primary financial coverage was Medicaid; and percentage of self-pay, uninsured mothers.[12]

We used geographic information systems technology to assign prenatal clinics to point locations on the basis of street address. All clinics in New York City were included to allow for travel to clinics outside Brooklyn. The clinics are operated by public and voluntary agencies and primarily serve low- and middle-income mothers. Of the clinics, 30% are located in hospitals, and the rest are freestanding.

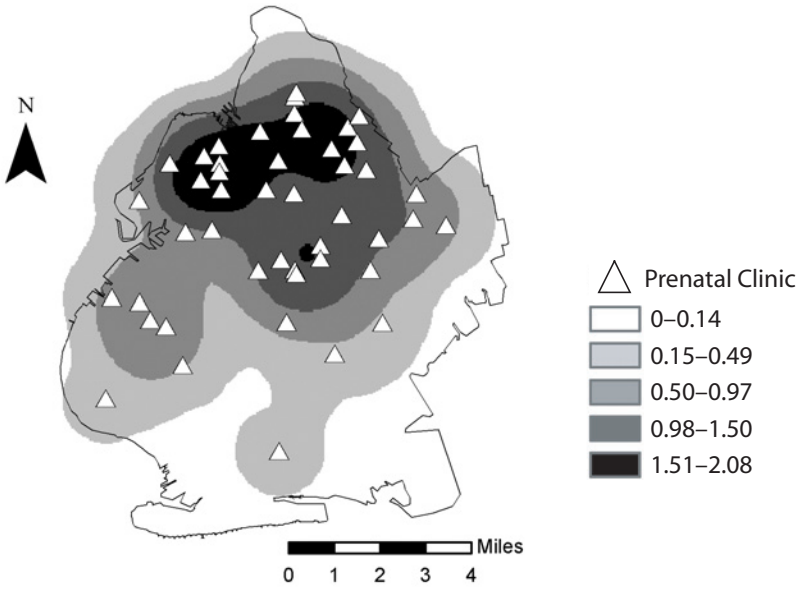
To measure geographic availability of clinics, we used kernel estimation.[13–16] Kernel estimation depicts the density of points (clinics) as a spatially continuous variable that can be represented as a smooth contour map. Peaks on the map show areas of high clinic density, and valleys show areas of low clinic density. In computing density, a circle, centered at small, evenly spaced grid cells, is moved over the study area. The density of clinic locations (clinics per square mile) is computed within each circle according to a kernel function.[13] A critical issue is the choice of circle radius. We used a radius of 2 miles to reflect the localized nature of primary health care use in New York City. To check the sensitivity of results to the choice of radius, we repeated the analysis with values of 1.5 and 3 miles; results were very consistent. Figure 1 depicts a map of the density of prenatal clinics in Brooklyn according to kernel estimation. High densities indicate high geographic access to services.

To analyze differences in clinic density by immigrant group, we assigned each mother the density value for the corresponding census tract of residence. The density value for a tract was computed as the average density value for all grid cells in the tract. Unpopulated coastal and park areas were clipped from the census tracts and thus removed from the average density calculations. To compare clinic density levels among immigrant groups, we analyzed descriptive statistics for mothers belonging to a specific group.

RESULTS

Prenatal clinics are unevenly distributed across Brooklyn, with higher densities in north and central regions of the borough (Figure 1). Immigrant and US-born mothers had similar geographic access to clinics, as reflected in median density values (0.855 US-born; 0.729 immigrant). Among US-born mothers, those covered by Medicaid had the highest median density (1.107), compared with 0.826 for uninsured mothers and 0.632 for mothers with third-party insurance coverage. For immigrant mothers, median density was highest for the Medicaid group (0.801) and lowest for uninsured mothers (0.461). The poor geographic access to clinics for uninsured immigrant mothers is noteworthy.

Geographic access to clinics differs substantially among immigrant mothers according to country of birth (Table 1). In general, we found the highest density values for certain



Source. McLafferty and Grady.[17]

FIGURE 1—Density of prenatal clinics (clinics per square mile) according to kernel estimation: Brooklyn, NY, 2000. The locations of prenatal clinics are marked by white triangles.

Caribbean and Central American immigrant groups, which shows that prenatal clinics are relatively well located in relation to the residential locations of these groups. Many of these immigrant groups have high need for services, as evidenced by high rates of low-birthweight infants and high percentages of women covered by Medicaid. Overall, median clinic density was positively correlated with low birthweight (Spearman $R=0.52$; $P=.004$) and inversely associated with percentage of self-pay mothers ($R=-0.40$; $P=.06$).

From a policy perspective, it is important to identify groups that have a high need for clinic-based services but poor geographic access. Immigrant mothers from Pakistan and Bangladesh fit this pattern. More than 80% of Pakistani and Bangladeshi mothers rely on Medicaid, and their rates of low-birthweight infants are high, especially for Pakistani mothers. For both groups, the density of prenatal clinics in nearby areas is relatively low. Median clinic densities for Pakistani and Bangladeshi mothers are 0.21 and 0.42, respectively, well below the corresponding values for all immigrant and US-born mothers. Several other groups (e.g., Egyptians, Russians, and Ukrainians) also have a low density of prenatal clinics nearby. However, these groups have relatively low indicators of need for prenatal services.

DISCUSSION

Differences in geographic access among immigrant groups reflect their uneven residential location patterns in the study area. Many immigrant groups cluster in space as a result of the economic, social, and political forces that shape their settlement patterns. Each group has a unique residential geography that constrains its spatial access to health care. Recent research highlights the diversity among immigrant groups in reproductive health outcomes and access to prenatal care.[2,18–22]

Our study emphasized the importance of geographic diversity in addition to diversity in culture, resources, and behaviors. In Brooklyn, some immigrant groups have relatively high levels of geographic access to prenatal clinics, whereas others are less well served by the current configuration of clinics. Groups with higher rates of low-birthweight infants tend to have a greater density of clinics nearby, which indicates that clinic locations are sensitive to prenatal care need; however, some groups do not fit this trend. We found that Pakistani and Bangladeshi mothers have a high need for prenatal care services but poor geographic access. Other studies point to low use of prenatal care among Asian immigrant women as an important public health concern.[21,23]

The need for health services varies in complex geographic patterns, and such patterns provide an important foundation for planning.[17,24–28] Kernel estimation, combined with small-area population health data, is useful for quickly evaluating the geographic correspondence between population needs and health service locations. Public health departments can use the methods discussed here to assess this correspondence and explore how it changes in response to demographic transitions.[29] As immigration reshapes health care needs in US cities, such information is crucial for developing health service networks that are responsive and effective for improving population health. ■

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Contributors

S. McLafferty originated the study and participated in planning of the study, analysis of the data, and writing of the brief. S. Grady contributed to preparation of data, analysis of the data, and writing of the brief.

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Human Participant Protection

The institutional review boards of the New York City Department of Health and Mental Hygiene and the City University of New York, Hunter College, approved this study.

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TABLE 1—Density of Prenatal Clinics and Need Indicators for Immigrant Mothers, by Country of Birth

Country of Birth	n	Clinic Density (Clinics/Sq Mile)		Need Indicators		
		Mean (95% CI)	Median	Medicaid, %	Self-Pay, %	Low Birthweight, %
Bangladesh	304	0.48 (0.43, 0.54)	0.42	87.2	4.6	7.9
Barbados	257	1.04 (0.98, 1.09)	1.22	52.5	3.9	13.2
China	1753	0.58 (0.55, 0.59)	0.64	65.0	8.5	5.0
Dominican Republic	1461	0.99 (0.96, 1.01)	0.96	83.4	2.4	6.2
Ecuador	497	0.92 (0.87, 0.97)	0.87	83.1	4.6	5.2
Egypt	206	0.37 (0.33, 0.41)	0.28	51.5	14.6	7.2
Grenada	414	1.02 (0.98, 1.06)	1.15	61.4	6.3	10.4
Guyana	919	0.88 (0.85, 0.91)	0.88	56.0	2.2	11.0
Haiti	1349	0.78 (0.76, 0.81)	0.73	62.8	3.5	13.0
Honduras	242	0.91 (0.84, 0.97)	0.81	83.5	5.0	3.3
Israel	570	0.61 (0.57, 0.65)	0.47	48.6	5.1	2.8
Jamaica	1641	0.92 (0.89, 0.94)	0.97	59.5	3.4	10.1
Mexico	2067	0.79 (0.76, 0.81)	0.76	93.6	4.0	5.9
Nigeria	205	0.84 (0.76, 0.91)	0.88	60.7	7.8	9.0
Pakistan	611	0.31 (0.28, 0.33)	0.21	84.3	3.8	9.8
Panama	222	0.93 (0.87, 0.99)	0.96	57.7	2.7	12.5
Poland	334	0.48 (0.44, 0.51)	0.40	53.6	7.8	4.5
Russia	541	0.27 (0.24, 0.30)	0.17	31.1	12.6	4.7
St. Vincent and Grenadines	259	1.05 (1.00, 1.09)	1.17	65.6	5.0	13.3
Syria	213	0.27 (0.23, 0.30)	0.19	55.4	4.2	6.9
Trinidad	1077	1.01 (0.99, 1.04)	1.15	61.2	5.2	9.0
Ukraine	391	0.20 (0.17, 0.22)	0.14	23.0	12.5	5.3

Note. CI = confidence interval.
Only countries of birth with 200 or more births are listed. Mothers came from more than 160 countries, but sample sizes for most countries were too small for statistical comparisons.

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