Published in final edited form as:

J Hum Lact. 2019 February ; 35(1): 90–99. doi:10.1177/0890334418768458.

Geographic Access to International Board-Certified Lactation Consultants in Pennsylvania

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Abstract

Background: Availability of professional lactation support has been associated with increased breastfeeding rates; however, data about access to International Board-Certified Lactation Consultants are limited.

Research Aims: (1) To assess geographic access to International Board-Certified Lactation Consultants in Pennsylvania, (2) to compare access in rural/urban counties and (3) by county-level breastfeeding initiation rates.

Methods: Using geographic information systems methodology and a cross-sectional observational design, we calculated the proportion of young children living within 15, 30, and 60 miles of International Board-Certified Lactation Consultants in Pennsylvania. We calculated these proportions for all children in Pennsylvania, for children in urban and rural counties, and for children in counties with low, medium, and high breastfeeding initiation rates. Comparisons were done to answer the research aims.

Results: Over 90% of young children live within 30 miles of an International Board-Certified Lactation Consultant. Compared to children in urban counties, fewer children in rural counties live within 15 and 30 miles of these providers. In counties with high breastfeeding initiation rates, a larger percentage of children live within 15 miles of an International Board-Certified Lactation Consultant than in counties with low breastfeeding initiation rates.

Conclusion: While most Pennsylvania children live in proximity of an International Board-Certified Lactation Consultant, this was true for a lower percentage of children in rural counties and in counties with lower breastfeeding rates.

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Conflict of interest

None. One author is an IBCLC.

Background

Breastfeeding has positive short- and long-term benefits for infants and mothers, prompting the American Academy of Pediatrics (2012) to recommend exclusive breastfeeding for the first 6 months of life, followed by continuation of breastfeeding for 1 year or longer. In the United States (US), the rate of initiation of breastfeeding is currently 82.5%, with only 55.3% of infants receiving any human milk at 6 months of age (CDC, 2017). Significant disparities in breastfeeding rates exist; researchers have documented lower initiation and duration rates among low income, racial and ethnic minority, and rural mothers (American Academy of Pediatrics Section on Breastfeeding, 2012; Anstey, Chen, Elam-Evans, & Perrine, 2017; Jones, Power, Queenan, & Schulkin, 2015; Morrell, 2017; American Medical Association, 2017).

Access to International Board-Certified Lactation Consultants (IBCLCs) has been associated with increased breastfeeding rates (Bonuck et al., 2014; Jonsdottir et al., 2014), and has been identified by mothers as helpful in overcoming breastfeeding barriers (Teich, Barnett, & Bonuck, 2014). The International Lactation Consultant Association (ILCA, 2017) defines an IBCLC as a “health care professional who specializes in the clinical management of breastfeeding.” While the International Board of Lactation Consultant Examiners (IBCLE) certifies all IBCLCs, some IBCLCs have additional professional licenses as registered nurses or medical doctors, while other IBCLCs do not. IBCLCs work in inpatient, ambulatory, and community settings, offering inpatient and outpatient support to nursing mothers. Recognizing the important role that IBCLCs can have on mothers’ decisions to initiate and maintain breastfeeding, ensuring access to IBCLCs was stated as a key action step in the *US Surgeon General’s Call to Action to Support Breastfeeding* (US Department of Health and Human Services, 2011).

Despite these national recommendations to provide access to IBCLCs, data about access to IBCLCs are largely limited to state-level assessments of the number of IBCLCs per 1,000 live births collected by the CDC. The Centers for Disease Control and Prevention (CDC, 2017) considers this to be an important indicator of access and tracks it bi-annually in its Breastfeeding Report Card. According to the CDC (2017), in 2015 there were 3.7 IBCLCs per 1,000 live births in the US, an increase from 2.1 IBCLCs per 1,000 live births in 2011. While the number of IBCLCs in the US is rising, access to IBCLCs’ care is known to vary significantly across states. Six states now have at least 6 IBCLCs per 1,000 live births, while 23 states, including Pennsylvania, have fewer than 3.5 IBCLCs per 1,000 live births (CDC, 2017). The *US Surgeon General’s Call to Action to Support Breastfeeding* (US Department of Health and Human Services, 2011) provides a recommended standard of 8.6 IBCLCs per 1,000 live births, yet IBCLC supply in nearly all of the US states remain below this threshold. These data provide a glimpse into IBCLC access at the state level.

Despite these state-level data, a knowledge gap remains regarding the availability of IBCLCs to specific mother-infant dyads or specific communities. It is clear that there is an unmet need for lactation support in the US, with only 57% of women reporting any lay or professional support for any breastfeeding problems (CDC, 2015). Granular, community-

level data about IBCLC access enables the quantification and parsing of access disparities in a way that supports actionable interventions.

To guide and contextualize an examination of geographic access to IBCLCs, we used the conceptual framework of access to health care proposed by Levesque and colleagues (2013), in which geographic location of providers is one component of availability of care. Availability of care, in turn, is one of five dimensions of accessibility of care, along with approachability, acceptability, affordability, and appropriateness. These five dimensions of accessibility interact with five dimensions of abilities of those seeking care, namely ability to perceive, seek, reach, pay, and engage (Levesque, Harris, & Russell, 2013). Thus an analysis focusing on geographic access to care (i.e., proximity to IBCLCs) provides data about one necessary component for availability of lactation services, but other system-level and individual-level factors may further facilitate or restrict IBCLC access.

Informed by this background and framework, the aims of this study were:

1. To determine the proportion of young children throughout Pennsylvania who have ready geographic access to IBCLCs and to IBCLCs who practice in specific clinical settings.
2. To compare the proportion of young children with geographic access to IBCLCs in rural and urban counties in Pennsylvania.
3. To compare the proportion of young children with geographic access to IBCLCs by county level of breastfeeding initiation rates (high, medium, or low) in Pennsylvania.

Methods

Design

This is a cross-sectional observational study using retrospective data. This study was reviewed and approved by the University of Pittsburgh Institutional Review Board. This cross-sectional approach using geographic information systems methodology allows for evaluation of geographic proximity to health care resources and has been employed previously to evaluate geographic accessibility of emergency and intensive care (Carr, Branas, Metlay, Sullivan, & Camargo, 2009; Wallace et al., 2014).

Setting

The state of Pennsylvania is the sixth largest state in the United States. As of the 2010 US Census, Pennsylvania had 12.7 million residents. It consists of 67 counties and is further subdivided into 9740 census block groups. Thirty-seven percent of counties are categorized as metropolitan, with the largest population centers around the cities of Philadelphia in the southeast and Pittsburgh in the southwest. Across Pennsylvania, 87.4% of adults over 25 years old completed high school, and 16.9% of children live below the poverty level (United States Census Bureau, 2010). A larger percentage of the population identified as belonging to racial/ethnic minorities in urban areas compared to rural areas. See Table 1 for the ethnic makeup of rural and urban areas.

Sample

The sample was the entire population of children 0–4 years of age in Pennsylvania. We identified the distribution of these children across census block groups using 2010 US census data, available from Esri (Esri, TomTom, & US Census, 2015). Census block groups are geographic subdivisions of the larger census tracts and generally comprise 600–3,000 individuals. We included all children 0–4 years old in Pennsylvania, as captured at the block group level in the most recent US census. We included children across these ages as a convenience sample because this is the youngest age bracket reported in US census data. While this sample includes young children no longer in infancy, inclusion of 1–4 year olds would not be expected to bias the results because the geographic distribution of these children is not likely to be significantly different from the geographic distribution of children 0–1 years old. There were no exclusion criteria, and no children were excluded.

Measurement

Data were collected and derived from multiple data sources to obtain the following variables needed for analysis; county rural-urban status, county breastfeeding rates, and Pennsylvania IBCLC location (Table 2). Because we obtained data about IBCLC location from two data sources, we assessed agreement between these two data sources during this stage of data preparation.

To identify members of the sample living in rural versus urban counties, we used the USDA rural-urban continuum codes (United States Department of Agriculture, 2015) to identify counties that were designated as urban (metropolitan, or rural-urban continuum codes 1–3) versus rural (non-metropolitan, or rural-urban continuum codes 4–9). To identify members of the sample living in counties with varying breastfeeding initiation rates, we used county-level breastfeeding initiation rates derived from Pennsylvania birth certificate data (Pennsylvania Department of Health, Bureau of Health Statistics and Research, 2012) to identify counties with high (76–87%), medium (68–75%), and low (52–67%) breastfeeding initiation rates.

The primary variable of interest was geographic access to IBCLCs. To identify and determine the location of IBCLCs within Pennsylvania, we obtained data about IBCLCs from two sources, the International Board of Lactation Consultant Examiners (IBLCE, 2016) and the International Lactation Consultant Association (ILCA, 2015) website. The IBLCE maintains a list of all IBCLCs, and provided a de-identified list of Pennsylvania IBCLC ZIP codes as of May 2016. This list captured all IBCLCs who had been certified in the state of Pennsylvania, but may over-estimate IBCLC availability due to possible inclusion of IBCLCs who no longer practice or have moved out of state. A portion of IBCLCs also has membership in ILCA, which maintains a publicly available directory that lists ILCA-member IBCLCs who elect to participate. The ILCA directory was expected to contain a subset of IBLCE-identified IBCLCs, including those most actively advertising their services and those that mothers may be likely to be able to find through online searches. ILCA-member IBCLCs voluntarily update their information on the ILCA website, with updates made available every 2 weeks. The ILCA directory captures IBCLCs actively practicing and advertising their services, but may underestimate IBCLCs by omitting those

who are not ILCA members or not participating in the directory. We extracted practice information for all IBCLCs listed in Pennsylvania on the ILCA directory as of October 2015. On the ILCA website, IBCLCs report their address and self-identify their breastfeeding consultation practice settings, including: “hospital”, “physician’s office”, “private practice”, and “community/public health/WIC.” IBCLCs could self-identify as having more than one practice setting, in which case we included them in the count for each specified type of IBCLC. For example, if an IBCLC self-identified as practicing in a hospital setting and a private practice setting, we included that IBCLC in the count for both hospital-based and private practice IBCLCs. Information on practice setting was not available for the IBCLC list obtained through IBLCE.

The IBLCE provided data for 485 IBCLCs in Pennsylvania, including their reported ZIP code. From the ILCA website, we identified 105 IBCLCs practicing in Pennsylvania, including their reported address and reported practice setting.

We examined agreement between these two data sources regarding IBCLC location at the ZIP code level. Both data sources were in agreement about the number of IBCLCs present in 1906 out of 2174 Pennsylvania ZIP codes (87.7%), with IBLCE data reporting more IBCLCs than ILCA data in 258 ZIP codes (11.9%) and ILCA data reporting more IBCLCs than the IBLCE data in 10 ZIP codes (0.5%).

Recognizing the strengths and weaknesses of these different data sources, we performed separate analyses using the two data sources, and we present the separately. Using ArcMap 10.1 (Esri, Redlands, California), we geocoded the location of each IBCLC identified through both IBLCE and ILCA data. Because IBLCE data were limited to IBCLC ZIP code, we assigned the IBCLCs identified in these data to their ZIP code centroid. Because ILCA data included more granular geographic information, we assigned the IBCLCs identified in these data to their street address.

Data Analysis

To describe the population living in all of Pennsylvania and in rural and urban counties within Pennsylvania, we used descriptive statistics. To answer research aim #1, we determined the percent of children 0–4 years old who live within 15, 30, and 60 straight-line miles of any IBCLC. We first allocated the population of children 0–4 years old for each census block to the census block group centroid. In separate analyses, we then determined the distance from each census block centroid to the closest IBCLC first using IBLCE data and then using ILCA data. Using the practice settings available in ILCA data, we also determined the distance to the closest IBCLC in specific settings: hospital, office-based, private practice, and WIC-affiliated. Using multiple buffer rings, we identified the child population living within 15, 30, and 60 straight-line miles of the closest of each type of IBCLC. We used straight-line distance (i.e., the distance drawn directly from one point to another, regardless of roads and obstacles) based on prior work in which Boscoe and colleagues (2012) demonstrated that straight-line distance is highly correlated with on-road travel time and may be used as a proxy for driving time in geographic studies. For all spatial analyses, we used ArcMap 10.1 (Esri, Redlands, California).

To answer research aim #2, we compared the percent of children 0–4 years old within 15, 30, and 60 straight-line miles of IBCLCs in urban versus rural counties. We separately applied multiple buffer rings as described previously for children in block groups in urban counties and in rural counties. We then used chi-squared tests to test for significant differences in the percentage with geographic access to an IBCLC at the $p < 0.05$ level using StataSE 14 (StataCorp LP, College Station, Texas).

To answer research aim #3, we compared the percent of children 0–4 years old within 15, 30, and 60 straight-line miles of IBCLCs in counties with high, medium, and low breastfeeding initiation rates. We again applied the previously described methods separately for children in block groups in counties with high, medium, and low breastfeeding initiation. We then used chi-squared tests for significant differences at the $p < 0.05$ level between counties with high, medium, and low breastfeeding initiation rates.

Results

Sample characteristics

The total population within Pennsylvania was 12,702,379. Children 0–4 years old comprised 5.7% of the Pennsylvania population, with 89.0% living in urban counties and 11.0% living in rural counties (Table 1). Residents of rural counties were less likely to identify as Black or Hispanic compared to residents of urban counties.

Among the ILCA website IBCLCs ($n=105$), 59 reported consulting in a hospital setting, 17 in a physician office-based setting, 32 in private practice, and 9 in WIC-affiliated or other public health settings. IBCLE identified 485 IBCLCs in Pennsylvania.

Study aim 1: Geographic access to IBCLCs in Pennsylvania

From both data sources, IBCLCs were unequally distributed throughout the state (Figure 1a & 1b), with higher concentration in the more populous southern portion of the state, while other regions of the state, especially the northwest, had lower concentrations of IBLCE-identified IBCLCs and lacked any ILCA-identified IBCLCs.

Based on IBLCE and ILCA data, respectively, 96% and 80% of Pennsylvania residents 0–4 years old live within 15 miles of an IBCLC. Of the four specific types of IBCLCs examined using ILCA data, those who are hospital-based appear to have the highest accessibility throughout Pennsylvania, although they remain clustered in the southeast and southwest (Figure 2a). Based on ILCA data, examination of the population distribution relative to hospital-based IBCLC location showed that 75% of children live within 15 miles of a hospital-based IBCLC. Access to IBCLCs outside of hospital-based settings was lower, with 59% of children living within 15 miles of a private practice IBCLC (Figure 2b) and 51% of children living within 15 miles of a physician's office-based IBCLC (Figure 2c). Of the four types of IBCLCs examined within ILCA data, WIC-affiliated IBCLCs have the lowest availability throughout Pennsylvania (Figure 2d), with only 39% of children living within 15 miles of a WIC-affiliated IBCLC.

Study aim 2: Geographic access to IBCLCs in rural versus urban counties

Young children living in rural compared to urban counties in PA had significantly lower access to IBCLCs using both ILCA and IBLCE data (Table 3). Using ILCA data, 88% of children in urban counties lived within 15 miles of any IBCLC. The same was true for only 18% of children in rural counties ($p<0.001$). Using the IBLCE data, access to IBCLCs appears better, but still demonstrates a rural-urban disparity, with 99% of children in urban counties living within 15 miles of any IBCLC compared with only 73% of children living in rural counties ($p<0.001$). Access to each type of IBCLC within 15, 30, and 60 miles was significantly lower for children in rural versus urban counties ($p<0.001$, all). The largest difference by type of IBCLC access was for private practice IBCLCs; 66% of urban compared to 1% of rural children had access to a private practice IBCLC within 15 miles ($p<0.001$).

Study aim 3: Geographic access to IBCLCs by county level of breastfeeding initiation rates (high, medium, or low)

Finally, differential proximity to IBCLCs was identified for children living in counties with low, medium, and high breastfeeding initiation rates (Table 4). Within ILCA data, the largest difference in access within 15 miles by breastfeeding initiation rates was observed for hospital-based and private practice IBCLCs. Among children living in counties with the highest breastfeeding initiation rates, 88% had access to a hospital-based IBCLC within 15 miles compared to 69% of children living in counties with the lowest breastfeeding initiation rates ($p<0.001$).

Discussion

Using geographic information systems methodology, we found that the majority of young children in Pennsylvania lived within 15 miles of an IBCLC. However, our results indicated lower geographic access to IBCLCs within outpatient practice settings (i.e., offices and private practices), lower geographic access to IBCLCs for children in rural counties, and lower geographic access to IBCLCs for children in counties with the lowest breastfeeding initiation rates. Below, we discuss the implications of these findings from each research aim, while also reviewing our results in the context of our conceptual model and discussing the relevance the different results obtained from the ILCA versus IBLCE data sources.

In the analysis of research aim #1, we found that outpatient lactation support was less accessible than hospital-based lactation support. While hospital-based lactation support may be crucial for initiation of breastfeeding, researchers have identified a range of breastfeeding challenges that can occur in the days, weeks, and months after hospital discharge (Demirci & Bogen, 2017), and have been associated with early breastfeeding cessation (Demirci & Bogen, 2017; Wagner, Chantry, Dewey, & Nommsen-Rivers, 2013). Our results indicate that increasing the outpatient IBCLC workforce may be necessary to meet the needs of mother-infant dyads after hospital discharge.

Through research aim #2, we identified particular concern for access to IBCLCs for Pennsylvania children living in rural counties. In a prior geographic analysis in Ohio,

Grubestic and Durbin (2017) found a similar decrease in most breastfeeding resources, including ILCA-identified IBCLCs, in the rural portion of that state. Relatedly, Allen and colleagues (2015) reported that hospitals in less urbanized counties perform more poorly on assessment of breastfeeding assistance, which could be partially related to decreased accessibility of hospital-based IBCLCs in these counties. Together, these results indicate a need to increase access to lactation services for children living in rural communities. However, demand in these lower-density population areas may not be enough to support full-time IBCLCs. Novel strategies (e.g., tele-lactation services) where mothers can access remotely located IBCLCs via two-way video conferencing (Uscher-Pines, Mehrotra, & Bogen, 2017) could be evaluated as a means to increase access to IBCLCs in these communities.

Through research aim #3, we identified decreased access to IBCLCs for children in counties with lower breastfeeding initiation rates. Grubestic and Durbin (2016) similarly reported a positive association between IBCLCs per capita and county-level breastfeeding initiation rates in the state of Kentucky. Wouk and colleagues (2017) found that a higher density of IBCLCs was associated with higher breastfeeding rates at 6 weeks in North Carolina. These correlations in cross-sectional analyses are not proof of causation – increased proximity and density of IBCLCs may be associated with higher breastfeeding rates due to higher community socioeconomic status or more breastfeeding-friendly medical communities. However, our results add to a growing body of work indicating that communities most in need of breastfeeding support are least likely to have ready access to IBCLCs.

It is important to note that while the results described here are informative in identifying gaps in geographic accessibility, geographic proximity to IBCLCs is only one component of access to lactation services. As Levesque and colleagues (2013) indicated in their conceptual framework, an individual's ability to reach care (i.e., transportation and mobility barriers) may further limit access. Availability of alternative providers (i.e., certified lactation counselors) and the quality of care from these providers are additional dimensions contributing to access to lactation support. Affordability and ability to pay also contribute to access (Levesque, Harris, & Russell, 2013), and are particularly relevant because few insurers cover IBCLC visits (Chetwynd, Meyer, Stuebe, Costello, & Labbok, 2013). While the Affordable Care Act (ACA; HealthCare.Gov, 2015) required all new private plans to cover breastfeeding support and counseling with in-network IBCLCs, post-ACA analysis did not reflect a substantial increase in lactation education (Hawkins, Noble, & Baum, 2017), suggesting financial accessibility remains an additional barrier, although Kapinos and colleagues (2016) did find increased breastfeeding initiation post-ACA. Ability to perceive a need for lactation consultation and ability to seek IBCLC care are additional important dimensions of access according to Levesque and colleagues (2013). Because most postpartum women reported use of technology for breastfeeding information and tracking (Demirci, Cohen, Parker, Holmes, & Bogen, 2016), incorporating guidance on when and where to seek care from IBCLCs in social media platforms may help address this barrier, although further research is needed.

The difference in IBCLC data across different data sources is a strength of the methodology used in this study. Data from the IBLCE identified four times as many IBCLCs in Pennsylvania as identified through the ILCA website. We present separate results using each set of data, with IBLCE data offering a more generous estimate of IBCLC access and ILCA data more conservative. True IBCLC access likely falls between these two estimates. Importantly, differences in access persisted for rural versus urban children and for children in counties with high, medium, and low breastfeeding initiation rates regardless of data source. In the future, researchers in this area will need to be mindful of the potential for significantly different results from these two sources.

Limitations

Several limitations to this study exist. First, this analysis is within a single US state and each state within the US has unique characteristics and contexts. Second, there are limitations in our data sources. The ILCA directory relies on self-report and may be outdated for some IBCLCs. For this reason, we also conducted the analysis with IBLCE data. In both data sources, there is also the potential for the reported geographic location to reflect residential rather than practice site. While estimates differed based on the data source, important differences in access persisted across counties. For these and other data sources used in this analysis, we used the most up-to-date data available; however, the data years included are not precisely the same throughout. Additionally, our analysis focused on straight-line distances rather than travel time. Researchers have suggested that straight-line distances versus on-road travel time often are highly correlated (Boscoe et al., 2012). However, especially for families relying on public transportation, our analysis may have over-estimate accessibility of IBCLCs. We based our analysis on children 0–4 years old rather a younger cohort, as this was the youngest age bracket in our data source at the block group level. Because our analysis focused on the relative geographic distribution of children (rather than absolute population), we would not expect results to differ within different age ranges, unless there were significant differences in the geographic distribution of 0–1 year olds compared to 2–4 year olds across the state. We examined only the association between access to IBCLCs and breastfeeding initiation; we recognize the potential value of further research focused on breastfeeding exclusivity and duration. Finally, while other providers offer crucial lactation support (e.g., certified lactation educators/counselors, lactation support providers, other pediatric health care providers), we did not incorporate these groups into our study.

Conclusion

We identified decreased geographic proximity to IBCLCs for children in rural counties compared to urban counties and for children in counties with lower breastfeeding initiation rates compared to counties with higher breastfeeding initiation rates. We also observed that the percentage of children with proximity to hospital-based IBCLCs exceeded the percentage with proximity to outpatient IBCLCs (i.e., office-based, private practice, and WIC-affiliated). While several other factors contribute to access, increased distance to IBCLCs for these vulnerable populations is concerning.

Funding

Supported in part by grants from the Agency for Healthcare Research and Quality (K12HS022989), the National Institute of Nursing Research (K99NR015106), and the authors' institution. The content is solely the responsibility of the authors and does not necessarily represent the official views of the funders. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. Additionally, county breastfeeding initiation data provided by the Bureau of Health Statistics and Research, Pennsylvania Department of Health; the Department specifically disclaims responsibility for any analyses, interpretations, or conclusions.

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1a: Access to Any IBLCE-identified IBCLC

1b: Access to Any ILCA-identified IBCLCs

Figure 1: Geographic access to International Board Certified Lactation Consultants (IBCLCs) in Pennsylvania

Note: Location of specific types of international board certified lactation consultants (IBCLCs) within Pennsylvania indicated by closed circles. Geographic access to IBCLCs identified in each data source indicated by hatched areas (closest IBCLC within 15 miles), striped areas (closest IBCLC within 30 miles), and open areas (closest IBCLC within 60 miles). Data sources: IBLCE (2016), ILCA (2015), Esri Data & Maps (2015).

Figure 2: Geographic access to ILCA-identified International Board Certified Lactation Consultants (IBCLCs) practicing in specific settings in Pennsylvania

Note: Location of specific types of international board certified lactation consultants (IBCLCs) within Pennsylvania indicated by closed circles. Geographic access to each of types of IBCLCs indicated by hatched areas (closest IBCLC within 15 miles), striped areas (closest IBCLC within 30 miles), and open areas (closest IBCLC within 60 miles). Data sources: ILCA (2015), Esri Data & Maps (2015).

Table 1.

Demographics Characteristics of Residents of Pennsylvania Counties Overall and grouped by Rural-Urban Status

Characteristics	All Counties N=12,702,379 n (%)	Urban Counties n=11,192,164 n (%)	Rural Counties n=1,510,215 n (%)
Age (years)			
0–4	729,538 (5.7)	649,454 (5.8)	80,084 (5.3)
5–9	753,635 (5.9)	669,560 (6.0)	84,075 (5.6)
10–14	791,151 (6.2)	701,646 (6.3)	89,505 (5.9)
15–19	905,066 (7.1)	801,186 (7.2)	103,880 (6.9)
20–44	4,000,934 (31.5)	3,555,005 (31.8)	445,929 (29.5)
45–64	3,562,748 (28.0)	3,122,200 (27.9)	440,548 (29.2)
>65	1,959,307 (15.0)	1,693,113 (15.1)	266,194 (17.6)
Race/Ethnicity			
White	10,406,288 (81.9)	8,961,646 (80.0)	1,444,642 (95.6)
African American	1,377,689 (10.8)	1,345,126 (12.0)	32,563 (2.2)
Other Race ^a	818,402 (7.2)	885,392 (7.9)	33,010 (2.2)
Hispanic Ethnicity	719,660 (5.7)	695,045 (6.2)	24,615 (1.6)
Gender			
Males	6,180,363 (48.7)	5,431,316 (48.5)	759,047 (50.3)
Females	6,512,016 (51.3)	5,760,848 (51.5)	751,168 (49.7)
Households	5,018,904	4,416,585	602,319

^a Other race includes individuals who selected the following US Census categories: Asian (349,088), American Indian/Alaska Native (26,843), Native Hawaiian and Other Pacific Islander (3,653), Other (300,983), or individuals who selected two or more race categories (237,835).

Table 2.

Operational Definitions and Data Sources of Study Variables.

Variables (Data Sources)	Definitions
County Rural-Urban Status (USDA Rural-Urban Continuum Codes, 2015)	Metropolitan – Counties with USDA Rural-Urban Continuum Codes 1–3 Non-Metropolitan – Counties with USDA Rural-Urban Continuum Codes 4–9
County Breastfeeding Initiation Rate (Pennsylvania Department of Health, Bureau of Health Statistics and Research, 2012)	High – Counties with breastfeeding initiation rates 76–87% Medium – Counties with breastfeeding initiation rates 68–75% Low – Counties with breastfeeding initiation rates 52–67%
IBCLC Location (International Board of Lactation Consultant Examiners, 2016)	IBCLCs identified and geolocated by ZIP code provided by IBLCE
(International Lactation Consultant Association, 2015)	ILCA-member IBCLCs identified and geolocated by address extracted from ILCA website

Abbreviations: USDA, United States Department of Agriculture; IBCLC, International Board-Certified Lactation Consultant; IBLCE, International Board of Lactation Consultant Examiners; ILCA, International Lactation Consultant Association.

Table 3.

Children with Access to IBCLCs Overall and grouped by Rural-Urban Status

All Children		Children in Urban Counties		Children in Rural Counties	
	N=729,538	N=649,454	N=80,084		
Distance	n (%)	n (%)	n (%)	Chi-square	p
IBCLCs in any practice setting ^a					
15 mi	703,688 (96)	645,036 (99)	58,652 (73)	1.4×10 ⁵	<0.001
30 mi	725,749 (99)	649,454 (100)	76,295 (95)	3.1×10 ⁴	<0.001
60 mi	729,538 (100)	649,454 (100)	80,084 (100)	NA	NA
IBCLCs in any practice setting					
15 mi	585,699 (80)	571,060 (88)	14,639 (18)	2.2×10 ⁵	<0.001
30 mi	663,110 (91)	618,306 (95)	44,804 (56)	1.3×10 ⁵	<0.001
60 mi	698,757 (96)	631,731 (97)	67,026 (84)	3.3×10 ⁴	<0.001
Hospital Based IBCLCs					
15 mi	546,931 (75)	532,729 (82)	14,202 (18)	1.6×10 ⁵	<0.001
30 mi	656,303 (90)	612,123 (94)	44,180 (55)	1.2×10 ⁵	<0.001
60 mi	698,626 (96)	631,731 (97)	66,895 (84)	3.3×10 ⁴	<0.001
Private Practice IBCLCs					
15 mi	429,919 (59)	428,165 (66)	1,754 (2)	1.2×10 ⁵	<0.001
30 mi	601,824 (82)	574,755 (88)	27,069 (34)	1.5×10 ⁵	<0.001
60 mi	689,812 (95)	626,671 (96)	63,141 (79)	4.3×10 ⁴	<0.001
Office-Based IBCLCs					
15 mi	372,231 (51)	371,824 (57)	407 (1)	9.2×10 ⁴	<0.001
30 mi	559,665 (77)	550,954 (85)	8,711 (11)	2.2×10 ⁵	<0.001
60 mi	659,997 (90)	612,838 (94)	47,159 (59)	1.0×10 ⁵	<0.001
WIC-Affiliated IBCLCs					
15 mi	281,507 (39)	280,925 (43)	582 (1)	5.5×10 ⁴	<0.001
30 mi	461,330 (63)	451,524 (70)	9,806 (12)	1.0×10 ⁵	<0.001
60 mi	619,630 (85)	576,649 (89)	42,981 (54)	6.9×10 ⁴	<0.001

Notes. Data source is International Lactation Consultant Association (2015) unless otherwise specified. Results indicate number (%) of children 0–4 years old living within the designated number of miles from the specified type of IBCLC. Abbreviations: IBCLC, International Board-Certified Lactation Consultant; NA, not applicable.

The data source for the first three rows of results is the International Board of Lactation Consultant Examiners (2016).

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Table 4.

Children with Access to IBCLCs grouped by County-Level Breastfeeding Initiation Rates

County Breastfeeding Initiation Rate					
Distance	Low (52–67% initiation)	Medium (68–75% initiation)	High (76–87% initiation)	Chi-square	p
	n=214,373 n (%)	n=196,783 n (%)	n=318,382 n (%)		
IBCLC in any practice setting ^a					
15 mi	200,863 (94)	189,254 (96)	313,571 (98)	8.7×10 ³	<0.001
30 mi	211,481 (99)	196,783 (100)	317,485 (100)	4.2×10 ³	<0.002
60 mi	214,373 (100)	196,783 (100)	318,382 (100)	NA	NA
IBCLC in any practice setting					
15 mi	150,387 (70)	144,274 (73)	291,038 (91)	4.5×10 ⁴	<0.001
30 mi	187,777 (88)	166,927 (85)	308,406 (97)	2.5×10 ⁴	<0.001
60 mi	209,045 (98)	179,060 (91)	310,652 (98)	1.5×10 ⁴	<0.001
Hospital Based IBCLC					
15 mi	148,716 (69)	119,532 (61)	278,683 (88)	5.2×10 ⁴	<0.001
30 mi	186,243 (87)	162,214 (82)	307,846 (97)	3.1×10 ⁴	<0.001
60 mi	208,961 (97)	179,060 (91)	310,605 (98)	1.5×10 ⁴	<0.001
Private Practice IBCLC					
15 mi	118,310 (55)	84,960 (43)	226,649 (71)	4.1×10 ⁴	<0.001
30 mi	155,432 (73)	151,783 (77)	294,609 (93)	4.1×10 ⁴	<0.001
60 mi	205,759 (96)	173,651 (88)	310,402 (97)	2.1×10 ⁴	<0.001
Office Based IBCLC					
15 mi	109,873 (51)	98,829 (50)	163,529 (51)	69.7	<0.001
30 mi	133,214 (62)	138,291 (70)	288,160 (91)	6.4×10 ⁴	<0.001
60 mi	196,047 (91)	160,675 (82)	303,275 (95)	2.6×10 ⁴	<0.001
WIC-Affiliated IBCLC					
15 mi	105,912 (49)	20,432 (10)	155,163 (49)	9.0×10 ⁴	<0.001
30 mi	124,558 (58)	99,008 (50)	237,764 (75)	3.4×10 ⁴	<0.001
60 mi	160,641 (75)	153,509 (78)	305,480 (96)	5.4×10 ⁴	<0.001

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Notes. Data source is International Lactation Consultant Association (2015) unless otherwise specified. Results indicate number (%) of children 0–4 years old living within the designated number of miles from the specified type of IBCLC. Abbreviations: IBCLC, International Board-Certified Lactation Consultant; NA, not applicable.

^aThe data source for the first three rows of results is the International Board of Lactation Consultant Examiners (2016).