ELSEVIER

CrossMark

Disability and Health Journal 8 (2015) 434–442

Disability and Health Journal

www.disabilityandhealthjnl.com

Research Paper

Geo-social and health disparities among persons with disabilities living in Monterrey, Nuevo Leon and Dallas, Texas

Silviya P. Nikolova, Ph.D.[a,*], Eusebius Small, Ph.D.[b], and Claudia Campillo, Ph.D.[c]

[a]*Department of Social Medicine and Healthcare Organization, Medical University Varna, 55 Marin Drinov Street, Varna 9002, Bulgaria*

[b]*School of Social Work, University of Texas Arlington, USA*

[c]*School of Social Work and Human Development, Autonomous University of Nuevo León, Mexico*

Abstract

Background: In low and high income countries alike, disability exacerbates social, economic, and health disparities, in spite of their differences.

Objective: This study seeks to identify factors that predict the circumstances people with disabilities face, including poverty.

Methods: A cross-sectional study design was employed using census track level data for the cities of Monterrey, Nuevo Leon, and Dallas, Texas, from Mexico 2010 and USA 2000 census data collections. Two methods, spatial autocorrelation and geographically weighted regression were used to identify spatial patterns of disability and to explore the relation between disability and context-specific socio-demographic factors.

Results: Results indicated that people with disabilities living below the poverty line experience high segregation levels in the semi-central zones of Dallas. In Monterrey, people with disabilities clustered in central areas of the city. A Geographically Weighted Regression (GWR) from both data analyses reported high goodness of fit ($R \geqslant 0.8$ for Dallas data and $R \geqslant 0.7$ for Monterrey data, respectively) and predictability of disability prevalence when social disadvantage factors such as unemployment, housing insecurity, household living conditions, and lack of education were present.

Conclusions: The divergent and sometimes conflicting trends in practices and policies addressing disability in low and high income environments renders a reexamination of the framework of disability. An understanding of local characteristics joins a grounded socio-cultural understanding of the various contexts that shape location-based social networks and political decisions in providing such an analysis.

Keywords: Disability; Geography; Disparity; Low- and high-income countries

Health is disproportionately distributed across geopolitical and social economic boundaries. Persons of lower educational levels, income, or occupational status experience worse health and die earlier than their better-off counterparts, irrespective of their country of residence.[1] In fact, some have documented that people with disabilities are among the poorest and most excluded demographic groups in the world.[2] Yet, disability report data indicate that increasing numbers of individuals are reporting disabilities in the United States.[3] Furthermore, individuals with disabilities experience a large number of barriers to health promotion and disease prevention.[3] No study to our knowledge has compared and analyzed disability prevalence profiling two different socio-economic contexts. Factors of social and economic inequity do exacerbate the risk of chronic illness and disability among people living in low and high income countries. Through a comparative analysis of health disparities and disability between two cities, this article seeks to provide insights into contemporary frameworks that attempt to understand the intersectionality between disability and health in diverse geo-social, economic, and cultural environments.

Twenty-one years after the enactment of the first disability act in history [Americans with Disabilities Act (ADA)], the World Report on Disability [WRD] (2011) revealed a chilling trend of disadvantages people with disabilities have faced in both low-income and high-income countries. These include educational, economic, and gender disparities in the distribution of resources and overall health.[4] This article reviews the connection between health disparities and contextual variables and provides several potential explanations for socio-economic-based disparities. It reveals that social, spatial, and policy health

Funding statement: This research received no specific grant from any funding agency in the public, commercial or not-for profit sectors.

* Corresponding author.

E-mail address: silviya.p.nikolova@mu-varna.bg (S.P. Nikolova).

1936-6574/$ - see front matter © 2015 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.dhjo.2015.03.004

disparities among people with disabilities in Dallas and Monterrey have remarkably similar contours.

For example, educational completion rate is higher for people with no disabilities (7.03 years) compared to their counterparts (5.96 years). In a particularly sobering indicator, educational completion rate among women with disabilities is longer (6.26 years) than their counterparts without disabilities (4.98 years).[4] Across income levels, individuals with disabilities have limited opportunities and live in poverty at higher rates than people without disabilities. In the United States, a person with a disability is 18.6% more likely to be unemployed than person without disabilities and likelier to be a victim of housing and racial discrimination.[5,6] For people with a disability living in developing countries (where 80% of people with a disability live), the health disparities are even grimmer. In Mexico half of the people living in poverty are individuals with some type of a disability; a majority are unemployed (85%), uneducated (60%), and have no health insurance (64%).[7,8] Correspondingly, many countries in other parts of the world—Africa, Asia, Latin America, and the Caribbean face similar problems.[9] Studies have documented a vicious poverty–disability cycle in which people with disabilities are more likely to live in chronic poverty,[10,11] which in turn can lead to disabling conditions.[12–14] It is safe to conclude, therefore that disability is a problem of disproportional magnitude and inevitably leads to marginalization and spatial exclusion. Gaines (2004), for example, describes the risk of ghettoization in housing for individuals with disabilities that contributes to limited access to services and necessary resources.[15] Assessments of methodological approaches such as geomapping and spatial applications have been used to assess the level of segregation affecting people with disabilities who live in low-income environments.[16,17] Goli and colleagues (2014), for example, found evidence that the prevalence of a disability follows patterns in residential and gender distribution and these patterns reflect poverty and health inequity, causing spatial agglomeration and clustering of ''hot'' and ''cold'' spots of disability.[18]

Within this context, this paper seeks to describe and analyze disability prevalence in two distinct socio-economic geographical contexts. It postulates that factors of social and economic inequity may exacerbate health risk among populations, creating chronic illnesses and disabling situations in both low and high income countries.

Conceptual framework

Theories of disability have long recognized the importance of both the person and environment in understanding the nature and causes of disability.[19,20] To underscore the interaction between individuals with disability and their environment, the study used the person-in-environment theory, which examines the role of social structures in human development and critiques the approaches that are solely focused on individual factors.[21] An important piece of the person-environment framework is the concept of space and place. *Space* (the subjective livelihood of people) and *place* (the environmental surroundings) have a qualitatively distinguishable conceptual meaning.[22] Space can be a subjective construct that goes beyond its personalization,[22] but the meaning and usage of space can have a profound implication for disability and poverty indicators. It is within this thought and conceptualization that the social model of disability is to be re-evaluated.[23]

Empirical research has documented the etiology of many conditions that lead to disability, including environmental factors such as water, sanitation, and hygiene, pollution and other disabling environments such as political decision making, architectural factors of modernity and factors of social-cultural norms that are identifiers of geo-social and cultural environments.[24–26] Likewise, research has demonstrated a strong correlation between conditions of poor health and low levels of social and human development.[14] People with a disability who may lack access to social services, educational, and labor opportunities are more likely to be poor, marginalized, or socially excluded than their fully-able counterparts.[7,12] A reciprocal effect of enhanced vulnerability to chronic illness and impairments among people living in low socio-economic environments has also been reported.[9]

This study highlights the complex nature of individuals and their socio-environmental relations, particularly for people with a disability and their spatial and social representations.

Methods

Study area

The research explores the geographical inequities in disability in relation to census based socio-demographic factors of two cities: Monterrey, Mexico, and Dallas, Texas (Fig. 1 provides a locator map). Monterrey is the capital city of the state of Nuevo León and is the third largest metropolitan area in Mexico with a population of 4.19 million people. The Dallas-Forth Worth metropolitan area is the 9th largest metropolitan area in the United States, with a population of 6.5 million; the county considered here has 2.2 million.

Study analyses included all census tract areas considered part of the urban metropolitan area of Monterrey, and the most populated county in Dallas, Dallas county. The objective was to enhance sample parsimony and the representativeness of the population. The cities were chosen for this analysis because they have a long historical relationship in which immigrants from Monterrey settle in Dallas. Table 1 provides detailed information regarding the number of people with disabilities included in the final study.

Fig. 1. Locator map.

Data

Data for this study on disability cases were obtained from 2000 U.S. Census survey and Mexico's 2010 Population and Housing Census survey. Both data represented the second historical instance of official data collection on disability in their respective countries. Census surveys used census long-forms and probabilistic sampling strategies. The chief reason the study does not use data from the 2010 U.S. Census is that it did not gather disability data on census track level. Instead the census used estimates from the American Community Survey as a substitute of the long-form in the 2010 survey. Both countries' surveys included constructs of physical, sensory, or mental conditions as well as constructs of self-care and states of independence in daily living activities. The framework excludes data on employment and mobility from the 2000 U.S. questionnaire because they are known to be misleading.[27] The outcome variable in the present analysis is disability as a composite variable encompassing all types of disabilities.

Methods of analysis

The research used a combination of spatial methods implemented in two steps of data analysis: (1) descriptive, and (2) analytical. The first used Moran's global (I) and local index (Ii) of spatial autocorrelation to identify clusters of disadvantaged areas (tracts) with people with disability.[28] The global Moran's index (I) determines whether the spatial distribution of a population (i.e. people with disabilities) is concentrated, random, or dispersed. The local Moran's index (LISA) measures the agglomeration process at the census tract level and identifies four potential spatial agglomeration patterns.[29]

Table 1
Number of people with disabilities in both geographic areas

	Monterrey, N.L.		Dallas county, Texas	
	Total	Percentage	Total	Percentage
Men	93,599	50.5%	1,815,503	50.3%
Women	91,828	49.5%	1,790,039	49.7%

Source: US Census Bureau 2000; INEGI 2013.

Table 2
Census-based socio-demographic characteristics

Variable	Total number
Monterrey	
Illiterate population (over 15 years)	80,949
Unemployed	80,156
No health coverage	901,029
Households with no social goods*	2859
Households with more than 2.5 people/bedroom*	208,413
Dallas county	
Not enrolled in school	273,642
House owner with no vehicle	14,073
House renter with no vehicle	51,175
Unemployed	120,271

* Social goods in this study are: electricity, water, household utilities, car, telephone, TV, computer, internet, and number of people sharing a bedroom included as criteria in defining the level of marginalization in Mexico by the National Population Council in Mexico (Consejo Nacional de Población, 2010).[48]
Source: US Census Bureau 2000[46]; INEGI 2013.[47]

(i) Disability cores. High value census tracts surrounded by high value census tracts (Hot spots, HH: high–high).
(ii) Disability free cores. Low value census tracts surrounded by low value census tracts (Cold spots, LL: Low–Low),
(iii) Disability islands. High value census tracts surrounded by low value census tracts (Spatial outlier, HL: High–Low)
(iv) Disability free islands. Low value census tracts surrounded by high value census tracts (Spatial outlier, LH: Low–High).

When census tracts with high and very high concentrations of disability areas overlap, spatial cores and islands in the agglomeration layer create disability clusters.[28] HH and HL in the agglomeration layer are the high disability cores and islands respectively; their neighboring High and Very-high census tracts are areas of dense disability concentration. The spatial combination of both cores and islands and their areas of influence constitute the potential clusters of disability. The importance of these relationships is in their ability to improve the process of problem identification and prioritize problem-solving on concrete data and locality.

The second phase applied the Geographically Weighted Regression (GWR) to determine the spatial dependence of disability on predictors such as household characteristics and conditions, education, employment, and health coverage. The GWR model has considered gender and racial effect on disability. Table 2 indicates socio-demographic characteristics for the population living in Dallas and Monterrey. Variables indicating living conditions could not be equalized because they did not measure the same

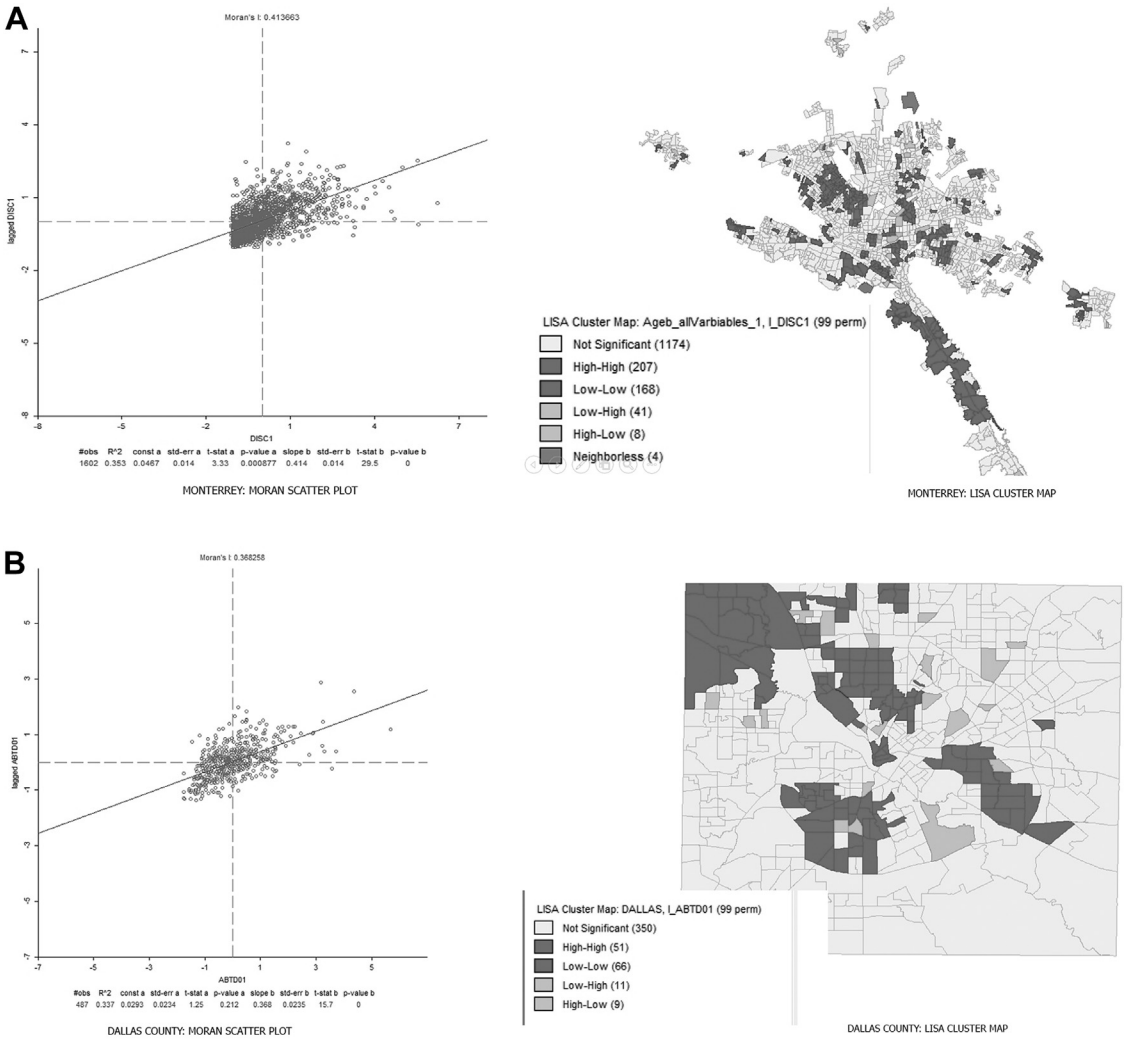

Fig. 2. A) Geoda global (Moran Scatter) and local indicator of spatial association. B) Geoda global (Moran Scatter) and local indicator of spatial association.

parameters. It is important to note that the demographic data in Table 2 represents people living in disadvantaged conditions who may or may not have a disability. Additionally, data regarding health insurance coverage on a census tract level was not available from the U.S. census data and was therefore not included in the U.S. regression model.

Akaike Information Criterion (AICc) was used to determine the optimal number of neighboring tracts that form clusters with disability.[30] The regression analysis permits the identification of spatial trends in disability prevalence related to social and economic inequalities.[31] Separate GWR models evaluated the gender, race, and ethnic disparities in disability prediction by considering adjusted *R*-square values and coefficient estimates at the 5% significance level. The importance of using these two methods of estimates (the Moran index and GWR) is that it allows for identification of spatial clusters and combines maps with statistical graphics important in mapping public health problems such as disability.[28]

We used two programs for mapping and visualization of the analyzed information: (1) GeoDa version 13.0 used geostatistical data to calculate the process of spatial agglomeration, and (2) ArcGIS version 10.1 analyzed the GWR and mapped the disparities in disability in both cities.

Results

Results from the spatial autocorrelation analysis in Monterrey showed positive results (Moran's I = 0.41, *p*-value: 0.001) and indicated areas with high disability clusters in the inner urban zones of the Monterrey metroplex. Likewise, results from the spatial autocorrelation analysis for disability in Dallas county indicated positive spatial patterns (Moran's I = 0.368, *p*-value: 0.001) and disability clusters located in the southeastern part of the county (high rate of disability prevalence, surrounded by other high rate areas (High–High)) (Fig. 2). The study focuses on the

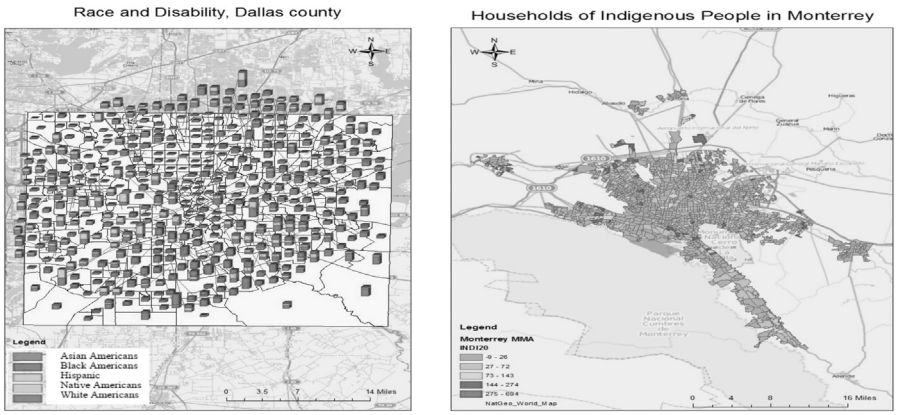

Fig. 3. Disability, ethnicity and race.

regions with high prevalence of disability located in low prevalence areas in central and semi-central zones in both cities (High–Low) (see LISA Cluster maps, Fig. 2).

Disability statistics of selected socio-demographic factors showed that White residents dominate in the study area in Dallas County, followed by Hispanic and African American residents with disabilities. African Americans and Hispanic people conformed to spatial patterns of population concentration (clusters) (Fig. 3). A small number of indigenous tribes, including the Náhuatl, Huasteco and Otomí, conform to an ethnic pattern in Monterrey (124 households ($N = 2312$)), with high densities in some areas but no pattern of spatial concentration (Fig. 3).

A set of proxy variables measured the state of poverty for people with disabilities living in Dallas county and Monterrey (i.e. education, employment, health insurance; house and car ownership; household conditions of living) (see Table 2). Overall, the visualization of the data showed clear patterns of clustered areas of people with disabilities in Dallas county who also live below the poverty line and overlap with areas of different minority groups (see Figs. 3 and 4). Likewise, patterns of marginalization in Monterrey have been observed in the periphery and some central and semi-central areas of the city (Fig. 4).

Spatial distributions of the disability factors under investigation showed evidence of spatial clustering based on the statistically significant GWR results ($p = 0.005$). The AICc values decreased (see Tables 3 and 4) while adjusted R-square values increased from 0.7 (OLS) to 0.8 (GWR) for the Dallas disability model, and from 0.6 (OLS) to 0.7 (GWR) for the Monterrey disability model. The results obtained from both cities; OLS and GWR models (coefficient estimates and model performance indicators) appear in Tables 3 and 4 In addition, Fig. 5 shows a set of maps for all local R-square values to compare the results of the GWR model for Dallas County and Monterrey.

GWR results for Monterrey showed high predictability (R-square is over 0.6). Disability prevalence in Monterrey was highly predictable by two factors: poor household conditions and unemployment, both contributing to the poverty-building framework. Moreover, predictability of disability was sensitive to ethnicity. Highest model fit (R-square of 0.78) was reported after ethnicity was included as a factor variable in the model. Finally, disability was predicted in semi-peripheral and semi-central zones of the metropolitan area (Fig. 5). Although the degree of predictability varied from place to place, it is evident that aggravating social factors such as poverty, unemployment, and

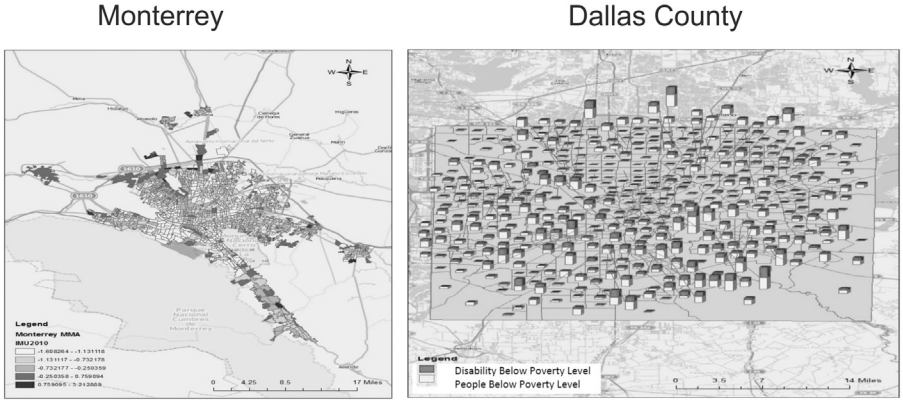

Fig. 4. Poverty and marginalization.

Table 3
Predicted disability in Monterrey

Variable	OLS R^2	GWRR^2	OLS AICc	GWR AICc	*b*	Poor education	Not employed	No health coverage	Indigenous ethnicity	HH with 2.5p./room	HH no social goods
Disability (total)	0.618	0.747	16,867	16,626	H:72 L:−8	H:1.2 L:−0.7	H:1.5 L:−0.2	H:0.22 L:−0.05	H:3.5 L:−2.5	H:0.6 L:−0.7	H:4.2 L:−9.2
Disability (female)	0.639	0.699	15,471	14,755	H:18 L:−12	H:1.5 L:−0.7	H:0.47 L:−0.4	H:0.49 L:−0.4	H:1.56 L:−1.35	H:1.39 L:−0.85	H:3.18 L:−2.4
Disability (male)	0.643	0.784	15,344	14,254	H:23 L:−5	H:0.64 L:−0.3	H:0.66 L:−0.17	H:0.08 L:−0.02	H:1.7 L:−1.3	H:0.3 L:−0.3	H:2.08 L:−4.06

H: high value; L: low value; $p \leqslant 0.05$.

poor household conditions shape the in-place prevalence of disability in Monterrey. Likewise, disability analysis of data from Dallas County included four separate regressions for males and females, two of which included ''race'' as a factor in the GWR model.

Overall, employment and house ownership emerged as important predictors of disability prevalence in the county. The first model showed a strong prediction effect on the outcome variable for females, including education, employment, house (renting/owner) and vehicle ownership as regression factors. Compared to the model predicting disability among males in low-income households, the only stronger predictors were employment and house ownership. Interestingly, education had a strong prediction effect on disability among females. Additionally, adding variables of race and ethnicity in the models improved the overall model fit (improved *R*-square), and decreased the AIC criterion from 4347 to 4225 for a GWR model with female data and from 4441 to 4223 for the GWR model with male disability data (see Table 4).

Discussion

This study was designed to explore the spatial variation of disability prevalence in two different socio-economic and cultural environments. To this end, spatial autocorrelation methods such as the global and local Moran's tests were used to identify areas with high and low disability concentration for each tract area in Monterrey and Dallas county. Additionally, geographically weighted regression was used to estimate and compare the predictability of disability by gender and racial/ethnic origin in both urban settings. The results of the performed spatial analysis in the two settings are quite revealing on several fronts.

One of the important findings from this study is the similarity observed in disability patterns in resource-scarce environments. The index of spatial autocorrelation (I = 0.41, $p \leqslant 0.001$ Monterrey; I = 0.36, $p \leqslant 0.001$ Dallas County) indicated favorable cluster patterns, meaning that people with disabilities were more likely to form spatial clusters that were not random. Previous research tends to support the interpretation of a link between socio-economic status (SES), i.e. low-income environments and disability status correlate with patterns of spatial segregation. For example, disability and chronic illness have been linked to unemployment and place of residence.[32] Støver and associates (2012) found that unemployment increased the risk of receiving a subsequent disability pension.[32] Other studies on healthy and safe communities reported very substantial differences in the quality of available resources in low and high-income places. For example, low-income environments have fewer stores selling fresh produce, and more selling liquor; higher crime rates, and fewer recreation areas.[33,34] By adding a market dimension to where people with a disability live, there is a possibility that the unhealthy produce could increase poor outcomes for people with disability. Therefore, using geomapping to understand social and spatial patterns is important in identifying the barriers to healthy living that cause social disparities.

Other factors that influence the environmental clustering and disparities among people with disability are their minority status. Results from the geographically weighted regression in both metropolitan areas indicated high *R*-square values (above 0.6, $p \leqslant 0.05$) of disability predictability in models including the effect of variables such as race and ethnicity. Still, the result was higher in the Dallas county model, where racial/ethnic group disparity was greater than it was in the Monterrey model ($R^2 = 0.8 > R^2 = 0.7$, $p \leqslant 0.05$; see Tables 3 and 4). One way to interpret the variation in racial and ethnic disparities in disability prevalence across studies is to speculate that disability conditions may have different paths of development, depending on the management of diseases and the understanding of specific health conditions by different cultural groups.[35] For example, new Latino immigrants report lower correlation of severity with disability than Blacks or non-Hispanic Whites.[36] This epidemiological fact is known as the ''Latino paradox''—new Latino immigrants suffer lower rates of chronic and mental illness than the average native-born American, despite having on average lower incomes and highly stressful lives.[37] Alternately, the failure to take confounds such as educational attainment, age, and type of disability into account, may mask and under estimate the nature of disparities among diverse racial/ethnic groups of people with disabilities. For example, the study of Moody-Ayers, Mehta, Lindquist, Sands and Covinsky (2005) compared non-Hispanic White and Black elderly populations and found that elderly Blacks

Table 4
Predicted disability in Dallas county

Variable	R^2 GWR	R^2 OLS	AICc GWR	AICc OLS	*b*	Poor education	Not employed (16–20 years)	Not employed (21–64 years)	Empl. disability-not employed (21–64years)	Race	Rent/no car	Rent/one car	Own house/no car
Disability (female)	0.838	0.811	4347	4296	H:6.4 L:−18	H:0.25 L:−0.08	H:0.57 L:−0.27	H:0.42 L:−0.07	H:0.41 L:−0.39	Variable not Included in the model	H:0.30 L:0.04	H:0.02 L:−0.05	H:0.31 L:0.11
Disability (male)	0.819	0.796	4441	4340	H:13 L:−16	H:0.06 L:−0.04	H:0.78 L:−0.10	H:0.48 L:−0.23	H:0.51 L:−0.37	Variable not included in the model	H:0.33 L:0.04	H:0.04 L:−0.04	H:0.42 L:−0.17
Disability and race (female)	0.856	0.728	4275	5483	H:7.8 L:−3.6	H:0.15 L:−0.10	H:0.19 L:−0.12	H:0.34 L:−0.003	H:0.16 L:−0.23	A:0.07−0.10 B:0.04−0.02 W:−0.008~−0.02 H:0.05−0.009 N:0.13−0.19	H:0.17 L:−0.06	H:0.004 L:−0.02	H:0.12 L:0.02
Disability and race (male)	0.834	0.727	4323	5483	H:7.4 L:−3.5	H:0.02 L:−0.02	H:0.24 L:−0.09	H:0.14 L:−0.008	H:0.05 L:−0.02	A:0.04−0.05 B:0.04−0.02 W:−0.005~−0.01 H:0.04−0.02 N:0.11−0.13	H:0.18 L:0.06	H:0.006 L:−0.01	H:0.15 L:−0.05

A: Asian; B: Black; N: Native Americans; W: White; H: Hispanic; $p \leqslant 0.05$.

experienced the onset of disability at a higher rate and earlier than Whites.[38] Furthermore, literature has discussed the overrepresentation and the underrepresentation of White and Black students with a learning disability in the education system.[39] Of concern is the fact that White students with learning disabilities are more likely to be educated in regular classrooms, while Black students with behavioral and emotional difficulties are most likely to receive education in separate environments.[39] Indeed, the results of the present study reveal a racial discrepancy between White and ethnic minority groups. White race was in a negative relationship as a predictor of the prevalence of households with people with disability living below poverty (regression coefficients were negative in both GWR models for males and females, see Table 4). Perhaps more importantly, the potential effect of the White racial factor is confounded by the fact that disability occurrence is tested in a context that encompasses factors that disproportionately advantage Caucasians: including education, income, and net worth.[40] The importance of these study findings is that the impact of the racial/ethnic component on disability is multidimensional. It can be inferred that understanding the variability of disability occurrence (higher or lesser) and access to social goods must be made with reference to race-specific context characteristics.

An important finding in this study is the prediction of disability by gender in both urban settings. The results from the geographically weighted regression indicated greater predictability of disability among males and females living in Dallas county. One possible alternative explanation for this is that disability as a function of assessed social goods depends on several intangible societal factors, such as social and family roles and cultural attitudes. In a paternalistic culture such as Mexican society, the role of women is widely perceived to be that of housewives or caregivers.[41] This cultural perception may mask the effect of the measure of inclusion of individuals with disability because of the impact of cultural-specific meanings attached to gender roles, rights and expectations. In the United States, gender egalitarianism and democratic opportunities for men and for women with disabilities vary.[42,43] Nevertheless, questions of labor integration policies and equality in remuneration still pose great challenges in both countries. Disparities in labor market participation provide another possible explanation for the observed differences in the gender results. In the United States, factors such as low payments, part-time working schedules, and lower ranked-positions drive part of the gender differences in employment outcomes that might generate less advantageous lifetime trajectories for women than their male counterparts.[44] In this context, gender differences in accessing and sustaining equal pay might compound group-based social disadvantages arising from social marginalization. This is one of the thornier issues of today's disability study agenda, an issue this research seeks in part to address.

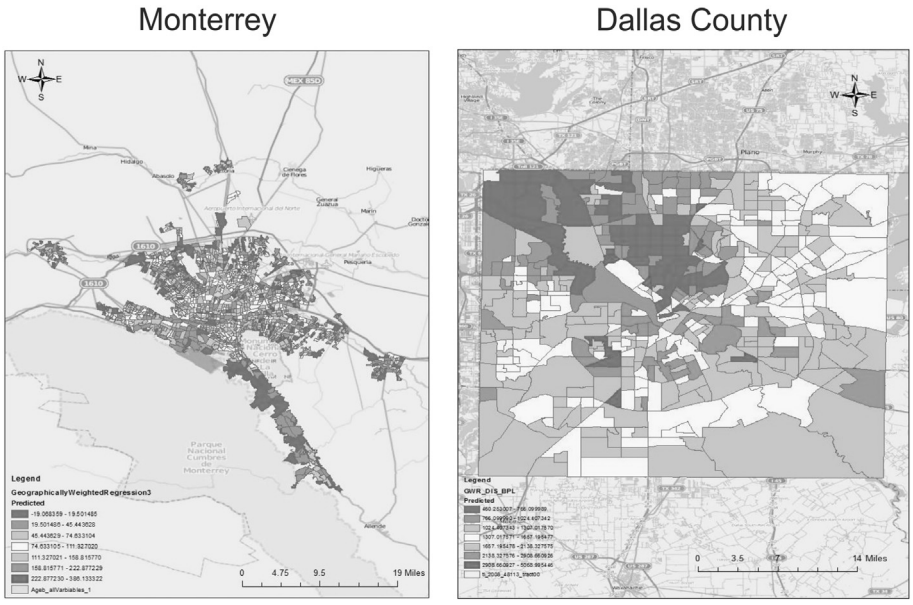

Fig. 5. Predicted disability prevalence.

Conclusion

The findings of this study suggest interventions aimed at improving service for people with a disability, along with enhanced access to social services such as education, health care, housing and needed accommodation will go a long way to improving the living conditions of the affected population and enhance social integration. It is proposed that health care professionals, as well as policy and community leaders, provide the necessary resources to facilitate better living conditions and improved lives for people with a disability. GIS and other geospatial data tools are powerful techniques for researchers and professionals to use in innovative ways to understand the conditions of people with disabilities.[45]

In conclusion, a focus on the disparities facing persons with disabilities living in diverse social contexts is needed to better understand the challenges of their everyday living *in situ*. Despite the fundamental differences in the level of social development in Mexico and the United States, disability resonates in both countries as alarming symbol of unachieved social justice and inclusion. This study indicates that disability is not an isolated social phenomenon but related to health, social, spatial, and cultural dimensions. Given the divergent and sometimes conflicting trends in practices and policies addressing disability in low and high income environments, it becomes crucial to re-examine the framework of disability by gauging local characteristics and by infusing a grounded socio-cultural understanding of the various contexts that consequently shape place-based social behaviors and political decisions.

That said, there are study limitations that are worthy noting. This is a cross-sectional study, carried out at one time point or over a short period and thus we may not infer causality. However, similar to other studies, there is a significant association between disability and health disparities. We also recognize that using two geopolitically diverse economies (USA and Mexico) can create comparison problems given their differences. The choice of the cities of Monterrey, Nuevo Leon, and Dallas, makes the study invaluably important because of the long historical and cultural reasons. Despite these limitations, the study has several strengths. We identified two unique methods, spatial autocorrelation and geographically weighted regression to identify spatial patterns of disability and to explore the relation between disability and context-specific socio-demographic factors. To our knowledge, this is the first study that has used these methods to compare and analyze disability prevalence in two different socio-economic contexts.

Future studies should examine the impoverishment of people due to disability as part of the knowledge needed to break the cycle of social disadvantages of people with disability living in low and high income environments.

References

1. Adler N, Newman K. Socioeconomic disparities in health: pathways and policies. *Health Aff*. 2002;21(2):60–76.
2. Mulligan D, Gooding K. *The Millennium Development Goals and People with Disabilities: Policy Briefing*. UK: Sightsavers International; 2009.
3. Centers for Disease Control and Prevention. CDC health disparities and inequalities report — United States, 2011. *MMWR*. 2011;60(suppl 1):1–113. Atlanta: CDC.
4. World report on disability. *Lancet*. 2011;337(9782):1997.
5. Turner MA, Herbig C, Kaye D, Fenderson J, Levy D. *Discrimination against Persons with Disabilities: Barriers at Every Step*. Washington

D.C.: HUD User, Department of Housing and Urban Development; 2005.
6. Bureau of Labor Statistics. *Decennial Census of Population and Housing*. Retrieved from, http://www.census.gov/people/disability/methodology/decennial.html; 2000.
7. Gonzalez B, Makowski S, Rosas AS, Manzini F. *Discapacidad y pobreza en Nuevo Leon*. Nuevo Leon: Consejo de Desarrollo Social; 2008.
8. *Consejo Nacional de Evaluación de la Política Social [CONEVAL]. (2009). Informe*. México: CONEVAL; 2009.
9. Mitra S, Posarac A, Vick B. *Disability and Poverty in Developing Countries: A Snapshot from the World Health Survey. (Social Protection Discussion Paper N. 1109)*. Washington D.C.: World Bank; 2011.
10. Lusting D, Strauser D. Causal relationship between poverty and disability. *Rehabil Couns Bull*. 2007;50(4):194–202.
11. Trani J, Loeb M. Poverty and disability: a vicious circle? Evidence from Afghanistan and Zambia. *J Int Dev*. 2010;24:S19–S52.
12. Batavia A. The financial vulnerability of people with disabilities: assessing poverty risks. *J Sociol Soc Welf*. 2001;28(1):139–162.
13. Gannon B, Nolan B. *The Dynamics of Disability and Social Inclusion in Ireland*. Dublin: The Equality Authority and the National Disability Authority; 2006.
14. Rosano A, Mancini F, Solipaca A. Poverty in people with disabilities: Indicators from the capability approach. *Soc Indic Res*. 2009;94:75–82.
15. Gaines D. Geographical perspectives on disability: a socio-spatial analysis of the mentally disabled population in Russia. *Middle State Geographer*. 2004;37:80–89.
16. Hoffman K, Webster TF, Weinberg JM, et al. Spatial analysis of learning and developmental disorders in upper Cape Cod, Massachusetts using generalized additive models. *Int J Health Geogr*. 2010;9(7).
17. Lai D. Spatial and temporal statistical analysis on the Chinese handicapped population. *Int J Disabil Hum Dev*. 2012;11(1):39–44.
18. Goli A, Kermany FS, Askarian M. Spatial prevalence on intellectual disability and related socio-demographic factors in Iran, using GWR: case study (2006). *Int J Prev Med*. 2014;5(3):313–325.
19. Oliver M. II. ¿Una sociología de la discapacidad o una sociología discapacitada? In: Barton L, ed. *Discapacidad Y Sociedad*. Madrid: Morata; 1998:34–59.
20. Reid-Cunningham AR, Fleming VC. Theories of disability: findings from an analysis of textbooks on human behavior and the social environment. *J Hum Behav Soc Environ*. 2009;19(1):10–25.
21. Spatscheck C, Wolf- Ostermann K. *Social Space Analysis and the Socio-spatial Paradigm in Social Work. Working Paper Serien 1*. Lunds: Lunds University; 2009.
22. Leach N. Belonging: towards a theory of identification with space. In: Hillier J, Rooksby E, eds. *Habitus: A Sense of Place*. Aldershot: Ashgate; 2002:297–315.
23. Francescutti C. UN convention on the rights of persons with disability, eligibility criteria and the International Classification of Functioning Disability and Health. *BMC Public Health*. 2011;11(suppl 4):S1.
24. Gleeson B. Disability and the open city. *Urban Stud*. 2001;38(2):251–265.
25. Imrie R, Thomas H. The interrelationships between environment and disability. *Local Env*. 2008;13(6):477–483.
26. Prüss-Üstün A, Bonjour S, Corvalán C. The impact of the environment on health by country: a meta-synthesis. *Environ Health*. 2008;7(7).
27. Stern S, Brault M. *Disability Data from the American Community Survey: A Brief Examination of the Effects of a Question Redesign in 2003*. Retrieved from, http://www.census.gov/people/disability/methodology/acs.html; 2005.
28. Anselin L, Syabri I, Kho Y. GeoDa: an introduction to spatial data analysis. *Geogr Anal*. 2006;38:5–22.
29. Anselin L. *Exploring Spatial Data with GeoDa: A Workbook*. Retrieved from, http://geodacenter.asu.edu/system/files/geodaworkbook.pdf; 2005.
30. Fotheringham AS, Brunsdon C, Charlton ME. *Geographically Weighted Regression: The Analysis of Spatially Varying Relationships*. Chichester: Wiley; 2002.
31. Comber AJ, Brunsdon C, Radburn R. A spatial analysis of variations in health access: linking geography, socio-economic status and access perceptions. *Int J Health Geogr*. 2011;10(44):1–12.
32. Støver M, Pape K, Johnsen R, et al. Unemployment and disability pension—an 18-year follow-up study of a 40-year-old population in a Norwegian county. *BMC Public Health*. 2012;28(12):148.
33. Romero AJ. Low-income neighborhood barriers and resources for adolescents' physical activity. *J Adolesec Health*. 2005;36:253–259.
34. Moore L, Roux A. Associations of neighborhood characteristics with the location and type of food stores. *Am J Public Health*. 2006;96(2):325–331.
35. Manton KG, Stallard E. Health and disability differences among racial and ethnic groups. In: Martin LG, Soldo BJ, eds. *National Research Council (US) Committee on Population. Racial and Ethnic Differences in the Health of Older Americans*. Washington (DC): National Academies Press (US). Retrieved from, http://www.ncbi.nlm.nih.gov/books/NBK109844/; 1997.
36. Huang FY, Chung H, Kroenke K, Spitzer RL. Racial and ethnic differences in the relationship between depression severity and functional status. *Psychiatr Serv*. 2006;57(4):498–503.
37. McGlade M, Saha S, Dahlstrom M. The Latina paradox: an opportunity for restructuring prenatal care delivery. *Am J Public Health*. 2004;94(12):2062–2065.
38. Moody-Ayers SY, Mehta KM, Lindquist K, Sands L, Covinsky KE. Black-white disparities in functional decline in older persons: the role of cognitive function. *J Gerontol A Biol Sci Med Sci*. 2005;60(7):933–939.
39. Blanchett W. Telling it like it is: the role of race, class, & culture in perpetuation of learning disability as a privileged category for the white middle class. *Disabil Stud Q*. 2010;30(2):24–28.
40. Fuller-Thomson E, Nuru-Jeter A, Meredith M, Jack M. Black–White disparities in disability among older Americans: further untangling the role of race and socioeconomic status. *J Aging Health*. 2009 Aug;21(5):677–698.
41. Alvarez de Vicencio ME. Realidad de la mujermexicana y propuestaspara mejorarsusituacion. In: UNAM, ed. *Derechos humanos. Memoria del IV Congreso Nacional de Derecho Constitucional III*. Mexico: Mexico, D.F; 2001:127–151.
42. *Americans with Disabilities Act of 1990*; 1990. Pub. L. No. 101-336, 104 Stat. 328.
43. Job Accommodation Network [JAN]. *Workplace Accommodations: Low Cost, High Impact*. Retrieved from, http://askjan.org/media/downloads/LowCostHighImpact.pdf; 2009.
44. Parker G, Grebe C, Hirst M, Hendey N, Pascall G. *Double Discrimination? Gender and Disability in Access to the Labor Market (European Social Fund Report No. ESF 2237 12.07)*. Retrieved from, http://www.york.ac.uk/inst/spru/pubs/pdf/double.pdf; 2007.
45. Elwood S. Critical issues in participatory GIS: deconstructions, reconstructions, and new research directions. *Trans GIS*. 2006;10(5):693–708.
46. U.S. Census Bureau. *Census Population and Housing*. Retrieved from, http://www.census.gov/data/2000; 2000.
47. Instituto Nacional de Estadística y Geografía [INEGI]. *Las personas con discapacidad en México, una visión al 2010*. INEGI: Aguascalientes; 2013.
48. Consejo Nacional de Población. *Indice de Marginacion Urbana 2010*. Mexico: Conapo; 2010.