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Proximity to healthcare clinic and depression risk in South Africa: Geospatial evidence from a nationally representative longitudinal study

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Abstract

Proximity to primary healthcare facilities may be a serious barrier to accessing mental health services in resource-limited settings. In this study, we examined whether the distance to the primary healthcare clinic (PHCC) was associated with risk of depression in KwaZulu-Natal (KZN) Province, South Africa. Depressive symptoms and household coordinates data were accessed from the nationally representative South African National Income Dynamics Study (SA-NIDS). Distances between households and their nearest PHCCs were calculated and mixed-effects logistic regression models fitted to the data. Participants residing <6 kms from a PHCC (aOR=0.608, 95% CI:0.42–0.87) or 6–14.9 kms (aOR=0. 612, 95% CI:0.44–0.86) had a lower depression risk compared to those residing ≥15 kms from the nearest PHCC. Distance to the PHCC was independently associated with increased depression risk, even after controlling for key socioeconomic determinants. Minimizing the distance to PHCC through mobile health clinics and technology could improve mental health.

Keywords

primary healthcare clinic; depression; social disconnectedness; GPS; South Africa

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Introduction

The importance of proximity to a primary healthcare (PHC) facility has been well-established in resource-limited settings [1–3]. Within the communicable diseases context, for example, distance to clinic and cost of transportation are recognized as major barriers to HIV treatment adherence [4–6]. A growing emphasis on community models of care that integrate mental health treatments into PHC systems [7] has focused attention on the role these barriers may have in the mental health context. Lack of access to, and availability of, mental health services (MHS) for individuals with mental illness, is a major challenge in sub-Saharan Africa [8]. Community-based mental health services (CMHS) are scarce or even absent, and many individuals have to access care at psychiatric (tertiary) hospitals that are located far from their homes.

Major depression represents a growing public health burden across the world. According to a recent systematic review, depressive disorders contribute more to ‘years lived with a disability’ than other mental and behavioral challenges [9]. Depression is a major public health challenge in South Africa [10], where, despite the availability of effective treatments, the need for CMHS is high and the treatment gap considerable. Previous research has shown that 9.8% of all South African adults have experienced a common mental disorder [11], but less than one quarter (22.6%) of those with a major depressive disorder sought care within the past 12 months [12]. It is likely that this substantial mental health treatment gap is partly a consequence of its historic past, where the enforced spatial separation of races created enduring disparities in access to healthcare services that have not been overcome. Black South Africans were particularly disadvantaged by being legally excluded from urban areas and forcibly moved into ethnically based undeveloped rural ‘homelands’. In post-apartheid South Africa, disparities in access to health services remain an enduring challenge [13], and many black South Africans remain socially disconnected from government-funded PHC services due to financial constraints [14,15].

Within many developing countries, mental health services receive a disproportionately small proportion of state funding, and the scarcity of mental health resources in these contexts has serious implications for access to effective care [8]. This is particularly evident in KwaZulu-Natal (KZN) Province in South Africa, where inadequate funding and a lack of human resources in mental health services have been reported [16]. Research shows that untreated depressive symptoms at a sub-threshold level can lead to major depression with a longer phase of residual symptoms [17], making timely access to care critical. As the frontline of the public healthcare provision in KZN [18], primary healthcare clinics (PHCC) provide treatment for various medical challenges, and a community-based healthcare model may be the key to realizing better mental health within this population. To date, however, the geospatial barriers to mental health that have planning and policy implications for implementing CMHS in the sub-Saharan African context have not been adequately understood. In the current study, we use data from a nationally representative longitudinal study to assess the association between proximity to the nearest primary healthcare clinic PHCC and the risk of depression within KZN.

Methods

Conceptual framework

The conceptual framework for this analysis is the Behavioral Model of Health Services Use framework [19], which was developed to address concerns related to social inequity in access to healthcare services among families [20], ethnic minorities and individuals from rural areas [21]. The rationale of this framework is that an individual's decision to access healthcare services is often constrained by his or her position in the social structure, as well as the availability of these services. There are three major components to this framework [19]: predisposing factors (i.e. demographic background, social class, health beliefs); enabling factors (i.e. income, ability to travel, availability of services in the community); and need for care (i.e. perception of health needs). More recently, the model has been modified to account for geographic access (i.e., distance) as a predisposing factor that may constrain individuals from seeking care [22]. The magnitude of social disconnectedness [23], characterized by the experience of living far from the nearest PHCC, may increase and ultimately have a negative impact on individuals at risk of mental health problems, particularly depression.

Study design and sample

We used data from the South African National Income Dynamics Study (SA-NIDS), this being the first nationally representative panel study to contain in-depth information about participants of all ages in South Africa [24]. The SA-NIDS utilized a stratified, two-stage cluster sample design, and approximately 7,300 households were chosen from 400 of Statistics South Africa's primary sampling units in the first wave. The adult questionnaires were administered to every consenting member aged 15 or older from eligible households. Our study utilized data from three waves: Wave 1 (2008), Wave 2 (2010), and Wave 3 (2012), with the sample limited to adult household members living in KZN. The adult questionnaires were available and administered in the country's 11 official languages. Permission for the study was obtained from the University of KwaZulu-Natal Biomedical Research Ethics Committee (BE 111/14).

Measurement

The primary outcome of our current investigation was self-reported depressive symptoms obtained from the adult questionnaire (Waves 1–3). SA-NIDS utilizes the 10-item abridged version of the Center for Epidemiologic Studies Depression Scale (CES-D) to assess the severity of depressive symptomatology. Comparable to the original 20-item CES-D [25], the abridged version [26] has been shown to retain psychometric validity [27, 28]. The instrument captures depressive symptoms during the past week using four possible responses: 0 = rarely or none of the time (less than 1 day); 1 = some or little of the time (1–2 days); 2 = occasionally or a moderate amount of time (3–4 days); and 3 = almost or all of the time (5–7 days). Depression symptomatology is based on a total score of 10 items (range from 0–30; Cronbach's alpha = 0.75), with a cutoff score of ≥ 10 used to indicate significant depressive symptoms (i.e. risk of depression). This cutoff value was derived from the seminal CES-D report by Andresen and colleagues [26].

The main study predictor for depressive symptoms was household proximity to the nearest primary healthcare clinic (PHCC). Proximity was calculated as the ellipsoidal distance between the participant's household and his/her nearest PHCC. Household GPS coordinates were accessed (with permission) from the DataFirst's Secure Data Centre at University of Cape Town, while publically available GPS co-ordinates for PHCCs were obtained from the KZN Department of Health [29]. The nearest PHCC was identified using QGIS version 2.12 "Lyon" [30]. The ellipsoidal distance between the households and their nearest PHCC was calculated using the "GEODIST" package [31] in Stata version 14. The ellipsoidal distance is known to be a computationally more intensive and accurate method for calculating the distance between two points along the surface of a mathematical model of the earth [32]. A previous South African study on the relationship between proximity to PHCC and health outcome utilized 5 and 7 km to indicate thresholds of 'long distance' [33]. The current study utilized a middle value of 6 km radius as that threshold. Information on age, education attainment, gender, marital status, race/ethnicity, employment status, household income, and geographic typology of residence (i.e. rural) was also obtained from the adult questionnaires (Waves 1–3), and included in the model to adjust for potential confounders.

Analysis

The analysis consisted of two stages. In the first stage we used descriptive statistics to summarize the baseline sociodemographic, clinical and household characteristics of our study cohort. In the second stage we investigated the association between the distance to the nearest PHCC and depressive symptoms using a mixed-effects logistic regression model. We adjusted the analysis for age, education attainment, gender, marital status, race/ethnicity, employment status, household income, geographic typology of residence, as well as the year of the NIDS assessment (for time trend). As SA-NIDS was designed as a complex survey, we further adjusted the analysis using post-stratification weights for the three waves. These weights were based on the age-sex-race distribution for the mid-year population estimates in 2008, 2010 and 2012 using figures obtained from Statistics South Africa [34,35].

Results

The summary of the baseline sociodemographic, household and clinical characteristics of our study cohort (n=4,039), which are presented in Table 1. Over half of study participants were female (60.0%) and aged less than 35 years old (55.9%), with the majority being Black African (78.6%). Most of the participants had completed at least a high school equivalent level of education (86.9%). Approximately half were single (54.7%), and not employed (59.2%), while a third (33.8%) had significant depressive symptoms. The majority of households (84%) were located <6 km from their closest PHCC.

Figure 1 show that the PHCCs in KZN are concentrated predominantly in urban areas (e.g. Durban). Table 2 shows the adjusted mixed effects regression results for the association between the distance to PHCC and risk of depression. In comparison with those participants residing ≥15 km from a PHCC, those residing 6–14.9 kms away (adjusted odds ratio [aOR]=0. 612, 95% confidence interval [CI]: 0.44–0.86) and those residing <6 kms away (aOR=0.608, 95% CI: 0.42–0.87) had a significantly lower odds of depressive

symptomatology. In addition, we found that female gender, older age, African/Coloured race/ethnicity, unemployed status, and urban informal residence were significantly associated with depressive symptomatology.

Discussion

Residing far from a primary healthcare clinic (PHCC) poses a significant and independent risk for depressive symptoms among KZN adults who participated in the SA-NIDS survey, even after controlling for key socioeconomic determinants of depression. As hypothesized, participants who were physically (and thus we suggest socially) disconnected from the closest PHC facility (by virtue of residing further away) were more likely to be at risk of depression.

Our study results can be explained by the Behavioral Model of Health Services Use framework [19], which provides a conceptual link between the distance to a PHCC and depression symptomatology. Notably, McLaren and colleagues [33] reported that participants residing further from a clinic had a lower likelihood of a health consultation, while a six-nation primary care study (including both developed and developing countries) showed that longer distance was a major obstacle to accessing treatment for depression [36]. Aspects of treatment that are likely influenced by geographic inaccessibility include: having reduced contact with healthcare service providers [37]; limited available psychotherapy [38]; and less access to outpatient treatment [39–40].

We also found, as indicated in Table 2, that certain residential typology (i.e. rural compared to urban informal area) was significantly associated with lower depression risk, warranting further discussion about the role of health and place within the South African context. International findings on urban-rural differences are often contradictory, but most reviews suggest that depression is marginally higher in urban areas [41–47]. A recent South African study confirmed a high prevalence in young individuals residing in an urban informal settlement, with almost 50% of males and almost 60% of females reporting significant depressive symptoms [48]. South Africa has a long history of labor migration, with mining being the bedrock of the country's economy throughout the 20th century [49]. Out of economic necessity, many individuals, in particular young Black South Africans, left families behind to seek employment outside their rural/traditional home areas [50], resulting in erosion of the traditional way of life and broken family ties [51,52]. Furthermore, Black African migrants often lived in under-resourced 'townships' and other urban informal areas on the city outskirts that often lacked urban planning and provided little or no basic services. This living arrangement (e.g. mining hostels) has continued after the advent of democracy [53]. The loss or lack of psychosocial support as result of disconnection from family of origin, as well as poor amenities/services associated with living in urban informal areas, may in part account for the association we have found between urban informal residence and higher risk for depression.

There were several study limitations. First, SA-NIDS is a nationally (rather than provincially) representative sample by design, and our results may therefore not be generalized to the entire KZN. Second, it is acknowledged that the data on mental health

services utilization (and level of care provision at PHCC) in SA-NIDS is limited. Assumptions had to be made that PHCCs provide limited mental health services (with little variation across clinics) for patents presenting with depression and/or comorbid medical illness.

Notwithstanding these limitations, the current study is one of only a few within a Sub-Saharan setting that examined the relationship between household proximity to healthcare facility and depression risk. Furthermore, our study has important policy implications for addressing population mental health needs in countries that have limited resources. It is well established that in order to be effective, the optimal treatment for depression as a life-long condition requires both pharmacotherapeutic and psychotherapic approaches [54], the latter in particular requiring frequent contact with a provider [37]. This highlights the need for expanding PHC services that have appropriately integrated mental healthcare interventions. Our results suggest that where primary services are geographically accessible, treatment coverage is likely to be improved in the population; and the burden associated with common mental disorders mitigated to some extent. Importantly, while the rationale for integrating mental health into PHC is evident, research on the feasibility, acceptability, and effectiveness of such care models is warranted in South Africa [55].

Beyond a focus on PHC, we also acknowledge other potential solutions that may reduce inaccessibility to mental health services, such as mobile health clinics and mHealth (mobile health) technologies. Although the latter is at a formative stage of implementation, there are a number of South African studies demonstrating its potential for treating depression [56,57]. Finally, in addition to reaffirming the call for integration of mental health care into community-based primary care in KwaZulu-Natal Province [58], we argue that a geospatial or ‘place-based’ approach [59–61] to mental health care provision is critical to understanding the structural factors contributing to risk for mental disorders within developing country settings.

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Waves 1–3 Data: Southern Africa Labour and Development Research Unit. National Income Dynamics Study. Cape Town: Southern Africa Labour and Development Research Unit [producer], 2015. Cape Town: DataFirst [distributor], 2015. We thank Lynn Woolfrey at DataFirst at the University of Cape Town.

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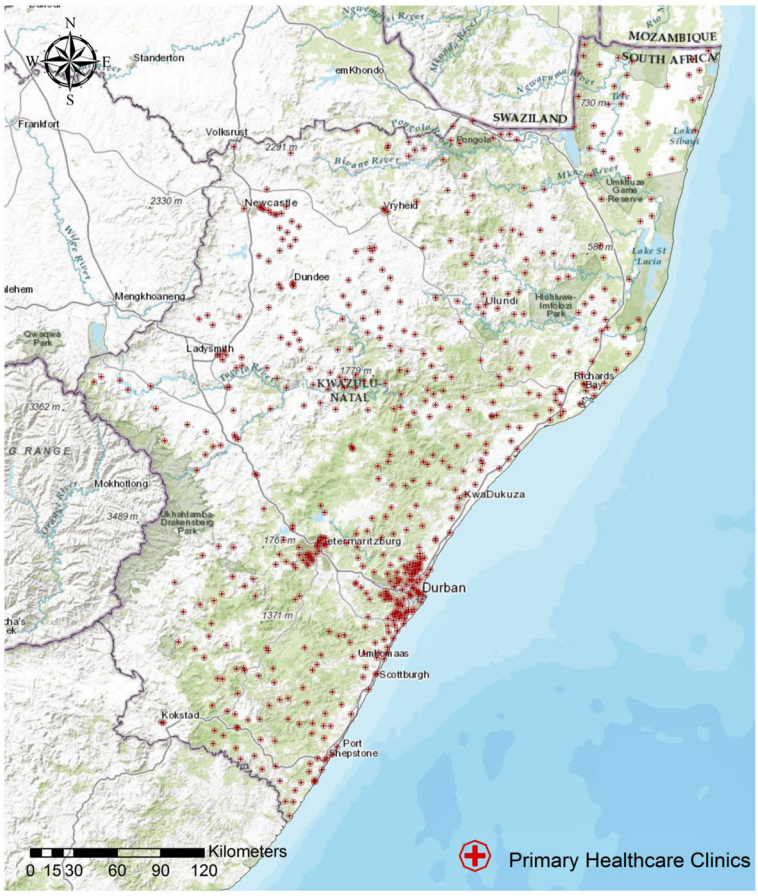

Figure 1.
Location of primary healthcare clinics in KwaZulu-Natal

Table 1

Baseline sociodemographic and clinical characteristics

		n	%
Individual characteristics (n=4,039):			
Gender:	Male	1,473	40.05%
	Female	2,566	59.95%
Age group:	15–19	828	18.50%
	20–24	581	14.47%
	25–29	423	13.00%
	30–34	337	9.89%
	35+	1,862	44.14%
Race/ethnicity:	African	3,793	83.62%
	Coloured‡	49	1.86%
	Asian/Indian	150	8.66%
	White	47	5.86%
Educational attainment:	Less than high school	798	13.12%
	Completed high school	2,548	62.66%
	Beyond high school	693	24.22%
Marital status:	Married/living with partner	1,144	31.01%
	Divorced/widow/separated	467	10.43%
	Single	2,413	58.56%
Employment status:	Not employed	2,468	56.37%
	Employed	1,548	43.63%
Depression risk:	CES-D<10	2,559	66.16%
	CES-D≥10	1,462	33.84%
Household characteristics (n=1,765):			
Geographic typology:	Rural formal	261	14.39%
	Tribal authority	1,121	42.53%
	Urban formal	274	26.11%
	Urban informal	109	16.98%
Income quantiles:	Bottom	747	36.20%
	Bottom/middle	460	22.46%
	Middle	264	14.87%
	Middle/high	168	10.40%
	High	126	16.07%
Distance to PHC clinic:	< 6 km	1,360	84.51%
	6–14.9 km	363	14.50%
	≥15km	40	1.00%

PHC stands for primary healthcare.

‡The term “coloured” is used by Statistics South Africa [62]. Coloured is an ethnic label for individual of “mixed-blood” that includes children/descendants from Black-White, Black-Asian, White-Asian, and Black-Colored unions [63].

Table 2

Relationship between proximity to PHC clinic and depression risk using mixed-effects logistic regression

		aOR	Robust SE	Z	95% CI:	
Proximity to PHC clinic:	[≥15km]					
	6–14.9 km	0.612	0.11	−2.84	0.44	0.86
	<6 km	0.608	0.11	−2.70	0.42	0.87
Gender:	[Male]					
	Female	1.20	0.08	2.66	1.05	1.38
Age group:	[15–19]					
	20–24	1.29	0.14	2.40	1.05	1.58
	25–29	1.91	0.22	5.72	1.53	2.39
	30–34	2.15	0.28	5.92	1.67	2.77
	35+	2.63	0.27	9.32	2.15	3.23
Race/ethnicity:	[White]					
	African	4.31	1.92	3.29	1.81	10.30
	Coloured	3.62	1.74	2.68	1.41	9.28
	Asian/Indian	1.70	0.94	0.95	0.57	5.04
Educational attainment:	[Less than high school]					
	Completed high school	0.96	0.08	−0.49	0.82	1.13
	Beyond high school	0.84	0.10	−1.48	0.67	1.06
Marital status:	[Married/living with partner]					
	Divorced/widow/separated	1.23	0.17	1.56	0.95	1.60
	Single	1.14	0.10	1.52	0.96	1.35
Employment status:	[Not employed]					
	Employed	0.73	0.06	−3.71	0.62	0.86
Geographic typology:	[Urban informal]					
	Rural formal	0.61	0.10	−2.95	0.44	0.85
	Tribal authority	0.71	0.06	−3.92	0.59	0.84
	Urban formal	0.90	0.10	−0.92	0.72	1.13
Income quantiles:	[Bottom]					
	Bottom/middle	1.06	0.09	0.65	0.90	1.24

	aOR	Robust SE	Z	95% CI:	
Middle	0.88	0.08	−1.41	0.75	1.05
Middle/high	0.84	0.08	−1.83	0.70	1.01
High	0.81	0.09	−1.95	0.66	1.00
Assessment period:					
[2008]					
2010	0.72	0.06	−4.23	0.62	0.84
2012	0.86	0.07	−1.92	0.74	1.00

Reference category in bracket.

PHC stands for primary healthcare.