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Distance to health services and treatment-seeking for depressive symptoms in rural India: a repeated cross-sectional study

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Distance to health services and treatment-seeking for depressive symptoms in rural India: a repeated cross-sectional study

Running head: Distance and treatment-seeking for depression in India.

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**Conflicts of Interest**

None.

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The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

**Availability of Data and Materials**

Interested parties may notify the PRIME investigators of their interest in collaboration, including access to the data set analysed here, through the following website:

http://www.prime.uct.ac.za/contact-prime.

**Abstract**

**Aims**
Research from high-income countries has implicated travel distance to mental health services as an important factor influencing treatment-seeking for mental disorders. This study aimed to test the extent to which travel distance to the nearest depression treatment provider is associated with treatment-seeking for depression in rural India.

Methods

We used data from a population-based survey of adults with probable depression (n=568), and calculated travel distance from households to the nearest public depression treatment provider with network analysis using GIS. We tested the association between travel distance to the nearest public depression treatment provider and 12 month self-reported use of services for depression.

Results

We found no association between travel distance and the probability of seeking treatment for depression (OR 1.00, 95% CI 0.98-1.02, p=0.78). Those living in the immediate vicinity of public depression treatment providers were just as unlikely to seek treatment as those living 20km or more away by road. There was evidence of interaction effects by caste, employment status and perceived need for health care, but these effect sizes were generally small.

Conclusions

Geographic accessibility – as measured by travel distance – is not the primary barrier to seeking treatment for depression in rural India. Reducing travel distance to public mental health services will not of itself reduce the depression treatment gap for depression, at least in this setting, and decisions about the best platform to deliver mental health services should not be made on this basis.

Background

Depression treatment gap

According to the World Health Organization (WHO), depression affects 4.4% of the world’s population (WHO, 2017), but less than half are estimated to receive treatment (Kohn et al., 2004). In India, 1 in 20 people meets criteria for depression but fewer than 15% of these report seeking treatment (Gururaj et al., 2016). There are global efforts underway to reduce this “treatment gap”
by integrating mental health care into primary care services, as exemplified by the five-country Programme to Improve Mental Health Care (PRIME) (Lund et al., 2012).

Access to care and geographic accessibility

The geographic accessibility of health services is implicated in most major models of access to care (Aday & Andersen, 1974, Penchansky & Thomas, 1981, Peters et al., 2008, De Silva et al., 2014). Reducing distance to the nearest mental health service through strategies such as decentralisation and integration is therefore expected to lead to increases in service uptake; a phenomenon known as “Jarvis’ Law” (Hunter & Shannon, 1985).

In India, greater distance to facilities has been linked to reduced treatment-seeking for general and maternal health needs, particularly affecting disadvantaged groups such as scheduled tribes and women (Ager & Pepper, 2005, Kumar et al., 1997, Kumar et al., 2014, Sawhney, 1993, Shariif & Singh, 2002, Vissandjée et al., 1997). To our knowledge, no studies have tested this association for mental disorders in an Indian context.

Mental health systems in India

India has a great variety of healing systems, including allopathic (biomedical) services, indigenous forms of health care (including Ayurveda, yoga, naturopathy, Unani, Siddha, homoeopathy, and local systems of medicine), and spiritual or religious healing (Halliburton, 2004). Patients’ explanatory models of mental illness may align more closely with those of traditional or religious practitioners than biomedical models (Wilcox et al., 2007) but the parallel use of multiple systems is common (Albert et al., 2015; Shankar, 2015).

Private services have also become increasingly dominant in the Indian health system (De Costa & Johansson 2011), with 80% of outpatient consultations now taking place in the private sector (Selvaraj & Karan 2009; Kumar et al., 2011). Much of this sector is composed of small-scale practitioners with little or no formal training (De Costa & Diwan 2007; Ranga & Panda 2016), many of whom dispense psychopharmacological treatment (Ecks & Basu 2009, 2014).

Nonetheless, the existence of traditional and informal services is frequently ignored in discourse on mental health care in India (Quack, 2012). Both Indian mental health policy (Ministry of Health &
Family Welfare, 2014) and WHO-recommended strategies to expand access to mental health treatment (WHO, 2008) focus on public, allopathic services.

PRIME

Through PRIME, a mental health care plan (MHCP) was implemented in 2014 in Sehore district, Madhya Pradesh, in partnership with the state Ministry of Health (Shidhaye et al., 2016b). The MHCP aimed to reduce the treatment gap for priority mental disorders by integrating services into public primary care facilities, thus making them more geographically accessible to the rural population. Increased accessibility of public, allopathic mental health services (the target of PRIME) was expected to reduce the treatment gap for depression (a key goal of PRIME). While this expectation arguably overlooks the great variety of care systems in the Indian context, it mirrors current accepted wisdom in global mental health that the treatment gap reflects limited access to formal mental health care. We therefore set out to test this hypothesis empirically, to inform future initiatives to reduce the depression treatment gap.

Objectives

This study aimed to:

(1) Compare travel distance by road from the households of individuals with depression to the nearest public depression treatment provider, before and after implementation of the MHCP.

(2) Measure the association between travel distance to the nearest public depression treatment provider and the probability of treatment-seeking for probable depression in rural India.

(3) Assess whether this association varies by gender, caste, symptom severity, socio-economic status (as measured by housing type, employment status, land ownership and education level), and perceived need for healthcare.
Methods

Setting

[Figure 1]

Sehore sub-district, within Sehore district, Madhya Pradesh (figure 1) is 74% rural, with a population of 427,432. Fewer than 4% own cars and 34% own scooters/motorcycles, with lower proportions among rural residents (Office of the Registrar General and Census Commissioner, 2011). Prior to MHCP implementation there were two public mental health specialists serving a district population of 1.3 million (Hanlon et al., 2014).

The study area (Shidhaye et al., 2015), MHCP (Shidhaye et al., 2016b), and evaluation plan (De Silva et al., 2016) have been previously described. Psychological interventions for depression were delivered by case managers and pharmacological treatments prescribed by medical officers at Community Health Centres (CHCs). Case managers conducted community case-finding and screened patients in CHCs. Some community awareness activities were conducted, such as meetings and film screenings. The term “implementation area” refers to those villages where MHCP activities were fully implemented (see figure 1).

Data collection

As part of the PRIME evaluation, we carried out a population-based community survey with two rounds, with the primary aim of measuring change in the proportion of people with depression and alcohol use disorders who sought treatment. The data collection methods and sampling strategy have been described elsewhere (De Silva et al., 2016, Rathod et al., 2016). Data collection for the first round took place prior to MHCP implementation, in two waves (May-June 2013, January-March 2014). The second round was conducted after MHCP implementation (October-December 2016). Inclusion criteria were: aged ≥18, fluency in spoken Hindi, residency in selected households, willingness to provide informed consent, and absence of cognitive impairments that would preclude informed consent or ability to participate.

This secondary analysis of the survey data considered residents of the MHCP implementation area with probable depression. Since there was no difference in the proportion of people who sought treatment for depression between rounds (Shidhaye et al. 2019), we pooled data from both rounds for analysis. Across both rounds, 6201 adults were recruited. 6134 (98.9%) consented to participate.
Of these, 4,297 resided within the implementation area, of whom 568 had probable depression (round 1: 289, round 2: 279).

Questionnaires were administered orally, in Hindi, by trained local fieldworkers. Fieldworkers recorded participant responses using a questionnaire application programmed on Android tablet devices, which also recorded the interview location’s GPS coordinates.

Measures

The screening tools and other measures are described in detail elsewhere (Rathod et al., 2016). Briefly, we measured current depression symptoms using the Patient Health Questionnaire, 9-item version (PHQ-9), using the standard cut-off point of $\geq 10$ (Manea et al., 2012). In an international meta-analysis, the PHQ-9 had a pooled sensitivity of 0.77 (95% CI 0.66–0.85) and specificity of 0.85 (95% CI 0.79–0.90) to detect major depressive disorder with this criterion (Manea et al., 2015). The main outcome of interest was treatment-seeking for depression symptoms, measured by asking: “Did you seek any treatment for these problems at any time in the past 12 months?” Participants who responded affirmatively were asked to specify from whom they had sought treatment. These were divided into formal providers (generalist and specialist health workers, in the public or private sector) and complementary providers (traditional and alternative healers). Case managers, who were available in round 2 only, were categorised as formal providers. Additionally, we collected data on socio-demographic characteristics and barriers to health care use (Rathod et al., 2016).

Geographic measures

Household coordinates were missing for 62.8% of round 1 data and 17.6% of round 2 data. In these cases, we substituted coordinates for the village centre from India Place Finder (Mizushima Laboratory, 2013). These are based on geographic information from the 2001 Census of India, which we cross-referenced with mean GPS coordinates for households in the village. For households with GPS coordinates, the mean difference between households and their respective village centres was 935 metres (SD = 746m).

The primary distance measure used was the shortest distance by road to the nearest public depression treatment provider (referred to as “travel distance”), calculated using network analysis in ArcGIS 10.5 (Esri, 2011). This is a recommended measure of geographic accessibility in contexts where most travel is vehicular (Delamater et al., 2012), as in 77.8% of recent health care visits reported by participants. We defined the nearest public depression treatment provider as the
nearest of: Sehore city or Bhopal city only (rounds 1 and 2), plus any of the three CHCs (round 2 only). We used Open Street Maps (© OSM contributors) road network data to calculate travel distance, after cleaning these data to ensure connectivity. Since some households were located at a distance from the nearest road, we added straight line distances to the nearest road to estimate total travel distance.

Analysis strategy

We first described the socio-demographic characteristics of the sub-sample, stratified by travel distance (0<5km, 5<10km, 10<20km, ≥20km).

We then compared the median travel distance from cases to a public depression treatment provider by round using the Mann-Whitney test.

Next we estimated the change in odds of treatment-seeking associated with travel distance (in kilometres) to the nearest public depression treatment provider. We considered the following covariates as potential confounders in a logistic regression model; age, education level, gender, marital status, economic status (using housing type and employment status as proxy measures), symptom severity, disability, perceived need for health care, survey round, and 12-month exposure to mental health communications. We excluded covariates from the final model after checking for collinearity with variance inflation factors and a correlation matrix of all variables. Regression analyses were repeated using two alternative outcomes: (a) any depression treatment, and (b) treatment from the formal health sector only.

Next we used the final regression model to test for interaction effects. We hypothesised that the effect size would be larger for women and disadvantaged castes, those with milder symptoms, individuals with lower socio-economic status, and those with a perceived need for health care, based on previous Indian and international literature. Stratum-specific effects are presented when a Wald test for all interaction terms had p<0.10.

With the exception of counts, all figures were adjusted for the multi-stage sampling design and village-level clustering. Stata 14.2 (StataCorp, 2015) was used to conduct all analyses.
Ethics

All participants were provided with an information sheet in Hindi, which was read aloud if required. After any questions were answered, they indicated informed consent with a signature or thumb print. The original survey, including the collection and analysis of GPS coordinates as part of the PRIME evaluation, was approved by the institutional review boards of Sangath, Goa, India; the Indian Council of Medical Research, New Delhi, India; WHO, Geneva, Switzerland; and the University of Cape Town, Cape Town, South Africa. The current analyses form part of the work that was approved by these committees. Ethical approval for these analyses was additionally provided by London School of Hygiene & Tropical Medicine, London, UK (LSHTM Ethics Ref: 10439).

Results

Sample characteristics, by distance

Table 1 shows the characteristics of adults with probable depression, stratified by travel distance. 69.6% of participants living <5km from the nearest depression treatment provider were female, compared to 49.9% of those living more than 20km away (p=0.08). As shown in the table, the following sample characteristics varied by travel distance to the nearest facility: employment status; land ownership; and religion.

[Table 1]

Objective 1: Travel distance by survey round

Implementation of the MHCP reduced the median travel distance to a public depression treatment provider from 26.9km in round 1 (25th and 75th percentiles: 16.0km, 36.2km; skewness 2.40) to 9.7km in the second round (25th and 75th percentiles: 6.5km, 16.8km; skewness 4.29), (p<0.0001).

Objective 2: Travel distance and treatment-seeking for depressive symptoms

As previously reported (Shidhaye et al., 2018), of the 568 people with probable depression in both rounds, 75 (13.9%) sought treatment for these symptoms.
There was no evidence of an association between treatment-seeking and distance to a public depression treatment provider, either in unadjusted or adjusted models, with any provider or only formal providers (see table 2). We checked for differences between rounds and found no evidence of an association at either time point (round 1: OR 1.00, 95%CI: 0.99-1.01; round 2: OR 0.97, 95%CI 0.93-1.02).

[Table 2]

**Objective 3: Treatment-seeking and travel distance among sub-groups**

Table 3 shows the association between travel distance and treatment-seeking by sub-group (where Wald P-values for interaction terms <0.10; full table in supplementary material). There was evidence of interaction with caste, employment status, and perceived need for health care, weak evidence of interaction with age, but no evidence of any interaction effects by gender, education level, religion, marital status, housing type, land ownership, symptom severity, or exposure to mental health communications.

The effect sizes by caste and perceived need for health care were small and in the opposite direction from expected; e.g. for every 1km increase in travel distance to the nearest treatment provider, individuals from scheduled castes had 4% higher odds of seeking treatment. There was a larger effect for the unemployed sub-group, with a 27% reduction in the odds of seeking treatment for every 1km increase in travel distance.

[Table 3]

**Discussion**

**Principal findings**

Travel distance to the nearest public depression treatment provider was significantly reduced after the implementation of the MHCP, but the proportion of people with probable depression who sought treatment remained low regardless of distance to services. To our knowledge, this is the first study from India to examine associations between travel distance and treatment-seeking for mental disorders.
The lack of evidence of an association between travel distance and treatment-seeking contrasts with literature from high-income countries (HIC) on “Jarvis’ law” in mental health care (Almog et al., 2004, Bille, 1963, Davey and Giles, 1979, Packness et al., 2017, Shannon et al., 1986, Stampfer et al., 1984, Zulian et al., 2011). The narrow range of the confidence intervals indicates that this finding is unlikely to be due to low statistical power.

Mechanisms and methodological differences

There are several potential explanations for the difference in findings compared to studies from HIC.

Threshold effects

Research from HIC has pointed to a “zone of indifference”, beyond which distance ceases to affect rates of mental health service use (Shannon et al., 1986, Stampfer et al., 1984). However, we found no evidence of such threshold effects in our data.

Over-utilisation

Distance decay effects in HIC primarily affect those with milder symptoms (Joseph & Boeckh, 1981) and may reflect over-utilisation of services by those in the vicinity of health services (Davey & Giles, 1979). Since the current analysis was restricted to people with probable depression, treatment-seeking by those without clinical need was largely excluded.

Population-based vs. facility-based samples

Unlike most previous research on this topic, this study used a population-based sample. In facility-based studies, geographic differences in prevalence complicate the interpretation of utilization data. Furthermore, it appears that the decision to seek any care may be influenced by different factors than the choice of provider among those who seek help (Fortney et al., 1998). In the Indian setting, where public services are not the only option, the location of public services may therefore influence the choice of provider but not the overall likelihood of treatment-seeking.

Differences in health systems

Perhaps most importantly, the context of medical pluralism in India means that, unlike countries with more homogeneous health systems, access to services is far more complex than the availability or accessibility of public, allopathic health services (Halliburton, 2004). The current findings clearly
undermine the assumption that reducing travel distance to public mental health services will reduce the overall treatment gap for depression in India and comparable settings, and suggest that future research should focus on the role of the wider health sector in influencing treatment-seeking for depression, including private and complementary providers (Quack, 2012).

Implications

Both international and Indian mental health policies advocate the integration of mental health services into primary care (Ministry of Health & Family Welfare, 2014, WHO, 2008, WHO & WONCA, 2008), partly on the basis that this improves the geographic accessibility of services. However, this study found that those living in the immediate vicinity of public mental health services are no more likely to seek care than those facing longer journeys, demonstrating that distance to the nearest public depression service is not a primary factor in explaining low treatment-seeking rates.

One interpretation of this finding is that increased accessibility of services is insufficient to reduce the treatment gap in areas where demand for these services is very low. The Vidarbha Stress and Health Program (VISHRAM), another depression programme in central India, included village-level demand generation activities and reported a six-fold increase in treatment-seeking in the implementation area (Shidhaye et al., 2017), in contrast to PRIME.

An alternative interpretation is that the accessibility of public, allopathic mental health services is of little relevance to treatment-seeking behaviour, since these represent a minority of services and are not the preferred choice of healthcare for many (De Costa & Diwan, 2007, De Costa & Johannson, 2011). The finding that the location of public, allopathic mental health services has negligible effects on the treatment gap in this context should prompt us to re-examine the sole focus on these in current mental health policy, and to take into account the complexity of the health system in future initiatives to improve access to care (Dalal, 2005).

Caution is needed in interpreting the results of the sub-group analyses, since multiple tests were performed, increasing the likelihood of chance findings, and the effect sizes were small. The preliminary finding that for some groups, those living further from public health services were slightly more likely to seek treatment, could indicate that other mechanisms, such as stigmatisation, might be involved. Further investigation and replication of these results are necessary to understand the processes involved in decisions around treatment-seeking for depression. Unemployed adults may be more sensitive to travel distance to public services as an obstacle to treatment-seeking than
the rest of the population, although this group represents only 4.2% of individuals with probable depression.

**Strengths**


**Limitations**

GPS coordinates were missing for some households, including a large proportion in round 1. However, we believe that the error introduced by substituting village centroid coordinates in these cases is relatively small, given the size of villages in the implementation area. When we excluded those with missing coordinates, we found no difference in our results for either round.

Our exposure of interest was an estimate of travel distance, but we lacked data on access to transportation to convert these to travel time estimates, which may be of greater relevance to treatment-seeking decisions. Future research should generate more nuanced estimates of travel time and cost for this setting.

The data were cross-sectional, meaning that some factors (e.g. symptom severity, perceived needs) may have changed over the period asked about. Recall bias is possible since we used self-reported outcome data (Bhandari and Wagner, 2006), although this affects binary measures of treatment-seeking less than measures of volume or frequency (Carroll *et al.*, 2016, Raina *et al.*, 2002). Differential misclassification is possible if longer journeys lead to greater recollection of treatment-seeking, which could explain the apparent positive association between distance and treatment-seeking among some groups.

We did not have data on the location of private or complementary providers in order to calculate travel distance to these, since these are highly numerous and no official register of these services
exists. Future studies might usefully attempt to map these to generate more context-specific measures of geographic accessibility.

It would also have been useful to investigate whether distance to the nearest public provider affected the likelihood of consulting a public rather than private or complementary provider, among those who sought depression treatment. However, the number who sought treatment was too small to enable this. Finally, the low rate of treatment-seeking overall limits the chances of finding an association between distance and treatment-seeking, although the narrow confidence intervals suggest a relatively high degree of precision in our estimates.

**Conclusion**

The current study identified no association between travel distance to the nearest public depression treatment provider and treatment-seeking for probable depression, except for the small sub-group of unemployed adults. Low geographic accessibility of public, allopathic services does not explain the treatment gap for depression in this context, and decentralising public mental services to reduce travel distance will not of itself reduce the treatment gap for depression in rural India. Future research should examine alternative measures of geographic accessibility of mental health services, taking into account the health systems context of India which includes many private and complementary service providers.
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Abstract

Aims
Research from high-income countries has implicated travel distance to mental health services as an important factor influencing treatment-seeking for mental disorders. This study aimed to test the extent to which travel distance to the nearest depression treatment provider is associated with treatment-seeking for depression in rural India.

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**Results**

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**Conclusions**

Geographic accessibility – as measured by travel distance – is not the primary barrier to seeking treatment for depression in rural India. Reducing travel distance to public mental health services will not of itself reduce the depression treatment gap for depression, at least in this setting, and decisions about the best platform to deliver mental health services should not be made on this basis.

**Background**

**Depression treatment gap**

According to the World Health Organization (WHO), depression affects over 300 million people or 4.4% of the world’s population (WHO, 2017), but less than half of those affected are estimated to receive treatment (Kohn et al., 2004). Depressive disorders are closely linked with social and economic disadvantage (Lund et al., 2010), cause significant disability (Ormel et al., 2008), and...

India currently has one of the highest suicide rates in the world (Patel et al., 2012). In India, 1 in 20 people meets criteria for depression (Gururaj et al., 2016), which accounts for 5% of the total burden of disease (Patel et al., 2011) but, however, fewer than 15% of people with depression in India report seeking treatment (Gururaj et al., 2016). There are global efforts underway to reduce this “treatment gap” by integrating mental health care into primary care services, as exemplified by the five-country Programme to Improve Mental Health Care (PRIME) (Lund et al., 2012).

Access to care and geographic accessibility

Travel distance. The geographic accessibility of health services is implicated in most major models of access to care (Aday & Andersen, 1974, Penchansky & Thomas, 1981, Peters et al., 2008, De Silva et al., 2014). Reducing distance to the nearest mental health service through strategies such as decentralisation and integration is therefore expected to lead to increases in service uptake; a phenomenon known as “Jarvis’ Law” (Hunter & Shannon, 1985).

In India, greater distance to facilities has been linked to reduced treatment-seeking for general and maternal health needs, particularly affecting disadvantaged groups such as scheduled tribes and women (Ager & Pepper, 2005, Kumar et al., 1997, Kumar et al., 2014, Sawhney, 1993, Shariff & Singh, 2002, Vissandjée et al., 1997). To our knowledge, no studies have tested this association for mental disorders in an Indian context.

Mental health systems in India

India has a great variety of healing systems, including allopathic (biomedical) services, indigenous forms of health care (including Ayurveda, yoga, naturopathy, Unani, Siddha, homoeopathy, and local systems of medicine), and spiritual or religious healing (Halliburton, 2004). Patients’ explanatory models of mental illness may align more closely with those of traditional or religious practitioners than biomedical models (Wilcox et al., 2007) but the parallel use of multiple systems is common (Albert et al., 2015; Shankar, 2015).
Private services have also become increasingly dominant in the Indian health system (De Costa & Johannson 2011), with 80% of outpatient consultations now taking place in the private sector (Selvaraj & Karan 2009; Kumar et al., 2011). Much of this sector is composed of small-scale practitioners with little or no formal training (De Costa & Diwan 2007; Ranga & Panda 2016), many of whom dispense psychopharmacological treatment (Ecks & Basu 2009, 2014).

Nonetheless, the existence of traditional and informal services is frequently ignored in discourse on mental health care in India (Quack, 2012). Both Indian mental health policy (Ministry of Health & Family Welfare, 2014) and WHO-recommended strategies to expand access to mental health treatment (WHO, 2008) focus on public, allopathic services.

Access to care and geographic accessibility

PRIME

Through PRIME, a mental health care plan (MHCP) was implemented in 2014 in Sehore district, Madhya Pradesh, in partnership with the state Ministry of Health (Shidhaye et al., 2016b). The MHCP aimed to reduce the treatment gap for priority mental disorders by integrating services into public primary care facilities, thus making them more geographically accessible to the rural population. Increased accessibility of public, allopathic mental health services (the target of PRIME) was expected to reduce the treatment gap for depression (a key goal of PRIME). While this expectation arguably overlooks the great variety of care systems in the Indian context, it mirrors current accepted wisdom in global mental health that the treatment gap reflects limited access to formal, publicly provided mental health care. We therefore set out to test this hypothesis empirically, to inform future initiatives to reduce the depression treatment gap.

Since 66% of India’s population lives in rural areas (World Bank, 2018) while 75% of India’s psychiatrists work in urban areas (Kumar, 2012), this “treatment gap” is likely to be geographically uneven.

Access to care and geographic accessibility

To understand the treatment gap, De Silva and colleagues (De Silva et al., 2014) proposed a framework of access to care, based on the work of Tanahashi et al. (Tanahashi, 1978). This
framework postulates that, to be used by the target population, services must to be: (a) available; (b) financially and geographically accessible; and (c) acceptable.

The geographic accessibility of services also features in other influential models of access to health care (Aday and Andersen, 1974, Penchansky and Thomas, 1981, Peters et al., 2008), and can be manipulated through service planning strategies such as decentralisation. The phenomenon that treatment-seeking declines with distance from mental health services has been named “Jarvis’ Law” (Hunter and Shannon, 1985).

Gaps in the literature

A recent systematic review (Roberts et al., 2018) identified a lack of evidence from low- and middle-income countries (LMIC) on factors that influence treatment-seeking for depression and anxiety. It also highlighted a dearth of population-based studies of the relationship between geographic accessibility and treatment-seeking for these disorders.

One study from Zambia has replicated findings from high-income countries that rates of treatment-seeking for mental disorders decline with distance from facilities (Haworth, 1980). Another from South Africa found that the prevalence of depression increased with distance from health services, which the authors attributed to reduced mental health service use (Tomita et al., 2017).

Within India, greater distance to facilities has been linked to reduced treatment-seeking for general and maternal health needs, particularly affecting disadvantaged groups such as scheduled tribes and women (Ager and Pepper, 2005, Kumar et al., 1997, Kumar et al., 2014, Sawhney, 1993, Shariff and Singh, 2002, Vissandjée et al., 1997). To our knowledge, no studies have tested this association for mental disorders in an Indian context.

PRIME

Through the Programme to Improve Mental Health Care (PRIME) (Lund et al., 2012), a mental health care plan (MHCP) was developed and implemented in 2014 in Sehore sub-district, Madhya Pradesh, in partnership with the state Ministry of Health (Shidhaye et al., 2016b). The MHCP aims to increase contact coverage (the proportion of those with a given disorder who seek treatment) for priority mental disorders, including depression, by integrating mental health care into community health centres (CHCs).
We aimed to understand the contribution of geographic accessibility to the depression treatment gap. We hypothesised that greater proximity to services for depression would be associated with increased likelihood of seeking treatment.

**Objectives**

This study aimed to:

1. Compare travel distance by road from the households of individuals with depression to the nearest public depression treatment provider, before and after implementation of the MHCP.

2. Measure the association between travel distance to the nearest public depression treatment provider and the probability of treatment-seeking for probable depression in rural India.

3. Assess whether this association varies by gender, caste, symptom severity, socio-economic status (as measured by housing type, employment status, land ownership and education level), and perceived need for healthcare.

**Methods**

**Setting**

[Figure 1]

Sehore The sub-district of Sehore, within Sehore district, Madhya Pradesh (figure 1) is 74% rural, with a population of 427,432, and covers an area equivalent to greater London (Office of the Registrar General and Census Commissioner, 2011). At the most recent census, fewer than 4% owned cars and 34% owned scooters/motorcycles, with lower proportions among rural residents (Office of the Registrar General and Census Commissioner, 2011). Prior to the MHCP implementation there were two public mental health specialists providers in the public sector, serving a district population of 1.3 million (Hanlon et al., 2014).
The study area (Shidhaye et al., 2015), MHCP (Shidhaye et al., 2016b), and evaluation plan (De Silva et al., 2016) have been previously described in detail elsewhere. Under the MHCP, psychological interventions for depression were delivered by case managers and pharmacological treatments prescribed for severe cases by medical officers at Community Health Centres (CHCs). Case managers conducted proactive community case-finding and screened patients in CHCs. Some community awareness activities were conducted to encourage service uptake, such as meetings and film screenings in villages. The term “implementation area” refers to those villages where MHCP activities were fully implemented (see figure 1).

Data collection

As part of the PRIME evaluation plan, we carried out a population-based community survey with two rounds, with the primary aim of measuring change in contact coverage the proportion of people with for depression and alcohol use disorders who sought treatment before and after MHCP implementation. The data collection methods and sampling strategy have been previously described in detail elsewhere (De Silva et al., 2016, Rathod et al., 2016). Data collection for the first round took place prior to MHCP implementation, in two waves (May-June 2013, January-March 2014). The second round was conducted after MHCP implementation (October-December 2016). The target population was adults (≥18 years). Additional inclusion criteria were: aged ≥18, fluency in spoken Hindi, residency in selected households, willingness to provide informed consent, and absence of cognitive impairments that would preclude informed consent or ability to participate.

This secondary analysis of the survey data considered adult residents of the MHCP implementation area with probable depression residing within the MHCP implementation area. Since there was no difference in the proportion of people who sought treatment for depression between rounds (Shidhaye et al. 2019), we pooled data from both rounds for analysis. Across both rounds, 6201 adults were recruited. 6134 (98.9%) consented to participate. Of these, 4,297 resided within the implementation area, of whom 568 had probable depression (round 1: 289, round 2: 279).

Questionnaires were administered orally, in Hindi, by trained local fieldworkers. Fieldworkers recorded participant responses using a questionnaire application programmed on Android tablet devices, which also recorded the interview location’s GPS coordinates.
Measures

The screening tools and other socio-demographic questions and measure of treatment-seeking measures (used to calculate contact coverage) are described in detail elsewhere (Rathod et al., 2016). Briefly, we measured current depression symptoms using the Patient Health Questionnaire, 9-item version (PHQ-9), using the standard cut-off point of ≥10 to screen positive (Manea et al., 2012). In an international meta-analysis, the PHQ-9 was found to have had a pooled sensitivity of 0.77 (95% CI 0.66–0.85) and specificity of 0.85 (95% CI 0.79–0.90) to detect major depressive disorder when applying with this criterion (Manea et al., 2015).

The main outcome variable of interest was treatment-seeking by adults with probable depression symptoms (PHQ-9≥10), which we measured by asking: “Did you seek any treatment for these problems at any time in the past 12 months?” Participants who responded affirmatively were asked to specify from whom they had sought treatment. These were divided into formal providers (generalist and specialist health workers, in the public or private sector) and complementary providers (traditional and alternative healers). The new cadre of health workers (case managers), who were available in round 2 only, were categorised as formal providers. Additionally, we collected data on socio-demographic characteristics and barriers to health care use (Rathod et al., 2016). The number who sought treatment was too low to analyse the consultation of each provider type separately.

Geographic measures

Household coordinates were missing for 62.8% of round 1 data and 17.6% of round 2 data. In these cases, we substituted coordinates for the village centre, downloaded from India Place Finder (Mizushima Laboratory, 2013). These are based on geographic information from the 2001 Census of India, which we cross-referenced with mean GPS coordinates for households in the village. For households with GPS coordinates, the mean difference between the households and their respective village centres was 935 metres (SD = 746m).

The primary distance measure used was the shortest distance by road to the nearest public depression treatment provider (referred to here as “travel distance”), calculated using network analysis tools in ArcGIS 10.5 (Esri, 2011). This has been a recommended measure of geographic accessibility in contexts where most travel is vehicular (Delamater et al., 2012), as in 77.8% of recent health care visits reported by study participants. We defined the nearest
public depression treatment provider as the nearest of: Sehore city or Bhopal city only (in rounds 1 and 2), plus any of the three CHCs (in round 2 only). We used Open Street Maps (© OSM contributors) road network data to calculate travel distance to the nearest facility, after cleaning these network data to ensure connectivity. Since some households were located at a distance from the nearest road in the network, we added straight line distances to the nearest road to create an estimate of total travel distance.

Analysis strategy

We first described the socio-demographic characteristics of the sub-sample, stratified by travel distance (0<5km, 5<10km, 10<20km, ≥20km).

We then compared the median travel distance from probable cases to a public depression treatment provider by round using the Mann-Whitney test.

Next we sought to estimate the change in odds of treatment-seeking for depression associated with travel distance (in kilometres) to the nearest public depression treatment provider. We considered the following covariates as potential confounders in a logistic regression model, based on previous literature and knowledge of the local context: age, education level, gender, marital status, economic status (using housing type and employment status as proxy measures), symptom severity, disability, perceived need for health care, survey round, and 12-month exposure to mental health communications. We excluded covariates from the final model after checking for collinearity with variance inflation factors and a correlation matrix of all variables.

All regression analyses were repeated using two alternative outcomes definitions: (a) any depression treatment, and (b) treatment from the formal health sector only—to check whether the inclusion of complementary providers altered any association found.

Next we used the final regression model to test for interaction effects by characteristics of interest. We hypothesised that the effect size would be larger for women and disadvantaged castes, those with milder symptoms, individuals with lower socio-economic status (measured using education level, employment type, land ownership and housing type as proxy indicators), and those with a perceived need for health care, based on previous Indian and international literature. Stratum-specific effects are presented when a Wald test for all interaction terms had p<0.10.
With the exception of counts, all figures were adjusted for the multi-stage sampling design, accounting for and village-level clustering and weighting the data to reflect the probability of selection. Stata 14.2 (StataCorp, 2015) was used to conduct all analyses.

Ethics

All participants were provided with an information sheet in Hindi, which was read aloud to them by fieldworkers if required. After any questions were answered, they indicated informed consent with either a signature or thumb print. The original survey, including the collection and analysis of GPS coordinates as part of the PRIME evaluation, was reviewed and approved by the institutional review boards of Sangath, Goa, India; the Indian Council of Medical Research, New Delhi, India; the WHO, Geneva, Switzerland; and the University of Cape Town, Cape Town, South Africa. The current analyses form part of the work that was approved by these committees. Ethical approval for the secondary analysis of data from the PRIME programme analyses was additionally provided by London School of Hygiene & Tropical Medicine, London, UK (LSHTM Ethics Ref: 10439).

Results

Sample characteristics, by distance

Table 1 shows the characteristics of all adults with probable depression, stratified by travel distance. 69.6% of participants living less than 5km from the nearest depression treatment provider were female, compared to 49.9% of those living more than 20km away (p=0.08). As shown in the table, the following sample characteristics varied by travel distance to the nearest facility: employment status; land ownership; and religion.

[Table 1]

Objective 1: Travel distance by survey round

Implementation of the MHCP in CHCs in Sehore sub-district reduced the median travel distance for probable cases to a public depression treatment provider from 26.9km in round 1 (25th and 75th percentiles: 16.0km, 36.2km; skewness 2.40) to 9.7km in the second round (25th and 75th percentiles: 6.5km, 16.8km; skewness 4.29), (Mann-Whitney p<0.0001).
Objective 2: Travel distance and treatment-seeking for depressive symptoms

As previously reported by Shidhaye and colleagues (Shidhaye et al., 2018), of the 568 people with probable depression in both rounds, 75 (13.9%) sought treatment for these symptoms. As seen in table 2, there was no evidence of an association between the odds of treatment-seeking and the distance to a public depression treatment provider, either in unadjusted or adjusted models, with any provider or only formal providers (see table 2). We checked for differences between rounds and found no evidence of an association at either time point (round 1: OR 1.00, 95%CI: 0.99-1.01; round 2: OR 0.97, 95%CI 0.93-1.02).

Objective 3: Treatment-seeking and travel distance among sub-groups

Table 3 shows the association between travel distance and treatment-seeking by sub-group (only those factors for which Wald P-values for interaction terms < 0.10; see full table in supplementary material appendix E). There was evidence of interaction effects with caste, employment status, and perceived need for health care, and weak evidence of interaction effects with age, but no evidence of any interaction (Wald P-values for interaction terms > 0.10) for the relationship between distance and treatment-seeking effects by the following sub-groups: gender, education level, religion, marital status, housing type, land ownership, symptom severity, or exposure to mental health communications.

The effect sizes by caste and perceived need for health care were small and in the opposite direction from expected; e.g. for every 1km increase in travel distance to the nearest treatment provider, individuals from scheduled castes had 4% higher odds of seeking treatment. However, there was a more substantial larger effect of travel distance for the unemployed sub-group, with a 27% reduction in the odds of seeking treatment for every 1km increase in travel distance.

[Table 3]
Discussion

Principal findings

Travel distance to the nearest public depression treatment provider was significantly reduced after the implementation of the MHCP, but the proportion of people with probable depression who sought treatment remained low regardless of distance to services. To our knowledge, this is the first study from India to examine the associations between travel distance and treatment-seeking for mental disorders. Almost all previous research on this topic has been conducted in high-income countries (HIC), so this study extends our knowledge by examining whether the same relationships are observed globally.

The lack of evidence for an association between travel distance and treatment-seeking was surprising, given the contrasts with literature from high-income countries (HIC) on "Jarvis' law" in mental health care (Almog et al., 2004, Bille, 1963, Davey and Giles, 1979, Packness et al., 2017, Shannon et al., 1986, Stampfer et al., 1984, Zulian et al., 2011). The narrow range of the confidence intervals indicates that this null finding is not unlikely to be due to low lack of statistical power.

Mechanisms and methodological differences

There are several potential explanations for the difference in findings compared to previous studies from HIC, explored below.

Threshold effects

Research from HIC has pointed to a "zone of indifference", beyond which distance ceases to affect rates of mental health service use (Shannon et al., 1986, Stampfer et al., 1984). It is plausible that, in areas with high poverty rates and limited transport access, the majority of the population resides in the "zone of indifference". However, we found no evidence of such threshold effects in our data (11.3% of people with probable depression living in villages or towns where public depression treatment was available sought help, compared to 13.7% of those living elsewhere, p=0.40).

Over-utilisation

Distance decay effects in HIC primarily affect those with milder symptoms (Joseph & Boeckh, 1981) and may reflect over-utilisation of services by those in the vicinity of health services (Davey & Giles,
Since the current analysis was restricted to people with probable depression, treatment-seeking by those without clinical need was largely excluded.

**Population-based vs. facility-based samples**

Unlike most previous research on this topic, this study used a population-based sample rather than identifying cases through health services. In facility-based studies, cannot disentangle geographic differences in prevalence complicate the interpretation of utilization data from differences in. Furthermore, treatment-seeking behaviour. Furthermore, unless they assess the use of every potential provider, it appears that is not clear if distance affects whether affected individuals the decision to seek any care, may be influenced by different factors or merely than the choice of provider among those who seek help, which are thought to be separate decisions (Fortney et al., 1998).

A two-stage model of treatment-seeking could account for the difference in findings, in which the decision to seek help is distinct from the choice of provider, as proposed by Dear (Dear, 1978). In rural USA, Fortney and colleagues (Fortney et al., 1998) found that the affordability and availability of services had a far greater impact on choice of provider than on the decision to seek treatment. In the Indian setting, where public services are not the only option, the location of public services may therefore influence the choice of provider but not the overall likelihood of treatment-seeking. The hypothesis that travel distance affects choice of provider but not overall treatment-seeking rates is consistent with the increase in depression consultations with generalist providers after services were integrated into CHCs, despite the lack of change in overall contact coverage (Shidhaye et al., 2018). This model could be confirmed by examining distance decay effects from facility-based data in the same area.

**Disorder type**

Most previous studies on distance have included people with any psychiatric diagnosis. However, in those that have compared different disorders, the impact of distance in HIC seemed to be greater for those with common mental disorders, such as depression, than for those with severe mental disorders such as psychosis (Shannon et al., 1986) so the lack of an association remains surprising.

**Over-utilisation**

Using Australian data, Davey & Giles (1979) argued that distance decay effects may reflect over-utilisation of services by those in the vicinity of health services without a clinical need for care.
rather than under-utilisation by those living further afield (Davey and Giles, 1979). Since the current analysis was restricted to people with probable depression, treatment-seeking by those without clinical need was largely excluded. In Canada, Joseph & Boeckh (1981) have also shown that distance decay primarily affects those with milder symptoms (Joseph and Boeckh, 1981), so it is possible that distance decay effects are less relevant in settings where the subjective threshold for treatment-seeking is higher.

Use of private health care

Differences in health systems

Perhaps most importantly, as set out in the introduction, the context of medical pluralism within India (described above) means that, unlike countries with more homogeneous health systems, accessibility services is far more nuanced complex than the availability or accessibility of public, allopathic health services (Halliburton, 2004). The current findings clearly undermine the assumption that reducing travel distance to public mental health services will reduce the overall treatment gap for depression in India and comparable settings, and suggest that future research should focus on the role of the wider health sector in influencing treatment-seeking for depression, including private and complementary providers (Quack, 2012).

Indian mental health policy focusses primarily on public health services (Ministry of Health & Family Welfare, 2014), as the PRIME programme has done (Hanlon et al., 2014, Shidhaye et al., 2016b), to reduce financial barriers to care. However, private practitioners are ubiquitous in the current setting, and are likely to represent the default source of health care used for many of the target population (De Costa and Diwan, 2007, De Costa and Johannson, 2011)) which may be one reason why the location of public facilities is of little relevance to decisions around treatment-seeking. Greater attention to private providers may be warranted in future research.

Sub-group differences

The results of the sub-group analyses should be viewed with caution, since the number of tests performed increases the likelihood of chance findings. With the exception of the unemployed group, the effect sizes found were extremely small, suggesting that travel distance is not a major determinant of treatment-seeking even in these groups. Unemployed adults may be more sensitive to travel as an obstacle to treatment-seeking than the rest of the population. However, this group represents only 4.2% of individuals with probable depression.
Implications

Both international and Indian mental health policies advocate the integration of mental health services into primary care (Ministry of Health & Family Welfare, 2014, WHO, 2008, WHO and WONCA, 2008), partly on the basis that this improves the geographic accessibility of services. For example, a 2008 WHO report states that “when mental health is integrated into primary care, people can access mental health services closer to their homes... for the vast majority of people, primary care is far more geographically accessible than specialized mental health services” (WHO, 2008). However, this current study found that those living in the immediate vicinity of public mental health services were equally as or more likely to seek care than those facing longer journeys of 20km or more, demonstrating that distance to the nearest public depression service is not a primary factor in explaining low treatment-seeking rates.

One interpretation of this finding is that increasing the accessibility supply of services is insufficient to increase contact coverage reduce the treatment gap in areas where demand for these services is very low, even for those with minimal geographic barriers to reaching services. Interventions to increase demand are therefore necessary. In contrast with PRIME, evaluations of The Vidarbha Stress and Health Program (VISHRAM), another depression treatment programme in central India, included village-level demand generation activities and reported a six-fold increase in contact coverage treatment-seeking in the implementation area from pre- to post-implementation (Shidhaye et al., 2017), in contrast to PRIME. One of the major differences between the two programmes was village-level interventions to increase demand for mental health services the emphasis in VISHRAM on village-level interventions to increase demand for mental health services.

An alternative interpretation is that the accessibility of public, allopathic mental health services specifically is of little relevance to treatment-seeking behaviour, since these represent a minority of services and are not the preferred choice of healthcare for many (De Costa & Diwan, 2007, De Costa & Johannson, 2011). Indian mental health policy focusses primarily on public health services (Ministry of Health & Family Welfare, 2014), and the PRIME programme has done (Hanlon et al., 2014, Shidhaye et al., 2016b), both focussed on public health services. However, government services represent a minority of health services in this area, and are not the preferred choice of healthcare for many (De Costa and Diwan, 2007, De Costa and Johannson, 2011), given due to perceptions of its poor quality and pervasive problems with absenteeism (Dalal 2005). The finding that rates of treatment-seeking remain low regardless of distance to the nearest public provider is...
an important finding as it demonstrates that the location of public depression mental health services has negligible effects is not a primary determinant of the treatment gap in this context should prompt us to re-examine the sole focus on these in current mental health policy, and to take into account the complexity of the health system in future initiatives to improve access to care (Dalal, 2005), as is often assumed.

The results of the sub-group analyses should be viewed with caution, since the number of tests performed increases the likelihood of chance findings. With the exception of the unemployed group, the effect sizes found were extremely small. Caution is needed in interpreting the results of the sub-group analyses, since multiple tests were performed, increasing the likelihood of chance findings, and the effect sizes were small. The preliminary finding that for some groups, those living further from public health services were slightly more likely to seek treatment, could indicate that other mechanisms, such as stigmatisation, might be involved. Further investigation and replication of these results are necessary to understand the processes involved in decisions around treatment-seeking for depression. Unemployed adults may be more sensitive to travel distance to public services as an obstacle to treatment-seeking than the rest of the population, although. However, this group represents only 4.2% of individuals with probable depression.

The current findings provide reason to re-examine the assumption that reducing travel distance will reduce the treatment gap for depression. Either geographic accessibility does not act a barrier to treatment-seeking in the case of depression in this setting, or travel distance is not a good measure of accessibility in this context. It is still possible, however, that travel distance affects adherence to treatment, as found by Fortney and colleagues in the USA (Fortney et al., 1999).

Strengths

A particular strength of the study is the use of a community-based sample, and therefore reflects the behaviour of the general population better than including only those who came into contact with health facility-based studies. The sample size compares favourably with international previous international studies of treatment-seeking for depression (Roberts et al., 2018) and to previous India-based studies of treatment-seeking for mental disorders (Andrade et al., 2014, Jain et al., 2012, Lahariya et al., 2010, Mathias et al., 2015, Mishra et al., 2011, Shidhaye et al., 2016a). We chose network analysis using road network measures as the most rigorous method of calculating travel distance (Apparicio et al., 2008, Fortney et al., 2000, Nesbitt et al., 2014), although Euclidean (straight line) distances were sufficiently strongly correlated to provide a reasonable proxy.
proof measure ($R^2 = 0.77$, $p < 0.001$). We also conducted sensitivity analyses to check whether limiting the outcome to the use of formal health services only affected the results.

Limitations

GPS coordinates were missing for some households, including a large proportion in round 1. However, we believe that the error introduced by substituting village centroid coordinates in these cases is relatively small, given the size of villages in the implementation area. When we excluded those with missing coordinates, we found no difference in our results for either round.

Our exposure of interest. The measure of geographic accessibility used was an estimate of travel distance, which may be considered a proxy for travel time. We lacked data on access to transportation to be able to convert distance estimates to travel time estimates, which may be of greater relevance to treatment-seeking decisions. It is therefore possible that travel distance is a poor indicator of geographic accessibility in this context, if journey times vary by season, mode of transport and road conditions. Future research should build on these findings by generating more nuanced estimates of travel time and cost for this setting for all potential users of mental health care to compare the predictive value of alternative measures of geographic accessibility.

The data were cross-sectional, meaning that some potential confounding factors (e.g. symptom severity, perceived needs) or effect modifiers may have changed since the depressive episode over the period asked about in question; in particular symptom severity and perceived need for health care. Recall bias is possible since we used self-reported outcome data (Bhandari and Wagner, 2006), although this affects binary measures of treatment-seeking less than measures of volume or frequency (Carroll et al., 2016, Raina et al., 2002). It is possible that differential misclassification occurred if longer journeys lead to greater recollection of treatment-seeking, which could explain the apparent positive association between distance and treatment-seeking among some groups. Another limitation of the study is the use of self-reported outcome data, which can be subject to recall bias (Bhandari and Wagner, 2006), although some HIC studies have found that this affects binary measures of contact coverage less than measures of volume or frequency of health care utilisation (Carroll et al., 2016, Raina et al., 2002).

We did not have data on the location of private or complementary providers in order to calculate travel distance to these, since these are highly numerous and no official register of these services
exists. Future studies might usefully attempt to map these to generate more context-specific measures of geographic accessibility.

It would also have been useful to investigate whether distance to the nearest public provider affected the likelihood of consulting a public rather than private or complementary provider, among those who sought depression treatment. However, the number who sought treatment was too small to enable this.

Finally, the low rate of treatment-seeking overall limits the chances of finding an association between distance and treatment-seeking, although the narrow confidence intervals suggest a relatively high degree of precision in our estimates.

**Conclusion**

The current study identified no association between travel distance to the nearest public depression treatment provider and treatment-seeking for probable depression, except for the small sub-group of unemployed adults. This contrasts with research from high-income countries where travel distance has been shown to be an important predictor of treatment-seeking. Low geographic accessibility of public, allopathic services does not explain the overall low contact coverage treatment gap for depression in this context, as rates of treatment-seeking are equally low for those living within a short distance of services, and d. Decentralising public mental services to reduce travel distance will not of itself reduce the treatment gap for depression at least in rural India. Policymakers and service planners should therefore not base decisions about the best platform through which to deliver mental health services on these grounds. Future research should examine alternative measures of geographic accessibility of mental health services, taking into account and identify other factors that influence treatment-seeking for depression the health systems context of India which includes many private and complementary service providers.
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Table 1. Demographic and health-related characteristics of adults with probable depression by travel distance to the nearest public health facility offering depression services, Sehore sub-district, Madhya Pradesh, India, 2013-2016.

<table>
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<tr>
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<th>0-5km (n=59, 8.5%)</th>
<th>5-10km (n=121, 18.7%)</th>
<th>10-20km (n=150, 24.5%)</th>
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<tr>
<td>Less than primary</td>
<td>79.9</td>
<td>77.0</td>
<td>70.7</td>
<td>73.7</td>
<td>74.1</td>
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<tr>
<td>Primary</td>
<td>18.6</td>
<td>21.2</td>
<td>22.2</td>
<td>23.6</td>
<td>22.4</td>
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</tr>
<tr>
<td>Secondary or more</td>
<td>1.5</td>
<td>1.8</td>
<td>7.1</td>
<td>2.7</td>
<td>3.5</td>
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<tr>
<td>Employment status, %</td>
<td></td>
<td></td>
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<tr>
<td>Unemployed</td>
<td>0.0</td>
<td>2.0</td>
<td>5.1</td>
<td>5.4</td>
<td>4.2</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Productive non-income</td>
<td>60.3</td>
<td>52.9</td>
<td>33.0</td>
<td>31.8</td>
<td>38.5</td>
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<tr>
<td>Low income</td>
<td>30.7</td>
<td>39.0</td>
<td>54.1</td>
<td>59.6</td>
<td>51.9</td>
<td></td>
</tr>
<tr>
<td>High income</td>
<td>9.1</td>
<td>6.1</td>
<td>7.8</td>
<td>3.2</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Religion, %</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Hindu</td>
<td>70.3</td>
<td>92.4</td>
<td>97.2</td>
<td>93.3</td>
<td>92.1</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Muslim</td>
<td>29.7</td>
<td>7.6</td>
<td>2.8</td>
<td>6.7</td>
<td>7.9</td>
<td></td>
</tr>
<tr>
<td>Caste, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Scheduled Caste</td>
<td>19.2</td>
<td>16.0</td>
<td>14.6</td>
<td>15.9</td>
<td>15.8</td>
<td>0.88</td>
</tr>
<tr>
<td>Scheduled Tribe</td>
<td>3.3</td>
<td>5.0</td>
<td>6.2</td>
<td>3.0</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>Other Backwards Caste</td>
<td>64.8</td>
<td>69.0</td>
<td>68.9</td>
<td>73.8</td>
<td>71.0</td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>12.7</td>
<td>10.0</td>
<td>10.4</td>
<td>7.4</td>
<td>9.1</td>
<td></td>
</tr>
<tr>
<td>Marital status, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Single</td>
<td>10.6</td>
<td>8.1</td>
<td>3.5</td>
<td>6.5</td>
<td>6.4</td>
<td>0.28</td>
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<tr>
<td>Married</td>
<td>69.3</td>
<td>84.5</td>
<td>87.8</td>
<td>79.6</td>
<td>81.7</td>
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<tr>
<td>Widow(er)</td>
<td>18.6</td>
<td>7.4</td>
<td>7.4</td>
<td>12.1</td>
<td>10.6</td>
<td></td>
</tr>
<tr>
<td>Separated/Divorced</td>
<td>1.5</td>
<td>0.0</td>
<td>1.2</td>
<td>1.8</td>
<td>1.3</td>
<td></td>
</tr>
<tr>
<td>Housing quality, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lowest level (kucchta)</td>
<td>62.0</td>
<td>53.9</td>
<td>57.0</td>
<td>46.1</td>
<td>51.6</td>
<td>0.25</td>
</tr>
<tr>
<td>Mixed (semi-pucca)</td>
<td>13.2</td>
<td>17.7</td>
<td>17.9</td>
<td>13.2</td>
<td>15.2</td>
<td></td>
</tr>
<tr>
<td>Highest level (pucca)</td>
<td>24.8</td>
<td>28.3</td>
<td>25.1</td>
<td>40.7</td>
<td>33.2</td>
<td></td>
</tr>
<tr>
<td>Owns land, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>15.2</td>
<td>22.1</td>
<td>30.6</td>
<td>37.2</td>
<td>30.9</td>
<td>0.02</td>
</tr>
<tr>
<td>Depression symptom severity (total PHQ-9 score), %</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate (10-14)</td>
<td>95.4</td>
<td>80.8</td>
<td>75.4</td>
<td>75.0</td>
<td>77.9</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>15-19</td>
<td>19.2</td>
<td>20.3</td>
<td>23.1</td>
<td>20.1</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td>Moderately severe</td>
<td>4.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(≥20)</td>
<td>0.0</td>
<td></td>
<td>4.3</td>
<td>1.9</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Survey round</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round 1 (before MHCP</td>
<td>17.7</td>
<td>34.5</td>
<td>58.9</td>
<td>87.9</td>
<td>64.8</td>
<td></td>
</tr>
<tr>
<td>implementation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round 2 (after MHCP</td>
<td>82.3</td>
<td>65.5</td>
<td>41.1</td>
<td>12.1</td>
<td>35.2</td>
<td></td>
</tr>
<tr>
<td>implementation)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

P-values are calculated using Chi Squared. Counts are unadjusted for sampling design, percentages are adjusted for sampling design.

The productive non-income group consisted of students and housewives.
Table 2. Travel distance to nearest public depression treatment provider and odds of seeking treatment for adults with probable depression (n=568) in Sehore sub-district, Madhya Pradesh, India, 2013-2017.

<table>
<thead>
<tr>
<th>Use of any services for depression</th>
<th>Unadjusted OR (95% CI)</th>
<th>P</th>
<th>Adjusted OR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of formal services for depression</td>
<td>1.01 (1.00-1.01)</td>
<td>0.16</td>
<td>1.00 (0.98-1.02)</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>1.00 (0.99-1.01)</td>
<td>0.73</td>
<td>0.99 (0.97-1.02)</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Odds ratios, 95% CIs and P-values calculated using logistic regression.

Formal services include specialist doctors, generalist doctors, other mental health professionals (psychologists, counsellors, mental health nurses), other generalist health workers (social workers, community health workers, nurses, ANMs, ASHAs, AWWs), case managers. Excludes ojha/guni/dev maharaj, traditional healers, herbalists, spiritualists, or other providers.

Adjusted models include the following covariates: education level, marital status, symptom severity, gender, land ownership, employment, round, exposure to mental health communications, age group.
Table 3. Sub-group analysis for distance to depression treatment provider and odds of treatment-seeking for adults with probable depression (n=568) in Sehore sub-district, Madhya Pradesh, India, 2013-2017.

<table>
<thead>
<tr>
<th></th>
<th>Adjusted OR (95% CI)</th>
<th>Stratum-specific P-value</th>
<th>Wald P-value for interaction terms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Caste</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheduled castes</td>
<td>1.04 (1.01-1.06)</td>
<td>&lt;0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Scheduled tribes</td>
<td>0.98 (0.90-1.06)</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Other backward castes</td>
<td>0.98 (0.96-1.01)</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>General castes</td>
<td>1.00 (0.97-1.04)</td>
<td>0.87</td>
<td></td>
</tr>
<tr>
<td><strong>Employment status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.73 (0.60-0.90)</td>
<td>&lt;0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Productive no income</td>
<td>1.00 (0.98-1.02)</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>Low income</td>
<td>1.01 (0.99-1.02)</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>High income</td>
<td>0.98 (0.91-1.05)</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td><strong>Perceived need for health care</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health care needed</td>
<td>0.99 (0.97-1.01)</td>
<td>0.32</td>
<td>0.02</td>
</tr>
<tr>
<td>Health care not needed</td>
<td>1.02 (1.00-1.03)</td>
<td>0.06</td>
<td></td>
</tr>
</tbody>
</table>

Odds ratios, P-values and confidence intervals were calculated with logistic regression. Besides the interaction term, each model was adjusted for education level, marital status, symptom severity, gender, land ownership, employment, round, exposure to mental health communications, and age group.