A systems approach to mental healthcare provision and suicide prevention in Sofala, Mozambique

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Abstract

A systems approach to mental healthcare provision and suicide prevention in Mozambique

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The studies within this dissertation describe existing patterns of outpatient, inpatient, and emergency room mental healthcare, suicide attempts and deaths due to suicide, and the availability of essential mental health medications, all within Ministry of Health clinics in Sofala Province, Mozambique. Specifically, this work: describes the real availability of essential medicines for mental healthcare (*Aim 1*); describes trends in mental healthcare utilization and health facility determinants of diagnosis patterns (*Aim 2*); analyzes current outpatient and inpatient diagnosis and treatment patterns, along with who is at risk for common diagnoses (*Aim 3*); and describes the basic epidemiologic profile of emergency room psychiatric visits, suicide attempts, and deaths due to suicide, as well as methods used in suicide attempts or deaths (*Aim 4*).

In *Aim 1* we found that essential medicines for mental health were routinely unavailable. No atypical antipsychotics existed at any clinics and essential typical antipsychotics were haphazardly available. Further, no selective serotonin reuptake inhibitors (SSRIs) were readily available, which is concerning as they are essential for treatment of individuals with underlying cardiovascular disease and/or suicidal ideation. We recommend prioritizing the availability of at least one SSRI, one atypical antipsychotic, and consistent availability of selected typical antipsychotics.

In *Aim 2* we found that outpatient mental health utilization is increasing, but currently mostly focuses on epilepsy and schizophrenia/delusional disorders. Women appear more likely to present for neurotic/stress-related conditions (12.8% of consults for women, 5.7% for men, $p<0.001$), while men appear more likely to present for substance use (1.9% for women, 6.4% for men, $p<0.001$). Clinics with more psychiatric technicians have a 2.1-fold (CI: 1.2, 3.6) increased rate of schizophrenia/delusional disorder diagnoses. Rural clinics saw a higher proportion of epilepsy cases and a lower proportion of organic, substance use, schizophrenia, and mood disorder cases. Due to diagnostic or utilization differences, rural clinics may be missing important cases of organic, substance-use, schizophrenia, and mood disorders.

In *Aim 3* we found that current patterns of medication usage may not follow international evidence-based guidelines. This was especially prominent around the potential overuse of typical antipsychotics and the anticholinergic agent promethazine for movement side-effects. Utilization was most common for schizophrenia (37.4% of consultations), epilepsy (15.9%), delirium (6.9%), and organic behavioral disorders (2.7%). Most disorders had few new patients entering the care system, which argues for innovative efforts to broaden care beyond severe mental disorders. These findings can help target potential modifications to national treatment guidelines and essential drug lists.

In *Aim 4* we found that females were more likely to present with suicide attempts, but that deaths due to suicide were more often male. Females often employed less lethal suicide methods, such as toxic substances, whereas males used lethal methods, such as hanging. Over 65% of suicide attempts used rat poison. Approximately 54% of deaths due to suicide used a toxic substance, with the singular most common being rat poison (28% of deaths). Given these findings, policies to reduce the availability and toxicity of rat poison and other common suicide methods should be considered.

We aim for this work to inform the development of evidence-based mental health policy, along with additional population and systems-level studies on mental ill-health and suicidal behavior in Mozambique and other similar countries.

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DEDICATION

For anyone who has ever, or will ever, suffer from mental ill-health or thoughts of self-harm

CHAPTER 1: Introduction

Introduction:

While impressive strides have been made in the last decade across sub-Saharan Africa to address infectious causes of morbidity and mortality – such as HIV/AIDS, malaria, and tuberculosis – through large global collaborations and investments, the same cannot be said of non-communicable diseases (NCDs). Within NCDs, the common mental disorders (CMDs) of depression, anxiety, and drug use are the leading causes of disability worldwide[1]. The onset of the majority of mental disorders is in childhood and adolescence[1], leading to a lifetime of disability and suffering – those with serious mental illness die an average of 25 years earlier than the general population[2]. Untreated depression leads to an increased risk of suicide[3], infection with HIV and other infectious conditions[4], low adherence to life-saving antiretroviral medications[5], poor birth outcomes for pregnant women, and poor growth and cognitive development of children[6,7]. Aside from a high burden of disability, suicide is among the leading causes of death among those aged 15-44 globally[8], and over 80% of suicides are attributable to the CMDs of depression, alcohol, and substance abuse[9]. Globally, over 75% of suicides occur in low- and middle-income countries (LMICs), and in particular, Mozambique has the 7th highest suicide rate in the world, with a rate over double that of the global average[10].

Considering this high burden of disease, Mozambique lags far behind with regards to local research capacity on, as well as care and treatment for, CMDs. Currently, only 7.2% of all health facilities offer any services for mental health, and more than half of all districts in the country contain no facility offering services. Only 0.29% of the population is estimated to have access to basic mental health services[11]. Mental healthcare is out of reach of most Mozambicans, as it is confined largely to specialized psychiatric services at district-level health facilities or higher. However, the integration of mental health screening and core treatment packages into primary care is consistently listed as a leading research and implementation priority by the World Health Organization (WHO) and the Mozambican Ministry of Health[12].

However, even though these areas of research are seen as high priority locally and globally, currently there are *no* peer-reviewed publications on CMDs and the mental healthcare system in Mozambique, including basic systems questions of: (1) what medications are readily available

in real-world clinical settings; (2) who is being seen for mental ill-health; (3) what are common disorders seen in public mental healthcare; (4) who is at risk for which common mental illnesses, how are individuals currently treated, and are these treatments following up-to-date international evidence-based guidelines; (5) and finally, what system changes are we seeing as mental healthcare is increasingly scaled-up across Mozambique? In terms of suicide, there is also a paucity of literature in Mozambique, and Sub-Saharan Africa more broadly. There are no peer-reviewed publications on the epidemiologic profile of suicidal thoughts, attempts, or deaths due to suicide in Mozambique.

Together, these foundational systems-level analyses of mental ill-health and suicidal behavior are urgently needed to target systems improvement interventions and policies aimed at the prevention and treatment for mental ill-health and suicidal behavior in Mozambique and other similar LMIC settings. This dissertation, and the papers therein are an attempt to answer these initial questions around mental illness within the public-sector, Ministry of Health healthcare delivery system in Sofala, Mozambique, with a particular focus on care provided at the Beira Central Hospital.

Chapter two, entitled "*the availability of essential medicines for mental healthcare in Sofala, Mozambique*" builds upon current annual service provision assessments ongoing since July-August of 2011 in Sofala, Province. This publishable manuscript assesses the real availability of essential medications for mental healthcare within 24 public health facilities and 13 district warehouses across districts of Sofala, Province. The findings from this paper can help target policies and interventions to improve access to, and availability of, essential mental health medications in Mozambique. Further, it sets the context for chapter four, which includes information on the prescribing practices for individual mental disorders. Knowledge of the current availability of pharmaceuticals can be triangulated with treatment information to inform comparisons to evidence-based treatment guidelines.

Chapter three, entitled "*health system determinants and trends of ICD-10 outpatient psychiatric consultations across Sofala, Mozambique: time-series analyses from 2012 to 2014*" evaluates a census of aggregate outpatient psychiatric consultations conducted at public-sector

clinics across Sofala, Mozambique from January 2012-June 2014. This manuscript aims to determine trends in outpatient psychiatric consultations by ICD-10 diagnoses during a period when outpatient mental healthcare is being expanded from provincial capitals, such as Beira City, to district-level hospitals and clinics. Further, this paper explores health facility determinants of differences in ICD-10 diagnoses in these same public-sector clinics to understand and document any differential utilization or diagnosis of mental illness. These data aim to inform the scale-up of mental healthcare provision in Mozambique, as well as other similar LMIC settings.

Chapter four, entitled "*two years of mental healthcare service utilization in Sofala, Mozambique: who is being seen, who is at risk for common diagnoses, and are treatments following evidence-based guidelines?"* documents a near census of registry entries for outpatient psychiatric visits, including patient-level demographic and treatment data, along with inpatient records, at Beira Central Hospital in Sofala, Mozambique. This paper aims to fill a knowledge gap on current mental health utilization patterns, diagnoses and treatments provided, as well as the age, gender, and visit number profile of patients presenting for mental health services. We compare current treatments to evidence-based guidelines from the WHO in hopes of informing efforts to improve the quality of care provided for mental ill-health in Mozambique.

Chapter five, entitled "*suicide attempts and deaths in Sofala, Mozambique: who, where, and with what from 2011-2014*" reviews a census of 898 emergency psychiatric consultations and 1,173 violent death autopsy records over multiple years at Beira Central Hospital in Sofala, Mozambique. This paper fills a knowledge gap regarding the epidemiologic profile of suicide attempts and deaths due to suicide in Sofala. This includes the age and gender profiles of suicide attempts and deaths, as well as methods used and location of death. These data are essential as efforts to prevent and treat suicide attempts are intensified in Mozambique and can aid in targeting policies, along with community and systems-level interventions, to reduce the burden of suicidal behavior nationally.

In sum, this dissertation represents a base of initial mental health systems research in Mozambique. We hope these data can inform the development and targeting of future population- and systems-based research on this important topic in Mozambique and other similar Sub-Saharan African settings. Last, we hope these efforts can represent a small advocacy effort to increase funding and attention focused around mental ill-health and suicidal behavior globally.

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CHAPTER 2: The availability of essential medicines for mental healthcare in Sofala, Mozambique

Title Page

The availability of essential medicines for mental healthcare in Sofala, Mozambique

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Abstract

Introduction: We assessed the availability of essential medicines for mental healthcare (MH) across levels of the public healthcare system to aid in future systems planning.

Methods: Non-expired MH medications were assessed in 24 public health facilities and 13 district warehouses across Sofala province, Mozambique from July to August, 2014.

Results: Only 7 of 12 (58.3%) district warehouses, 11 of 24 (45.8%) of all health facilities, and 10 of 12 (83.3%) of facilities with trained MH staff had availability of at least one medication of each category. Thioridazine was the most commonly available antipsychotic across all facilities (9 of 24, 37.5%), while chlorpromazine and thioridazine were most common at facilities providing MH care (8 of 12, 66.7%). Atypical antipsychotics were not available at any facility or district warehouse. Amitriptyline was the most commonly available antidepressant (10 of 12 districts; 12 of 24 overall facilities; 9 or 12 MH facilities). Despite being on the national essential drug list, fluoxetine was only available at one quaternary-level facility and no district warehouses.

Discussion: Essential psychotropic medicines are routinely unavailable at public health facilities. Current essential drug lists include six typical but no atypical antipsychotics, which is concerning given the side-effect profiles of typical antipsychotics. Ensuring consistent availability of at least one selective serotonin reuptake inhibitor should also be a priority, as they are essential for treatment of individuals with underlying cardiovascular disease and/or suicidal ideation. Similar to successful task-sharing approaches used for HIV/AIDS, mid-level providers could be retrained and certified to prescribe and monitor first-line psychotropic regimens.

Introduction:

In 2001, the World Health Organization (WHO) published the World Health Report on global mental health, entitled "Mental Health – New Understanding, New Hope"(1). This report outlined ten recommendations to WHO member countries, with the first two being: provide mental health treatment in primary care; and improve the availability of psychotropic drugs globally. In addition, the last recommendation of the report was to support more global mental health research. Now thirteen years removed from this landmark publication and there remain no peer-reviewed implementation research articles on the distribution, availability, and/or the frequency of stock-outs regarding essential psychotropic medications in public health facilities in Mozambique – a country with a population of 25.8 million(2). More generally, there are few peer-reviewed articles focusing on access, cost, quality, and use of psychotropics in sub-Saharan Africa. This lack of up-to-date data on the availability of essential medicines for mental healthcare inhibits quality patient care and the development, targeting, and testing of implementation, operations, and quality-improvement approaches to improve care and treatment around mental disorders.

According to the 2010 Global Burden of Disease estimates for Mozambique, mental disorders account for 23.1% of all years lived with disability (YLD) when considering those aged 15-49(3). With this large burden of mental illness, Mozambique has an estimated shortage of 236 psychiatrists and 2,389 mental health technicians to achieve basic WHO targets for the provision of mental healthcare(4). Task-sharing approaches using non-specialist healthcare workers have been advocated to overcome the large mental health treatment gap that exists in most LMICs(5–8). However, a recent review among a sample of LMICs found that improved access to essential psychotropic medications was considered a basic prerequisite for the success of mental health task-sharing approaches(9).

Mozambique does not have an official approved mental health policy separate from the general health policy or dedicated mental health legislation, and apportions an estimated 0.16% of the national health budget to mental health(10). There are no family- or community-based support organizations for mental disorders in Mozambique(11). Mozambique does, however,

have an essential drug list that includes antipsychotics, antidepressants, benzodiazepines, antiepileptics and mood stabilizers, as well as anticholinergic medications(12).

Previous cross-national studies of LMICs (excluding Mozambique) have indicated that nations that have a national mental health plan, family-based organizations participating in drafting mental health legislation, and a higher proportion of the health budget dedicated to mental health are more likely to have consistent availability of essential psychotropic medications(13). In addition, the 2009 WHO Assessment Instrument for Mental Health System (WHO-AIMS) study of mental health systems in 42 LMICs found that, across a sample of African countries, only 14% had at least one psychotropic medicine in each of five categories (antipsychotics, anxiolytics, antidepressants, mood stabilizers, and antiepileptic drugs) available in all public health facilities. Medication cost was also an issue – the median cost in low-income countries of antipsychotic medication was 9% of the minimum wage(13). These data are limited by the fact that WHO-AIMS did not verify the availability of non-expired psychotropic medications at the point-of-care in the sampled countries, an aim of the present study. In Nigeria, even after a 15-year program focused the scale-up of mental health care treatment in primary care settings, the majority of public health facilities did not have routine availability of essential psychotropic medications(14).

Treatment of epilepsy with first-line antiepileptic drugs (such as carbamazepine), depression with generic antidepressants (such as amitriptyline or fluoxetine) plus brief psychotherapy, and psychosis with first-generation antipsychotics (such as haloperidol or fluphenazine) have been rated as among the most cost-effective interventions for non-communicable diseases in LMICs(15). Since mental disorders are often chronic in nature, stock-outs or lack of access to medicines in public health facilities can have a large impact on adherence and treatment effectiveness(16). In addition, since many psychotropic medications are subject to illicit use and can be habit-forming, accurate understanding and regulation of the distribution of these drugs in LMICs is essential(17,18).

Previous work in this same setting of Mozambique that assessed the availability of 15 essential medicines for primary care provision – such as erythromycin, injectable quinine,

condoms, and diphtheria, pertussis, and tetanus vaccine – found that stock-outs were common(19). Across three years of cross-sectional facility surveys, over 70% of visits had at least one essential medicine currently unavailable, which often occurred when drug stock was available at the district-level(19). These findings suggest that difficulties in transport and communication between districts and health facilities may be the most common reasons for drug stock-outs in this setting.

In 2011, a study using the WHO-AIMS framework in Mozambique found that over 90% of facilities providing outpatient psychiatric care had stock-outs of essential psychotropics in the last year(11). Studies from other LMIC settings, such as India and neighboring South Africa suggest that frequent stock-outs of medicines and/or a lack of availability of medicines for mental healthcare may contribute to attitudes that medications for mental health conditions are ineffective, decrease biomedical care-seeking for mental health conditions, and could increase stigma regarding those suffering from mental disorders(20–22).

The present study represents, to our knowledge, the first examination of verified availability of essential drugs for mental healthcare provision in Mozambique. We aim for this information to help inform approaches to improve prevention, care, and treatment for mental disorders in Mozambique and other settings facing a high burden of mental disorders, and limited resources in the health system.

Methods:

Study setting and sampling frame

As part of the evaluation framework for a comprehensive health-systems-strengthening intervention, we currently conduct annual service provision assessments (SPAs) in 27 of 156 total health facilities and all 13 district warehouses across Sofala Province, Mozambique(23). These cross-sectional SPAs have been ongoing since 2011, focusing on the availability of non-expired essential medicines and supplies, as well as functional essential equipment for primary healthcare provision. The survey instrument was adapted from the SPA data collection forms used for the demographic and health surveys (24), and included a list of tracer medicines (15

total), supplies (7 total), and functioning equipment (9 total) standardized across the five African Health Initiative countries(25).

In 2011, a two-stage sampling approach was used to select facilities for continued repeated cross-sectional SPA surveys. This sample yielded a total of 26 health facilities (two per district across the province), capturing the largest facility in each district and a randomly selected smaller health center. Only public, Ministry-run facilities were considered for inclusion in the sample. Unfortunately, due to civil unrest, we were unable to travel to three health facilities (two in Machanga district and one in Gorongosa district), and thus they are excluded from the 2014 sample. The quaternary-level Beira Central Hospital was included in our analyses because it is one of the primary providers of mental health services in the province.

Detailed information on the design, sampling frame, study setting of Sofala province, and the Mozambican supply-chain has been previously published(19). Briefly, medications are delivered to public health facilities either quarterly via a push (kit) mechanism or monthly using a pull (requisition) system. All essential mental health medications in the present study are delivered via the pull system, save diazepam and chlorpheniramine. Over 90% of health services in Mozambique are delivered through public-sector primary care clinics; there is no well-established private-sector healthcare delivery system(26). In addition, few to no private pharmacies exist outside of larger provincial capital cities.

In the 2014 iteration of the annual cross-sectional survey, essential medicines for mental healthcare were added, along with questions on the availability of mental health treatment manuals, mental healthcare staffing, and referral networks for mental health. Of the 24 health facilities sampled, 12 provide specialist mental healthcare services, most often staffed by a single psychiatric technician. The most recent essential drug list for Mozambique (published in 2010) includes 397 drug formulations that should be available at all times across Ministry of Health primary care facilities nationally(12).

Variables, measures, and analyses

We used the WHO model list of essential medicines(27), the Mozambican national pharmaceutical formulary(28) and essential drug list(12), along with discussions with local

mental health professionals to develop a list of essential medications for mental healthcare provision that respected both national and international guidelines, as well as local realities in Sofala, Mozambique. General categories of medications included: antipsychotics; antidepressants; benzodiazepines; antiepileptics and mood stabilizers; and anticholinergics. Availability of a specific medication refers to the current and un-expired availability of any formulation of medication delivery, whether tablet, injection, or other.

Availability of non-expired drugs was stratified by district-level availability, overall facility availability, availability at facilities with at least one trained specialist mental healthcare worker (psychiatrist, clinical psychologist, psychiatric technician), and by facility type. In addition to absolute availability, we also present data on facility-level availability when drugs are concurrently available at the district-level drug warehouse.

Results:

Facility descriptive statistics and referral networks

Of the 24 facilities, 83% (n=20) were rural and the mean number of general outpatient consultations per facility in 2013 was 54,728 (see Table 1). The majority of facilities in the sample were smaller rural type-2 facilities (n=11), followed by larger rural type-1 facilities (n=6), and rural hospitals (n=4). Only one facility (4.2%) did not have a health professional who could diagnose and prescribe medications for mental healthcare conditions. The vast majority of facilities had not referred a patient for mental health issues (n=21 facilities, 87.5%) or suicidal thoughts (n=20 facilities, 83.3%) in the last 30 days (Table 1).

District warehouse availability of essential medicines for mental healthcare

Of 12 district warehouses, only 58.3% (n=7) had current availability of at least one medication of each category for mental healthcare provision (see Table 2). Carbamazepine was the medication most available, with 91.7% (n=11) of warehouses having current availability, followed by amitriptyline (83.3% availability, n=10) and diazepam (75.0% availability, n=9). No district warehouses had current availability of risperidone, decanoate of fluphenazine, maprotiline, fluoxetine, midazolam, chlordiazepoxide, lithium carbonate, or phenytoin.

Haloperidol, chlorpromazine, and thioridazine were all available at 41.7% of warehouses (n=5). The most commonly available anticholinergics or antihistamines were promethazine and diphenhydramine, both available at 66.7% of warehouses (n=8); (Table 2).

Availability of essential medicines for mental healthcare across all facilities

Of 24 health facilities, only 45.8% (n=11) had current availability of at least one medication of each category for mental healthcare provision (see Table 2). All antipsychotic medications had less than 38% availability, with thioridazine being most available (37.5%, n=9), followed by haloperidol and chlorpromazine (both 33.3%, n=8). Amitriptyline was available in half of the facilities (n=12) and diazepam was available in 75.0% (n=18) of facilities. Phenobarbital was the most available antiepileptic drug (available in 62.5% of facilities, n=15), followed by carbamazepine (58.3%, n=14). Chlorpheniramine was available in 79.2% of facilities (n=19), followed by diphenhydramine (70.8% of facilities, n=17).

Facility availability of essential medicines for mental healthcare at facilities with specialized mental healthcare services

Over 83% (n=10) of the 12 facilities with specialized mental healthcare services had current availability of at least one medication from each category for mental healthcare provision (see Table 2). No medication was available at all facilities. The most commonly available medications were diazepam, carbamazepine, promethazine, and diphenhydramine, which were all available at 11 of 12 facilities (91.7%). No facilities had availability of risperidone or lithium carbonate and only one facility had availability of fluoxetine. Chlorpromazine and thioridazine were the most commonly available antipsychotics (66.7% of facilities, n=8) and amitriptyline was the most commonly available antidepressant (75% of facilities, n=9).

Facility availability of essential medicines stratified by facility type

No rural type 2 facilities had current availability of any antipsychotic medications (Table 2). At higher-level facilities, all types had greater than 75% of facilities with current availability of at least one drug of each category for care provision.

Facility availability mental health medications when available at district distribution point

For facilities providing specialized mental health services, there were few instances of medicines unavailable at the facility level with concurrent availability at the district warehouse. Sodium valproate was unavailable at 33.3% (n=4) of the 12 facilities while available at the district distribution point.

Discussion:

In this study of public-sector health facilities and a census of district-level drug warehouses, we found that essential medicines for the provision of mental healthcare were routinely unavailable. Medications were more often available at facilities with mental health specialists offering specialized outpatient or other types of mental healthcare, although 96% of all health facilities surveyed had at least one provider who could prescribe medications for mental health conditions. In contrast to previous assessments (19) of the availability of other classes of drugs (antibiotics, vaccines, antimalarials) for primary healthcare provision, where the majority of facility stock-outs occurred while drugs were available at district warehouses, the majority of psychotropic drug stock-outs appear to be due to more distal upstream factors – such as lack of drug stock at provincial or national levels – instead of mismanagement or delays in distribution of existing drugs from district warehouses to health facilities.

The Mozambican essential medicine list currently includes six typical antipsychotics, but no atypical antipsychotics. Not surprisingly, no district warehouses or health facilities had availability of risperidone, a WHO-recommended essential atypical antipsychotic. In regards to antidepressants, although the national essential drug list includes two tricyclics, one tetracyclic, and one selective serotonin reuptake inhibitor (SSRI), only the quaternary-level Central Hospital had availability of any antidepressants other than tricyclics. These findings give pause for a number of reasons. First, no single typical antipsychotic was available at greater than 67% of facilities offering specialized psychiatric services (no more than 37.5% of all facilities) or more than 42% of district warehouses. While it is laudable to strive for a diversity of antipsychotics to allow tailoring of medication regimens or shifting of treatments if side-effects develop, the inconsistent availability of any regimen is concerning. In reality, the current prioritization of six

typicals, all haphazardly available, likely forces providers to shift regimens frequently and often due to lack of stock, even if a given formulation has proven effective for a given patient.

Going forward, we recommend prioritizing the consistent availability of haloperidol, fluphenazine, and chlorpromazine, and the addition of the atypical antipsychotic risperidone. Risperidone was added to the WHO essential medicine list in 2013, cited as more effective in the treatment of psychosis, schizophrenia, and bipolar compared to typical antipsychotics(29). In addition, it has fewer extrapyramidal side-effects compared to typical antipsychotics, and thus represents an “essential” alternative for those who cannot tolerate older medications. This may be particularly important as very high rates of anticholinergic medication use to counter side-effects of typical antipsychotics have been cited in Mozambique(30). Available literature on the cost-effectiveness of risperidone indicates that it is either cost-neutral or perhaps even cost-saving compared to typical antipsychotics such as haloperidol for the treatment of schizophrenia, schizoaffective disorder, and psychosis(29); although, the vast majority of cost-effectiveness studies have been conducted in high-income settings. More efforts are needed to characterize the cost-effectiveness of atypical antipsychotics including risperidone in LMICs.

The lack of availability of SSRI antidepressants is also concerning as they are the first choice for the treatment of depression for individuals with ideas, plans, or acts of self-harm(31); this may be especially important given Mozambique was recently estimated to have the 7th highest suicide rate in the world, and the highest in Africa(32). Fluoxetine in particular is necessary for the treatment of adolescent and older adults with depressive illness, along with individuals with underlying cardiovascular disease or abnormalities, since tricyclics have consistently been associated with increased cardiovascular risk(31). Similar to antipsychotic medication in Mozambique, we recommend a more focused approach to ensure reliable access to both amitriptyline (a tricyclic) and fluoxetine (a SSRI) across all public facilities.

No antidepressants or antipsychotics were routinely available at smaller rural health facilities, referred to as rural type 2 or smaller facilities, and phenobarbital for the treatment of epilepsy was available at less than half of these facilities. Of approximately 1,300 public health facilities nationwide, around 1,000 (or 75%) are smaller rural health centers serving catchment

areas of 7,500-20,000 people and providing routine outpatient, prenatal, maternity, and well-child services. These facilities are the bedrock of primary care provision in Mozambique, especially for rural populations far from district capitals and major transport corridors, who do not have access to private pharmacies if medicines are unavailable at public-sector clinics. After effective care is ensured at larger referral facilities, a next step in moving beyond the current situation where only 0.3% of the population has reliable access to mental health services is to extend access to include these smaller, more rural health facilities(33). Given that not a single rural type 2 facility referred a single mental health patient in the past 30 days, a near-term strategy could be to strengthen mental health and self-harm referral networks. In the longer term, the mental healthcare service should take a lesson from the rapid and effective scale-up of antiretroviral treatment for HIV/AIDS and provide re-training and certification for nurses and other mid-level providers (such as medical technicians in the Mozambican context) to prescribe and monitor first-line regimens for outpatient primary mental healthcare(34,35). Once complete, first-line antipsychotic and antidepressant medications could be included in the routinely distributed push (kit) system nationally.

Given the current continued mental health treatment gap in Mozambique, the current model whereby medical doctors or specialists (including psychiatric technicians) are the only providers allowed to prescribe any antipsychotic or antidepressant should be reconsidered. Flexibility in prescribing regulations by cadre is especially important given the inconsistent availability of any specific psychotropic medications found in this study. For example, under the present system, medical technicians are allowed to prescribe phenobarbital, although depending on the level or type of health facility, carbamazepine may be the only available anti-epileptic. This could lead to a situation where a medical technician cannot continue treating a patient under official guidelines because phenobarbital is unavailable and they are not allowed to prescribe sodium valproate or carbamazepine. Issues such as these beg answering as essential drug lists and provider regulations are debated in Mozambique and other similar LMICs.

This study is not without limitations. We analyzed medication availability among a non-random sample of facilities in one province of Mozambique, and thus the findings may not be

representative of facilities across Sofala Province or other areas nationally. Although, the facilities selected here were among the largest facilities in the province and contained the majority of facilities currently providing specialized mental healthcare in the province. Availability was also assessed cross-sectionally, therefore patterns may not represent availability over longer time-periods. Furthermore, availability was defined as having current and un-expired drug of any formulation, whether injectable or tablet, and therefore the patterns outlined here likely over-represent the real availability of a given specific pharmaceutical formulation. Last, while availability is an essential precursor to effective treatment, we did not assess quality or dosage information which should be considered for future study.

These findings also have a number of strengths. Medication availability was physically assessed by visiting each facility and verifying the presence of non-expired medications – not through self-report or an external questionnaire. Second, availability was assessed at a census of all district warehouses, along with a sample including all levels of public facilities, from small rural facilities to the quaternary-level central hospital. Finally, a thorough and comprehensive list of mental health medications was assessed, triangulated between the national essential drug list, the national formulary, as well as WHO essential lists.

Conclusions:

In this study of public-sector Ministry of Health facilities and district drug warehouses in Sofala, Mozambique, we found that essential psychotropic medicines were often unavailable. More specifically, no more than half of district warehouses had current availability of any given essential typical antipsychotic and no district or individual facilities had any atypical antipsychotics. Even though listed on national and international essential medicine lists, fluoxetine was not available at any district warehouse, and only available at the Central Hospital. We recommend updating essential medicine lists and supply chains to prioritize consistent availability of the typical antipsychotics haloperidol, fluphenazine, and chlorpromazine, with the addition of the atypical antipsychotic risperidone. We also recommend a focused approach to ensure reliable access to both a tricyclic – amitriptyline, and an SSRI –

fluoxetine. As essential medicine lists are updated, restrictions around who can prescribe psychotropic medications should additionally be reviewed.

Table 1. Characteristics of 24 health facilities surveyed for availability of mental health medications, Sofala Province, Mozambique, July/August, 2014.

Characteristic	**All facilities n (%) unless noted**	**Facilities providing specialized mental health services n (%) unless noted**
Total facilities	**24 (100)**	**12 (50.0)***
Rural facility location	20 (83.3)	8 (66.7)
# of general outpatient consultations in 2013 (mean, SD)	54,728 (46,904)	87,519 (45,240)
Availability of mental health treatment manual	9 (37.5)	8 (66.7)
Type of health facility		
Central Hospital	1 (4.2)	1 (8.3)
Urban Health Center – Type A	2 (8.3)	2 (16.7)
Rural Hospital	4 (16.7)	4 (33.3)
Rural Health Center – Type 2	11 (45.8)	0 (0)
Rural Health Center – Type 1	6 (25.0)	5 (41.7)
Number of patients referred for mental health issues in last 30 days (mean, SD)	0.17 (0.48)	0.33 (0.65)
0	21 (87.5)	9 (75.0)
1	2 (8.3)	2 (16.7)
2	1 (4.2)	1 (8.3)
Number of patients referred for suicidal thoughts in last 30 days	0.17 (0.57)	0.33 (0.65)
0	20 (83.3)	11 (91.7)
1	2 (8.3)	0 (0)
2	2 (8.3)	1 (8.3)
Number of professionals who can prescribe medications for mental health	1.7 (0.98)	3.1 (2.5)
0	1 (4.2)	0 (0)
1	8 (33.3)	4 (33.3)
2	9 (37.5)	3 (25.0)
3+	6 (25.0)	5 (41.7)

* Percentages out of total number of facilities (24).

Table 2. Availability of non-expired mental health medications at district-level warehouses and health facilities, stratified by level of health facility, and whether a given facility has specialist mental health staff, Sofala Province, Mozambique, July/August, 2014.

Medication category	Specific medication*	On Ministry of Health "essential drug" list	Lowest-level provider allowed to prescribe‡	District-level warehouse availability n (%)	Overall facility availability n (%)	Facility with specialist mental health staff n (%)	Rural Type 2 n (%)	Rural Type 1 n (%)	Urban Type A n (%)	Rural Hospital n (%)	Central Hospital n (%)
	Total			**12 (100.0)†**	**24 (100.0) †**	**12 (50.0)†**	**11 (45.8)†**	**6 (25.0)†**	**2 (8.3)†**	**4 (16.7)†**	**1 (4.2)†**
Antipsychotics	Haloperidol	Y	M.D. or Specialist	5 (41.7)	8 (33.3)	7 (58.3)	0 (0)	4 (66.7)	1 (50.0)	2 (50.0)	1 (100.0)
	Chlorpromazine	Y	M.D. or Specialist	5 (41.7)	8 (33.3)	8 (66.7)	0 (0)	3 (50.0)	1 (50.0)	3 (75.0)	1 (100.0)
	Fluphenazine	Y	M.D. or Specialist	3 (25.0)	5 (20.8)	5 (41.7)	0 (0)	2 (33.3)	1 (50.0)	1 (25.0)	1 (100.0)
	Trifluoperazine	Y	M.D. or Specialist	2 (16.7)	6 (25.0)	6 (50.0)	0 (0)	2 (33.3)	1 (50.0)	2 (50.0)	1 (100.0)
	Thioridazine	Y	M.D. or Specialist	5 (41.7)	9 (37.5)	8 (66.7)	0 (0)	3 (50.0)	2 (100.0)	4 (100.0)	0 (0)
	Risperidone	N	n/a	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Decanoate of fluphenazine	Y	M.D. or Specialist	0 (0)	4 (16.7)	4 (33.3)	0 (0)	0 (0)	1 (50.0)	2 (50.0)	1 (100.0)
Antidepressants	Amitriptyline	Y	M.D. or Specialist	10 (83.3)	12 (50.0)	9 (75.0)	2 (18.2)	5 (83.3)	2 (100.0)	2 (50.0)	1 (100.0)
	Imipramine	Y	M.D. or Specialist	3 (25.0)	7 (29.2)	7 (58.3)	0 (0)	3 (50.0)	1 (50.0)	2 (50.0)	1 (100.0)
	Maprotiline	Y	M.D. or Specialist	0 (0)	1 (4.2)	1 (8.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100.0)
	Fluoxetine	Y	M.D. or Specialist	0 (0)	1 (4.2)	1 (8.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100.0)
Benzodiazepines	Diazepam	Y	CHW	9 (75.0)	18 (75.0)	11 (91.7)	6 (54.6)	5 (83.3)	2 (100.0)	4 (100.0)	1 (100.0)
	Midazolam	N	n/a	0 (0)	1 (4.2)	1 (8.3)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100.0)
	Chlordiazepoxide	Y	Nurse	0 (0)	0 (0)	1 (8.3)	0 (0)	1 (5.6)	0 (0)	0 (0)	0 (0)
Antiepileptics and mood stabilizers	Carbamazepine	Y	M.D. or Specialist	11 (91.7)	14 (58.3)	10 (83.3)	3 (27.3)	5 (83.3)	2 (100.0)	4 (100.0)	0 (0)
	Lithium carbonate	N	n/a	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	Sodium valproate	Y	M.D. or Specialist	8 (66.7)	7 (29.2)	7 (58.3)	0 (0)	2 (33.3)	2 (100.0)	2 (50.0)	1 (100.0)
	Phenytoin	Y	M.D. or Specialist	0 (0)	2 (8.3)	2 (16.7)	0 (0)	0 (0)	0 (0)	1 (25.0)	1 (100.0)
	Phenobarbital	Y	Med. Technician	6 (50.0)	15 (62.5)	9 (75.0)	5 (45.5)	4 (66.7)	2 (100.0)	4 (100.0)	0 (0)
Anticholinergics and Antihistamines	Promethazine	Y	M.D. or Specialist	8 (66.7)	11 (45.8)	11 (91.7)	0 (0.0)	5 (83.3)	1 (50.0)	4 (100.0)	1 (100.0)
	Biperiden	Y	M.D. or Specialist	2 (16.7)	6 (25.0)	6 (50.0)	0 (0.0)	1 (16.7)	2 (100.0)	2 (50.0)	1 (100.0)
	Chlorpheniramine	Y	CHW	6 (50.0)	19 (79.2)	10 (83.3)	8 (72.7)	6 (100.0)	1 (50.0)	3 (75.0)	1 (100.0)
	Diphenhydramine	Y	CHW	8 (66.7)	17 (70.8)	11 (91.7)	5 (45.5)	6 (100.0)	2 (100.0)	4 (100.0)	0 (0)
At least one of each category				**7 (58.3)**	**11 (45.8)**	**10 (83.3)**	**0 (0)**	**5 (83.3)**	**2 (100.0)**	**3 (75.0)**	**1 (100.0)**

* Availability of medication refers to the current and un-expired availability of any formulation of medication delivery, whether tablet, injection, or other.

† Percentages are out of total number of facilities (24) for all percentages excluding the column for district-level warehouse availability, where there were 12 district warehouses surveyed. For clarification purposes, there were 24 total facilities and 12 district warehouses included in the sample. 12 of the overall 24 facilities had a trained specialist mental health staff present (either a psychiatric technician or psychiatrist). 11 of the 24 were rural type 2, 6 of the 24 were rural type 1 and so on across the other facility classifications. Rural type 2

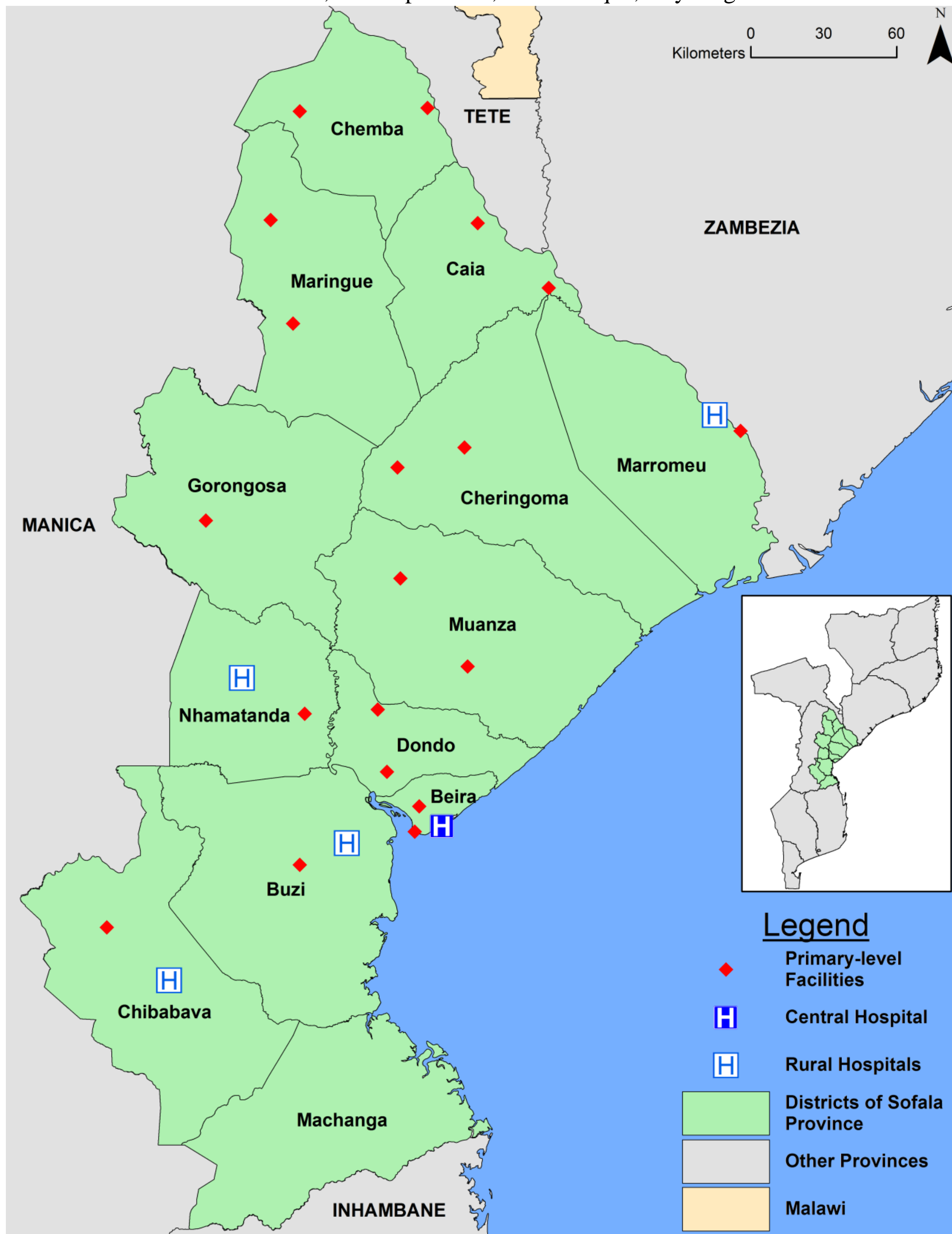
facilities serve catchment areas of 7,500-20,000 population, have an average of 4 healthcare staff, and conduct outpatient, prenatal, well-child, and maternity services. Rural type 1 facilities serve catchment areas of 16,000-35,000, have an average of 13-16 healthcare staff, and conduct outpatient, prenatal, well-child, and maternity services. Urban type A facilities serve catchment areas of 40,000-100,000, have 26-36 health staff, and conduct all main primary health care services, including x-ray capabilities, oral healthcare, emergency care including first-aid and minor surgery, and inpatient beds. Rural hospitals serve catchment areas of 150,000-900,000, have 60-100 healthcare staff, and provide specialized care including an advanced laboratory, radiology capabilities, blood banks, and major surgical wards. Central hospitals serve catchment areas of over 2 million, have a large staff of healthcare workers including specialists, and provide quaternary-level healthcare with specialized care such as neurology, cardiology, neuro-surgery, oncology, psychiatry, etc.
‡ M.D. or Specialist = Medical Doctor, Psychiatrist, or Psychiatric Technician; CHW = Community Health Worker

Table 3. Stock-outs of essential mental health medicines when drugs available at district distribution point, Sofala province, Mozambique, July/August, 2014.

Medication category	**Specific medication**	**No stock at facilities providing specialized mental healthcare when available at district level, n (%)**
	Total	**12 (50)***
Antipsychotics	Haloperidol	1 (8.3)
	Chlorpromazine	2 (16.7)
	Fluphenazine	1 (8.3)
	Trifluoperazine	0 (0)
	Thioridazine	1 (8.3)
	Risperidone	0 (0)
	Decanoate of fluphenazine	0 (0)
Antidepressants	Amitriptyline	2 (16.7)
	Imipramine	2 (16.7)
	Maprotiline	0 (0)
	Fluoxetine	0 (0)
Benzodiazepines	Diazepam	0 (0)
	Midazolam	0 (0)
	Chlordiazepoxide	0 (0)
Antiepileptics and mood stabilizers	Carbamazepine	2 (16.7)
	Lithium carbonate	0 (0)
	Sodium valproate	4 (33.3)
	Phenytoin	0 (0)
	Phenobarbital	0 (0)
Anticholinergics	Promethazine	1 (8.3)
	Biperiden	1 (8.3)
	Chlorpheniramine	0 (0)
	Diphenhydramine	0 (0)

* Percentages out of total number of facilities (24).

Figure 1. Map of health facilities assessed for availability of essential medicines for mental healthcare and referral networks, Sofala province, Mozambique, July/August 2014.



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CHAPTER 3: Health system determinants and trends of ICD-10 outpatient psychiatric consultations across Sofala, Mozambique: time-series analyses from 2012 to 2014

Title Page:

Health system determinants and trends of ICD-10 outpatient psychiatric consultations across Sofala, Mozambique: time-series analyses from 2012 to 2014

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Abstract
Background: Few peer-reviewed publications have taken a longitudinal or systems approach to mental healthcare (MH) utilization in low- and middle-income countries. We analyzed: (1) outpatient ICD-10 diagnoses over time and by gender; and (2) facility determinants of MH service utilization.

Methods: We reviewed a census of 15,856 outpatient psychiatric consultations conducted at Ministry clinics in Sofala province, Mozambique from January 2012-June 2014. Generalized estimating equations were used to model facility determinants of ICD-10 diagnoses.

Results: Across the period, 48.9% of consults were for epilepsy, 22.4% for schizophrenia/delusional disorders, and 8.8% for neurotic/stress-related disorders. The proportion of schizophrenia/delusional disorders has decreased over time (32% in 2012; 13% in 2014, p=0.003), in favor of greater diversity of diagnoses. Epilepsy has increased significantly in absolute and proportional terms. Women are more likely to present for neurotic/stress-related conditions (12.8% of consults for women, 5.7% for men, p<0.001), while men are more likely to present for substance use (1.9% for women, 6.4% for men, p<0.001). Clinics with more psychiatric technicians have a 2.1-fold (CI: 1.2, 3.6) increased rate of schizophrenia/delusional disorder diagnoses. Rural clinics saw a higher proportion of epilepsy cases and a lower proportion of organic, substance use, schizophrenia, and mood disorder cases.

Conclusions: Outpatient MH service provision is increasing in Mozambique, although currently focuses on epilepsy and schizophrenia/delusional disorders. Mid-level psychiatric providers appear to be associated with a higher proportion of schizophrenia/delusional disorder diagnoses. Due to diagnostic or utilization differences, rural clinics may be missing important cases of organic, substance use, schizophrenia, and mood disorders. Innovative diagnostic approaches are needed to balance simplicity for task-sharing and positive clinical outcomes for patients.

Keywords: Mental health services; outpatient psychiatry; health system determinants; time-trends; gender differences; Mozambique

Introduction:

With the advent of the first global burden of disease studies in the early 1990s, and the development of standardized metrics of "burden" in disability-adjusted life years (DALYs) or years lived with disability (YLDs), mental, neurological, and substance-use disorders began to be understood as a leading, if not *the* leading cause of disability worldwide [1]. This culminated in the 2001 World Health Report on global mental health, with an urgent call to increase resource allocation and service provision for mental health in primary care settings globally [2]. Over 7 years ago there appeared to be international agreement that there can be "no health without mental health" [3], yet the most updated World Health Organization (WHO) mental health atlas estimates that the average percent of health budgets allocated to mental health continues to stand at a shockingly low 0.62% in countries in the WHO African region [4, 5].

Across Sub-Saharan Africa as a whole there are few peer-reviewed studies detailing current systems profiles for mental healthcare provision, such as: 1) *who* is currently being served and *who* may be missed?; 2) *what* disorders are people presenting with and *what* are they being treated with?; 3) *where* are services currently located and *where* are the highest burden of patients located?; and 4) *how* are these systems currently organized (human resources, training programs, supply chains, financing, etc) and *how* can we target future systems improvement approaches? These foundational systems-level analyses should help inform community studies of incidence/prevalence and mental health risk factors to determine priority conditions and targeted expansion of mental healthcare systems in LMICs.

Mozambique, in particular, was recently estimated to have the 7th highest suicide rate in the world [6], yet currently only 7.2% of public health facilities offer any services for mental health, and more than half of all districts in the country contain no facility offering mental health services [7]. Given this low coverage, it is estimated that only 0.29% of the population has reliable access to basic mental health services [8]. While there has been much international discussion around implementing task-sharing approaches to scale-up care and treatment for common mental disorders in primary care settings [9–12], what literature is available has focused on testing the feasibility and efficacy of task-sharing approaches under controlled

settings [13–16]. The WHO *Mental Health Gap Action Programme* (mhGAP) aims to promote the scaling-up of prevention and treatment for mental disorders in low- and middle-income countries (LMICs) using task-sharing approaches, but the programme remains to be adapted or rolled-out in many countries, including Mozambique. The widely used mhGAP training materials [17] are not currently available in Portuguese – a barrier to adoption for most mid-level mental health providers in Mozambique.

Over a decade and a half ago the Mozambican Ministry of Health rolled-out a task-sharing approach through the development of a two-year psychiatric technician training program for graduates of at least the 10th grade. These technicians currently provide the vast majority of psychiatric services nationwide, diagnosing conditions and prescribing psychotropic medications. However, there have not been any systematic studies regarding the effectiveness of care provided by this growing and essential cadre of health workers in Mozambique.

Limited available mental health system data from Mozambique indicate that epilepsy is the leading diagnosis in outpatient consultations (53% of consultations), followed by child mental disorders (15%), and schizophrenia (14%) [7]. Regarding inpatient services, in one sample, 47% were diagnosed with schizophrenia, 31% with epilepsy or other organic disorders, and 18% with substance use. In Zambia, acute/transient psychotic states are the most common outpatient diagnosis, followed by schizophrenia, substance use, and dementia [18]. In Nigeria, 10.4% of patients attending a general outpatient clinic had a mental disorder as classified by the International Classification of Diseases and Related Health Problems, Tenth edition (ICD-10) [19], with depression being the most common at 4%, followed by generalized anxiety disorder (3%) [20].

The objective of the present study is to fill a gap in the peer-reviewed literature, aiming to: 1) detail the epidemiologic profile of mental healthcare utilization in rural and urban Mozambique; 2) analyze trends in utilization over the past two years; and 3) identify potential health system determinants of mental healthcare diagnosis and utilization, all across a census of health facilities providing mental health services in Sofala Province, Mozambique. We hope

these data can inform the scale-up of mental healthcare provision in Mozambique, as well as other similar LMIC settings.

Methods:

Study Setting

Following independence from Portugual in 1975, Mozambique began transitioning from mental healthcare mostly provided in asylums to a more decentralized community-based mental healthcare system. The first national seminar on mental health took place in 1984, highlighting the importance of: 1) decentralizing treatment facilities; 2) gathering data on the epidemiologic distribution of disorders in the country; 3) investing in human resources for mental health; 4) raising awareness about mental illness in the country; and 5) building multi-sectoral collaborations [7]. The national mental health program was formally adopted in 1990, which created the psychiatric technician training program, one of the first examples of task-sharing programs for mental health. The first cadre of 34 psychiatric technicians began service in 1996, with refresher courses rolled-out in 2005 [21].

From 1990 to 1996 the mental health care system expanded from 6 to 24 care centers nationally. Yet, the availability of services was still severely limited due to the lack of human resources, namely only one Mozambican, and two foreign psychiatrists [7]. Following the graduation of the first cadre of psychiatric technicians, outpatient psychiatric care evolved to all 11 provinces, primarily at large central or district-level referral hospitals. An additional 31 psychiatric technicians graduated in 2006, and the Ministry of Health has since offered the course every two years, graduating an average of 30 students per class with the goal of expanding psychiatric care to all districts nationally [7]. This goal is close to being met: as of 2012 there were 122 psychiatric technicians operating across 128 districts nationally [22].

Currently, Sofala province has at least one facility providing outpatient mental healthcare in 12 of 13 districts. With the exception of Beira City which houses 7 clinics, each district houses one facility with trained mental health professionals conducting routine outpatient consultations (thus, 18 total clinics providing services across the province; see Figure 2 for a map of mental health facilities). Outside of Beira City, all facilities providing mental healthcare are located at

the largest district-level facility (generally a district or rural hospital). Two separate clinics report from the Beira Central Hospital, the general psychiatric service and the child psychiatric service. In the province as a whole, as of the end of 2014, there were 14 psychiatric technicians, 2 adult psychiatrists, 1 child psychiatrist, and 11 clinical psychologists. Mental health diagnoses across all of Mozambique are made using the ICD-10 disease classification system [19].

Data sources and variables

We abstracted a census of outpatient mental healthcare utilization for all public-sector, Ministry-supported clinics in Sofala province from January 2012 – June 2014. Data are monthly aggregate counts of facility-level utilization broken down by ICD-10 code and gender. Due to changes in reporting, aggregate statistics are available for the province as a whole from January 2012 – June 2014, but facility-level data are only available from October 2012 – June 2014. Data are reported monthly at the district level, with child and adult services at Beira Central Hospital each reporting separately from other clinics in Beira City. This results in facility-level monthly data because all districts except Beira City (5 clinics reporting in Beira City) have only one health facility currently providing mental health services. For this reason, the 5 clinics in Beira City are included in provincial-level aggregate statistics but excluded for facility-level associative analyses explained below.

Data analyses

Data were analyzed in aggregate to: (1) determine overall trends in mental healthcare utilization from January 2012 – June 2014 by ICD-10 diagnostic category; and (2) to compare utilization figures by gender across this time period. For all aggregate analyses across the 18 operating MH clinics, trends and gender differences were computed for absolute differences in the number of outpatient consultations across time, as well as the proportion of outpatient consultations attributable to each ICD-10 overall diagnostic category. Prais-Winsten linear regression was used to account for autocorrelation in aggregate utilization figures by ICD-10 grouping while testing for changes across time and for gender differences in ICD-10 absolute or proportional diagnoses.

Facility-level data were used to examine health system determinants of ICD-10 outpatient psychiatric utilization from October 2012 – June 2014. We chose to use the outcome of the proportion of consultations attributable to each ICD-10 category in order to answer the question of whether patterns of outpatient mental health diagnoses/utilization differ by health facility characteristics. Available health facility characteristics included: number of yearly general outpatient consultations, rural/urban clinic location, level of health facility (primary, secondary, tertiary, quaternary), and mental health staffing (number of psychiatric technicians, psychologists, or psychiatrists). General outpatient (non-mental health) consultation data were abstracted from the national health information system (*Módulo Básico)* and estimates for 2014 were generated by doubling the first 6 months of utilization data. Rural or urban clinic location was determined by Ministry of Health official facility classifications. We abstracted the level of health facility from official Ministry of Health documents and author Cumbe, V. provided mental health staffing numbers.

We used negative binomial generalized estimating equations to model the fully-adjusted effect of each predictor simultaneously on the count of each individual ICD-10 classification group. An offset term was used equal to the natural log of the denominator of total ICD-10 consults. An exchangeable working correlation matrix and robust standard errors were used, with data clustered at the facility level. All analyses used Stata 13 and an alpha value of 0.05. Due to small numbers of diagnoses leading to instability of model estimates and difficulty in model convergence, mental health staffing variables were excluded from multivariable models for all ICD-10 diagnostic categories, save schizophrenia/delusional disorders and epilepsy.

Results:

Clinics providing mental health services had an average of 78,418 general outpatient (non-mental health) consultations per clinic from Jan 2012 – June 2014 (see Table 1). Over 55% of clinics were in rural locations (10 of 18 clinics) and the majority (67%) were primary level facilities (Table 1). Of those clinics with complete staffing information (13 of 18), 85% (11 of 13) had no psychiatrists, 69% (9 of 13) had no psychologists, and 77% (10 of 13) had one psychiatric technician.

Aggregate trends over time across all public clinics providing mental health services

Across Sofala Province, mental health services conducted 6,629 outpatient consultations in 2012, 8,522 in 2013, and 5,858 through June of 2014, representing a significant increase in total consultations (from 552 per month in 2012 to 976 in 2014, $p<0.001$); (Table 2). Absolute utilization numbers increased significantly for most ICD-10 sub-groups, except no significant change in utilization for mental and behavioral disorders due to substance use and a significant decrease for schizophrenia, schizotypal, and delusional disorders (177.4 consults per month in 2012 to 125.8 in 2014, $p=0.045$). The proportion of consults increased significantly for many ICD-10 categories, save a proportional decrease of mental and behavioral disorders due to substance use, a large proportional decrease in schizophrenia, schizotypal, and delusional disorders, and no change for mood disorders, neurotic and stress-related disorders, and mental retardation; (See Table 2 and Figure 1).

Gender comparison of distribution of ICD-10 outpatient consultations

In absolute and proportional terms, significantly more males presented at outpatient psychiatric visits for mental and behavioral disorders due to substance use, with these conditions comprising 6.4% of all consultations for men, but only 1.9% for women ($p<0.001$); (Table 3). This trend was reversed when considering neurotic, stress-related, and somatoform disorders, which comprised 12.8% of all consultations for women and only 5.7% for men ($p<0.001$).

Health system determinants of the proportional distribution of ICD-10 outpatient consultations

Controlling for other available health system determinants, larger clinics (those with more general outpatient consultations) had a 10% (CI: 18%, 3%) lower rate of diagnoses for schizophrenia, schizotypal, and delusional disorders per 10,000 increase in general outpatient consultations (Table 4). Compared to urban clinics, those clinics in rural areas had significantly lower rates of consultations for organic disorders (aRR: 0.32; CI: 0.13, 0.75), substance use disorders (aRR: 0.14; CI: 0.06, 0.30), schizophrenia and delusional disorders (aRR: 0.50; CI: 0.40, 0.63), and mood disorders (aRR: 0.22; CI: 0.07, 0.72). By contrast, rural clinics saw a 1.8-fold (CI: 1.2, 2.8) increased rate of consultations for epileptic disorders.

The level of health facility was a strong determinant of mental health systems diagnosis/utilization patterns. Compared to primary-level facilities, quaternary facilities diagnosed schizophrenia and delusional disorders at a 7.7-fold increased rate (CI: 1.3, 44.7) and mental retardation at an 11.3-fold increased rate (CI: 1.8, 71.6). On the other hand, secondary facilities diagnosed neurotic conditions at significantly decreased rates (aRR: 0.14; CI: 0.03, 0.69).

Each additional psychiatric technician was associated with a 2.1-fold (CI: 1.2, 3.6) higher rate of diagnoses for schizophrenia and delusional disorders (Table 4). In addition, each additional psychologist was associated with a 2.3-fold (CI: 1.2, 4.6) increased rate of epilepsy diagnoses.

Discussion:

This study is the first analytical assessment of trends and facility determinants of outpatient mental health diagnoses across a census of public health facilities offering outpatient services in Sofala province, Mozambique. The outpatient mental healthcare system in Mozambique is currently undergoing large-scale change. Our analyses found a rapid increase in the absolute number of outpatient consultations – almost a doubling over the past two years – likely due to the expansion of care into at least one district-level referral facility in 12 of 13 districts. While this is a major accomplishment, made possible by the increased number of trained psychiatric technicians, the majority of the population still does not have access to routine mental health services.

This expansion of mental health services away from the provincial capital of Beira City and into more rural districts has led to increased utilization and treatment, most notably for epileptic disorders. This is highlighted through a strong association between rural clinic location and a higher rate of patients seen for epilepsy. While epilepsy is not expected to be of higher incidence in rural versus urban areas, the observed relationship is likely due to a combination of epilepsy being relatively easy to diagnose during outpatient consultations, and lower utilization for other less-visible or severe mental health conditions. For instance, we also found a lower rate of consultations in rural areas for substance use disorders. Since a previous population-level

study in Mozambique found no rural/urban difference in daily drinking [23], future efforts should potentially target increased screening for alcohol-use disorders in rural areas.

Our finding that the overall number of consultations is balanced between males and females is a positive one, potentially indicating that access to outpatient mental health services is equitable by gender. Specific mental disorders may have disparate population burdens by gender, so any claims around equity of access must take a disorder-specific and population-level approach. For example, females may have disproportionately lower access to treatment for substance use disorders given previous population-level studies estimating a 2:1 male to female ratio for current drinking [23], yet we found a 3.5:1 ratio for outpatient diagnoses of substance use disorders. A similar gender difference in access, utilization, or diagnosis patterns may exist for neurotic disorders given we found a 2.1:1 female to male ratio in diagnoses. Clear next steps are to estimate population burden of specific conditions in rural and urban Mozambique to target future interventions to ensure equitable mental healthcare access.

Mood and neurotic disorders represent a very low (and not increasing) proportion of consultations, which is potentially worrisome as these conditions are hypothesized to have the highest population prevalence and disability burden in Mozambique, based on modeling studies [24]. It may be that, similar to other LMIC settings, individuals are more likely to seek care from community supports and healers rather than allopathic care for common, less severe forms of mental illness [25]. While we do not advocate the replacement of strong community supports for individuals suffering from depression, anxiety, or other common mental disorders, there are likely many individuals who could benefit from brief interventions, psychotherapy, or psychotropic treatment who are currently not identified and served by the care system. Given the setting, the implementation of easy-to-use and rapid screening tools such as the Patient Health Questionnaire-2 for depression, which is reliable in diverse primary care settings [26], could be considered. Increased identification and treatment of depression may be particularly important in Mozambique as the WHO recently estimated Mozambique to have the highest suicide rate in Africa, and the 7th highest rate worldwide [6]. While no studies exist on the proportion of suicidal behavior in Mozambique attributable to major depressive disorder or

other ICD-10-diagnosable conditions, it is likely that the expansion of formal treatment systems for these conditions could help prevent suicide and other forms of self-harm.

Across the two-year time period, we found a concerning association between psychiatric technicians serving at a facility and a higher rate of diagnoses for schizophrenia or delusional disorders. As this association remains after controlling for rural/urban status and other important system-level factors, psychiatric technicians may be in need of further situational analysis and possibly additional training and/or supervision by psychiatrists or other highly-trained specialists to ensure patients are receiving the best clinical care possible. Based on conversations with other highly-trained providers in Mozambique, many believe that schizophrenia or delirium may be currently used as a catch-all diagnosis for individuals presenting with severe non-specific symptoms such as hallucinations, psychosis, delusions, or disorganized and/or aggressive behavior. A similar association between psychologists and lower rates of schizophrenia diagnoses, but higher rates of epileptic diagnoses, remains to be well understood.

While the majority of the increase in the absolute number of consultations over the last two years has been for epilepsy, there has been a positive trend of an increased diversity of diagnoses across the ICD-10 spectrum. This increased diversity of diagnoses has paralleled a large decrease in the absolute and proportionate amount of patients seen for schizophrenia or delusional disorders. We posit that across the follow-up period, as training levels, experience, and re-training of providers have progressed, it appears as though this may have translated into more specific, and thus, more accurate and effective diagnoses.

These findings may also indicate that the use of a complex, non-overlapping, and western-developed classification systems, such as the ICD-10, should be re-evaluated. As the global mental health community recognizes the importance of cultural concepts of distress and culturally- validated tools [27], classification systems such as the ICD-10 or the Diagnostic and Statistical Manual of Mental Disorders (DSM) should undergo the same rigorous adaptation and validation processes, or potentially be replaced by locally-developed tools and systems [28, 29]. Novel classification and diagnostic systems should balance the complexity of ease-of-use by

primary care providers, or those on the receiving end of task-sharing approaches, and the importance of accurate and valid diagnoses for prevention and treatment purposes. A next step in Mozambique could be to conduct a formal evaluation of the psychiatric technician program including studies of diagnosis and treatment effectiveness under the existing ICD-10 classification system.

When interpreting findings of this study it is important to keep in mind four major limitations. First, our analyses are based on aggregate estimates within ICD-10 categories, not individual patients and thus there is potential for confounding or cross-level bias in our estimates. Yet, since our analyses and inferences are at the health facility level, rather than the level of the individual, concerns of cross-level bias should be minor. Second, the routine data system for mental health has not undergone any formal data quality audit procedures, as compared to other routine indicators in Mozambique [30], and therefore we cannot attest to the reliability or overall quality of these data. Although, a concurrent primary health care intervention [31] across the province has shown impressive and sustained increases in data quality for other routine health service indicators, with likely spill-over effects into other routine indicators [32]. Third, due to reporting issues, we are missing facility-level data for Beira City clinics, thus decreasing our sample size and potentially biasing results if these clinics are systematically different from those included in the sample. Last, given the small number of clusters (13 clinics) included in our time-series analyses and the small number of consultations for some ICD-10 categories, there was instability in some modelled estimates which necessitated exclusion of staffing variables from most ICD-10 diagnostic categories.

This study also has a number of notable strengths. Namely, these data can be considered a census of mental health outpatient consultations conducted across public-sector clinics operating in 12 of 13 districts across a province of approximately two million people [33]. Also, since these data are collected through routine data systems rather than a survey, they may be less prone to the Hawthorne effect or other reactive biases and are continuous over time [34].

Conclusion:

Outpatient mental healthcare is rapidly expanding in Mozambique, yet still remains underfunded and under-resourced relative to the estimated population burden of mental disorders nationally. Utilization is increasing, especially in rural areas, but currently mostly serves individuals with epilepsy and schizophrenia/delusional disorders. Task-sharing approaches utilizing psychiatric technicians have allowed rapid expansion of the care system, although care provided by this cadre should be reviewed to ensure evidence-based diagnostic and treatment guidelines are being followed. We also suggest a formal evaluation of the ICD-10 classification system in Mozambique and a potential transition to a system more amenable to the provision of mental healthcare in outpatient and primary care settings by non-specialized providers. Population-level surveys on the prevalence and care-seeking of common mental disorders are urgently needed to triangulate systems data with population burden to inform future efforts to expand equitable access to high-quality mental healthcare in Mozambique.

Table 1. Demographic characteristics of 14 health facilities providing outpatient mental healthcare for the period of January 2012-June 2014, Sofala Province, Mozambique.

Characteristic	**Number of clinics, n (%) unless noted**	**Number outpatient mental health consultations n (%)**
Total	***18 (100)***	***15,856* (100)***
Yearly general outpatient consults 2012-2014, Mean (SD)	78,418 (45,782)	n/a
Rural clinic location	10 (55.6)	8,869 (55.9)
Type of health facility		
Central Hospital	2 (11.1)	4,069 (25.7)
Urban Health Center – Type A	6 (33.3)	2,918 (18.4)
Rural Hospital	4 (22.2)	5,686 (35.9)
Rural Health Center – Type 2	0 (0)	0 (0)
Rural Health Center – Type 1	6 (33.3)	3,183 (20.1)
Level of health facility		
Primary	12 (66.7)	6,101 (38.5)
Secondary	4 (22.2)	5,686 (35.9)
Tertiary	0 (0)	0 (0)
Quaternary	2 (11.1)	4,069 (25.7)
Mental health staffing in 2014*		
Psychiatrists		
0	11 (61.1)	9,024 (56.9)
1	1 (5.6)	873 (5.5)
2	1 (5.6)	3,196 (20.2)
Missing (Beira City)	5 (27.8)	2,763 (17.4)
Psychologists		
0	9 (50.0)	7,882 (49.7)
1	2 (11.1)	1,142 (7.2)
2	0 (0)	2,746 (17.3)
3	2 (11.1)	1,323 (8.3)
Missing (Beira City)	5 (27.8)	2,763 (17.4)
Psychiatric technicians		
0	2 (11.1)	1,293 (8.2)
1	10 (55.6)	8,604 (54.3)
2	1 (5.6)	3,196 (20.2)
Missing (Beira City)	5 (27.8)	2,763 (17.4)

* Beira city is missing because data are reported in aggregate for all facilities.

Table 2. Change in the distribution of outpatient consultations using ICD-10 for mental disorders in Sofala, Mozambique, January 2012 – June 2014.

ICD-10 Diagnostic Category	Change in # of monthly consults β (95% CI)	p-value	Mean # monthly consults (SD)	Change in proportion of consults β (95% CI)	p-value	Mean proportion of consults (SD)
Total	**n/a**		**700.3 (195.9)**	**n/a**		**100**
Jan – Dec 2012	0 (reference)		552.4 (125.2)	n/a		100
Jan – Dec 2013	153.9 (72.7, 235.2)	<0.001	710.2 (96.4)	n/a		100
Jan – June 2014	426.0 (326.1, 525.9)	<0.001	976.3 (153.0)	n/a		100
F00-F09: Organic, including symptomatic, mental disorders			43.8 (28.7)			5.8 (3.1)
Jan – Dec 2012	0 (reference)		17.8 (11.7)	0 (reference)		3.2 (2.1)
Jan – Dec 2013	34.6 (20.7, 48.4)	<0.001	52.3 (20.7)	4.0 (1.9, 6.1)	<0.001	7.3 (2.8)
Jan – June 2014	61.0 (44.0, 78.0)	<0.001	78.7 (16.6)	4.7 (2.1, 7.2)	<0.001	8.1 (1.1)
F10-F19: Mental and behavioral disorders due to psychoactive substance use			28.9 (9.3)			4.4 (1.7)
Jan – Dec 2012	0 (reference)		29.7 (11.6)	0 (reference)		5.4 (1.8)
Jan – Dec 2013	-1.8 (-8.2, 4.6)	0.573	28.4 (7.1)	-1.4 (-2.6, -0.14)	0.003	4.1 (1.2)
Jan – June 2014	-1.7 (-9.5, 6.2)	0.665	28.3 (9.3)	-2.5 (-3.9, -1.0)	<0.001	2.9 (0.94)
F20-F29: Schizophrenia, schizotypal, and delusional disorders			145.9 (50.6)			22.4 (10.0)
Jan – Dec 2012	0 (reference)		177.4 (61.7)	0 (reference)		31.9 (8.6)
Jan – Dec 2013	-51.6 (-91.3, -11.9)	0.013	124.5 (31.2)	-11.4 (-18.8, -3.9)	0.004	17.5 (3.9)
Jan – June 2014	-49.7 (-98.3, -1.1)	0.045	125.8 (19.4)	-14.5 (-23.7, -5.3)	0.003	13.1 (2.7)
F30-F39: Mood (affective) disorders			24.3 (21.0)			3.3 (3.1)
Jan – Dec 2012	0 (reference)		12 (14.3)	0 (reference)		2.0 (2.1)
Jan – Dec 2013	19.2 (5.7, 32.8)	0.007	33.3 (25.2)	2.4 (0.36, 4.5)	0.023	4.8 (4.1)
Jan – June 2014	19.0 (2.4, 35.7)	0.026	31.0 (10.3)	1.0 (-1.5, 3.6)	0.400	3.1 (0.60)
F40-F48: Neurotic, stress-related, and somatoform disorders			61.6 (20.0)			8.8 (3.5)
Jan – Dec 2012	0 (reference)		44.5 (31.4)	0 (reference)		8.1 (4.9)
Jan – Dec 2013	24.7 (-1.6, 51.0)	0.065	69.2 (21.3)	1.6 (-2.5, 5.7)	0.438	9.7 (2.2)
Jan – June 2014	34.1 (1.9, 66.3)	0.039	80.5 (21.2)	-0.20 (-5.3, 4.9)	0.935	8.4 (2.4)

F50-F59: Behavioral syndromes associated with physiological disturbances and physical factors			11.8 (9.9)			1.6 (1.2)
Jan – Dec 2012	0 (reference)		4.0 (3.2)	0 (reference)		0.72 (0.59)
Jan – Dec 2013	13.1 (8.1, 18.2)	<0.001	16.8 (9.6)	1.6 (1.0, 2.3)	<0.001	2.3 (1.2)
Jan – June 2014	13.7 (7.5, 20.0)	<0.001	17.5 (9.8)	1.0 (0.22, 1.8)	0.015	1.7 (0.75)
F60-F69: Disorders of adult personality and behavior			4.8 (6.9)			0.58 (0.78)
Jan – Dec 2012	0 (reference)		0 (0)	0 (reference)		0 (0)
Jan – Dec 2013	7.1 (2.7, 11.5)	0.003	7.1 (6.8)	0.94 (0.41, 1.5)	0.001	0.94 (0.83)
Jan – June 2014	10.2 (4.8, 15.7)	0.001	10 (9.4)	1.0 (0.37, 1.7)	0.003	1.0 (0.79)
F70-F79: Mental retardation			17.3 (11.8)			2.4 (1.5)
Jan – Dec 2012	0 (reference)		10.2 (6.3)	0 (reference)		1.8 (1.1)
Jan – Dec 2013	11.9 (3.2, 20.7)	0.009	22.1 (12.7)	1.3 (0.20, 2.4)	0.022	3.1 (1.7)
Jan – June 2014	12.0 (1.3, 22.7)	0.029	22.2 (12.4)	0.46 (-0.88, 1.8)	0.486	2.3 (1.2)
F80-F89: Disorders of psychological development			7.2 (9.7)			0.91 (1.1)
Jan – Dec 2012	0 (reference)		0.83 (1.2)	0 (reference)		0.16 (0.23)
Jan – Dec 2013	10.2 (2.8, 17.7)	0.009	10.9 (9.9)	1.4 (0.47, 2.3)	0.004	1.5 (1.3)
Jan – June 2014	11.2 (2.1, 20.4)	0.018	12.5 (12.7)	0.98 (-0.12, 2.1)	0.079	1.2 (1.2)
F90-F98: Behavioral and emotional disorders with onset usually occurring in childhood and adolescence			7.5 (7.5)			0.95 (0.84)
Jan – Dec 2012	0 (reference)		2.7 (3.6)	0 (reference)		0.48 (0.62)
Jan – Dec 2013	6.3 (1.2, 11.4)	0.018	8.9 (7.3)	0.70 (0.06, 1.3)	0.033	1.2 (0.89)
Jan – June 2014	11.7 (5.4, 17.9)	0.001	14.3 (7.9)	0.97 (0.20, 1.8)	0.016	1.5 (0.70)
G40-41: Epilepsy and recurrent seizures			347.1 (130.6)			48.9 (7.4)
Jan – Dec 2012	0 (reference)		253.3 (65.9)	0 (reference)		46.2 (8.1)
Jan – Dec 2013	84.4 (34.4, 134.4)	0.002	336.8 (45.1)	-0.83 (-7.8, 6.1)	0.809	47.7 (5.2)
Jan – June 2014	304.1 (242.7, 365.4)	<0.001	555.5 (107.1)	9.4 (0.89, 18.0)	0.032	56.7 (4.3)

Table 3. Gender comparison of the distribution of outpatient consultations using ICD-10 for mental disorders in Sofala, Mozambique, January 2012 – June 2014.

ICD-10 Diagnostic Category	**Absolute gender difference β (95% CI)**	**p-value**	**Mean # monthly consults (SD)**	**Proportion gender difference β (95% CI)**	**p-value**	**Mean proportion of consults (SD)**
Total Male	19.8 (-73.4, 113.0)	0.671	362.8 (103.8)	n/a		100
Total Female	0 (reference)		344.7 (102.3)	n/a		100
F00-F09: Organic, including symptomatic, mental disorders						
Male	-0.12 (-16.6, 16.4)	0.988	22.3 (14.4)	-0.19 (-1.5, 1.1)	0.780	5.9 (3.3)
Female	0 (reference)		23.1 (16.9)	0 (reference)		6.0 (3.6)
F10-F19: Mental and behavioral disorders due to psychoactive substance use						
Male	15.3 (12.7, 17.8)	<0.001	21.7 (7.2)	4.5 (3.5, 5.5)	<0.001	6.4 (2.8)
Female	0 (reference)		6.4 (3.2)	0 (reference)		1.9 (0.9)
F20-F29: Schizophrenia, schizotypal, and delusional disorders						
Male	9.3 (-8.1, 26.8)	0.288	74.4 (27.0)	1.9 (-3.9, 7.6)	0.523	22.1 (10.3)
Female	0 (reference)		65.4 (24.2)	0 (reference)		20.5 (9.9)
F30-F39: Mood (affective) disorders						
Male	-4.2 (-10.6, 2.2)	0.192	10.2 (11.8)	-1.2 (-2.8, 0.30)	0.113	2.7 (3.6)
Female	0 (reference)		14.4 (10.5)	0 (reference)		4.0 (3.0)
F40-F48: Neurotic, stress-related, and somatoform disorders						
Male	-22.3 (-33.9, -10.7)	<0.001	21.1 (12.4)	-7.2 (-10.1, -4.4)	<0.001	5.7 (2.9)
Female	0 (reference)		43.7 (17.9)	0 (reference)		12.8 (5.0)
F50-F59: Behavioral syndromes associated with physiological disturbances and physical factors						
Male	1.9 (-1.7, 5.6)	0.290	7.2 (6.2)	0.47 (-0.20, 1.1)	0.163	1.9 (1.4)
Female	0 (reference)		5.2 (4.4)	0 (reference)		1.4 (1.1)
F60-F69: Disorders of adult personality and behavior						
Male	-0.48 (-3.1, 2.2)	0.718	2.4 (3.3)	-0.12 (-0.48, 0.23)	0.492	0.59 (0.76)
Female	0 (reference)		2.9 (4.0)	0 (reference)		0.71 (0.92)
F70-F79: Mental retardation						
Male	1.6 (-2.7, 5.9)	0.458	9.7 (6.7)	0.34 (-0.58, 1.3)	0.463	2.6 (1.7)
Female	0 (reference)		8.0 (6.1)	0 (reference)		2.3 (1.5)
F80-F89: Disorders of psychological development						
Male	-0.26 (-3.9, 3.4)	0.887	3.8 (5.1)	-0.13 (-0.68, 0.41)	0.631	0.93 (1.2)

Female	0 (reference)		4.1 (5.2)	0 (reference)		1.1 (1.2)
F90-F98: Behavioral and emotional disorders with onset usually occurring in childhood and adolescence						
Male	1.5 (-1.4, 4.4)	0.306	4.8 (4.3)	0.39 (-0.04, 0.83)	0.076	1.2 (1.0)
Female	0 (reference)		3.3 (4.0)	0 (reference)		0.81 (0.86)
G40-41: Epilepsy and recurrent seizures						
Male	17.5 (-64.1, 99.0)	0.669	185.2 (76.5)	1.6 (-3.9, 7.1)	0.564	50.0 (8.7)
Female	0 (reference)		168.3 (61.1)	0 (reference)		48.4 (7.2)

Table 4. Health system factors associated with the distribution of outpatient ICD-10 consultations for mental disorders in Sofala, Mozambique, October 2012 – June 2014.

Health system factor	**F00-F09 aRR* (95% CI)**	**P-value**	**F10-F19 aRR* (95% CI)**	**P-value**	**F20-F29 aRR* (95% CI)**	**P-value**	**F30-F39 aRR* (95% CI)**	**P-value**	**F40-F48 aRR* (95% CI)**	**P-value**
Num. outpatient consultations (per 10,000 increase)	1.06 (0.89, 1.24)	0.52	0.93 (0.84, 1.02)	0.13	0.90 (0.82, 0.97)	0.01	1.2 (0.88, 1.6)	0.26	1.1 (0.93, 1.3)	0.28
Rural clinic location	0.32 (0.13, 0.75)	0.009	0.14 (0.06, 0.30)	<0.001	0.50 (0.40, 0.63)	<0.001	0.22 (0.07, 0.72)	0.01	3.5 (0.82, 14.7)	0.09
Level of health facility										
Primary	1 (reference)		1 (reference)		1 (reference)		1 (reference)		1 (reference)	
Secondary	1.6 (0.46, 5.6)	0.45	0.72 (0.24, 2.2)	0.56	0.95 (0.53, 1.7)	0.85	2.1 (0.72, 6.2)	0.18	0.14 (0.03, 0.69)	0.02
Quaternary	1.5 (0.29, 8.0)	0.61	1.36 (0.48, 3.9)	0.57	7.7 (1.3, 44.7)	0.02	0.18 (0.009, 3.3)	0.24	0.59 (0.09, 3.9)	0.58
Mental health staffing†										
Psychiatrists	Excluded		Excluded		0.71 (0.25, 2.0)	0.52	Excluded		Excluded	
Psychologists	Excluded		Excluded		0.68 (0.46, 0.99)	0.05	Excluded		Excluded	
Psychiatric technicians	Excluded		Excluded		2.1 (1.2, 3.6)	0.006	Excluded		Excluded	

* All adjusted rate ratios (aRR) represent fully-adjusted coefficients adjusting for system factors simultaneously in a negative binomial regression model using generalized estimating equations and an exchangeable correlation matrix to control for facility-level correlation.

† Staffing variables are excluded from F00-F09, F10-F19, F30-F39, F40-F48, and F70-F79 models due to small sample size and instability in estimates if included.

Table 4. Continued.

Health system factor	**F70-F79 aRR* (95% CI)**	**P-value**	**G40-41 aRR* (95% CI)**	**P-value**
Num. outpatient consultations (per 10,000 increase)	1.07 (0.96, 1.2)	0.23	0.98 (0.91, 1.1)	0.56
Rural clinic location	1.2 (0.45, 3.1)	0.73	1.8 (1.2, 2.8)	0.009
Level of health facility				
Primary	1 (reference)		1 (reference)	
Secondary	0.23 (0.05, 1.01)	0.05	1.5 (0.93, 2.3)	0.10
Quaternary	11.3 (1.8, 71.6)	0.01	0.16 (0.02, 1.3)	0.09
Mental health staffing†				
Psychiatrists	Excluded		0.62 (0.27, 1.5)	0.27
Psychologists	Excluded		2.3 (1.2, 4.6)	0.01
Psychiatric technicians	Excluded		0.89 (0.58, 1.4)	0.59

* All adjusted betas (aβ) represent fully-adjusted coefficients adjusting for system factors simultaneously in a negative binomial regression model using generalized estimating equations and an exchangeable correlation matrix to control for facility-level correlation.

† Staffing variables are excluded from F00-F09, F10-F19, F30-F39, F40-F48, and F70-F79 models due to small sample sizes and instability in estimates if included.

Figure 1. Proportion of outpatient mental health consultations by ICD-10 diagnosis code in Sofala Province, Mozambique from January 2012 to June 2014.

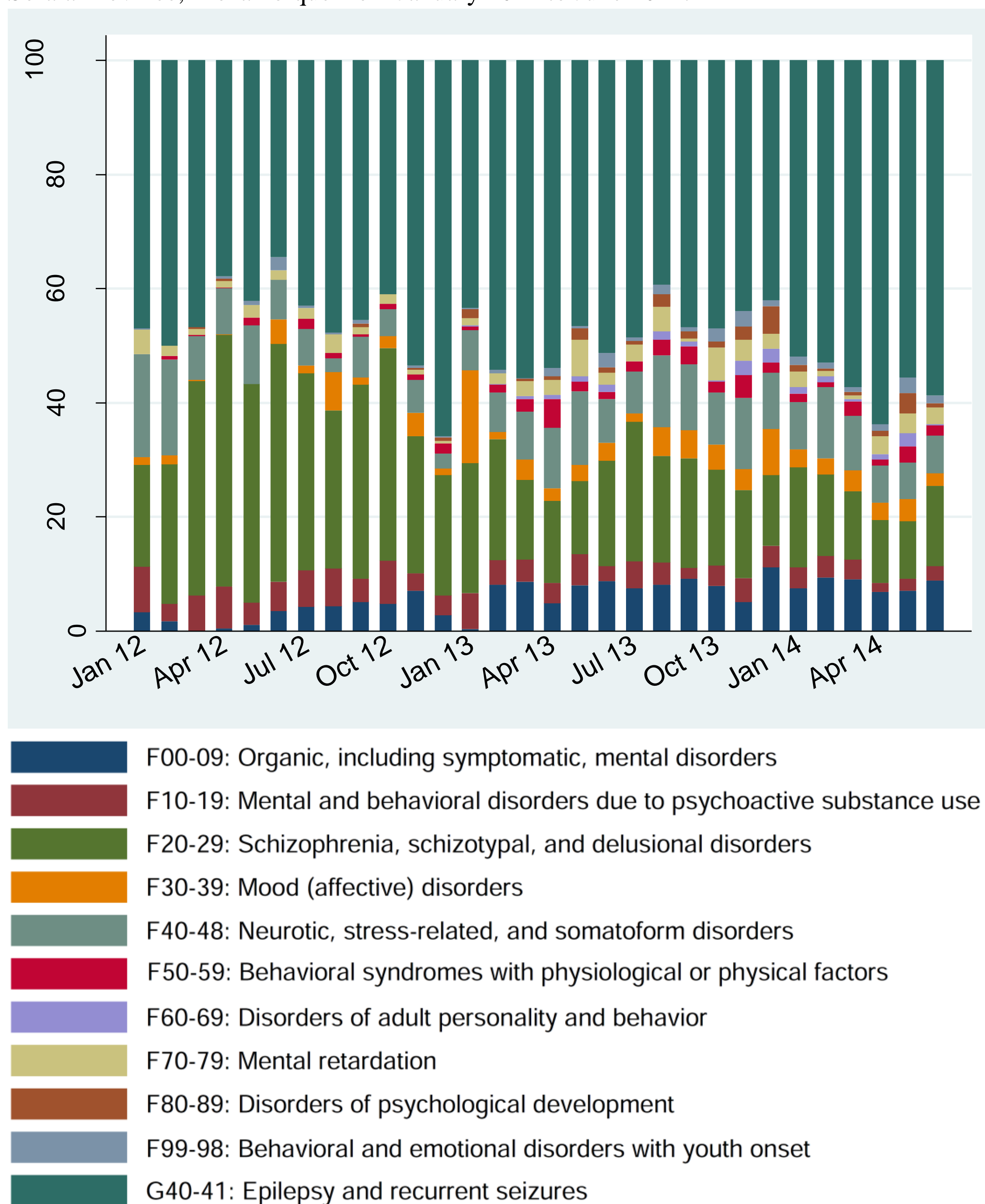
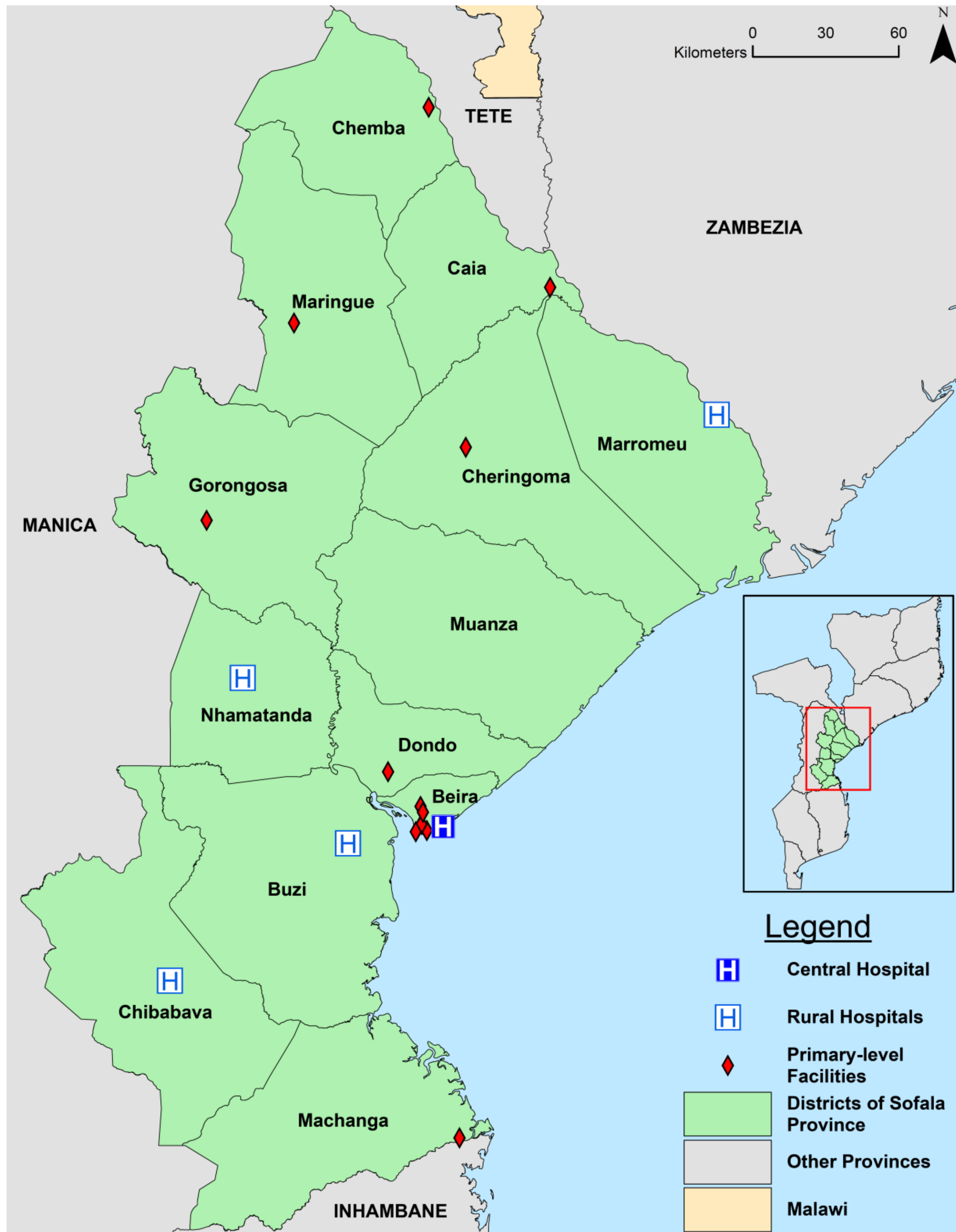


Figure 2. Map of health facilities providing outpatient mental healthcare services in Sofala Province, Mozambique, as of 2014.



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CHAPTER 4: Two years of mental healthcare service utilization in Sofala, Mozambique: who is being seen, who is at risk for common diagnoses, and are treatments following evidence-based guidelines?

Title Page:

Two years of mental healthcare service utilization in Sofala, Mozambique: who is being seen, who is at risk for common diagnoses, and are treatments following evidence-based guidelines?

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Running title: PSYCHIATRIC VISITS IN CENTRAL MOZAMBIQUE FROM 2012-2014

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Abstract

Introduction: We aimed to fill a knowledge gap on outpatient and inpatient mental health service utilization, diagnoses, and treatments provided in Mozambique.

Methods: We reviewed registry entries for 2,071 outpatient psychiatric visits from January 2012 – September 2014 and 380 inpatient records from January 2013 – September 2014 at the Beira Central Hospital in Sofala, Mozambique.

Results: The mean age of outpatient consultations was 34.7, 49.3% were female, and 14.1% were first consultations. Outpatient utilization was most common for schizophrenia (37.4% of consultations), epilepsy (15.9%), delirium (6.9%), or organic behavioral disorders (2.7%). Only 3.3% of consultations for schizophrenia were first-visit patients. Mood disorders made up only 2.4% of outpatient consultations. Women were more likely to present for mood disorders; (84.2% female, $p<0.001$), and neurotic disorders; (69.3%, $p<0.001$), but less likely to present for disorders due to substance use; (10.1%, $p<0.001$) and epilepsy; (40.5%, $p=0.002$). Typical antipsychotics (e.g., trifluoperazine, haloperidol, fluphenazine, chlorpromazine), most often paired with promethazine, dominated treatment regimens, including for behavioral disorders, dementia, alcohol or drug use, delirium, and mental retardation. Inpatients were younger, with a mean age of 30.8, and 26.1% were females; common diagnoses were delirium (34.2%), psychomotor agitation (27.4%), and behavioral disorder due to substance use (6.8%).

Discussion: Current patterns of medication usage, especially the potential overuse of typical antipsychotics and anticholinergic agents for movement side-effects, may warrant modifications to national treatment guidelines and essential drug lists. Innovative efforts are needed to broaden psychiatric care beyond severe mental disorders and few new patients entering the care system.

Introduction:

Across Mozambique, as in many other countries globally, the prevention, care, and treatment for mental disorders have been historically neglected relative to other chronic or infectious conditions. As of 2011, the Ministry of Health (MoH) in Mozambique allocated only 0.16% of the total health budget to mental health programs (1). This neglect of mental healthcare service provision occurs at the same time that mental, neurological, and substance-use disorders (MNS) are recognized as the primary drivers of disability worldwide (2), accounting for over 22% of all years lived with disability (YLD). Modeling from the 2010 Global Burden of Disease study estimates that, among those aged 15-49 years in Mozambique, mental disorders account for 23.1% of all YLD, while neurological disorders account for 4.3% (3). Mozambique bears the highest suicide rate in Africa (the 7th highest in the world) at 27.4 deaths per 100,000 population (4). In one small study of injury-related maternal deaths, 33% were due to suicide (5).

Regarding research and evidence on mental disorders nationally, no population-level measurements (6) exist on prevalence or incidence of high-burden common mental disorders of depression, anxiety, or substance use. Limited available data suggest that the prevalence of severe mental illness is high (>4%), especially in rural areas (7). Other non-representative samples have shown levels of general psychiatric symptoms as high as 63% (8), and the prevalence of PTSD as high as 66% among women living in central Mozambique five years (1997) after the end of the civil war, which lasted from 1976-1992 (9). The effects of this neglect of mental health services relative to population burden are clear: only 0.29% of the total population of approximately 25 million (10) is estimated to have access to basic mental health services (11) and there are currently only 8 Mozambican psychiatrists working in the public-sector health system. Only 7.2% of public health facilities are known to offer services for psychiatry and mental health, operating in less than half of the districts countrywide (12).

To our knowledge, no peer-reviewed studies exist assessing current mental health care-seeking, utilization, care/treatment, and mental health systems functioning in Mozambique. A 2011 report implementing the World Health Organization’s Assessment Instruments for Mental

Health Systems (WHO-AIMS) indicated that, nationally, epilepsy (53%), child mental disorders (15%), and schizophrenia (14%) were the most common outpatient psychiatric consultations, and 40% of mental health consultations were for women (12). Regarding inpatient services, 47% were diagnosed with schizophrenia, 31% with epilepsy or other organic disorders, and 18% for substance use.

Elsewhere in Sub-Saharan Africa, similar utilization patterns for allopathic mental health care utilization have been found in Zambia, with acute/transient psychotic states, schizophrenia, substance use, and dementia being the most common MNS conditions diagnosed at a tertiary mental health referral hospital (13). In Nigeria, 10.4% of patients attending a general outpatient facility had a mental disorder as classified by International Statistical Classification of Diseases and Related Health Problems, Tenth Edition (ICD-10) code (14), with depression being the most common at 4.2%, followed by generalized anxiety disorder (2.9%); however, no patients with anxiety or depression received antidepressants (15).

The objective of the present study is to address the gap in the peer-reviewed literature documenting current outpatient mental health utilization patterns, diagnoses and treatments provided, as well as the epidemiologic profile of patients presenting for mental health services in Mozambique. Current treatment patterns are compared to guidelines from the WHO mental health gap (mhGAP) evidence resource center – the preeminent group aggregating evidence on the care and treatment of mental disorders in low- and middle-income (LMIC) settings. We aim for these findings to inform the scaling-up and improvement of evidence-based mental health care in Mozambique and other similar LMICs.

Methods:

Study setting

Sofala Province, Mozambique has approximately two million inhabitants and 14 psychiatric technicians, 2 adult psychiatrists, 1 child psychiatrist, and 11 clinical psychologists providing mental health services operating out of 18 health facilities (16). 12 of 13 districts have at least one clinic providing outpatient mental healthcare services, primarily located at large central or

district-level referral hospitals. The Beira Central Hospital is one of three quaternary-level facilities in Mozambique, and provides the largest number of outpatient psychiatric consultations of any facility in Sofala Province, along with inpatient and emergency room psychiatric services. These services are staffed by 2 adult psychiatrists, 2 psychiatric technicians, and 3 clinical psychologists. All Mozambican MoH clinics use the International Classification of Diseases and Related Health Problems, Tenth edition (ICD-10) diagnostic system (14). The MoH in Mozambique has designated a total of 397 medications as essential, meaning they should be continuously available at all primary care facilities nationally (17).

Data collection, sources, and variables

We reviewed outpatient psychiatric visit registry entries for 2,071 consultations from January 2012 – September 2014 at the Beira Central Hospital. Registries are hand-written with one line per patient including: date of consultation, age, sex, visit number (first visit or 2+), narrative diagnosis or visit reason, treatments provided, and corresponding ICD-10 code. For logistics reasons, on alternating days, consultations are conducted either at the psychiatric building or the outpatient consultations center – thus, two separate registry books exist, one at each locale. We abstracted all available outpatient registry books which included: a census of all consultations conducted in 2014 at either site (1,274; 61.5% of abstracted records), and a sample of consultations conducted during 2012 (364, 17.6% of abstracted records) and 2013 (433, 20.9% of abstracted records). The sample for 2012 and 2013 included only those consultations conducted at the psychiatric building. Two trained abstractors manually entered data into Excel 2013. Inconsistencies between data abstractors and illegible handwriting were resolved by revisiting the registry and crosschecking with the psychiatrist or psychiatric technician responsible for a given entry.

A census of inpatient registry entries from January 2013 – September 2014 followed a similar procedure. Upon intake, an entry was made for each patient including: date of entry, age, sex, and provisional diagnosis. Upon discharge, principal diagnosis and date of exit were added to each registry entry. Due to >60% missingness of principal diagnosis at discharge, we abstracted provisional diagnoses assigned at intake (<4% missingness).

Data analyses

Outpatient ICD-10 diagnosis codes were analyzed by continuous age and the percent female for each grouping. Two-sample t-tests were used to compare continuous age distributions of those in each outpatient ICD-10 code to the mean age of all other ICD-10 codes. Chi-squared tests were used to test for whether outpatient ICD-10 diagnoses differed by gender; Fisher's exact tests were used if any cell was less than 5. Stata 13 was used for all statistical analyses. All tests were two-tailed and employed an alpha value of 0.05.

Outpatient narrative diagnoses were tabulated by ICD-10 codes and the four most common primary diagnoses are reported. Similar procedures as above were used to compare age and gender distributions. Treatment regimens were tabulated for each diagnosis and the three most common regimens are presented, unless there was no majority. Narrative diagnoses at inpatient intake were tabulated and the ten most common diagnoses are presented, with similar statistical analyses conducted on age and gender distributions. Mean inpatient stay length was also tabulated and is presented.

Results:

Descriptive statistics for outpatient psychiatric consultations

The mean age of outpatients was 34.7 (range: 2-90; Standard deviation [SD]: 13.1) and 49.3% (n=949) of those with complete gender information were female (Table 2). Only 14.9% (276) of consultations were first visits. Of ICD-10 groupings, the only group with no diagnoses over the follow-up period was disorders of psychological development (F80-F89); (Table 3).

The majority of outpatient consultations were patients with schizophrenia, schizotypal, and delusional disorders (F20-F29; 43.2%; n=894), followed by epilepsy and recurrent seizures (G40-G41; 12.7%; n=262), organic, including symptomatic, mental disorders (F00-F09; 9.3%; n=192), and neurotic, stress-related, and somatoform disorders (F40-F48; 4.7%; n=97); (Table 3). Of these common conditions, schizophrenia and delusional disorders had the lowest proportion of first visit consultations at 6.1% ($p<0.001$), followed by epilepsy at 11.8%

(p=0.15), organic disorders with 22.3% (p=0.004), and neurotic disorders with 25.6% (p=0.005).

Those presenting with organic mental disorders (F00-F09) were significantly older than the average patient, with a mean age of 41.9. By contrast, those presenting with mental retardation (F70-F79) and epilepsy (G40-G41) were significantly younger, with mean ages of 27.4 and 30.6, respectively. Individuals diagnosed with organic mental disorders (F00-F09), mood/affective disorders (F30-F39), and neurotic/stress-related disorders (F40-F48) were significantly more likely to be female, while those presenting for disorders due to substance use (F10-F19), behavioral syndromes associated with physiological disturbances (F50-F59), and epilepsy (G40-G41) were more likely to be male.

Specific diagnoses, age, gender, visit number, and treatments provided across ICD-10 codes

Due to the large volume of data and findings, we refer readers to Table 4 for these findings.

Psychiatric inpatient descriptive statistics and common diagnoses

The mean age of patients admitted for inpatient psychiatric services was 30.8 (Table 5) and over 73% (277) of patients were male. The mean length of inpatient stay was 19.2 days (Range: 0-110). The ten most common diagnoses for inpatients are listed in Table 6. By far the most common reasons for inpatient stays in the psychiatric unit were delirium (34.2% of all visits; n=130) and psychomotor agitation (27.4%; n=104). Individuals presenting for behavioral disorder due to substance use were significantly younger (mean age 27.0, p=0.04) than average. Those presenting with delirium, behavioral disorder due to substance use, and substance dependence were significantly more likely to be male. Mean inpatient stay length was shortest for suicide attempts at 3.5 days, and longest for stupor and psychomotor agitation at 24.5 and 24.3 days, respectively.

Discussion:

This study is the first examination of mental health service utilization in Mozambique, detailing gender and age profiles of common diagnoses by ICD-10 code, as well as typical treatment regimens among over 2,000 outpatient consultations over a 20-month period. We

found that outpatient mental healthcare utilization was primarily for severe mental illnesses, namely schizophrenia, schizotypal, or delusional disorders, which accounted for over 40% of all outpatient consultations. Schizophrenia was the single most common diagnosis, comprising almost 30% of all outpatient consultations. Of common diagnoses, schizophrenia had the lowest proportion of first-visit patients, with less than 4% of consultations being new patients. More generally, less than 14% of all outpatient consultations were for new patients. These figures are concerning as they indicate few new patients are entering the outpatient care system. As schizophrenia is not expected to have differential incidence or prevalence by gender based on cross-national studies from other settings (18,19), it is encouraging that there were no significant gender differences in utilization for schizophrenia in our sample. Additionally, overall mental health service utilization was almost perfectly balanced between genders, a positive indicator of potential equity in access to mental health services.

Following schizophrenia, epilepsy was the second most common outpatient mental health diagnosis, with patients with epilepsy being significantly younger than the average consult and more likely to be male (60% of cases were men). These data suggest that men may have a higher burden of epileptic disorders in Central Mozambique, which is not surprising as studies indicate that men may have a higher incidence of epilepsy in other sub-Saharan African countries (20). Gender differences in mental health diagnoses or utilization may be especially important for neurotic and mood disorders; these conditions were rarely diagnosed in our outpatient sample (only 4.7% and 1.9% of diagnoses, respectively), and those that were diagnosed were more likely to be female. For example, 87% of patients with a depressive episode, 73% of patients with an adjustment disorder, and all patients diagnosed with bipolar disorder were female. This yields greater than a 4:1 ratio of females to males diagnosed with depressive illness, which is surprising in contrast to most international settings where major depressive disorder prevalence is estimated at a 2:1 gender ratio (21). The elevated mean age of 40-45 years for those seen for depressive illness may indicate heterogeneity in diagnoses, care-seeking, or prevalence of depression by age – an important question for future studies.

With only 5 total cases of bipolar diagnosed of 2,071 total consultations (<0.25%) and the relatively stable population point prevalence of 0.7-1% from other settings globally (22,23), it seems likely that bipolar disorder may be routinely misdiagnosed. This could represent a major missed opportunity for suicide prevention, given that individuals with bipolar disorders are estimated to be 60 times more likely to die from suicide than the general population (24).

As expected, given the cultural climate around alcohol and drug use, males were more likely to be diagnosed with disorders related to psychoactive substance use. A previous population-level study of alcohol consumption in Mozambique found only a 2-fold higher prevalence of current alcohol drinking comparing men to women (25). The current ratio of almost 9 males for every female could be a result of either under-utilization or under-diagnosis of females with drug and alcohol-related issues due to a strong stigma against females using psychoactive substances.

In terms of treatment patterns, the typical antipsychotics of trifluoperazine, fluphenazine, decanoate of fluphenazine, haloperidol, and chlorpromazine – all of which are on the essential medication list – were the most common treatment regimens provided to patients for most types of organic disorders, as well as psychoactive substance use, schizophrenia and delusional disorders, and mental retardation. Most often, these typical antipsychotics were prescribed alongside promethazine – an unusual combination as promethazine is not a first-line treatment for prevention of extrapyramidal side-effects in high-income countries nor is it recommended in the mhGAP.

Evidence-based guidelines from the WHO mhGAP program state that anticholinergic medications should: (1) not be routinely prescribed to prevent the development of extrapyramidal side-effects; (2) only be considered for short-term use in patients with significant existing side-effects; and (3) anticholinergics should not be prescribed for long-term use among pregnant women (26). Given that a large proportion of patients treated in this setting are women of reproductive age and that promethazine is not first-line treatment for the prevention or treatment of extrapyramidal symptoms, the routine pairing of promethazine or other anticholinergic agents with typical antipsychotics should be reviewed. Moreover,

antipsychotics and anticholinergics are contraindicated in the treatment of delirium and dementia (27), with an increased mortality risk, although this was the treatment of choice in our sample. As evidence-based guidelines recommend biperden for first-line treatment of extrapyramidal side-effects (28), its availability could be prioritized and going forward it could be used in place of promethazine.

The most cost-effective treatment for schizophrenia in LMICs includes antipsychotics plus psychosocial interventions, which increase the improvement over no treatment from 15%-26% (29). Similarly, evidence-based recommendations suggest that diazepam is preferable to manage acute alcohol withdrawal, and that antipsychotics are not indicated as stand-alone treatment (30). In the present outpatient setting an increased focus on brief (5-30 minute) psychosocial interventions for substance use and schizophrenia with potential follow-up seems warranted and is supported by strong evidence from other settings (28,31).

There are many reasons why a treatment regimen not initially indicated in evidence-based guidelines would be prescribed in this setting – namely that: (1) clinicians treat patients with complex symptoms which may not always correspond to a single narrative diagnosis based in western-developed classification systems; (2) many best evidence treatments are not consistently (or ever) available across clinics in Mozambique or other similar LMICs; and (3) the reality of available financing, time, and information access to uptake recent evidence-based treatment guidelines is limited in Mozambique and other similar settings. As an example, in regards to point #1 above, the use of typical antipsychotics for individuals with a primary diagnosis of a disorder due to substance use may make sense if these patients present with comorbid psychotic symptoms. In regards to #2 above, methadone, buprenorphine, acamprosate, naloxone, and disulfiram are all indicated as evidence-based treatment to manage alcohol withdrawal or to reduce relapse among alcohol dependent patients, but none are available in the Mozambican context. Last, most mental health consultations and treatments in Mozambique are provided by psychiatric technicians, who have 2-years of training following a minimum of a 10th grade education. Many of these technicians have been practicing since 1996 with few opportunities for formal re-training as new formularies are adopted and evidence-

based guidelines change. The WHO mhGAP intervention guide aimed at ensuring mid-level and non-specialist providers follow evidence-based treatment guidelines has yet to be implemented in Mozambique or translated into Portuguese. Going forward, a formal evaluation of the psychiatric technician program, including curriculum, knowledge, and effectiveness of treatments provided should be conducted to drive improvement in quality of care.

Population-level prevalence surveys across common mental disorders should be considered an essential next step in determining how best to target the expansion of mental healthcare to ensure appropriate access and coverage across gender and age. Our data suggest that mood disorders may be an under-recognized issue for males, perhaps masked by co-morbid substance use issues. A simple potential intervention to improve case finding could be the implementation of culturally-adapted short screening instruments, such as the Patient Health Questionnaire-2 for depression, which has been shown to be reliable in diverse primary care settings (30).

Given that the treatment of schizophrenia, delusional disorders, and epilepsy commands a very large portion of the human and financial resources for mental healthcare in Mozambique, and that the majority of these consultations are patients returning for medication pick-up, administration of injectable antipsychotics or antiepileptics, and routine regimen monitoring, task-sharing approaches to engage nurses and other non-specialist providers in routine regimen management of could be very beneficial in this setting of limited mental health specialists.

It is important to keep in mind a number of limitations of this study. First, our consultation data lack a gold standard comparison diagnosis, impeding the determination of whether, for example, men are simply more likely to be diagnosed with epilepsy than women, or if more men are truly presenting with symptoms emblematic of an epileptic disorder. Second, these data are from one clinic in Mozambique, and thus may not be representative of diagnostic and treatment patterns in other areas. Last, mental health registry data have not undergone formal data quality auditing, thus the completeness and reliability are not known.

Conclusions:

Psychiatric services in Sofala, Mozambique are currently dominated by treatment for severe mental illness, most commonly for schizophrenia, epilepsy, delirium, or other organic disorders. Mood disorders, while hypothesized to have high population prevalence, are currently not well addressed by the care system. Medication use currently focuses on typical antipsychotics routinely paired with promethazine or another anticholinergic agent for most diagnoses. Some of these regimens may not be following up-to-date evidence-based guidelines, indicating that a larger review of provider knowledge and national training materials/guidelines could help ensure all patients are receiving the best possible care. Essential medicine lists could be revised to include evidence-based treatments for substance-use disorders and at least one atypical antipsychotic. Task-sharing approaches for medication administration and regimen guidance for follow-up patients with schizophrenia, delirium, or epilepsy could decrease burden on limited numbers of specialists. Systems-level assessments must be triangulated with population-based incidence and prevalence surveys to target improvement efforts. More generally, increased governmental and international resources are urgently necessary assure delivery and availability of culturally sensitive, evidence-based mental healthcare provision in Mozambique.

Table 1. Essential medicines for mental healthcare in Mozambique according to official Ministry of Health documents[17], 2010.

Medication category	**Specific essential medications**
Antipsychotics	Chlorpromazine; decanoate of fluphenazine, fluphenazine, haloperidol, thioridazine, trifluoperazine
Antidepressants	Amitriptyline; fluoxetine; imipramine; maprotiline
Benzodiazepines	Diazepam; chlordiazepoxide; flurazepam
Antiepileptics and mood stabilizers	Carbamazepine; clonazepam; phenobarbital; phenytoin; sodium valproate
Anticholinergics and Antihistamines	Biperiden; chlorpheniramine; diphenhydramine; promethazine

Table 2. Demographic characteristics of 2,071 patients seeking care from outpatient psychiatric services at Beira Central Hospital from January 2012 – September 2014.

Characteristic	**N (%) unless noted**
Age [mean (SD)]	**34.7 (13.1)**
<18	52 (2.5)
18-25	437 (21.1)
26-35	773 (37.3)
36-45	370 (17.9)
46-55	205 (9.9)
56+	163 (7.9)
Missing	71 (3.4)
Gender	
Female	949 (45.8)
Male	974 (47.0)
Missing	148 (7.2)
Visit number	
1	276 (13.3)
2+	1,575 (76.1)
Missing	220 (10.6)

Table 3. ICD-10 classification, age, gender, and first-visit percentage of 2,071 patients seeking care from outpatient psychiatric services at Beira Central Hospital from January 2012 – September 2014.

Characteristic	**N (%) unless noted**	**Mean age (SD)**	**Age p-value**	**Percent female**	**Gender p-value**	**% first visits**	**First-visit p-value**
ICD-10 Diagnosis Code							
F00-09: Organic, including symptomatic, mental disorders	192 (9.3)	41.9 (18.7)	<0.001	59.3	0.005	22.3	0.004
F10-19: Mental and behavioral disorders due to psychoactive substance use	92 (4.4)	33.3 (11.1)	0.32	10.1	<0.001	26.5	0.002
F20-29: Schizophrenia, schizotypal, and delusional disorders	894 (43.2)	34.4 (11.2)	0.50	51.7	0.07	6.1	<0.001
F30-39: Mood (affective) disorders	40 (1.9)	38.6 (13.1)	0.05	84.2	<0.001	20.0	0.39
F40-48: Neurotic, stress-related, and somatoform disorders	97 (4.7)	35.6 (10.9)	0.44	69.3	<0.001	25.6	0.005
F50-59: Behavioral syndromes associated with physiological or physical factors	23 (1.1)	35.4 (12.4)	0.78	23.8	0.019	50.0	<0.001
F60-69: Disorders of adult personality and behavior	7 (0.34)	30.8 (6.4)	0.49	50.0	1.0	0.0	1.0
F70-79: Mental retardation	40 (1.9)	27.4 (9.9)	<0.001	57.5	0.23	21.6	0.25
F80-89: Disorders of psychological development	0 (0)	n/a	n/a	n/a	n/a	n/a	n/a
F99-98: Behavioral and emotional disorders with youth onset	2 (0.10)	35 (46.7)	0.97	50.0	1.0	0.0	1.0
G40-41: Epilepsy and recurrent seizures	262 (12.7)	30.6 (12.4)	<0.001	40.5	0.004	11.8	0.15
Missing	422 (20.4)	34.8 (13.6)	0.73	46.4	0.20	24.2	<0.001

Table 4. Four most common narrative primary diagnoses by ICD-10 code along with age, gender, first-visit percentage, and common treatments provided for 2,071 patients seeking care from outpatient psychiatric services at Beira Central Hospital from January 2012 – September 2014.

ICD-10 diagnosis code (total n of 1,654 with complete ICD-10)	**Four‡ most common primary narrative diagnoses**	**N (%) of total in each ICD-10 category**	**Mean age (SD)**	**Percent female**	**% first visit**	**Most common treatment regimen (n, %)§**
F00-09: Organic, including symptomatic, mental disorders (192)	1. Organic behavioral disorder - unspecified	45 (23.4)	38.3 (16.3)	53.7	14.6	Trifluoperazine + biperiden (10, 22.2) Trifluoperazine + promethazine (6, 13.3) Chlorpromazine + promethazine (6, 13.3)
	2. Organic behavioral disorder – HIV	31 (16.2)	36.7 (12.1)	**70.0***	10.3	Fluphenazine + promethazine (6, 19.4) Trifluoperazine + promethazine (2, 9.1) Trifluoperazine (2, 9.1)
	3. Organic psychosis	22 (11.5)	37.4 (15.1)	59.1	**33.3***	Haloperidol + promethazine (5, 22.7) Trifluoperazine + promethazine (2, 9.1)
	4. Dementia	19 (9.9)	**68.0† (13.1)**	64.7	**37.5***	Chlorpromazine + promethazine (4, 21.1) Chlorpromazine (4, 21.1)
F10-19: Mental and behavioral disorders due to psychoactive substance use (92)	1. Behavioral disorder due to alcohol	22 (23.9)	**40.4* (10.8)**	**13.6†**	22.2	Chlorpromazine + promethazine (3, 13.6)
	2. Behavioral disorder due to multiple drugs	22 (23.9)	**27.5* (7.6)**	**9.5†**	**10.0†**	Fluphenazine + promethazine (5, 22.7) Chlorpromazine + promethazine (3, 13.6) Haloperidol + promethazine (3, 13.6)
	3. Alcohol dependence	18 (18.6)	37.6 (12.2)	**5.6†**	**44.4†**	None (7, 38.9) Chlorpromazine (2, 11.1)
	4. Substance dependence	10 (10.9)	31.6 (7.4)	25.0	12.5	Chlorpromazine + promethazine (2, 20.0)
F20-29: Schizophrenia, schizotypal, and delusional disorders (894)	1. Schizophrenia	617 (69.0)	34.4 (10.6)	52.9	**3.3†**	Decanoate of fluphenazine + promethazine (131, 21.2) Trifluoperazine + promethazine (62, 10.1)
	2. Delirium	114 (12.8)	35.2 (12.0)	50.5	10.5	Fluphenazine + promethazine (25, 21.9) Chlorpromazine + promethazine (20, 17.5)
	3. Persistent delirium	40 (4.5)	38.4 (14.1)	46.2	10.8	Trifluoperazine (8, 20.0) Trifluoperazine + promethazine (5, 12.5) Fluphenazine + promethazine (5, 12.5)

	4. Chronic psychosis	22 (2.5)	34.8 (11.8)	50.0	0.0	Haloperidol + promethazine (7, 31.8)
F30-39: Mood (affective) disorders (40)‡	1. Depressive episode	15 (37.5)	**44.5* (15.3)**	**86.7***	23.1	Imipramine (3, 20.0) Amitriptyline (3, 20.0)
	2. Depression	13 (32.5)	39.3 (9.4)	81.8	27.3	Amitriptyline (6, 46.2) Fluoxetine (3, 23.1)
	3. Bipolar	5 (12.5)	32.8 (4.4)	100.0	0.0	Risperidone + carbamazepine (2, 40)
F40-48: Neurotic, stress-related, and somatoform disorders (97)	1. Adjustment disorder	19 (19.6)	40.2 (7.9)	73.3	**33.3***	Amitriptyline (4, 21.1) Imipramine (3, 15.8)
	2. Neurotic disorder	14 (14.4)	34.1 (9.5)	46.2	**30.8***	Amitriptyline (4, 28.6) Fluoxetine (4, 28.6)
	3. Somatic disorder	13 (13.4)	35.2 (9.5)	46.2	**36.4***	Amitriptyline (4, 30.8)
	4. Anxiety	8 (8.3)	34.6 (9.5)	85.7	37.5	Amitriptyline (4, 50.0) Imipramine (2, 25.0)
F50-59: Behavioral syndromes associated with physiological or physical factors (23)	1. Insomnia	9 (39.1)	33.2 (15.0)	22.2	33.3	Flunitrazepam (3, 33.3) Bromazepam (2, 22.2)
	2. Sexual dysfunction	4 (17.4)	42.8 (9.6)	0.0	**100.0†**	
	3. Organic insomnia	4 (17.4)	38.3 (17.6)	66.7	25.0	Flunitrazepam (2, 50.0)
	4. Non-organic insomnia	4 (17.4)	34 (6.1)	33.3	50.0	
F60-69: Disorders of adult personality and behavior (7)‡	1. Personality disorder - general	5 (62.5)	31.3 (6.6)	60.0	0.0	
	2. Schizoid personality disorder	2 (25.0)	30 (8.5)	0.0	100.0	
F70-79: Mental retardation (40)‡	1. Mental retardation	40 (100)	**27.4† (9.9)**	59.0	21.6	Haloperidol (8, 20.0) Haloperidol + promethazine (6, 15.0)
F80-89: Disorders of psychological development (0) ‡	n/a	n/a	n/a	n/a	n/a	n/a
F99-98: Behavioral and emotional disorders with youth onset (2)‡	1. Motor hyperactivity	1 (50)	2 (n/a)	100.0	missing	Carbamazepine (1, 100.0)
	2. Tardive dyskinesia	1 (50)	68 (n/a)	0.0	0.0	Promethazine (1, 100.0)
G40-41: Epilepsy and recurrent seizures (264)‡	1. Epilepsy	262 (100)	**30.6† (12.4)**	**40.5***	11.8	Carbamazepine (167, 63.7) Phenobarbital (34, 13.0)

* $p < 0.05$

† $p < 0.001$
‡ Less than four most common narrative diagnoses are listed because there was no other majority diagnosis after those listed.
§ Top two most common treatment regimens are listed, unless a tie for second. In this case, three are listed. If a three way tie for 2nd most common treatment regimen, then only one is listed. If no majority, no treatment is listed. All medications listed are included in the essential medication list with the exception of risperidone.

Table 5. Demographic characteristics of 380 patients seeking care from inpatient psychiatric services at Beira Central Hospital from January 2013 – September 2014.

Characteristic	**N (%) unless noted**
Age, mean (SD	**30.8 (9.9)**
<18	6 (1.6)
18-25	128 (33.7)
26-35	148 (39.0)
36-45	61 (16.1)
46-55	19 (5.0)
56+	11 (2.9)
Missing	7 (1.8)
Gender	
Female	99 (26.1)
Male	277 (72.9)
Missing	4 (1.1)
Number of inpatient days, mean (SD)	19.2 (17.8)

Table 6. Ten most common diagnoses at inpatient intake along with inpatient stay length, age, and gender breakdown of 380 patients seeking care from inpatient psychiatric services at Beira Central Hospital from January 2013 – September 2014.

Ten most common diagnoses (n, %)	Mean age (SD)	Age p-value	Percent female	Gender p-value	Mean stay length in days (SD)
Delirium (130, 34.2)	31.2 (10.6)	0.65	33.9	0.01	20.2 (18.3)
Psychomotor agitation (104, 27.4)	30.4 (9.3)	0.60	21.2	0.16	24.3 (22.9)
Behavioral disorder due to substance use (26, 6.8)	27.0 (6.4)	0.04	7.7	0.03	13.6 (9.1)
Chronic or persistent psychosis (21, 5.5)	34.0 (12.3)	0.13	23.8	0.79	17.1 (12.3)
Hallucinations (19, 5.0)	31.0 (10.9)	0.95	36.8	0.29	12.9 (5.5)
Substance dependence (17, 4.5)	33.2 (8.8)	0.32	0.0	0.009	13.3 (14.3)
Psychosis (9, 2.4)	25.9 (5.7)	0.13	0.0	0.12	18.8 (6.2)
Stupor (7, 1.8)	30.3 (4.9)	0.88	14.3	0.68	24.5 (29.0)
Suicide attempt (6, 1.6)	20.8 (2.5)	0.12	50.0	0.19	3.5 (3.7)
Schizophrenia (5, 1.3)	40.0 (0)*	0.19	20.0	0.99	17 (0)*

* Age is missing for three of the five individuals; inpatient stay length missing for four of five individuals

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CHAPTER 5: Suicide attempts and deaths in Sofala, Mozambique: *who*, *where, and with what* from 2011-2014

Title Page:

Suicide attempts and deaths in Sofala, Mozambique: *who*, *where, and with what* from 2011-2014

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Abstract

Background: Mozambique was recently estimated to have the highest suicide rate in Africa.

Aims: To fill a knowledge gap on the epidemiology of emergency psychiatric visits, suicide attempts, and suicide deaths.

Methods: We reviewed a census of 898 emergency psychiatric consultations from March 2013 – July 2014 and 1,173 violent death autopsy records from June 2011 – August 2014 at Beira Central Hospital in Sofala, Mozambique.

Results: Over 65% of suicide attempts used rat poison, followed by unspecified method (19.8%), and unspecified intoxication (6.8%). Women more often presented with suicide attempt (68.3% female, $p<0.001$). The mean age of suicide deaths was 30.8 and 67.3% were male. Common suicide death methods were hanging (43.2%), unspecified substance (28.0%), or rat poison (26.3%). Common places of death were hospital or transit to hospital (46.4%), and household (35.7%). Women completing suicide were more likely to use toxic substances ($p=0.04$) and less likely to use hanging ($p=0.04$).

Discussion: Females more often present with suicide attempts, but deaths due to suicide are more often male. Females employ less lethal suicide methods, such as toxic substances, whereas males use lethal methods, such as hanging. Policies to reduce the availability and toxicity of rat poison should be considered.

Introduction:

Over 800,000 individuals globally are estimated to have died from suicide in 2012 (World Health Organization, 2014), although this number is very likely an under-estimate due to misclassification of suicide deaths (Rockett & Thomas, 1999), as well as limited coverage of vital registration (Mathers, Fat, Inoue, Rao, & Lopez, 2005) and autopsy systems (Kapusta et al., 2011) in many countries. Trends in suicide rates have shown disparate patterns globally over the past decade. While estimated suicide rates have dropped over 45% in low- and middle-income countries (LMICs) in the Western Pacific Region, rates have increased over 35% in LMICs in the African region (World Health Organization, 2014). Across all countries, there are an estimated 1.9 male suicides for every female suicide and 20 suicide attempts for each completed suicide (World Health Organization, 2014). Unfortunately, World Health Organization (WHO) member states only report suicide mortality statistics; globally there are no official or routinely-collected data on suicide attempts.

Sex ratios for completed suicide differ markedly across the world, most often attributed to differences in methods of suicidal behavior (Biddle et al., 2010; Booth, 1999; Gunnell & Eddleston, 2003; Park, Ahn, Lee, & Hong, 2014; Phillips, Li, & Zhang, 2002; Phillips, Yang, et al., 2002). Globally, women are more likely to attempt suicide, but often employ a less lethal method than males, leading to the so called “suicide paradox” whereby females are more likely to attempt suicide but males have higher rates of death due to suicide (Bertolote et al., 2005; Nock et al., 2008; Schrijvers, Bollen, & Sabbe, 2012). This is not the case in China, where females have higher rates of completed suicide than males, attributed to elevated rates of completed suicide amongst rural women using highly toxic dichlorvos and parathion organophosphate pesticides (Eyer et al., 2003; Hendin et al., 2008; Phillips, Li, et al., 2002; World Health Organization, 2014). A number of risk factors for death due to suicide have been consistently observed across countries and cultures, including: the presence of a mental disorder, family history of psychopathology, stressful life events in the past month, young or old age, low socioeconomic status, and previous suicide attempts (Phillips, Yang, et al., 2002; Vijayakumar, John, Pirkis, & Whiteford, 2005; Vijayakumar & Rajkumar, 1999; Yoshimasu,

Kiyohara, & Miyashita, 2008). Across eight diverse emergency-care settings in LMICs, self-poisoning has been identified as the primary method of attempted suicide across all locations, accounting for 69-98% of attempts. In neighboring South Africa, 71% of suicide attempts identified in the ER were female and the mean age was 21 years (Fleischmann et al., 2005).

Previous suicide prevention efforts in diverse settings have focused on: (1) reducing the availability or toxicity/danger of commonly used suicide methods such as pesticides, domestic gasoline, or handguns; (2) media interventions to ensure responsible reporting practices around suicide to limit imitation or glamorization of suicide; (3) school-based interventions around crisis-management and coping skills; and (4) ensuring positive attitudes towards suicidal patients and understanding of local idioms of distress among medical professionals (Bhana, Petersen, Baillie, Flisher, & The Mhapp Research Programme Consortium, 2010; Etzersdorfer, Vijayakumar, Schony, Grausgruber, & Sonneck, 1998; Hagaman et al., 2013; Hendin et al., 2008; Khan, 2005; World Health Organization, 2001, 2008a, 2008b). Up to 45% of individuals who die by suicide visit their primary care physician within one month of suicidal death and over 75% of suicide deaths have contact with their provider within one year of death, highlighting the missed opportunities for prevention without adequate integration of mental health and targeted suicidal screening into primary care settings (Luoma, Martin, & Pearson, 2002).

According to the 2014 WHO world suicide report, Mozambique has the 7th highest suicide rate in the world (27.4/100,000), with a rate over double the global average of 11.4 per 100,000 (World Health Organization, 2014). However, Mozambique has no published national suicide statistics, no comprehensive vital registration system, and to our knowledge, there are only two peer-reviewed publications that mention suicide. The first details that suicides made up 4.2% of deaths due to injury in Maputo City in the year 2000 (Nizamo, Meyrowitsch, Zacarias, & Konradsen, 2006), and the second indicates that, of injury-related maternal deaths from 1991-1995 in Maputo, 33% were due to suicide (Granja, Carla, Zacarias, & Bergstrom, 2002). To date, there are no peer-reviewed studies in Mozambique on the epidemiologic profile (age, gender profile, method used) regarding suicide deaths. In addition to a lack of detailed

understanding around suicide deaths in Mozambique, there are no peer-reviewed studies in Mozambique detailing the demographic and epidemiologic profile of utilization of ER psychiatric services. In northern Uganda, at established psycho-trauma centers, 45% of diagnoses were for depression, followed by epilepsy (40.3%), PTSD (37.5%), alcohol/substance use disorders (9.0%), and suicide attempts (5.2%); (Nakimuli-Mpungu et al., 2013). In the United States, ER psychiatric visits focus on stress/anxiety/depression (62%), schizophrenia/delusional/psychosis (19.5%), bipolar disorder (18.3), followed by suicidal/homicidal ideation (6.8%); (The Centers for Disease Control and Prevention, 2013).

The present study was developed to address these gaps in the mental health literature, representing the first assessment of ER psychiatric utilization by age, sex, and diagnosis, as well as analyzing deaths due to suicide and suicide methods used. We aim for these data to inform future policies and programs to improve the prevention, care, and treatment for mental disorders and suicidal behavior across Mozambique, and other similar LMIC settings.

Methods:

Study setting

Sofala Province, Mozambique has approximately two million inhabitants (United States Central Intelligence Agency, 2014a) and 14 psychiatric technicians, 2 adult psychiatrists, 1 child psychiatrist, and 11 clinical psychologists providing mental health services operating out of 18 health facilities. 12 of 13 districts have at least one clinic providing outpatient mental healthcare services, primarily located at large central or district-level referral hospitals. In the Mozambican system, psychiatric technicians can diagnose and prescribe psychotropic medications following a two-year training program in place since the first cadre graduated in 1996 (dos Santos, 2011).

The Beira Central Hospital is one of three quaternary-level specialist facilities nationwide and provides the largest number of outpatient psychiatric consultations of any facility in Sofala Province, in addition to inpatient and emergency room psychiatric services. Adult outpatient, inpatient, and emergency psychiatric services at the Beira Hospital are staffed by 2 adult psychiatrists (one Mozambican and one Cuban), 2 psychiatric technicians, and 3 clinical

psychologists. All Mozambican Ministry of Health clinics use the International Classification of Diseases, Tenth Edition (ICD-10) code (World Health Organization, 1992) system to categorize diagnoses of mental disorders.

Emergency room record review

We reviewed 898 ER psychiatric consultations, representing a census of those conducted at Beira Central Hospital in Sofala, Mozambique from March 2013 – July 2014. At intake to the ER, if the attending provider recognizes that a given patient has an issue that is psychiatric in nature, they refer the patient to the on-call psychiatric specialist (psychiatrist or psychiatric technician) to conduct a specialized psychiatric consultation. The ER psychiatric consultation registries are hand-written, bound books filled out by the psychiatric specialist at the time of consultation and include the variables of: date of consultation, age, gender, visit number (first visit or 2+ visit), and diagnosis. Two abstractors entered data into Excel 2013. Inconsistencies between data abstractors and illegible handwriting were resolved by revisiting the registry and crosschecking with the psychiatric specialist responsible for a given entry.

Legal medicine record review

We reviewed 1,173 autopsies for violent deaths, representing a census of those conducted at Beira Central Hospital legal medicine department from June 2011 – August 2014. For suicide data, two data abstractors entered data into Excel 2013, and any inconsistencies between data abstractors or illegible handwriting were resolved by revisiting the registry and/or crosschecking with the legal medicine expert responsible for the registry entry. All available variables were abstracted and included: age, sex, race, date of autopsy, location of death, and cause of death.

Statistical analyses and variable classification

ER narrative diagnoses were tabulated and two-sample t-tests were used to compare continuous age distributions of those with each narrative diagnosis to the mean age of the full sample. Chi-squared tests were used to test for gender differences among diagnoses. Fisher's exact test was used if any cell was less than 5.

Suicide death records were tabulated by suicide method, and similar procedures as above were used to compare continuous age distributions of each method (t-tests), as well as gender

differences (Chi-squared tests, or Fisher's exact). For each suicide method, the three most common places of death were tabulated. A one-sample test for proportions using the null hypothesis of 50% female and 50% male was used to test gender differences among all suicide deaths. We used Stata 13 for all statistical analyses. All tests were two-tailed with an alpha value of 0.05.

Results:

Emergency room psychiatric consultations

Of those without missing data, the mean age of ER consultations was 30.0 (SD: 11.5), 59.1% of consultations were males, and 64.5% were first visit consultations (see Table 1). A total of 149 (16.6%) records were missing data for age, 92 (10.2%) for gender, 70 (7.8) for visit number, and 30 (3.3%) were missing diagnostic information.

Common ER diagnoses were delirium (n=259, 28.8% of consultations), suicide attempt (n=162, 18.0%), psychomotor agitation (n=132, 14.7%), psychosis (n=66, 7.3%), and behavioral disorder due to psychoactive substance use (n=52, 5.8%); (see Table 2 for full list). Individuals presenting for psychomotor agitation were significantly less likely to be female (25.9% female, $p<0.001$). The most common types of psychosis were organic (n=24, 36.4% of psychosis consultations), chronic (n=17, 25.8%), and acute (n=5, 7.6%). Those presenting for behavioral disorder due to substance use were significantly less likely to be female (13% female, $p<0.001$), with the most common substances used being: poly drug use (n=24, 46.2% of substance use consultations), alcohol (n=19, 36.5%), and cannabis (n=6, 11.5%).

Intoxication by rat poison (known locally as Ratex) was by far the most common method of suicide attempt (n=107, 66.0% of attempts), followed by unspecified method (n=32, 19.8%), unspecified medication intoxication (n=11, 6.8%), and unspecified chemical intoxication (n=5, 3.1%); (see Table 2). Those presenting for a suicide attempt were significantly younger (mean age: 26.8, $p<0.001$) than the average psychiatric ER patient, and were significantly more likely to be female (68.3% female, $p<0.001$). This gender difference was most pronounced for unspecified medication intoxication, which was 81.8% female ($p=0.006$); (Table 2).

Suicide deaths from legal medicine autopsy records

Of the 1,173 autopsies for violent death conducted from June 2011 – August 2014, 777 (66.2%) were accidents, 185 (15.8%) were homicides, 118 (10.1%) were suicides, and 93 (7.9%) were deemed natural deaths (Table 3). The mean age of suicide deaths was 30.8 (SD: 15.8, Range: 11-81) and there were significantly more male deaths (n=76, 64.4% male, $p<0.001$). Seven individuals (5.9%) were missing age information and 5 (4.2%) were missing gender information.

The most common method of completed suicide was hanging (n=51, 43.2%), followed by unspecified toxic substance (n=33, 28.0%), intoxication by rat poison (n=31, 26.3%), jumping from a high place (n=2, 1.7%), and asphyxia (n=1, 0.8%); (Table 4). Men were significantly more likely to employ hanging (22.5% female, p=0.04) and women were more likely to employ using an unspecified toxic substance (46.9% female, p=0.04). The majority of deaths for toxic substance ingestion died at the hospital (54.8%-75.0%), whereas the majority who used hanging died in their household (n=31, 67.4%).

Discussion:

This study sought to understand the epidemiologic profile of ER psychiatric service utilization, suicide attempts, and suicide deaths along with common suicide methods used. We found that suicide attempts were the 2nd most common cause of emergency room psychiatric visits in Central Mozambique, following delirium. Individuals presenting for suicide attempts were predominantly young females (2.2:1 female to male ratio) who had ingested rat poison. By contrast, suicide deaths were most likely to be young males (2.1:1 male to female ratio) who had ingested a toxic substance or employed hanging. In terms of ER psychiatric utilization, the majority of individuals were first-visit patients who presented with unspecified delirium, suicide attempt, or unspecified psychomotor agitation. Our findings of a majority of first-visit psychiatric ER patients could imply that most patients are receiving necessary follow-up care at established outpatient centers, such as the outpatient psychiatric service at the Beira Central Hospital.

Our data indicate that the Mozambican suicide profile is similar to well-established "Western" suicide patterns whereby women attempt suicide at a higher rate than males, but die from suicide at lower rates due to the use of less-deadly suicide methods. Our findings are in line with a recent systematic review of suicidal behavior in African countries, finding that the most frequent methods of suicide across diverse settings are hanging and pesticide poisoning, and that men are, on average, around three times as likely to die from suicide as women(Mars, Burrows, Hjelmeland, & Gunnell, 2014). That both suicide attempts and deaths were mostly among young individuals (48% of deaths under age 26) is not necessarily surprising given the young age structure of the population in Mozambique (67% of the population is under the age of 25 (United States Central Intelligence Agency, 2014b), yet highlights the importance of targeting youth and teenagers in future suicide prevention interventions.

Given that the majority of suicide deaths follow the ingestion of a toxic substance, and that a combined 65 percent of these patients die only after reaching the hospital, the improvement of hospital treatment protocols and training of emergency provider in poisoning interventions could have a significant effect on survival rates. Additional interventions could target increased access and effectiveness of emergency transport or improved linkages and referral networks for patients at rural or peripheral facilities. Assessing and implementing strategies to manage stigma towards suicide and, more generally, individuals suffering from mental health issues among the general population and healthcare workers (Hagaman et al., 2013) may be essential to obtain more accurate reporting of suicide and suicide attempts. An additional next step for these analyses could be to conduct specific studies on death rates for suicide attempts of various methods to determine how to better improve treatment and suicide case-fatality rates. Future studies could focus on rural areas, as they may have higher rates of death from ingestion of toxic substances, either due to less access to effective treatment or the use of different suicide methods, such as fertilizer, that may have higher death rates.

Mixed-methods studies should be conducted to understand why rat poison is so frequently used and to determine other common toxic substances used for suicide attempts. Policies shown to be effective in other LMIC settings (Bhana et al., 2010; Etzersdorfer et al., 1998; Hagaman et

al., 2013; Hendin et al., 2008; Khan, 2005; World Health Organization, 2001, 2008a, 2008b) should then be adapted and tested around potential restriction of access to these common toxic substances or reformulating them to be less toxic. While it is easier to affect pesticide restriction/toxicity than restricting access to means of hanging, prevention interventions for hanging could center on changing perceptions of hanging as an easy, painless, effective, or rapid method of suicide(Biddle et al., 2010). With the well-established connection between media reporting practices and potential for "suicide contagion", efforts should additionally be directed towards policies and norms around suicide reporting in Mozambique. Case-control and other population-based epidemiologic studies should be prioritized to understand Mozambican-specific risk factors for suicide attempts or deaths. Currently, less than 1 percent of the population is estimated to have access to basic mental health services (World Health Organiation, 2011); thus, the improved integration of mental healthcare, depression/mood disorder screening, and suicide prevention into primary care could have a positive impact on rates of suicide attempts and deaths.

A major limitation of the present analyses is that our data are exclusively from one large referral hospital serving the entire northern region of Mozambique. While our data are a census of available records from this Central Hospital, we have no clear understanding of the population coverage of these suicide death data. Previous efforts to improve vital registration systems in Mozambique have often excluded violent deaths from "natural" deaths. Going forward we urge these systems to be financed and built in parallel, rather than a fragmented fashion. In the shorter term, efforts should be made to triangulate all available suicide death information to estimate population and sub-population burden. While the WHO has recently published data indicating that Mozambique has the highest suicide rate in Africa, the current low levels of vital registration, lack of effective violent cause-of-death reporting system nationally, lack of transparency in data sources used for the WHO estimates for Mozambique, and the lack of other rigorous peer-reviewed population-level suicide analyses preclude any strong statements regarding the validity of the published WHO statistics.

In terms of ER psychiatric utilization not related to suicide, most utilization was for severe mental disorders. The preponderance "delirium" and "psychomotor agitation" cases is likely related to provider difficulty in making a differential diagnosis for a first-visit patient who is agitated or delirious presenting under emergency circumstances. We postulate that the most common causes of psychomotor agitation are related to alcohol or other drug use, potentially among individuals with underlying psychiatric or neurologic conditions. This appears corroborated by the elevated male percentage presenting with psychomotor agitation. In conversations with providers in Mozambique, we understood that many patients with delirium may likely be suffering from underlying schizophrenia, psychosis, bipolar, neurological conditions such as epilepsy, or advanced infections such as sepsis or malaria. The 6.5:1 ratio of males to females presenting with substance use may be elevated given that population-level surveys of alcohol have found only a 2-fold higher prevalence of current alcohol drinking comparing men to women (Padrão et al., 2011). Rational next steps would be to conduct: (1) verbal and psychological autopsy studies to understand population burden of suicidal behavior and risk factors to target preventive interventions; (2) population-level care-seeking studies to determine if there is differential utilization of mental health services by gender or other key demographic characteristics; and (3) facility-based studies to assess and improve the reliability and validity of classification/diagnostic systems (Day, 1999), and to improve the treatment of severe mental disorders and agitation (Wilson, Pepper, Currier, Holloman, & Feifel, 2012) in emergency settings in Mozambique.

Conclusions:

The majority of suicide attempts and deaths in Sofala, Mozambique are among young individuals under the age of 30 who ingest toxic substances, with the single most common substance being rat poison. Females are more likely to attempt suicide using toxic substances, while males make up the majority of suicide deaths and are more likely than females to use hanging. Given the recent WHO publication highlighting Mozambique as having the highest suicide rate in Africa, and 7th globally, this initial systems-level study should urgently be

followed-up with larger population-based studies to determine risk factors, burden, and the epidemiologic profile of suicide attempts across Mozambique. Policies and interventions to decrease access, toxicity, and/or allure of utilizing rat poison as a suicide method should be examined concurrently. Systems-level assessments should be carried out to ensure those who attempt suicide receive optimal care given the constraints on the public-sector health system in Mozambique.

Table 1. Demographic characteristics of 898 emergency room psychiatric consultations conducted March 2013 – July 2014 at Beira Central Hospital, Sofala province, Mozambique.

Characteristic	N (%) unless noted
Age [mean (SD)]	**30.0 (11.5)**
<18	36 (4.0)
18-25	274 (30.5)
26-35	273 (30.4)
36-45	100 (11.1)
46-55	28 (3.1)
56+	38 (4.2)
Missing	149 (16.6)
Gender	
Female	330 (36.8)
Male	476 (53.0)
Missing	92 (10.2)
Visit number	
1	534 (59.5)
2+	294 (32.7)
Missing	70 (7.8)

Table 2. Ten most common diagnoses along with visit number, age, and gender breakdown of 898 patients seeking care from emergency room psychiatric services from March 2013 – July 2014 at Beira Central Hospital, Sofala province, Mozambique.

Ten most common syndromic diagnoses (n, %)*	**Mean age (SD)**	**Age p-value**	**Percent female**	**Gender p-value**	**% first visit**	**First-visit p-value**
Delirium (259, 28.8)	**29.7 (10.8)**	**0.68**	**37.5**	**0.21**	**56.6**	**0.003**
Suicide attempt (162, 18.0)	**26.8 (10.1)**	**<0.001**	**68.3**	**<0.001**	**89.5**	**<0.001**
Medication intoxication – rat poison (107, 66.0)	26.9 (9.9)	0.004	65.5	<0.001	88.0	<0.001
Suicide attempt – unspecified (32, 19.8)	27.9 (12.3)	0.33	68.8	<0.001	90.3	0.002
Medication intoxication – unspecified (11, 6.8)	24.9 (7.5)	0.16	81.8	0.006	90.0	0.11
Chemical intoxication – unspecified (5, 3.1)	21.8 (5.5)	0.15	80.0	0.17	100.0	0.17
Chemical intoxication – battery acid (3, 1.9)	All missing†	n/a	100.0	0.07	100.0	0.56
Chemical intoxication – batteries (2, 1.2)	24 (0)†	0.60	50.0	1.0	100.0	0.54
Chemical intoxication – gasoline (1, 0.62)	Missing†	n/a	100.0	1.0	100.0	1.0
Suicide attempt – hanging (1, 0.62)	36 (0)	0.60	100.0	0.41	100.0	1.0
Psychomotor agitation (132, 14.7)	**29.4 (10.3)**	**0.60**	**25.9**	**<0.001**	**47.2**	**<0.001**
Psychosis (66, 7.3)	**31.3 (12.2)**	**0.37**	**47.7**	**0.25**	**60.7**	**0.54**
Organic psychosis (24, 36.4)	31.2 (12.9)	0.61	52.2	0.27	73.7	0.40
Chronic psychosis (17, 25.8)	35.3 (14.0)	0.09	52.9	0.31	7.1	<0.001
Acute psychosis (5, 7.6)	33.8 (9.2)	0.46	40.0	1.0	100.0	0.30
Transitory psychosis (5, 7.6)	22.6 (4.0)	0.15	0.0	0.08	80.0	0.66
Reactive psychosis (4, 6.1)	41.7 (17.2)	0.08	50.0	1.0	100.0	0.56
Psychosis – unspecified (3, 4.5)	25.7 (10.5)	0.52	33.3	1.0	66.7	1.0
Organic psychosis – HIV (3, 4.5)	22.0 (7.2)	0.23	100.0	0.07	100.0	0.56
Epileptic psychosis (2, 3.0)	26.5 (2.1)	0.67	0.0	0.52	50.0	1.0
Febrile psychosis (1, 1.5)	31 (0)	0.93	0.0	1.0	100.0	1.0
Post-partum psychosis (1, 1.5)	35 (0)	0.66	100.0	n/a	0.0	0.36
Senile psychosis (1, 1.5)	Missing†	n/a	100.0	0.41	100.0	1.0
Behavioral disorder due to substance use (52, 5.8)	**28.3 (9.4)**	**0.32**	**13.0**	**<0.001**	**54.2**	**0.12**
Behavioral disorder – multiple drugs (24, 46.2)	27.9 (10.1)	0.44	10.0	0.004	52.2	0.21
Behavioral disorder – alcohol (19, 36.5)	28.9 (6.9)	0.70	22.2	0.15	56.3	0.49
Behavioral disorder – cannabis (6, 11.5)	21.8 (3.3)	0.11	0.0	0.08	50.0	0.67
Behavioral disorder – alcohol & cannabis (2, 3.8)	29 (5.7)	0.90	0.0	0.52	50.0	1.0

Behavioral disorder – alcohol & HIV (1, 1.9)	57 (0)	0.02	0.0	1.0	100.0	1.0
Hallucinations (35, 3.9)	**30.6 (8.3)**	**0.75**	**24.1**	**0.06**	**50.0**	**0.08**
Missing diagnosis (30, 3.3)	**30.8 (10.9)**	**0.72**	**32.0**	**0.36**	**74.1**	**0.41**
Behavioral disorder due to organic etiology (19, 2.1)	**38.8 (15.7)**	**<0.001**	**58.8**	**0.13**	**68.8**	**0.72**
Behavioral disorder – malaria (10, 52.6)	36.2 (18.1)	0.10	44.4	1.0	71.4	1.0
Behavioral disorder – HIV (6, 31.6)	37.2 (11.4)	0.13	100.0	0.005	50.0	0.67
Behavioral disorder – unspecified (3, 15.8)	49.7 (15.4)	0.003	0.0	0.52	100.0	0.56
Adjustment disorder (12, 1.3)	**31.1 (10.1)**	**0.77**	**75.0**	**0.02**	**91.7**	**0.07**
Epilepsy (12, 1.3)	**27.6 (7.7)**	**0.56**	**27.3**	**0.54**	**83.3**	**0.23**
Schizophrenia (12, 1.3)	**28.4 (7.8)**	**0.69**	**50.0**	**0.52**	**27.3**	**0.02**

* Percentages for sub-groupings are out of the sub-group total, not out of the total N of 898.

† Age is missing for these sub-groups

Table 3. Demographic characteristics of 118 suicide deaths from autopsies conducted June 2011 – August 2014 at Beira Central Hospital's legal medicine department, Sofala province, Mozambique.

Characteristic	N (%) unless noted
Age [mean (SD)]	**30.8 (15.8)**
<18	19 (16.1)
18-25	38 (32.2)
26-35	19 (16.1)
36-45	14 (11.9)
46-55	10 (8.5)
56+	11 (9.3)
Missing	7 (5.9)
Gender*	
Female	37 (31.4)
Male	76 (64.4)
Missing	5 (4.2)

* $P<0.001$ using one-sample test for proportion with null hypothesis of 50% female, 50% male.

Table 4. Most common suicide methods and place of death by age and gender for 118 suicide deaths from autopsies conducted June 2011 – August 2014 at Beira Central Hospital's legal medicine department, Sofala province, Mozambique.

Suicide Method (n, %)	**Mean age (SD)**	**Age p- value**	**Proportion female**	**Female p-value**	**Three most common places of death (n, %)**
Hanging (51, 43.2)	33.7 (18.2)	0.11	22.5	0.04	Household (31, 67.4) Transit to hospital (3, 6.5) In public (3, 6.5)
Toxic substance – unspecified (33, 28.0)	27.5 (13.0)	0.16	46.9	0.04	Beira Central Hospital (24, 75.0) Household (3, 9.4) In public (3, 9.4)
Medication intoxication – ratex* (31, 26.3)	29.0 (14.6)	0.47	34.5	0.82	Beira Central Hospital (17, 54.8) Household (5, 16.1) Transit to hospital (3, 9.7)
Jumped from high place (2, 1.7)	35 (2.8)	0.71	50.0	0.55	Beira Central Hospital (2, 100.0)
Asphyxia (1, 0.8)	51 (0.0)	0.20	0.0	1.0	Household (1, 100.0)

*Ratex is the locally-understood term for rat poison.

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CHAPTER 6: Conclusions

Conclusions and future research:

This dissertation is a compilation of four publishable manuscripts, as a whole attempting to improve the understanding of current public-sector mental health system activities around emergency, outpatient, and inpatient psychiatric care, as well as suicide prevention in Sofala province, Mozambique.

This work has a number of important findings. We found that public-sector mental healthcare provision is rapidly scaling-up, but is still inaccessible for most residents of Sofala. Moreover, current mental healthcare provision focuses almost exclusively on schizophrenia, other severe psychoses, epilepsy, substance-use disorders, and organic disorders of unknown cause and those related to HIV infection. Mood disorders, while hypothesized to have a high population prevalence using complicated modeling approaches from the global burden of disease [1], are not prevalent amongst patients attending outpatient, inpatient, or emergency care. This could be the result of many factors, including: (1) the cultural context of Mozambique and local conceptualizations of depression- and anxiety-like symptoms; (2) the dominance of non-biomedical care-seeking for depression or anxiety-like illness, including family members, religious leaders, traditional healers, or other local care providers [2]; (3) the possibility that providers, including primary care providers and specialists, may currently fail to recognize and accurately diagnose more common, mild cases of depression and anxiety; and/or (4) that perhaps the global burden of disease estimates, based on advanced statistical modeling approaches which fail to include a single study on any mental health disorder in model building, could be wrong.

Given our findings around the availability of mental health medications, efforts should be made to discuss findings with Ministry of Health colleagues in Mozambique to improve access to, and availability of, psychotropic medications. For example, as highlighted in the manuscript in *chapter 2*, current prescribing guidelines could be updated to reflect the reality of the lack of mental health specialists in most public-sector clinics in Mozambique. Further, consideration could be made to include risperidone on the national essential medicine list, and to streamline and focus on the consistent availability of one or

two first-line typical antipsychotics, rather than the current situation of haphazard availability of 5-6 typical antipsychotics with similar side-effect profiles.

Our systems findings in *chapter 3* on differential diagnostic patterns by provider type and training level may indicate that current classification and diagnostic systems are insufficient for the complex reality of primary mental healthcare provision and task-sharing with lower-level healthcare providers. Simplified and locally-adapted diagnostic algorithms and tools, including short screening instruments using local idioms of distress and local conceptualizations of mental ill-health [3, 4], could potentially help improve the current situation where rural clinics appear to be missing important cases of organic, substance-use schizophrenia, and mood disorders.

Patterns of outpatient and inpatient psychiatric visits from *Chapter 4* should be compared to population-level surveys using validated and locally-relevant diagnostic interviews to understand differences between population burden and biomedical care-seeking for mental ill-health documented in the present studies. These differences between facility and population-level patterns in mental disorders could then help target improved outreach around mental health care-seeking and prevention. Given that some patterns of medication usage do not follow international evidence-based guidelines, targeted updates and modifications to national treatment guidelines could be considered. Given the domination of outpatient care by few high-burden patients, task-sharing for routine medication administration and patient follow-up could help free up limited specialists to address other serious cases and engage in management, training, and coordination of non-specialist mental health workers.

Regarding the prevention and treatment of suicide, our analyses of emergency-room psychiatric visits and review of violent death autopsies can help guide policy formation, as well as future studies on suicidal behavior in Mozambique and other similar countries. Our finding that a combined 65% of deaths due to suicide die after reaching the hospital suggests that improvements in emergency transport and training of hospital providers on how to better treat toxic substance suicide attempts could have a positive effects on case fatality rates. Our observations that rat poison is by far the most common method for

attempted suicide, as well as the most common individual toxic substance used for completed suicide, can help drive future mixed-methods studies to understand why rat poison is so frequently used. These findings can also inform efforts to reduce access to rat poison or to change the formulation of available rat poison to be less toxic if ingested. We hope this first facility-based study on suicide attempts and deaths can provide a base with which to organize future population-based assessments and interventions.

Future directions

It has been twelve years since the first foundational randomized controlled trials were published showing that drug and/or psychological treatments for depression are efficacious and feasible to delivery to populations in LMICs, with examples from Chile [5], Uganda [6], and India [7]. Bolstered by mounting evidence available through the global burden of disease studies on the amount of preventable suffering caused by common mental disorders globally, the past decade has seen enormous growth in the published literature focused on the urgent need to "scale-up" and treat mental distress globally [8–11]. Authors have promoted the idea that it would cost only approximately $1.85 to $2.60 per year in LMICs to provide a basic package of mental healthcare provision.[9]

Given the proven efficacy of mental health treatments in LMICs, increasing attention should be now focused on implementation research and pragmatic trials within existing public health systems to study how to iteratively improve access to quality mental health services in LMICs. Nonetheless, few such applied systems interventions or trials exist to date. Our findings presented in this dissertation can help direct the development of additional studies using mixed-methods approaches to understand facilitators and barriers to implementing systems change, along with quality-improvement and operational research to identify bottlenecks in existing systems. In addition, given the increasing understanding that integrating care for mental ill-health alongside primary healthcare systems or care for other chronic illness can lead to great benefits in terms of health outcome, cost, and system feasibility, trials and studies to this end should be considered going forward in Mozambique. Since many of interventions implemented in real-world systems are are not amenable to randomization, quasi-experimental impact evaluation designs must be

used, with increasing focus on improving quality and use of mental health information systems for evaluating impact and progress, and to guide micro- and macro-level system decision making [12].

This dissertation represents a base of initial research on the public-sector mental healthcare system in Mozambique. These findings should be triangulated with future population-based studies of the prevalence of common mental disorders, existing care-seeking behavior and interactions between biomedical and non-biomedical care providers, local idioms of distress and cultural conceptualizations of optimal and sub-optimal mental health, along with studies to determine population burden of suicidal thoughts, death due to suicide, and risk/protective factors. Going forward, we hope these findings can help with the development and contextualization of Mozambique-specific quality improvement, implementation science, and health systems interventions and policies to improve access to quality public-sector mental healthcare for all Mozambicans.

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Education

2012- 2015 **University of Washington**, Seattle, WA
PhD – Epidemiology

2010-2012 **Emory University**, Atlanta, GA
MPH – Global Epidemiology

2004-2008 **St. Olaf College,** Northfield, MN
BA – Psychology, Focus: Neuroscience, Minor: Statistics
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Professional Positions

2014-current **Research Coordinator, Department of Global Health, Univ. of Washington, Seattle, WA**
- Providing technical support to strengthen integrated primary health care in Mozambique.
- Particular focus is building the evidence-base regarding common mental disorders to improve the integration of mental healthcare into primary care settings.
- Preparing analyses for publication in high-impact peer-reviewed journals.

2013 **Research Assistant, Department of Global Health, Univ. of Washington, Seattle, WA**
- Wrote implementation research articles on improving public-sector health systems in Mozambique.

2012–2013 **Research Assistant, Social Development Research Group, Univ. of Washington**
- Analyzed 8-year longitudinal community-randomized study of communities that care (CTC) intervention using multiple imputation and hierarchical modeling approaches.

2010–2012 **Research Assistant, Department of Epidemiology, Emory University**
- Carried out large-scale Facebook surveys of HIV/AIDS knowledge among men who have sex with men (MSM) in Africa and the United States.

2008–2010 **Community Health Educator, U.S. Peace Corps, Hina, Extreme-North, Cameroon**
- Worked two-years in rural village providing health education and support for development projects in Northern Cameroon.

2006 **Research Assistant, University of Florida, College of Medicine**
- Partnered with biostatisticians to conduct Box-Jenkins time-series analyses investigating the effects of tax increases on alcohol-related disease and mortality in Alaska.

Honors and Awards

2013-2014 **School of Public Health Endowed Award, University of Washington, $5,000**
Award given to one student (of over 1,100) at the School of Public Health based on merit.

2013 **2nd Place, UW Science and Policy Summit Poster Competition**

2012 **Selected to Participate in *Y-mind* Global Mental Health Conference, São Paulo, Brazil**
One of seven individuals selected to represent the US at all-expense-paid conference on global mental health in São Paulo, Brazil with 100 other young investigators.

2012 **Eugene J. Gangarosa Award, Emory University**
Presented to graduating student who demonstrated creative approaches to solving public health problems and who shows promise for outstanding global service.

2012 **1st Place, International Emory Global Health Institute Case Competition, $6,000**
Successfully competed against 22 national and international multi-disciplinary teams.
2012 **1st Place, Intramural Emory Global Health Institute Case Competition, $3,000**
2012 **Student Choice Award, Intramural Emory Global Health Institute Case Competition, $300**
2012 **Inducted into Delta Omega, Phi Chapter, Emory University**
National public health society representing no more than 10% of graduating students.
2007 **Gordon Allport Award, $500**
Awarded to outstanding psychology student who supports personal growth in themselves and others, an open and eclectic view of psychology, and the idea that individuals can overcome adversity by taking conscious control of their own lives.

Academic and Research Fellowships

2014-2015 **Foreign Language Area Studies Fellowship, University of Washington, $33,000**
One-year fellowship to support acquiring Portuguese skills and expertise in global mental health to aid in dissertation research on common mental disorders in Mozambique.
2010-2012 **Mary Ansley Miller Merit Fellowship, Emory University, $20,000**
Awarded to most promising student whose studies and career will result in the improvement of the quality of life among populations in developing parts of the world.
2010-2012 **Merit Research Fellowship, Emory University, $10,000**
Guaranteed funding for entirety of MPH to engage in research with faculty member(s) or organization(s) of choice. Research supervised by Patrick Sullivan, DVM, PhD, Brandon Kohrt, MD, PhD, and Saad Omer, MBBS, MPH, PhD.

Peer-Reviewed Research Articles

1. Wagenaar A.C., Maldonado-Molina M.M., & **Wagenaar B.H.** (2009). Effects of alcohol tax increases on alcohol-related disease mortality in Alaska: Time-series analyses from 1976 to 2004. *American Journal of Public Health, 99*(8), 1464-1470. doi: 10.2105/AJPH.2007.131326.
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11. **Wagenaar, B.H.**, Gimbel, S., Hoek, R., Pfeiffer, J., Michel, C., Manuel, J., Cuembelo, F., Quembo, T., Afonso, P., Gloyd, S., Sherr, K. (2014). Stock-outs of essential health products in Mozambique – Longitudinal analyses from 2011 to 2013. *Tropical Medicine & International Health.* doi: 10.1111/tmi.12314
12. Kaiser, B.N., McLean, K.E., Kohrt, B.A., Hagaman, A.K., **Wagenaar, B.H.**, Kohry, N.M., Keys, H.M. (2014). *Reflechi twòp* – Thinking too much: description of a cultural syndrome in Haiti's Central Plateau. *Culture, Medicine, and Psychiatry*. doi: 10.1007/s11013-014-9380-0
13. Fernandes, Q., **Wagenaar, B.H.**, Anselmi, L., Pfeiffer, J., Gloyd, S., Sherr, K. (2014). Effects of health systems strengthening on under-5, infant, and neonatal mortality: 10-year provincial-level time-series analyses from Mozambique. *Lancet Global Health, 2*(8), e468-e477. doi: 10.1016/S2214-109X(14)70276-1
14. McLean, K.E., Kaiser, B.N., Hagaman, A.K., **Wagenaar, B.H.**, Therosme, T.P., & Kohrt, B.A. (2015). Task sharing in rural Haiti: Qualitative assessment of a brief, structured training with and without apprenticeship supervision for community health workers. *Intervention.* doi:10.1097/WTF.0000000000000074
15. **Wagenaar, B.H.**, Sherr, K., Fernandes, Q., Wagenaar, A.C. (2015). Using routine health information systems for well-designed health evaluations in low and middle-income countries. *Health Policy & Planning. doi:* 10.1093/heapol/czv029
16. **Wagenaar, B.H.**, Gimbel, S., Hoek, R., Pfeiffer, J., Michel, C., Manuel, J., Cuembelo, F., Quembo, T., Afonso, P., Porthé, V., Gloyd, S., Sherr, K. (2015). Effects of a health information system data quality intervention on concordance in Mozambique: time-series analyses from 2009-2012. *Population Health Metrics, 13(*9). doi: doi:10.1186/s12963-015-0043-3
17. Gloppen, K.M., Brown, E.C., **Wagenaar, B.H.**, Hawkins, D. J., Rhew, I.C. (in press). Sustaining adoption of science-based prevention through communities that care. *Journal of Community Psychology.*
18. Kaiser, B.N., Kohrt, B.A., **Wagenaar, B.H.**, Kramer, M.M., McLean, K.E., Hagaman, A.K., Khoury, N.M., Keys, H.M. (in press). Scale properties of the Kreyòl Distress Idioms (KDI) screener: Association of an ethnographically-developed instrument with depression, anxiety, and sociocultural risk factors in rural Haiti. *International Journal of Culture and Mental Health.*
19. **Wagenaar, B.H.**, Stergachis, A., Hoek, R., Cumbe, V., Rao, D., Napúa, M., & Sherr, K. (in press). The availability of essential medicines for mental healthcare in Sofala, Mozambique. *Global Health Action.*

Peer-Reviewed Research Articles – Under Review

1. **Wagenaar, B.H.**, Gimbel, S., Hoek, R., Pfeiffer, J., Michel, C., Manuel, J., Cuembelo, F., Quembo, T., Afonso, P., Gloyd, S., Sherr, K. (under review). Wait and consult times for primary health care services in central Mozambique: A time-motion study. *Health Policy & Planning*.
2. **Wagenaar, B.H.,** Cumbe, V., Raunig-Berho, M., Rao, D., Kohrt, B.A., Stergachis, A., Napúa, M., & Sherr, K. (under review). Two years of mental healthcare service utilization in Sofala, Mozambique: who is being seen, who is at risk for common diagnoses, and are treatments following evidence-based guidelines? *Psychiatric Services.*
3. **Wagenaar, B.H.**, Raunig-Berho, M., Cumbe, V., Rao, D., Napúa, M., & Sherr, K. (under review). Suicide attempts and deaths in Sofala, Mozambique: *who*, *where, and with what* from 2011-2014. *Crisis: The Journal of Crisis Intervention and Suicide Prevention.*
4. **Wagenaar, B.H.**, Cumbe, V., Raunig-Berho, M., Rao, D., Napúa, M., Hughes, J., & Sherr, K. (under review). Health system determinants and trends of ICD-10 outpatient psychiatric consultations across Sofala, Mozambique: time-series analyses from 2012 to 2014. *BMC Psychiatry.*
5. Gimbel, S., Hoek, R., **Wagenaar, B.H.**, Michel, C., Pio, A., Karagianis, M., Cuembelo, F., Macuacua, F., Gremu, A., Manuel, J.L., Pfeiffer, J., Gloyd, S., & Sherr, K. (submitted). Sustaining effective data quality audits in resource-limited settings: the example of Sofala Province, Mozambique 2009-2013. *Bulletin of the World Health Organization*.
6. Rustagi, A.S., Henley, C., **Wagenaar, B.H**., Sherr, K. (submitted). Six- and 12-month loss to follow-up rates among initial implementation of Option B+ programs: a systematic review. *Journal of Acquired Immune Deficiency Syndromes*.

Conference Presentations - Oral

1. **Wagenaar, B.H.** (2013). Explanatory models, care seeking, and associated factors of depression and suicide in rural Haiti. *Y-mind Conference*, Sao Paulo, Brazil.
2. **Wagenaar, B.H.**, Gimbel, S., Hoek, R., Pfeiffer, J., Michel, C., Manuela, J., Cuembelo, F., Quembo, T., Afonso, P., Gloyd, S., Sherr, K. (2014). Stock-outs of essential health products in Sofala Province, 2011-2013. *Ministry of Health Regional Health Conference: Better Decision Making Using Data.* Beira, Mozambique.
3. **Wagenaar, B.H.,** Cumbe, V., Raunig-Berho, M., Rao, D., Kohrt, B.A., Stergachis, A., Napúa, M., & Sherr, K. (2015). Outpatient and inpatient psychiatric consultations in Sofala, Mozambique: gender, age, and treatments provided from 2012-2014. *International Mental Health Congress*, Lille, France.
4. **Wagenaar, B.H.**, Raunig-Berho, M., Cumbe, V., Rao, D., Napúa, M., & Sherr, K. (2015). Suicide attempts and deaths in Sofala, Mozambique: *who*, *where, and with what* from 2011-2014. *International Mental Health Congress*, Lille, France.

Conference Presentations - Poster

1. **Wagenaar, B.H.**, Thornblad, S.C., & Luithly, P. (2008). Adolescents develop tolerance to the sedating effects of alcohol more rapidly than adult mice. *National Conference on Undergraduate Research (NCUR).* Salisbury, MD.
2. Rocklage, M., **Wagenaar, B.H.**, Andersen, R., Fiebelkorn, B., Johnson, A., Gilbertson-Wilke, N., Hertel, A., Dickinson, S. (2008). Perceptions of normative drinking habits: responsible behavior and negative consequences. *Minnesota Undergraduate Psychology Conference (MUPC)*. St. Paul, MN.
3. **Wagenaar, B.H.** & Sullivan, P.S. (2011). HIV knowledge and associated factors in American and African Men who have Sex with Men (MSM). *Scholars in Action Research Symposium.* Rollins School of Public Health, Atlanta, GA.
4. **Wagenaar, B.H.** & Sullivan, P.S. (2011). HIV knowledge and associated factors in American and African men who have Sex with Men (MSM). *Destination Public Health.* Rollins School of Public Health, Atlanta, GA.
5. **Wagenaar, B.H.**, Hagaman, A.K., McLean, K. (2011). *Nou bezwen anpil chitas:* Exploring mental health in rural Haiti. *Global Field Experience Presentations*. Rollins School of Public Health, Atlanta, GA.
6. **Wagenaar, B.H.**, Hagaman, A.K., McLean, K., Pope, B., Nguyen, M., Etheart, M., Fullard, B., & Kohrt, B.A. (2011). *Nou bezwen anpil chitas:* Exploring mental health in rural Haiti. *Global Health Institute Research Symposium*. Rollins School of Public Health, Atlanta, GA.
7. **Wagenaar, B.H.** (2013). Explantory models, care seeking, and associated factors of depression and suicide in rural Haiti. *3rd Annual Science and Policy Summit*. University of Washington, Seattle, WA.
8. Gloppen, K.M., Brown, E.C., **Wagenaar, B.H.**, Hawkins, D., Rhew, I. (2014). Sustaining Adoption of Science-Based Prevention: Long-Term Effects of Communities That Care. *Symposium Paper: Society for Social Work and Research (SSWR) Conference.* San Antonio, TX.
9. **Wagenaar, B.H.**, Gimbel, S., Hoek, R., Pfeiffer, J., Michel, C., Manuel, J., Cuembelo, F., Quembo, T., Afonso, P., Gloyd, S., Sherr, K. (2014). Stock-outs of Essential Health Products in Mozambique – Analyses from 2011 to 2013. *The Global Healthies*. University of Washington, Seattle, WA.
10. **Wagenaar, B.H.**, Sherr, K., Fernandes, Q., Wagenaar, A.C. (2014). Using routine health information systems for well-designed health evaluations in low and middle-income countries. *Society for Epidemiologic Research (SER)*. Seattle, WA.
11. Gloppen, K.M., Brown, E.C., **Wagenaar, B.H.**, Hawkins, D., Rhew, I. (2014). Sustaining Adoption of Science-Based Prevention: Long-Term Effects of Communities That Care. *Society for Prevention Research (SPR) Annual Meeting,* Washington, DC.
12. Hoek, R., Michel, C., Afonso, P., Quembo, T., Cuembelo, F., **Wagenaar, B.H.**, Pio, A., Manuel, J., Sherr, K. (2014). Improving quality and use of routine HIS data in Sofala, Mozambique. *Health Systems Global*, Cape Town, South Africa.
13. Gimbel, S., Rustagi, A.S., **Wagenaar, B.H.**, Coutinho, M.J., Nduati, R., Wariua, G., Gloyd, S., Kouyate, S., Cumbelo, M., Sherr, K. (2014). Evaluating quality-improvement processes and strategies: Experiences from central Mozambique. *Health Systems Global*, Cape Town, South Africa.

14. Rustagi, A.S., Henley, C., **Wagenaar, B.H.**, Sherr, K. (upcoming - 2015). Six- and 12-month loss to follow-up among early implementation of Option B+: a systematic review. *International AIDS Society.* Vancouver, Canada

Popular-Press Articles (Newspapers, Magazines, Blogs, Podcasts)

1. Wagenaar, B.H. (2014). Officially, over 2 million children under-5 don't exist in Mozambique. *The Healthy Newborn Network*. Available: http://bit.ly/15GIdF4
2. Wagenaar, B.H., Mosites, E.M., Wagner, A. (2014-2015). The curious epidemiologist: A podcast. Available: http://bit.ly/1F3vOr6

Invited Lectures

1. **Wagenaar, B.H.,** Hagaman, A.K. (2011). Global mental health: Haiti case study. *Invited lecture for Dr. Stan Foster's Introduction to Global Health Class (GH501)*. Rollins School of Public Health, Atlanta, GA.
2. **Wagenaar, B.H.** (2011). *Invited panelist on water and sanitation in Haiti for Dr. Christine Moe's Water and Sanitation in Developing Countries Class (GH529).* Rollins School of Public Health, Atlanta, GA.
3. **Wagenaar, B.H.**, Collender, P.A. (2011). *Invited lecture on ecology of malaria in Sub-Saharan Africa for Dr. Justin Remais' Environmental Determinants of Infectious Disease Class (EHS 750).* Rollins School of Public Health, Atlanta, GA.
4. **Wagenaar, B.H.** (2014). The why and how of using administrative data in low- and middle-income countries (LMICs): data quality / validation. *Invited guest lecture for Dr. Kenneth Sherr's Doctoral-level Methods Lab of GH541*. University of Washington's School of Public Health, Seattle, WA.
5. **Wagenaar, B.H.** (2015). The why and how of using administrative data in low- and middle-income countries (LMICs): data quality / validation. *Invited guest lecture for Dr. Kenneth Sherr's Doctoral-level Methods Lab of GH541*. University of Washington's School of Public Health, Seattle, WA.
6. **Wagenaar, B.H.** (2015). Advocacy and action for suicide prevention among farmers: lessons from India, Mozambique, and the United States. *Invited panelist for UW Program on Global Mental Health panel discussion and reception*. Seattle, WA.
7. **Wagenaar, B.H.** (2015). Introduction to Global Mental Health. *Invited guest lecture for Mary Coucoules' Women's Health Course*. Seattle Pacific University, Seattle, WA

Grants and Research Funding

2014-2015 PI: Kenneth Sherr $39,668 ONGOING
Royalty Research Fund Grant, supported by the University of Washington
"Prevalence, risk/protective factors, care seeking, and local context for common mental disorders in Mozambique"
Will be first to collect foundational mixed-methods data on common mental disorders and suicidal behavior in Mozambique, while also developing a locally-relevant screening tool for use in epidemiologic monitoring and delivery of mental healthcare.
Role: Key Personnel; Study Manager

2014 PI: Bradley Wagenaar $4,000 COMPLETED
Global Opportunities for Health Grant, supported by the University of Washington
"An Epidemiologic Assessment of Mental Health Systems Functioning in Sofala Province, Mozambique"
Research grant to support dissertation research around availability of psychotropic medications, current diagnosis and treatment patterns around mental disorders, and deaths due to suicide in Sofala Province, Mozambique.

2011 PI: Bradley Wagenaar $2,500 COMPLETED
CFAR Micro Grant, supported by the Emory Center for AIDS Research
"Size Estimation / Piloting Combination HIV Intervention among MSM in Malawi"
Provided technical support and coordination on USAID funded feasibility study of a combination HIV/AIDS intervention/prevention strategy and respondent driven sampling (RDS) size estimation for men who have sex with men (MSM).

2011 PI: Bonnie Fullard $12,000 COMPLETED
Global Health Institute Team Scholars Award, supported by Emory Rollins School of Public Health
"Developing a Culturally Competent Mental Health Intervention"
Developed curriculum to empower community health workers, priests, traditional healers, NGOs, community groups, teachers, and families to address depression, anxiety, local idioms of distress, and functional impairment in their communities.

Role: Co-investigator

2011 PI: Bradley Wagenaar $1,900 COMPLETED
Global Field Experience Scholars Award, supported by Emory Rollins School of Public Health
"Prevalence, Risk Factors, and Care Seeking for Mental Health Disorders"
Measured prevalence, risk factors, care seeking, and perceptions of causes of depression/suicide, anxiety, local idioms of distress, and functional impairment using household epidemiologic survey.

2006-2008 PI: Bradley Wagenaar $6,000 COMPLETED
Center for Interdisciplinary Research Award, supported by St. Olaf College
"Undergraduate Statistics Fellow Program"
Research conducted with diverse faculty providing statistical consulting support from designing research studies through all stages of analyses to dissemination.

2007 PI: Bradley Wagenaar $5,000 COMPLETED
Howard Hughes Medical Institute International Research Award, supported by St. Olaf College
"Screening Potential Antifolate Drugs for Effectiveness"
Screened new malaria drugs for effectiveness at inhibiting DHFR malarial enzyme while tracking drug-resistant mutations. Conducted radioactive/fluorescence labeling studying the mechanism and migration of calcium ATPase in the malaria parasite.

Referee and Editorial Experience

Peer Reviewer: *Bulletin of the World Health Organization* (2013, 2014)
Journal of Immigrant and Minority Health (2014)
Int. Journal of STD & AIDS (2014)
Health Education Journal (2014)
Global Health Action (2014)

Leadership & Service

2014-2015 **Curriculum Committee Representative, Department of Epidemiology, Univ. of Washington**
- Elected by student body to serve as full voting member to review existing/future courses and academic rules.

2011–2012 **Global Epidemiology Department Representative, Emory Rollins School of Public Health**
- Elected by student body to act as liaison between faculty and students. Organized diverse functions to build rapport between faculty and students, directed mentorship program for first-year MPH students, and represented department for prospective students.

2008 **Affordable Housing Volunteer, Bike & Build**
- Biked 4,000 miles from Jacksonville, FL to San Francisco, CA raising money and awareness for the affordable housing crisis in the United States.

2006–2008 **Captain of Club Ultimate Frisbee Team, St. Olaf College**
2004–2005 **TRiO Youth Mentor, St. Olaf College**

Teaching

2015 **Teaching Associate:** *Global Health Doctoral Seminar (GH 580),* School of Public Health, University of Washington
2013 **Teaching Assistant:** *Epidemiologic Data Analysis (EPI 510),* Stephen Hawes, PhD, School of Public Health, University of Washington
2011–2012 **Teaching Assistant:** *Evidence-Based Strategic Planning (GH 542),* Stanley Foster, MD, MPH, Rollins School of Public Health, Emory University
2011 **Teaching Assistant:** *Global Health Challenges and Opportunities (GH 501),* Deborah A. McFarland, MPH, PhD, Rollins School of Public Health, Emory University
2007 **Teaching Assistant:** *Statistical Modeling,* Julie Legler, PhD, St. Olaf College
2006–2007 **Preceptor:** *Introductory Psychology Lab*, St. Olaf College

Professional Memberships

2011 –ongoing Delta Omega, Phi Chapter

2007 –ongoing Phi Beta Kappa
2007 –ongoing Psi Chi

Languages

French, proficient spoken and intermediate proficiency written language
Haitian Creole, intermediate proficiency spoken language
Fulfulde, low proficiency spoken language
Portuguese, low oral/written proficiency

Skills

Statistical packages: SAS, Stata, SPSS, Minitab, Epiinfo, NORM
Geographic Information Systems: ArcGIS
Certifications: Interpersonal psychotherapy level-A certification; HIV counseling, testing, and referral; AIRE-1 avalanche safety