

Mental Health in Sub-Saharan Africa

Harvard University Effective Altruism Student Group

Philanthropy Advisory Fellowship Report

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For Child Relief International

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Executive Summary

Mental health, as defined by the World Health Organization, is “a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.”¹

Although traditionally mental health has not been considered an immediate cause for concern in Sub-Saharan Africa, it is increasingly receiving more attention as the extent in which people suffer from various disorders has become apparent. As such, within this report, our team seeks to quantify and analyze the burden of mental health disorders in the region, focusing on total disability-adjusted life years (DALYs) from the 2013 Global Burden of Disease Study. Identifying depressive disorders as being the top contributor to total DALYs related to mental health in Sub-Saharan Africa, we dive into promising interventions such as Psychoeducation, Cognitive Behavioral Therapy, Module-Based Treatment, and Crisis Assistance and attempt to estimate their cost-effectiveness. To understand their potential impact, a cost-effectiveness comparison of mental health to sanitation is detailed. Based on research and interviews, we provide information on various organizations operating in Sub-Saharan Africa within the mental health field. Based on our analysis on not only the organizations but also on the mental health landscape in Sub-Saharan Africa as a whole, we provide three specific recommendations for investment consideration, the Alderman Foundation, AEGIS Foundation, and Network for Empowerment and Progressive Initiative, as these organizations show potential in leadership, scalability, cost-effectiveness of programs, and proven success. Finally, we then seek to hone in on current research opportunities related to depressive disorders and other similar mental health areas of concern. The research areas we recommend are: propranolol for PTSD, trace lithium for suicide, and computer-based CBT for anxiety/depression.

Supplemental Resources

Research spreadsheet: Problems, Interventions, Experts, and Organizations

https://docs.google.com/spreadsheets/d/1iX5wDxeH_NFRmu-uGlhQ-ghaF-D3i7Vbuw5tK_0lpgs/edit?usp=sharing

Trace lithium literature review:

https://docs.google.com/spreadsheets/d/1uQUu-fnBVw3QsA_PQI8DzSp6qlySRgy85j3mb92_AWI/edit?usp=sharing

¹ http://www.who.int/features/factfiles/mental_health/en/

The Problem

Size of Problem

To quantify the magnitude of mental health across the world, researchers have relied on the Global Burden of Disease Study, specifically the calculation of disability-adjusted life years (DALYs). DALYs are essentially the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for people living with the health condition or its consequences.² Therefore, to understand the impact of mental health as compared to other diseases, one can look at related DALYs.

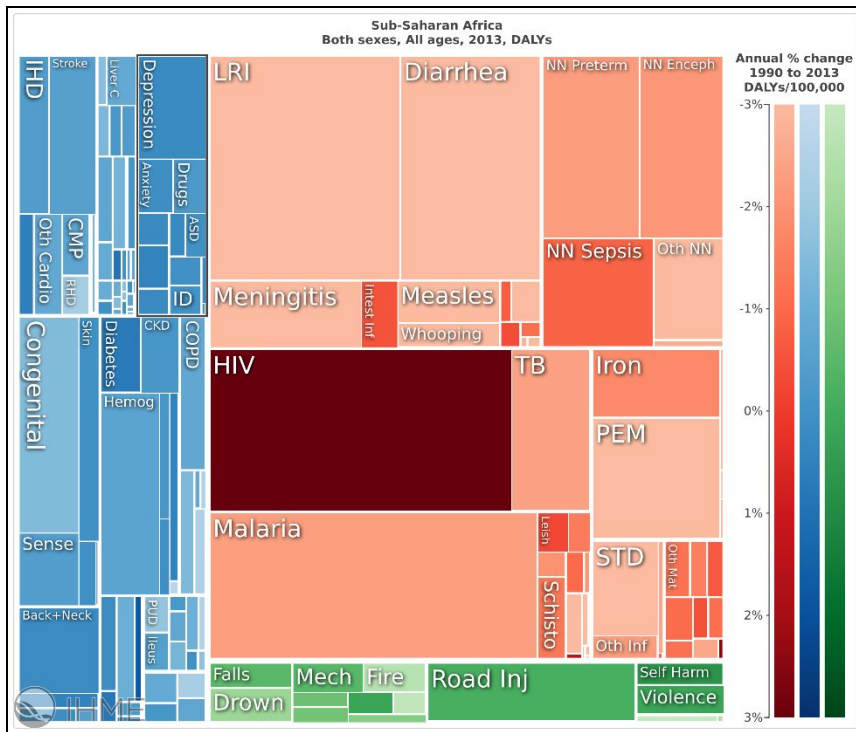
Of the total DALYs for Sub-Saharan Africa for 2013 (all ages, all sexes) at 554,262,341, mental and substance use disorders account for 21,490,540 (approximately 4 percent). The breakdown of the burden for Sub-Saharan Africa is as follows:

| Mental and Substance Use Disorder | DALYS |
|--|--------------|
| Schizophrenia | 1,237,783 |
| Alcohol use disorders | 1,644,871 |
| Drug use disorders | 2,148,901 |
| Opioid use disorders | 711,682 |
| Cocaine use disorders | 67,017 |
| Amphetamine use disorders | 192,260 |
| Cannabis use disorders | 28,458 |
| Other drug use disorders | 1,149,483 |
| Depressive disorders | 8,524,467 |
| Major depressive disorder | 7,660,183 |
| Dysthymia | 864,284 |
| Bipolar disorder | 1,024,784 |
| Anxiety disorders | 2,363,886 |
| Eating disorders | 231,065 |
| Anorexia nervosa | 38,052 |
| Bulimia nervosa | 193,013 |
| Autistic spectrum disorders | 1,080,142 |
| Autism | 682,691 |
| Asperger syndrome | 397,452 |
| Attention-deficit/hyperactivity disorder | 79,838 |
| Conduct disorder | 1,153,976 |

² http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/

| | |
|--|-------------------|
| Idiopathic intellectual disability | 1,157,431 |
| Other mental and substance use disorders | 843,396 |
| Total | 21,490,540 |

To further comprehend the scale of related disorders to others in the region, below is a graphical comparison as compiled by the Global Burden of Disease Study (see mental health section boxed in the upper-left corner).



It is important to note that “self-harm” is reported outside of the scope of the mental and substance use disorders. For the 2013 study, self-harm was reported at 2,414,509 DALYs and 50,325 Deaths for Sub-Saharan Africa. Deaths from mental and substance use disorders was reported at 40,115.

While the Global Burden of Disease Study has been widely accepted as an appropriate measuring tool for determining the impact of mental and substance use disorders, the Study is not without flaw in calculating the true burden. According to a recent study, the burden of mental illness is actually underestimated by more than a third using current approaches.³ They believe this underestimation is from: “overlap between psychiatric and neurological disorders; the grouping of suicide and self-harm as a separate category; conflation of all chronic pain syndromes with musculoskeletal disorders; exclusion of personality disorders from disease burden calculations; and inadequate consideration of the contribution of severe mental illness to

³ “Estimating the true global burden of mental illness.” Vigo, Daniel et al. The Lancet Psychiatry , Volume 3 , Issue 2 , 171 - 178.

mortality from associated causes.” Using their adjustment, a more accurate picture of the burden of mental health and substance abuse in Sub-Saharan Africa would be 6-8% of total DALY’s instead of 4%. Therefore, mental health is a pressing and growing issue in Sub-Saharan Africa as more research and insight into its true burden is revealed.

Problem Focus: Depression

As indicated in the breakdown of mental and substance use disorders, depressive disorders has the largest burden of disease in regards to total DALYs in Sub-Saharan Africa. Depressive disorders can be further divided into major depressive disorder and dysthymia (“A chronic depression of mood, lasting at least several years, which is not sufficiently severe, or in which individual episodes are not sufficiently prolonged, to justify a diagnosis of severe, moderate, or mild recurrent depressive disorder”⁴), with major depressive disorder having a substantially higher burden. Nevertheless, as countries within Sub-Saharan Africa are not uniform, it is key to understand the burden on an individual basis. Below is the detail on the DALYs per 100,000 people for each country of interest (as preselected). DALYs per 100,000 people were used for comparison to take into account differences in population size.

| DALYS per 100,000 people | | | |
|--------------------------|----------------------|-----------|---------------------------|
| Country | Depressive disorders | Dysthymia | Major depressive disorder |
| Rwanda | 1,165 | 95 | 1,070 |
| Uganda | 1,148 | 84 | 1,063 |
| Kenya | 1,147 | 98 | 1,049 |
| Botswana | 1,012 | 110 | 902 |
| Tanzania | 1,089 | 93 | 996 |
| Namibia | 999 | 109 | 891 |
| Togo | 928 | 97 | 831 |
| Mali | 763 | 86 | 677 |
| Liberia | 750 | 95 | 655 |

As shown in the table, Rwanda appears to have the largest burden of disease from depressive disorders as compared to the other countries. To further dive into depressive disorders as it relates to postpartum depression in women (as preselected), additional analysis is needed to determine the number of women affected by the disease.

⁴ <http://apps.who.int/classifications/icd10/browse/2015/en#/F34.1>

| Country | Female Population 2015 (15-49) (thousands) | Survey | Percentage Never Giving Birth (45-49) | Total Females 15-49 Ever Giving Birth (thousands) | Estimate 5% Prevalence Postpartum Depression (thousands) | Estimate 10% Prevalence Postpartum Depression (thousands) | Estimate 15% Prevalence Postpartum Depression (thousands) | Estimate 20% Prevalence Postpartum Depression (thousands) |
|----------|--|-------------|---------------------------------------|---|--|---|---|---|
| Rwanda | 2,982 | 2013 MIS | 1.5 | 2,937 | 147 | 294 | 441 | 587 |
| Uganda | 8,699 | 2011 DHS | 3.4 | 8,403 | 420 | 840 | 1,260 | 1,681 |
| Kenya | 11,175 | 2014 DHS | 1.9 | 10,963 | 548 | 1,096 | 1,644 | 2,193 |
| Botswana | 628 | 1988 DHS | 3.2 | 608 | 30 | 61 | 91 | 122 |
| Tanzania | 12,306 | 2011-12 AIS | 3.5 | 11,875 | 594 | 1,188 | 1,781 | 2,375 |
| Namibia | 654 | 2013 DHS | 4.6 | 624 | 31 | 62 | 94 | 125 |
| Togo | 1,785 | 2013-14 DHS | 2.1 | 1,748 | 87 | 175 | 262 | 350 |
| Mali | 3,846 | 2012-13 DHS | 2.2 | 3,761 | 188 | 376 | 564 | 752 |
| Liberia | 1,060 | 2013 DHS | 0.5 | 1,055 | 53 | 105 | 158 | 211 |

Assumptions:

Female Population: United Nations Department of Economic and Social Affairs, Population Division World Population Prospects (2015) for women aged 15 to 49 years.

Percentage Never Giving Birth (45-49): StatComplier (DHS Program, USAID)

Total Females (15-49) Ever Giving Birth: Estimation from Female Population and Percentage Never Giving Birth (45-49)

Prevalence of Postpartum Depression: After analyzing various studies on postpartum depression in Sub-Saharan Africa, prevalence appears to expand across a wide range, without an agreed upon percentage. Therefore, we conducted a sensitivity analysis to estimate the number of women in each country. As postpartum depression in the United States is reported at approximately 10 percent, we assume this is a fair estimate for further calculations within this report.

As shown in the table, postpartum depression appears to affect more women in Tanzania and Kenya on an absolute basis at approximately 1,100,000. Therefore, an intervention to target postpartum depression in one of these countries would seem to have the greatest potential impact. Nevertheless, an intervention in any of the listed countries is clearly needed based on the calculated affected population.

Tractability

Examination of potential intervention strategies revealed numerous techniques demonstrating effectiveness within Sub-Saharan Africa (SSA). The majority of interventions considered focus on improving awareness and knowledge related to mental health issues, and target symptoms associated with depression. Additional mental health issues addressed include anxiety and anxiety-based concerns, relational distress, suicidality, and conduct related behaviors.

Promising Interventions

Psychoeducation

While all cognitive behavioral strategies will presumably include psychoeducation within their intervention introduction, one intervention considered relied solely on psychoeducation-based concepts. This intervention relied on a two-session psychoeducation strategy, targeting parents of children (mean age 12.3 years, 60.8% female) in Burundi who had been screened for elevated psychosocial distress (Jordans, Tol, Ndayisaba, & Komproe, 2013). The first session aimed at increasing dialogue and understanding of problems affecting children (i.e., alcoholism of parents, maltreatment, gang-formation), as well as of ways of communicating with children. The second session focused on advising parents how to manage their children's problems (i.e., setting limits, promote school attendance), specifically aiming to correct maladaptive disciplining strategies (e.g., instructions to avoid harsh corporal punishment). These groups were led by two lay community counselors, providing psychoeducation to 58 parents (97 associated children). A statistically significant difference was demonstrated between intervention group and control group for mean change scores on aggression, which comprised a significant reduction of aggression in the intervention group and a significant increase in the control group ($p < .001$). This mean difference represented a moderate effect size ($d = 0.60$). The majority of the parents (93.3%) reported to be quite or very satisfied with the received intervention. This was reinforced by their reflections on what they learned from the intervention.

Cognitive Behavioral Therapy

Cognitive Behavioral Therapy (CBT) is a well-recognized, evidence-based treatment effective in addressing a multitude of mental health concerns. In low- and middle-income countries (LAMICS), the standard treatment protocol is often adapted to meet the socio-cultural needs of the context. Culturally adapted CBT strategies have been used within SSA to address general distress and depression-related symptoms. Targeting depression aligns with its increased prevalence rates, ranging from 33 to 45.5% in samples of poor, rural or peri-urban-based individuals, which is around four times higher than the estimated prevalence of 7-12% in high-income countries. CBT treatment has shown utility in SSA both when administered as individual interventions and in a group-administered format, with treatment length ranging from 7-16 sessions (Vally & Maggott, 2015). The majority of CBT treatment interventions in SSA were delivered within the context of primary healthcare centers by trained mental health professionals or within the community by well-trained lay community workers. When considering the effectiveness of treating depression through CBT interventions, as assessed by the BDI or HADS, the pooled effect size was quite large ($d=1.12$) and statistically significant.

Module-Based Treatment

Within SSA, two separate module-based treatment strategies were identified, including a Classroom-Based Psychosocial Intervention (CBI) and a Stepped Care Intervention (SCI). Modular treatments rely on protocolized interventions, which may guide interactions on a per session or task-specific basis.

CBI is a school based psychosocial intervention with aims to reduce distress and increase resilience and empowerment through enhancing coping and pro-social behavior. The CBI intervention was developed by Centre for Trauma Psychology in Boston. Numerous studies conducted within LMICs have utilized CBI and found the intervention to be effective. Current CBI interventions within SSA have specifically focused on children, ages 6-16, affected by conflict in LMICs (Barry, Clarke, Jenkins, & Patel, 2013). The protocol included 15 sessions, delivered over course of 5 weeks, provided by para-professionals. Outcomes included improvement when examining attributional style (how an individual characterizes the factors associated with negative outcomes), perceived credibility, inter-personal trust, communication skills, levels of self-blame, hyperactivity, emotional symptoms, conduct problems, and peer problems. While the technique has been found to be widely effective, it has demonstrated reduced beneficialness for boys 12-16 years of age.

SCI is a manualized multicomponent stepped care intervention package for depression, which includes specific pre-outlined goals for each session with the overall program involving psychoeducation, activity scheduling, and problem solving. While SCI targets depression, it also includes components that may positively influence numerous sources of distress. In a recent study utilizing SCI in Nigeria, 18 primary health care providers (6 nurses, 3 community health officers, and 9 community health extension workers), who received a 3-day SCI training, provided either SCI (intervention) or treatment-as-usual (control) to 234 individuals (Oladeji, Kola, Abiona, Montgomery, Araya, & Gureje, 2015). At 6 months follow up, depression symptoms had improved in 73.0% from the intervention arm compared to 51.6% control. Compared to the mean scores at baseline (PHQ-9, WHOQOL-B, & WHODAS), there was improvement in the mean scores on all outcome measures in both arms at six months. A key strength of SCI is that existing lower-level health care workers can provide the intervention, which improves sustainability of community mental health programs utilizing SCI. Currently, another SCI-based research project is underway targeting depression specifically among peri- & post-natal women.

Crisis Assistance

Crisis assistance techniques traditionally rely on manned phone centers, allowing for individuals experiencing crises, typically related to addiction or suicidality, to call and access resources while reducing barriers to accessing care (e.g. stigma or lack of availability/accessibility). Crisis hotlines are manned by lay volunteers who have usually received some form of training, along with professional mental health service workers. After the immediate crisis has been de-escalated, those who demonstrate high-risk can be referred to therapists or agencies that

provide services to provide more comprehensive care. In a study in the U.S. examining the efficacy of brief phone-based therapy provided to individuals utilizing crisis hotlines, it was found that compared to the wait-list control, providing brief psychotherapy led to a statistically significant reduction of symptoms as measured by the Brief Symptom Inventory (F value = 8.02, $p < .01$; Rhee, Merbaum, Strube, & Self, 2005). It is important to note that therapy was provided by social workers, or students in the field, and only those demonstrating low-risk for suicide were included in the study. While crisis hotlines have demonstrated effectiveness, and can be crucial in providing assistance during acutely challenging moments, lack of phone access and/or mental health professionals, to whom hotlines can refer suicidal patients to, may limit scalability in some rural areas .

Cost-effectiveness Estimates

It is challenging to estimate cost effectiveness in SSA as the examination of economic burden associated with mental health issues has been conducted almost solely within developed countries. However, recent findings have illustrated that the economic burden of depression within the U.S. is approximately \$13,669 per person meeting criteria for some form of depressive disorder (Greenberg et al., 2015). This is about 26% of the average annual income of an individual residing in the U.S. If we extrapolate from these findings, based on World Bank WDI data, the approximate economic burden of depression in SSA would be \$2,143.44 (based on an \$8,244 average annual income) or \$1,463.28 (based on an \$5,628 average annual income, representing the annual income of SSA after removing the average annual income of upper-middle-income economies) per person meeting criteria for a depressive disorder.

Cost-effectiveness evaluations are lagging even within developed countries, and are almost non-existent within developing regions. However, if we consider the economic burden associated with depression and assume a linear relationship between economic burden and symptomatic expression, module-based interventions, specifically SCI, could reduce total economic burden by \$22 for every \$1 spent, or \$6.30 more than treatment-as-usual (TAU) for every \$1 spent. While the SCI intervention outlined above is projected to have cost \$49 per participant¹ based on costs associated with programs in similar regions,² it saved approximately \$307 per participant in economic burden associated with depression when compared to those receiving TAU.³ Additionally, providing SCI over TAU significantly helped an additional 35 cases of depression, at a cost of \$233 per case helped.⁴ When considering strict CBT interventions - based on amalgamated research findings, and assuming similar programmatic costs as SCI - the reduced economic burden would be approximately \$25 for every \$1 spent. Additionally, based on examination of Lifeline in Australia, crisis hotlines are seen to provide added value of \$8.40 for every \$1 spent. However, this finding is only focused on assessing the savings provided when specifically considering the costs associated with crisis response, emergency services, and medical care, and does not account for future savings associated with

increased functioning of the individual receiving services. Additionally, when considering the effectiveness of the intervention in monetary terms, on average, we estimate that a crisis hotline in Sub-Saharan Africa would cost only ~\$40 to significantly help an individual - typically through the reduction of mental health symptoms.⁵

¹ Training Costs:

- 2 psychiatrists required for 7 days each to train the trainees (6 days of training and 1 day of preparation each): $\$27$ (projected daily physician salary) x 2 people x 7 days = $\$378$.
- 9 primary health care workers, representing those who were working within the intervention clinics, underwent 6 days of training (an initial 3-day training and a follow-up 3-day training approximately one month into the study): 54 hours of training over 6 days per worker x 9 health care workers x $\$3.75$ hourly training wage = 486 hours of training x $\$3.75$ per hour = $\$1,822.50$
- 9 primary health care workers, representing those who were working within the control clinics, underwent 2 days of training: 18 hours of training over 2 days per worker x 9 health care workers x $\$3.75$ hourly training wage = 162 hours of training x $\$3.75$ per hour = $\$607.50$

Program Salaries:

- Salary for 9 health workers and one supervisor over treatment period (Potential of 16 weeks of treatment among 3 intervening sites (9 health workers) = $\$2,880$, one supervisor salary for 16 weeks = $\$3,200$) = $\$6,080.00$

*An additional 30% to total program costs are incorporated in order to account for the Projected overhead costs (administrative costs, monitoring and evaluation, etc.).

Program Total:

- $\$11,554$ (Training and Salaries = $\$8,888$ + Overhead costs = $\$2,666$)

Cost Per Participant:

- $\$11,554$ (total costs)/ 234 (sample size) = $\$49$ per participant

² Cost projections associated with the SCI program were estimated based on costs reported within the Millennium Villages Project, which outlined training costs ($\$300$), monthly salary for CHWs/paraprofessionals ($\$80$), and monthly salary for supervisors ($\$800$) who were mainly doctors and could supervise up to 30 CHWs. These estimates represent average costs associated with the project, which was conducted across 10 developing countries.

³ 165 patients participated in the intervention, with improved depression scores being observed in 73.0% of the intervention participants compared to 51.6% in the treatment as usual group at 6 months follow up (OR 2.7). We estimate that 21% of the intervention patients benefited over

what they would have received in TAU, in terms of significantly reducing their depression ($\$1,463.28 \times .21 = \307 reduction in economic burden associated with depression when compared to those receiving TAU).

⁴ Assuming 21% of participants benefit in SCI relative to TAU: $\$49/\text{participant} / 0.21 = \233 .

⁵ Lifeline has \$21M AUD in funding and receives 822,000 calls per year. $\$21\text{M AUD} / 822,000 \text{ calls} = \$25/\text{call}$. We do not convert AUD to USD because before 2015, the two currencies were roughly 1-1. Rhee 2005 estimated a Cohen's $d=0.75$ effect size for a crisis help line, which translates into 1 out of 3.7 people significantly helped. $\$25/\text{call} * 3.7 = \92.5 per case helped. Lifeline is a global organization primarily based in Australia, so cost per case helped in Sub-Saharan Africa would likely be 2-4x cheaper, so \$25-50 per case helped.

Cost-Effectiveness Comparison: Mental Health vs. Sanitation

Since CRI also invests in sanitation efforts, it is important to consider the implicit tradeoff in funding more mental health work vs. more sanitation work, from the perspective of which interventions yield more “bang for the buck” in terms of cost per positive outcome reached. DALY's provide a useful metric for comparing outcomes across different diseases, but as our report mentions previously, this metric tends to systematically undervalue mental health, by as much as a factor of 3. Furthermore, reasonable people may differ fundamentally on the relative weights assigned to different health outcomes such as physical illness, death, or mental illness, which would lead to different funding decisions. Therefore, we've tried to examine this question from both an adjusted (with a 2x boost for mental health) cost per DALY approach and cost per (counterfactually-adjusted) outcome approach.

For comparing interventions on a cost-per-DALY metric, the Disease Control Priorities Project (DCP3 -- <http://dcp-3.org/>) provides the broadest and most rigorous analysis. For the most cost-effective interventions against diarrheal disease, such as disinfecting water, promoting handwashing, and oral rehydration, estimates range between \$100-200 per DALY averted.

Table 9.1 Cost-Effectiveness and Unit Cost of Interventions for Diarrheal Diseases

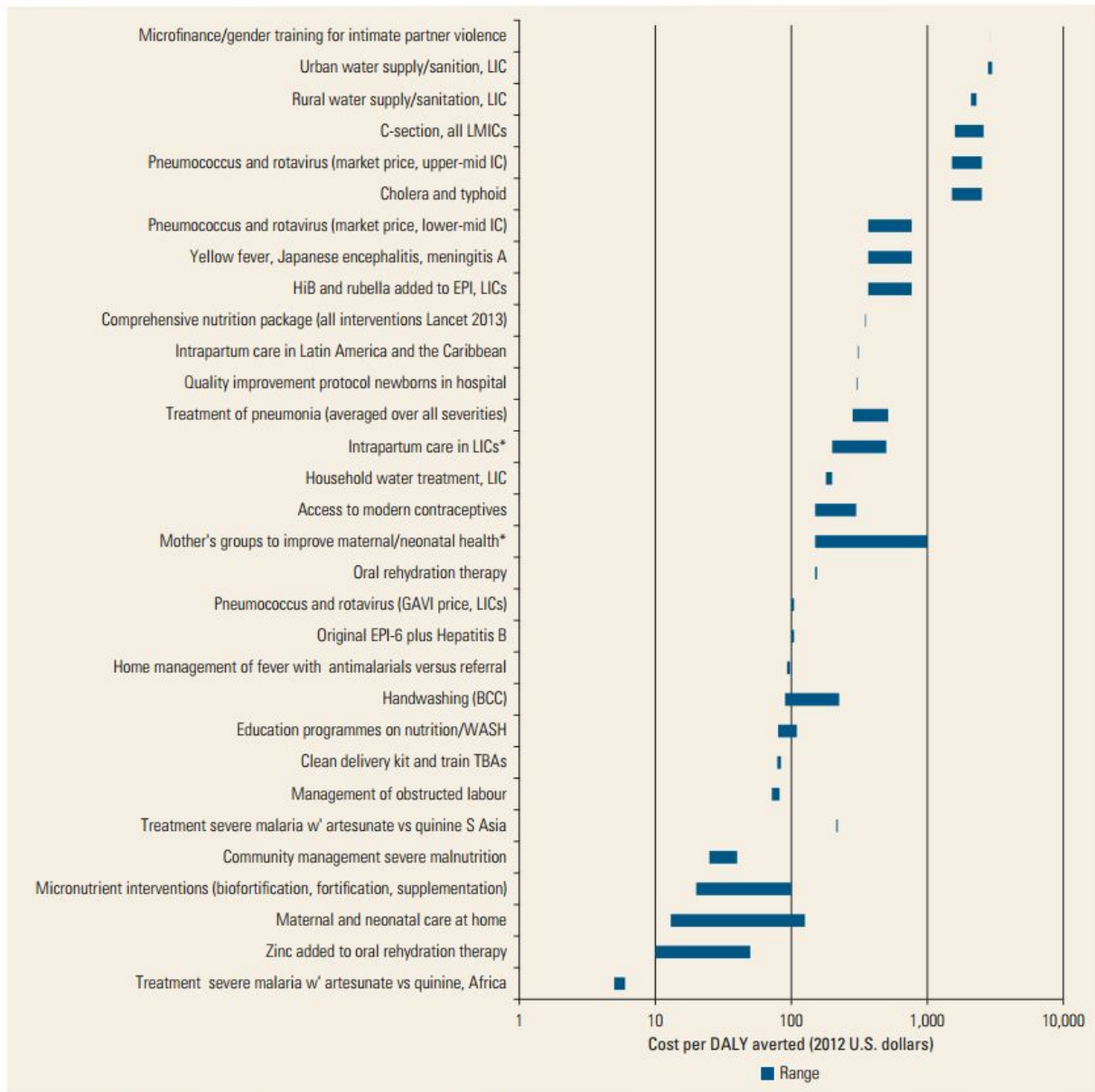
| Intervention | Region | Cost-effectiveness (US\$/DALY averted) | Unit cost (US\$) |
|---|---------------------------|---|--|
| Oral rehydration solution (versus no ORS) | AFR-E | < 200 | 2.20/diarrhea episode |
| Prophylactic zinc with ORS (versus ORS alone) | AFR-E and SEA-D | < 100 | 0.61/diarrhea episode |
| Rotavirus vaccine (versus no vaccine) | Low-income countries | < 200 at 5/dose (less at 0.20/dose) | 5/dose for two doses (Gavi price); Gavi-eligible countries pay 0.20/dose for two doses |
| Clean water (at household: chlorination or solar disinfection versus untreated water) | AFR-E and SEA-D | < 200 | 0.07/person/year SEA-D 0.13/person/year AFR-E (in 2000 U.S. dollars) |
| Improved rural water and sanitation (versus unimproved) | AFR-E and SEA-D | < 2,000 | 28/household (well); 52/household (latrine) |
| Piped water and sewer connection (versus no connections) | AFR-E SEA-D | < 2,000 < 3,000 | 136/household (water); 160/household (sewer) |
| Cholera vaccine (versus no vaccine) | High-endemicity countries | 2,000–10,000 | 1.33/person |
| Behavior change | Low-income countries | Large variation | Large variation |
| RUTF added to standard rations (versus standard rations) | AFR-E | > 10,000 considering only benefits for diarrhea | 527/child/year |

Source: See Horton and Levin 2016, chapter 17, on cost-effectiveness in this volume.

Note: AFR-E = high-mortality Africa (WHO subregion); DALY = disability adjusted life year; Gavi, the Vaccine Alliance; ORS = oral rehydration solution; RUTF = ready-to-use therapeutic foods; SEA-D = high-mortality South-East Asia (WHO subregion). Costs and cost per DALY averted are higher in other regions. Interventions costing less than US\$240 per DALY in 2012 would be very cost-effective even in the poorest low-income country; those costing less than US\$720 would be cost-effective even in the poorest low-income country (Burundi's per capita gross national income was US\$240 in 2012) (World Bank 2014). All costs converted to 2012 U.S. dollars (except as noted otherwise).

Source: <http://dcp-3.org/sites/default/files/chapters/DCP3%20RMNCH%20Ch9.pdf>

Figure 17.1 Cost-Effectiveness of Interventions for RMNCH, in 2012 U.S. Dollars per DALY Averted



Note: DALY = disability-adjusted life year; EPI = Expanded Program of Immunization; Gavi = Global Alliance for Vaccines and Immunization; HiB = *Haemophilus influenzae* B; LIC = low-income country; RMNCH = reproductive, maternal, newborn, and child health; WASH = water, sanitation, and hygiene.
 a. Converted from life-years, assuming that a newborn life is equivalent to 32 DALYs or 60 life-years.

Source: <http://dcp-3.org/sites/default/files/chapters/DCP3%20RMNCH%20Ch17.pdf>

The DCP3 recommends episodic treatment in primary care with antidepressants as one of the most cost-effective interventions against depression. They estimate that for Sub-Saharan Africa, cost-effectiveness in these interventions would be roughly \$1,400 per DALY averted.

Table 12.1 Regional Cost-Effectiveness of Interventions for MNS Disorders
(cost per disability-adjusted life year averted or healthy life year gained, 2012 US\$)

| Disorder: intervention | World Bank region | | | | | |
|---|--------------------|---------------------------------|------------------------------|-------------------------|------------|-----------------------|
| | Sub-Saharan Africa | Latin America and the Caribbean | Middle East and North Africa | Europe and Central Asia | South Asia | East Asia and Pacific |
| Schizophrenia | | | | | | |
| SCZ-1: community-based treatment with older (neuroleptic) antipsychotic drug | 8,390 | 20,465 | 21,263 | 13,799 | 4,915 | 5,688 |
| SCZ-2: community-based treatment with newer (atypical) antipsychotic drug | 7,978 | 18,961 | 19,755 | 12,891 | 4,718 | 5,414 |
| SCZ-3: community-based treatment with older antipsychotic drug + psychosocial treatment | 6,005 | 13,858 | 14,413 | 11,396 | 3,490 | 3,865 |
| SCZ-4: community-based treatment with newer antipsychotic drug + psychosocial treatment | 6,014 | 13,649 | 14,192 | 11,233 | 3,523 | 3,890 |
| Bipolar disorder | | | | | | |
| BIP-1: community-based treatment with older mood stabilizer drug (lithium) | 4,571 | 14,261 | 12,120 | 9,999 | 3,392 | 4,402 |
| BIP-2: community-based treatment with newer mood stabilizer drug (valproate) | 7,930 | 16,470 | 13,911 | 12,339 | 5,047 | 5,839 |
| BIP-3: community-based treatment with older mood stabilizer drug + psychosocial care | 4,516 | 13,292 | 11,440 | 9,329 | 3,281 | 4,136 |
| BIP-4: community-based treatment with newer mood stabilizer drug + psychosocial care | 7,583 | 15,287 | 13,094 | 11,426 | 4,784 | 5,434 |
| Depression | | | | | | |
| DEP-1: episodic treatment in primary care with older antidepressant drug (TCAs) | 1,410 | 3,491 | 3,171 | 2,668 | 786 | 899 |
| DEP-2: episodic treatment in primary care with newer antidepressant drug (SSRIs) | 1,395 | 3,361 | 3,057 | 2,456 | 788 | 894 |
| DEP-3: episodic psychosocial treatment in primary care | 2,189 | 4,838 | 4,594 | 2,724 | 1,161 | 1,223 |
| DEP-4: episodic psychosocial treatment + older antidepressant | 2,083 | 4,427 | 4,232 | 2,722 | 1,128 | 1,178 |
| DEP-5: episodic psychosocial treatment + newer antidepressant | 2,144 | 4,477 | 4,285 | 2,660 | 1,167 | 1,218 |
| DEP-6: maintenance psychosocial treatment + older antidepressant | 2,461 | 4,866 | 4,783 | 3,225 | 1,315 | 1,373 |
| DEP-7: maintenance psychosocial treatment + newer antidepressant | 2,532 | 4,927 | 4,847 | 3,137 | 1,367 | 1,425 |
| Alcohol use disorders | | | | | | |
| ALC-8: brief physician advice in primary care | 407 | 878 | — | 494 | 684 | 332 |
| Epilepsy | | | | | | |
| EPI-1: older anti-epileptic drug in primary care | 694 | 1,511 | 1,450 | 2,516 | 600 | 1,057 |
| EPI-2: newer anti-epileptic drug in primary care | 1,884 | 2,854 | 2,877 | 4,115 | 1,639 | 2,249 |

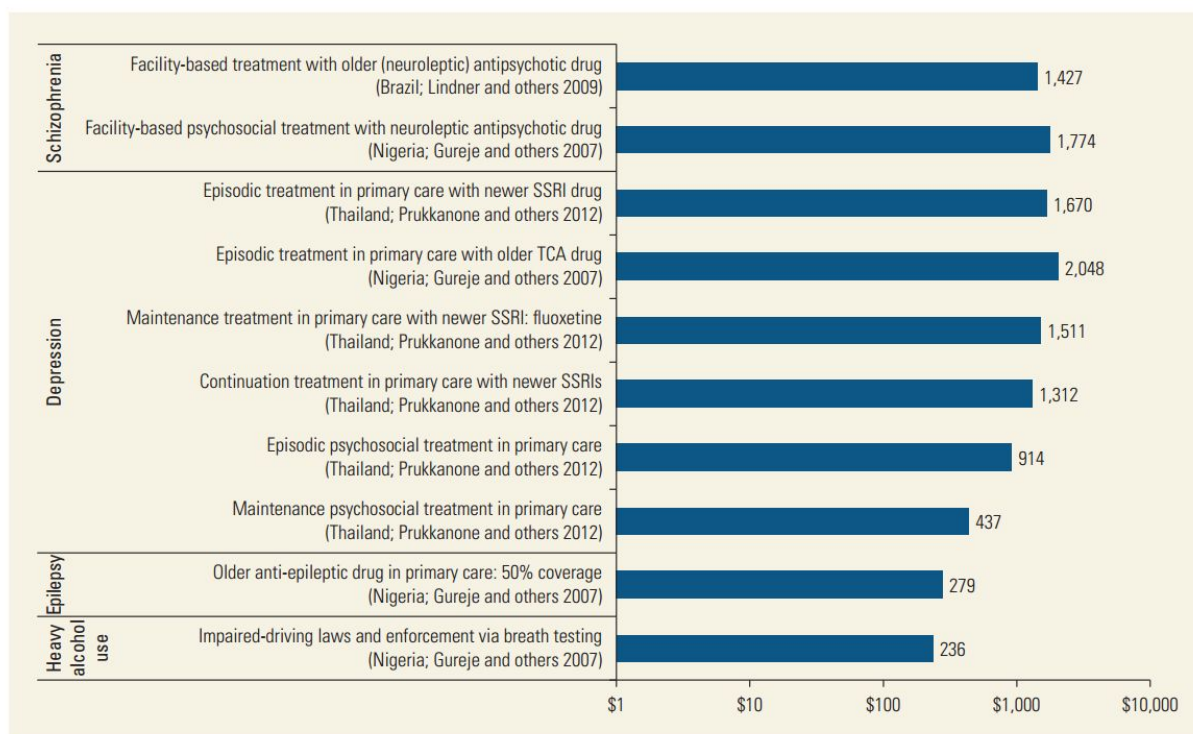
Sources: Chisholm and Saxena 2012; Hyman and others 2006.

Note: MNS = mental, neurological, and substance use; TCAs = tricyclic antidepressants; SSRIs = selective serotonin reuptake inhibitors; — = not available.

Source: http://dcp-3.org/sites/default/files/chapters/DCP3%20Mental%20Health%20Ch_12.pdf

However, these assumptions are highly sensitive to the specifics of the individual program -- one study in Thailand found that maintenance therapy delivered via primary care achieved cost-effectiveness of \$437/DALY.

Figure 12.1 Country-Specific Cost-Effectiveness of MNS Interventions
(cost per disability-adjusted life year averted or healthy life year gained, 2012 US\$)



Note: ** = effects measured in quality-adjusted life years gained; all other effect estimates are measured as disability-adjusted life years averted; MNS = mental, neurological, and substance use; SSRI = selective serotonin reuptake inhibitor; TCA = tricyclic antidepressant. All reported cost-effectiveness estimates have been converted to 2012 US\$.

Source: http://dcp-3.org/sites/default/files/chapters/DCP3%20Mental%20Health%20Ch_12.pdf

Given a 2x adjustment factor to account for DALYs undercounting the severity of mental health, a ~\$400/DALY anti-depression program would be nearly on par with the \$100-200/DALY sanitation interventions, but if we expect that average anti-depression interventions in Sub-Saharan Africa will cost roughly \$1,400/DALY, then that would be 4-6 times less cost-effective than sanitation work after the adjustment.

Another approach is to look at cost per outcome achieved. Our analysis above suggests that the SCI intervention cost \$233 per case of depression helped, and that in theory, a crisis hotline in Africa could cost as little as \$40 per case of depression helped. Note that these are our own back-of-the-envelope calculations. In our review of NEPI Liberia, we cite a study which concluded that NEPI can prevent a crime (such as theft, burglary, or drug dealing) for just \$21. To compare these numbers to sanitation interventions, we looked at a World Bank study in China that estimated the cost-effectiveness of moving from shared toilets/latrines to improved

sanitation options. It found that sanitation improvements cost roughly \$3 per case of disease (generally diarrhea) averted, and ~\$6,000 per death averted.

TABLE A: RURAL AREA EFFICIENCY MEASURES FOR MAIN GROUPINGS OF SANITATION INTERVENTIONS, COMPARING DIFFERENT POINTS ON THE SANITATION LADDER (QIUBEI RURAL SITE)

| Efficiency measures | Moving from shared toilet to | | | Moving from pit latrine to | | |
|------------------------------------|------------------------------|-------------|--------|----------------------------|--------|-------------------|
| | Pit latrine | EcoSan UDDT | Biogas | EcoSan UDDT | Biogas | Septic tank + STF |
| COST-BENEFIT MEASURES | | | | | | |
| Benefits per US\$ input | 3.8 | 4.5 | 7.3 | 4.5 | 5.0 | 2.1 |
| Internal rate of return (%) | >100% | >100% | >100% | >100% | >100% | 40% |
| Payback period (years) | 1.2 | <1.0 | <1.0 | <1.0 | 1.6 | 3.9 |
| Net present value (\$) | 164 | 270 | 339 | 270 | 315 | 142 |
| COST-EFFECTIVENESS MEASURES | | | | | | |
| Cost per DALY averted (\$) | na | 325 | 230 | 325 | 335 | 557 |
| Cost per case averted (\$) | na | 3.1 | 2.2 | 3.1 | 3.2 | 5.3 |
| Cost per death averted (\$) | na | 5,840 | 4,139 | 5,840 | 6,026 | 10,010 |

Note: na: not calculated due to improved pit latrine assumed to have the same health impact as improved shared latrine.
STF - septage treatment facility.

Source:

https://www.wsp.org/sites/wsp.org/files/publications/WSP-EAP-ESI2-Yunnan-Province-China-Technical-Paper_0.pdf

Given the uncertainty around these estimates, and the difficulty of weighing the subjective severity of the outcomes (disease vs. crime, depression vs. death), we do not have any specific recommendation on how to prioritize these two areas, other than to carefully consider the tradeoffs and implicit value judgments.

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Organizations

Recommended Organizations

Alderman Foundation

Description: The Alderman Foundation is one of the largest organizations operating specifically in the mental health space in sub-saharan Africa. It operates as an NGO, with the goal of transforming mental and psychological care for those affected by war and organized violence. The foundation touches 30K patients per year (education & treatment), targeting a wide range of disorders from depression to psychological stress. They are the 'front-line' for mental healthcare.

There are several different components to their work

- Clinical care is the primary component. Currently, there are 15 treatment centers in Uganda, mostly located in level 3 trauma centers. The foundation trains laymen as community health workers to deliver care. They believe that there is a shortage of trained clinicians, and this gap will be difficult to fill. The community health workers are also responsible for recruiting and educating the community.
- Maternal mental health is targeted to reduce mental health issues before and after birth. Currently scaling the program to treat 4,000 moms across 4 clinics per year.
- New projects include the Rhino Refugee Camp (mental health services for those fleeing from Sudan and into the Rhino Refugee Camp) and Child Soldier Project (heal emotional wounds of former child soldiers)

Location: It currently operates clinics in 3 countries (Uganda, Kenya, Cambodia), with its primary presence in Uganda.

Team: The foundation currently has 6 staff members, based in New York, but traveling frequently to Uganda. It also has a broad Board of Advisors, International Board, and Clinical Advisors. The operating team is dedicated and has a broad range of relevant experiences (international humanitarian relief, PhD in global mental health).

Funding/Budget: [Redacted]

Cost per outcome: In terms of efficacy, Alderman Foundation is focused on outcomes - across the whole spectrum of mobilization, assessment, and treatment. They estimate their treatment costs at \$37/patient (conversation with Allan Freedman), but \$50/patient may be more accurate (\$1.5M budget / 30,000 patients). However, there is significant opportunity to improve understanding to return on investment. They believe that this is critical work, however, do not have the funding earmarked to support this work.

Our recommendation is the Alderman foundation is a very interesting potential target. The approach is practical and can be scaled to more areas of Uganda and more countries. There is an existing strong relationship with the government. Also, Alderman Foundation has a fantastic leadership team, with a wide range of educational and practical experience for operating a mental health organization. The first wave of funding could be used to analyze the return of investment on their approach and also to research the optimal approach.

Sources for the Alderman Foundation include their website and interview with Allan Freedman, Executive Director at Alderman Foundation.

AEGIS Trust

Description: Works in countries who have suffered mass-traumas, such as genocides. Aegis focuses on peace building education, which often have psychological components, which include critical thinking, personal responsibility and values, and empathy.

The Aegis Trust has developed a successful model for peace education in Rwanda, giving tens of thousands of young people across the country the knowledge and tools to overcome the legacy of fear and suspicion left by the genocide, to break the long term cycle of violence and to build reconciliation, trust and cooperation for a brighter future. 12,000 children have received services in Rwanda.

The peace education program helps to increase awareness and empathy among youth to inoculate future generations against the outbreak of atrocities. Given its success, the program is being scaled up in Rwanda, and Aegis is looking to replicate the program's success in other East and Central African countries, such as Kenya, South Sudan and as part of a public USAID-private partnership in the Central African Republic. This has potential to be used as a model to break cycles of hatred through adopting this approach within a mental health lens.

Location: Most significant presence in Rwanda

Team: While the Trust is headquartered in the UK, each country where it operates has their own team, so all members directly in charge of programs in Rwanda are located in Rwanda (mainly Rwandese).

Funding sources: [Redacted]

Recommendation: We recommend AEGIS Trust because Lori has worked with them in the past, and we are confident that their staff is invested in the projects they are implementing, and that the organization is capable of effectively introducing programs into, and addressing the needs of, the surrounding community.

NEPI (Network for Empowerment and Progressive Initiative)

Intervention: Culturally-adapted CBT + Unconditional Cash Transfers

Location(s): Liberia, but the team is also interested in training similar organizations in Ghana, Uganda, and S. Sudan on their methodology.

Description: NEPI supports men formerly engaged in Liberia's two civil wars by rehabilitating them through culturally-adapted cognitive behavioral therapy. Their flagship program, Sustainable Transformation of Youth in Liberia (STYL), teaches men living lives of crime to become mainstream members of society by acting, dressing, and thinking differently through an 8-week group therapy program. NEPI partnered with Columbia University development economist Chris Blattman and Innovations for Poverty Action (IPA) to run an RCT on the STYL program, which also included a test of a \$200 unconditional cash transfer. The RCT found impressively strong impacts for the STYL program combined with the cash transfer.

Team: NEPI was founded in 2000 by Klubosumo Johnson Borh. Mr. Borh was forced to fight in Charles Taylor's army at the age of 19, but managed to escape. He was rehabilitated thanks to the work of other NGO's, and decided to dedicate his career to giving back to society. He earned a Bachelor's degree in Economics in Liberia, and earned a Master's in Non-profit Management from Columbia University School of Social Work in 2015. All the team members are Liberian.

Budget: [Redacted]

Funding sources: [Redacted]

Impact/Measurement: NEPI is unusual among African nonprofits in that it has participated in conducting a highly rigorous (n=1,000) RCT and demonstrated strong, cost-effect impacts. The RCT by Chris Blattman/IPA found that when CBT was combined with cash transfers, there were large sustained falls in criminal and anti-social behavior by 50% for at least 1 year. The study also measured lower impulsivity and found that the treatment increased income (by \$4/wk) temporarily for a few months. The outcomes measurement relied on self-reported data, but Blattman's team randomly selected 8% of participants for a validation group, whom they followed around all day to observe and measure criminal and anti-social behavior, and found the self-reported data to be accurate.

Cost per Outcome Estimate: Blattman estimates \$21 per crime averted, including the cost of CBT + cash transfer. Common crimes include theft, robbery, drug dealing, and pickpocketing. This measure, already impressive, does not capture the additional benefits of sustained self-esteem.

Sources

Conversation with Johnson Borh and Gugu Zawoo, 4/6/2016.

Internal NEPI documents

IPA: Sustainable Transformation for Youth in Liberia policy note (

<http://www.poverty-action.org/sites/default/files/publications/sustainable-transformation-for-youth-policy-memo.pdf>)

Freakonomics Podcast: “I don’t know what you’ve done with my husband but he’s a changed man” (

<http://freakonomics.com/podcast/i-dont-know-what-youve-done-with-my-husband-but-hes-a-changed-man-a-new-freakonomics-radio-episode/>)

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Other Organizations Considered

[Redacted]

There are also 3 other organizations that came to our attention at the end of the project, which we did not have time to fully review, but are deserving of further consideration:

- African Mental Health Foundation
 - <http://www.africamentalhealthfoundation.org/>
 - NGO in Kenya
 - Research and advocacy on mental health in Africa
- AFFIRM: Africa Focus on Intervention Research in Mental Health
 - <http://www.affirm.uct.ac.za/>
 - Academic project based at University of Cape Town, but active in Ethiopia, Ghana, Malawi, South Africa, Uganda, and Zimbabwe.
 - Cost-effectiveness research and capacity building
 - Funded by National Institute of Mental Health (USA)
- PRIME: Programme for Improving Mental Health Care
 - <http://www.prime.uct.ac.za/>
 - Research consortium across five Ministries of Health (Ethiopia, India, Nepal, South Africa & Uganda), with partners in the UK and the World Health Organization (WHO).

- Focused on research & advocacy to integrate mental health into primary and maternal health care systems in order to address the treatment gap
- Funded by Department for International Development (UK DFID)

Research Opportunities

There is an astounding lack of access to mental health care in Sub-Saharan Africa and developing countries in general -- the WHO estimates that 76-85% of those with severe mental health issues in the developing world receive no care at all.⁵ One way to address this gap would be to triple spending on mental health in the region, from roughly \$160M per year (estimated)⁶ to \$480M per year, but that would require dramatic shifts in health budgeting in those countries and by aid agencies. An alternative approach would be to research and promote new interventions that could potentially triple the cost-effectiveness of mental health spending. There are some new interventions on the horizon which look promising in this regard, which may be worth funding from an expected value perspective (probability multiplied by potential impact) even with a low probability of success (a strategy of pursuing “moonshots”).

Propranolol

Problem Area: PTSD

Description: Psychologists used to believe that memories are resistant to change, once formed. However, new evidence has brought to light a process of “reconsolidation,” in which memories are modified and re-encoded each time they are recalled. This finding led to a search for ways to modify traumatic memories through reconsolidation. Propranolol, a beta-blocker originally intended to treat high blood pressure, has been known to relieve anxiety, and has now been tested as a way to remove the stress from traumatic memories during reconsolidation, finding success in both rats and humans. The therapeutic procedure involves a clinician provoking the recall of a traumatic memory in a patient suffering from PTSD, immediately followed by an oral dose of propranolol, in up to 6 sessions. Propranolol requires a prescription in the US, but is generally safe for most people and has mild side effects. It is already on the WHO list of essential medicines, so it is generic, cheap, and widely available. This treatment stands out over existing approaches to PTSD in its simplicity and effectiveness.

Evidence: Dr. Merel Kindt at the University of Amsterdam has published anecdotal accounts of success with this treatment, which she helped pioneer (Lavine 2012). Dr. Alain Brunet at McGill

⁵ WHO Secretariat Report, December 2011: http://apps.who.int/gb/ebwha/pdf_files/EB130/B130_9-en.pdf

⁶ Ibid reports an average of \$0.20 spent per year per capita on mental health in developing countries. Population of Sub-Saharan Africa is 800M. $800,000,000 * \$0.20 = \$160,000,000$.

has conducted a small-scale (n=19), double-blind, randomized controlled trial in which only one session of propranolol treatment was administered to patients, which found large, statistically significant effects in physiological responses to traumatic stimuli. He followed it up with a series of pilots of multi-session propranolol therapy, which found that 70-80% lost their PTSD diagnosis following the treatment, compared to 8% in a (non-randomized) control group (Brunet et al, 2011). By comparison, standard treatments for PTSD are estimated to work about half the time (Kar 2011).

Dr. Brunet also performed a randomized experiment (n=45) in Nepal that compared propranolol with paroxetine (SSRI) for PTSD treatment (Descamps 2015). Paroxetine needs to be taken for 1 year, costs more than propranolol, has bad side effects (weight gain, sexual dysfunction, increased impulsivity), and has a high dropout rate. Effectiveness in relieving PTSD symptoms was the same in both conditions, meaning that propranolol may be a cost-effective, acceptable treatment for PTSD in non-Western, low-income contexts. He was also funded \$1.9M by the US Department of Defense for a placebo-controlled randomized controlled trial (n=48), which found a significant effect, but has not been published yet (Conversation with Dr. Brunet). He has also received \$1M in funding from a network of Parisian hospitals to train 100 clinicians to administer propranolol treatment for PTSD to 400 victims of the November 13, 2015 terror attacks, and his study there will focus on comparing cost-effectiveness against treatment-as-usual.

Cost-effectiveness: Propranolol treatment has significant effects after 1 session (<60 minutes), but up to 6 are recommended for maximum effect. Currently, the leading treatment for PTSD is prolonged exposure therapy, which requires 14 60-90 minute sessions (Foa et al, 2013). This suggests that propranolol treatment requires 1/3 the clinician time of prolonged exposure therapy, and is therefore 3 times more cost effective (the cost of the drug itself is negligible).

Leading Researchers:

Dr. Alain Brunet, McGill University Dept. of Psychiatry
(<http://www.chrcrm.org/en/rotm/dr-alain-brunet>)

Dr. Margaret Altemus, Weill Cornell Medical College
(<http://vivo.med.cornell.edu/display/cwid-maltemus>)

Funding Strategy: [Redacted]

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Conversation with Dr. Alain Brunet, McGill University, 6/18/2016

Conversation with Dr. Margaret Altemus, Weill Cornell School of Medicine, 6/3/2016

Trace Lithium

Problem Area: Suicide

Description: What if there was an undetected vitamin/mineral deficiency causing mental health problems for hundreds of thousands of people each year? That is the trace lithium hypothesis -- that lithium, an element similar to sodium, is an essential mineral required for healthy brain function, whose deficiency leads to mental health problems and increased risk of suicide. The bulk of the evidence for this hypothesis comes from correlational studies, started in 1970 (Dawson 1970), which have found that communities with higher amounts of naturally-occurring trace lithium in their water supply tend to have lower suicide rates. This issue has also been

briefly examined by the Open Philanthropy Project, which concluded that if the causal effect of trace lithium holds true, it could decrease the number of annual suicides by 10% (Open Philanthropy Project 2015). Some studies have also looked at rates of homicide, crime, and other indicators of mental health problems, and found trace lithium to be inversely correlated with those outcomes as well, suggesting that if it works, trace lithium would improve mental health in a general way on a population level. As is well known, lithium is widely used as a mood stabilizer for bipolar disorder, and is surprisingly effective. However, the high dosage used (1800 mg/day)⁷ comes with a number of unpleasant side effects for both physical and mental health. The trace amount considered in these studies amounts to less than 1 mg/day (Schrauzer 2002), suggesting an entirely different mechanism of action which hopefully avoids the harmful side effects. Furthermore, many people have assumed that public health officials would act on this by adding lithium to public drinking water supplies as was done with fluoride; however, that is likely to face significant political opposition and raises ethical concerns regarding consent. A more practical approach, if the evidence bears out the necessity of lithium as an essential mineral, would be for the FDA to issue a Reference Daily Intake (RDI) as it does for other vitamins and minerals such as potassium or sodium, and then fortify specific foods such as salt or multivitamins with the proper amount. Being able to read the amount of lithium on the Nutrition Facts label would preserve the public's ability to avoid added lithium. Developing countries would likely follow suit with their own fortification programs (as they have done with iodine, vitamins A and D, etc.) as these programs are straightforward to implement and enormously cost-effective.

Evidence: Eric compiled a list of all the original research on this topic ([spreadsheet here](#)) due to gaps in the existing literature reviews. Out of 13 studies, 9 found strong, significant correlations with trace lithium and lowered suicide rates. However, many of the studies were poorly designed due to small sample sizes, lack of variability in lithium levels, or failing to control for confounding factors. Only 4 of the studies did well on these criteria (Kapusta 2011; Bluml 2013; Pompili 2015; Ishii 2015), and 3 of those 4 found significant effects for the correlation. Each of those 4 studies was conducted in a different country, but so far, all of these correlational studies have looked at developed countries (US, Europe, and Japan) -- nobody has looked at this issue in developing countries yet, but biological mechanisms tend to translate well across geographies. The biological mechanism for lithium on the brain is not well understood yet (at either high or low doses), but neuroscience research has found that low levels of lithium have neuroprotective effects and reduce oxidative stress in cell cultures of human neurons (Allagui 2009; Nciri 2013). There has only been one very small-scale (n=24) randomized controlled trial of trace lithium in humans (Schrauzer 1994), which was successful in finding a positive effect on mood, but one cannot place much weight on it. The bulk of the evidence lies on a moderate correlation which cannot always be reproduced, so a healthy dose of skepticism is required. I estimate a 10% chance that the trace lithium hypothesis turns out to be correct.

⁷ Drugs.com: <http://www.drugs.com/dosage/lithium.html>

Cost-Effectiveness: Despite a low probability of success, research on trace lithium still looks very attractive from an expected value (probability multiplied by impact) perspective. Lithium itself, as a naturally occurring element, would be very inexpensive in the quantities needed for a fortification program (1 mg/person/year). Project Healthy Children, a non-profit that runs fortification programs in developing countries, estimates that their programs cost only \$100,000 per country per year.⁸ If we conservatively estimate that it would take \$50M of research funding (an arbitrary estimate) to conclusively determine whether lithium is an essential mineral, and that if so, fortification programs could be implemented worldwide that would reduce the 800,000 annual suicides by 10%, and consider only the first 5 years, then the cost per life saved would be roughly \$1,400.⁹

Leading Researchers:

- Nestor Kapucha, Medical University of Vienna
 - https://www.researchgate.net/profile/Nestor_Kapusta
- Marco Helbich, University of Utrecht
 - <http://www.uu.nl/staff/MHelbich>
- Daniel Smith, University of Glasgow
 - <http://www.gla.ac.uk/researchinstitutes/healthwellbeing/staff/danielsmith/>

Funding Strategy: Trace lithium research is probably underfunded for two main reasons: as an element, it cannot be patented, so pharmaceutical companies have no interest in it, and its negative perception by the public has made government funders wary of supporting it (Fels 2014). An additional factor may be that government funders tend to be risk-averse in their funding decisions, potentially missing high-risk high-reward opportunities.

Dr. Marco Helbich of University of Utrecht thinks more correlational studies are needed, but with smaller areas as the unit of analysis (and therefore higher sample sizes) than those previously conducted (personal communication). Dr. Daniel Smith of Glasgow University thinks that randomized controlled trials would be the best way to move the field forward now (personal communication). Dr. Nestor Kapusta of the Medical University of Vienna thinks that it is still too early for randomized controlled trials, and that more research is needed on the neurobiological effects at the cellular level (Open Philanthropy Project 2015). There seems to be a need for a non-profit organization that would prioritize, coordinate, and fund research in this area, and also engage government funders and policymakers in this issue.

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⁸ Project Healthy Children: <http://projecthealthychildren.org/what-we-do/cost/>

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Computer-based CBT

Problem Area: Anxiety/Depression

Description: A number of companies and research groups have developed self-service apps or websites that deliver Cognitive Behavioral Therapy (CBT) treatment for anxiety and depression. These tools enable users to interactively read content/watch videos and complete homework assignments, designed to give them cognitive skills to prevent bad patterns of thought. When effective, app-based CBT is highly scalable and cost-effective due to the fact that patients can use it themselves without a trained mental health professional (Solomon et al, 2015).

Evidence: Although one large RCT found no effect (Gilbody et al 2015), RCTs of other programs in other contexts have found significant effects (Guille et al, 2015; Solomon et al, 2015; Vernmark 2010; Warmerdam 2008). Two recent meta-studies of self-service computerized CBT found it to be helpful, with effect sizes of $d=0.25$ (Andersson 2009) and $d=0.36$ (Richards 2012). To illustrate, an effect size of Cohen's $d=0.30$ translates to a significant benefit for one out of every 11 people treated.¹⁰

Funding Strategy: [Redacted]

Cost-Effectiveness: In Sub-Saharan Africa, South Africa would be the most attractive market, with 23M smartphone users, half the country's population (MyBroadband 2015). Although the WHO estimates that >75% of people in LMIC's with severe mental illness have no access to treatment, this should be lowered to perhaps 50% for the smartphone-using population given that they have higher socioeconomic status than the rest of the population. Incidence of depression in South Africa is roughly 5% (Dewey 2013), leaving a target population of 575,000. If the promotional campaign managed to reach 20% of the target population, that would create 115,000 users for the app. Assuming that 1 in 11 people are significantly helped, based on the results of the meta-studies, would lead to roughly 10,000 cases of depression significantly improved. At a cost of \$300,000, this translates to \$30 per case helped, assuming the project is successful, which would be highly cost-effective.

Sources:

¹⁰ For more information, see: <http://rpsychologist.com/d3/cohend/>

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Other areas considered

- Psilocybin
 - Psilocybin is the active hallucinogenic substance in magic mushrooms. Although it may seem strange, it has been demonstrated to have strong therapeutic effects in treating depression and addiction with just one session (Carhart-Harris et al, 2016; Sessa & Johnson, 2015). However, we concluded that widespread adoption is unlikely to be practical given safety considerations, as it can cause panic attacks and psychosis in psychologically vulnerable people (Cowen 2016; van Amsterdam, et al, 2011; Conversation with Dr. Gastfriend).
- Psychological First Aid
 - Psychological First Aid operates on a train-the-trainer model that teaches people how to appropriately respond to the needs of others during or after a crisis. Although commonly used worldwide and well-regarded by expert consensus, three recent reviews found a dearth of evidence on the intervention (Dieljtens 2014; Fox 2012; Shultz 2014). Although more research in this area would be helpful, our cursory assessment is that it would be more valuable to invest in train-the-trainer models that already have a strong evidence base (SCI, CBT, etc.) or research areas with potential for greater impact (such as propranolol).

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Conversation with Dr. David Gastfriend, MD, former Director of Addiction Research at Massachusetts General Hospital (and also Eric's dad), 5/25/2016

Psychological First Aid:

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