Prevalence of undernourishment and associated factors among adults with major depressive disorder at two public hospitals in Northwest Ethiopia: a cross-sectional study

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ABSTRACT

Objective Undernourishment is overlooked in people with major depressive disorder (MDD); however, it could have huge impacts on recovery, functioning and quality of life. This study aimed to assess the prevalence of undernourishment and associated factors among adults with MDD attending two public hospitals in Northwest Ethiopia.

Design Institution-based cross-sectional study was used.

Setting This study was conducted in two public hospitals—a tertiary-level specialised care hospital (Felege-Hiwot Comprehensive Specialized Hospital) and a secondary-level referral hospital (Debre Markos Referral Hospital). Both hospitals are located around 200 km apart and are the busiest hospitals in Western Amhara region.

Participants A total of 396 participants were included in the study using a stratified sampling technique. The study participants were recruited from psychiatry units. Adults with MDD were recruited from both hospitals proportionally between September and November 2019.

Outcome measures Undernourishment was assessed using a body mass index measurement. Data were collected using a structured questionnaire and anthropometric measurements, and analysed using a binary logistic regression model.

Results The overall prevalence of undernourishment was 28.5% (95% CI: 23.7% to 33.4%) among adults with MDD attending psychiatric care in the two public hospitals in Northwest Ethiopia. Female gender (adjusted Odds Ratio (AOR)=2.18, 95% CI=1.20 to 3.96, p=0.01), rural residence (AOR=2.41, 95% CI=1.23 to 4.70, p=0.01), illiteracy (AOR=2.86, 95% CI=1.01 to 8.07, p=0.047), antidepressant side effects (AOR=2.04, 95% CI=1.08 to 3.88, p=0.028) and having HIV/AIDS (AOR=4.12, 95% CI=1.46 to 11.57, p=0.007) had a statistically significant association with undernourishment.

Conclusion The prevalence of undernourishment was high among adults with MDD in Northwest Ethiopia. This study suggests the need to include nutritional interventions for people with MDD in psychiatric care facilities.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study addressed a special population group and achieved a high response rate.
⇒ Anthropometric measurement was used to assess the undernourishment and that minimises recall bias.
⇒ However, the study could have introduced social desirability bias particularly on data related to alcohol and substance use.
⇒ The body mass index that was used to measure undernourishment in this study may not be the most accurate measurement to indicate nutritional status.
⇒ The association of undernourishment with food insecurity and income was not examined in this study.

BACKGROUND

Undernourishment is an insufficient intake of food and nutrients to meet an individual's nutritional needs and maintain good health.1 2 Undernourishment results from limited intake of food in quality or quantity, including suboptimal feeding practices that expose people to hunger, recurrent infection or diseases.2 An involuntary weight loss greater than 10% of body weight within 6 months indicates moderate to severe undernourishment.3 Undernourishment can also be defined as having a body mass index (BMI) score of <18.5 kg/m2, which can be further classified as mild (17–18.49 kg/m2), moderate (16–16.99 kg/m2) and severe (<16 kg/m2) undernourishment.4

Undernourishment is a major public health concern in low-income countries, which was as high as 35% in prevalence in the general population in South Asia.4 The prevalence of undernourishment varies with age, sex, demographic characteristics and underlying health conditions.5 6 Undernourishment is now becoming commonly prevalent among
adults in low-income countries. The 2010 United States Agency for International Development (USAID) report indicated a 26.9% prevalence of undernourishment among women of reproductive age group in Ethiopia. A very recent community-based study found a 27.6% prevalence of undernourishment among older adults in North Gondar district in Northwest Ethiopia. Another study from the southern part of Ethiopia reported a 23.7% prevalence of undernourishment among people with HIV/AIDS. A study conducted in a psychiatric care facility reported a 20.0% prevalence of undernourishment among people with mental health problems in the northeastern part of Ethiopia. A systematic review and meta-analysis study reported a 50.8% pooled prevalence of undernourishment among people with tuberculosis in Ethiopia. In all these studies, undernourishment has been frequently associated with rural residence, early marriage and poverty.

Poor mental health and undernourishment contribute to a significant burden of disease and both have shown strong relationships with each other. People with major depressive disorder (MDD) are more prone to undernourishment than the general population due to several reasons. The relationship between depression and undernutrition is justifiable as emotional, biological and economic factors mediate the association of the two health conditions. Emotionally, people with depression experience decreased mood, appetite and fatigue; therefore, chronic loss of appetite could lead to undernourishment. Additionally, depressed mood, sadness and depressive feelings could reduce digestive functioning, weight and energy loss. Furthermore, undernourishment could have significant impacts on the recovery, functioning and quality of life of people with MDD.

Undernourishment and MDD can appear as chronic comorbid conditions. Both have interconnected effects and aggravate the outcome of one on the other in a vicious circle. For example, MDD can cause undernourishment and undernutrition can exacerbate the severity of MDD but the mechanism needs more research. Undernourishment has serious medical consequences such as lowered resistance to infection, poor wound healing and prolonged hospitalisation and leads to a risk of high disability and mortality.

Although undernourishment is well studied in the general population around the world, there is a lack of evidence in special population, particularly among people with MDD in low-income countries including Ethiopia. The aims of this study were to assess the prevalence of undernourishment and identify associated factors among adults with MDD attending psychiatric follow-up at two public hospitals in Northwest Ethiopia.

METHODS
Study design and setting
In this study, we used an institution-based cross-sectional study. The study was conducted in psychiatry units at Felege-Hiwot Comprehensive Specialized Hospital (FHCSH) and Debre Markos Referral Hospital (DMRH) in Northwest Ethiopia. These two hospitals are 200 km apart from each other and are located in Northwest Ethiopia. FHCSH is a specialised care hospital with a capacity of 430 inpatient beds and 422 health professionals. DMRH is a referral hospital that provides general (non-specialised) care with 132 inpatient beds. More than 4000 clients received psychiatric care at both hospitals in 2019 and two-thirds of them attended FHCSH.

Sample size determination and sampling procedure
Sample size was calculated using a single population proportion formula, considering the following assumptions: a 31.4% prevalence of undernourishment among adults with MDD, a 5% margin of error and a 95% CI. Finally, the sample size became 405 when adding a 10% non-response rate.

Participants were proportionally recruited from both hospitals using a stratified sampling technique. The sample size was then proportionally allocated for both hospitals, so that 298 and 97 participants were taken from FHCSH and DMRH, respectively. Adults (18 years old and above) diagnosed with MDD were eligible for this study. Clients who had a low understanding of their illness as diagnosed by mental health professionals were excluded from the study. Additionally, those diagnosed with comorbid psychiatric conditions were excluded.

Data collection procedure and measurements/instruments
Data were collected from September to November 2019 using interviewer-administered and structured questionnaires, chart review and anthropometric measurements. The interviews were conducted by trained psychiatric nurses who had a considerable experience in quantitative data collection. Interviews were conducted in a separate room to ensure confidentiality.

The questionnaire was adapted from previous similar studies and was modified to the context of this study. Pretest was conducted on 5% of adults with MDD at Gondar Specialized Teaching Hospital before the actual data collection period. Necessary corrections were made based on the results of pretest data. The questionnaire was translated to local language (Amharic) and back to English by fluent speakers of the two languages. The collected data were checked for completeness and consistency daily by supervisors.

Height and body weight measurements were taken from each study participant. Height was measured using a portable anthropometric height measuring scale without shoes, wearing no head gear, knees fully straight. Both hands were held down to the side and the height recorded to the nearest 0.1 cm. The body weight was measured using a weighing scale maintaining participants with light clothing, bare foot, standing in erect position. Measuring instruments were checked and calibrated before the procedure to make measurements more reliable. Data collectors took at least two separate height
and weight measurements for each participant that were repeated when there was more than 0.1 kg weight and 0.1 cm height variation in the two measures. Finally, BMI was calculated by dividing body weight (kg) by the square of height (m²) to determine the nutritional status of the respondents. In this study, undernourishment was defined as a BMI <18.5 kg/m². Undernourishment was further classified as mild (17—18.49 kg/m²), moderate (16—16.99 kg/m²) and severe (<16 kg/m²) based on the evidence from previous studies.²²

**Statistical analysis**
The data were coded and entered into Epi-Data V.3.1 and exported to SPSS V.25 for analysis. Descriptive analysis was done to calculate frequencies, mean scores and proportions. A binary logistic regression model was fitted for analysis. Model fitness was checked using Hosmer-Lemeshow goodness-of-fit test. The p value of the Hosmer-Lemeshow goodness-of-fit test was 0.659, which confirms that the model is correctly specified. Bivariable and multivariable logistic regression analyses were conducted to identify associated factors with undernourishment. All covariates with a p value less than 0.25 in the bivariable analysis were taken into a multivariable analysis to control confounding factors and to identify true predictors of undernourishment. Those variables that showed a p value of less than 0.05 with 95% CI and adjusted Odds Ratio (AOR) were defined as factors significantly associated with undernourishment.

**Patient and public involvement**
No patient involved.

**RESULTS**

**Sociodemographic characteristics of the study participants**
Out of 405 candidate participants, 396 (97.7%) enrolled in the study. The median age of respondents was 29.5 years. More than one-third of participants were married (n=146, 36.9%) and 134 (33.8%) did not attend formal education. More than half of study participants (208, 52.5%) were urban residents and 278 (70.2%) were living with their parents (table 1).

**Prevalence of undernourishment among adults with MDD**
The overall prevalence of undernourishment was 28.5% (n=113, 95% CI: 23.7% to 33.4%) among adults with MDD attending psychiatric care at the two hospitals in Northwest Ethiopia. Among undernourished participants, 26.5% (n=105) had mild to moderate undernourishment. Of all the study participants, 56.6% (n=224) had a normal weight range, 10.9% (n=43) overnourishment and 4.0% (n=16) obesity (figure 1).

**Factors associated with undernourishment**
Female gender was significantly associated with undernourishment, that the odds of undernourishment were 2.18 times higher among women than men (AOR=2.18, 95% CI=1.20 to 3.96, p=0.01). Rural residence was associated with undernourishment, that the odds of undernourishment were 2.14 times higher among rural than urban residents (AOR=2.41, 95% CI=1.23 to 4.70, p=0.01). Additionally, illiteracy had a significant association with undernourishment, that the odds of undernourishment were 2.86 times higher among illiterate participants than those who attended higher education (AOR=2.86, 95% CI=1.01 to 8.07, p=0.04). Antidepressant side effect was associated with undernourishment, that the odds of undernourishment were 2.04 times higher among study participants with antidepressant side effects than those without side effects (AOR=2.04, 95% CI=1.08 to 3.88, p=0.02). Moreover, having a comorbid HIV/AIDS had positive association with undernourishment, that the odds of undernourishment were 4.12 times higher among those with HIV/AIDS than those without HIV/AIDS (AOR=4.12, 95% CI=1.46 to 11.57, p=0.007) (table 2).

**DISCUSSION**
The prevalence of undernourishment was high among adults with MDD attending psychiatric follow-up at the two public hospitals in Northwest Ethiopia. Undernourishment had a positive relationship with female gender, and...
rural residence, illiteracy, antidepressant side effects and diagnosis of comorbid HIV/AIDS.

The 28.5% prevalence of undernourishment was comparable with an older study finding of 31.4% prevalence among adults with MDD in Northwest Ethiopia. Undernourishment remains a big public health problem among adults with MDD in Ethiopia; however, there is a limited intervention against undernourishment particularly for people with psychiatric problems including MDD. Undernourishment has been overlooked among adults with MDD in low-income countries, and there is a huge lack of evidence in low-income countries. However, our study finding looks similar when compared with the 27.6% prevalence of undernourishment in the general population in Northwest Ethiopia. More research is needed in low-income settings to investigate the relationship between undernourishment and MDD to design a problem-based intervention because the cause of undernourishment may not be limited to food insecurity and poverty, and mental health-related factors.

The relationship between gender and undernourishment was supported by previous study findings that women were more prone to undernourishment than men in Ethiopia. Women breast feed their children for an extended period and are involved in energy-demanding household activities including housekeeping and outdoor farming. They are caretakers of the household and get inadequate meals that their body need, because they often eat after they have served every family member. According to the World Bank report, women are poorer economically than men, and are vulnerable to food insecurity. Therefore, empowering women to become economically self-sufficient could reduce the burden of undernutrition in Ethiopia and the rest of the world.

In this study, undernourishment was associated with illiteracy (no formal education), which is supported by a previous study finding in Ethiopia. Illiteracy is an important determinant of undernutrition because it is associated with poverty, food insecurity and low levels of health literacy to make a choice of healthy diets. Similarly, the AOR of undernourishment was higher among rural residents than those in urban areas. Rural people are mostly farmers who are excessively engaged in labour work. Poverty and food insecurity are common challenges for the rural communities in Ethiopia. All these could increase the likelihood of being undernourished due to low access to sufficient amount and quality of food to meet dietary needs.

This study found that those who had antidepressant side effects had higher AOR of undernourishment than those without side effects. Common side effects including nausea, vomiting, diarrhoea, fatigue and stomach upset affect the appetite and could lead to chronic anorexia. The ingested food may be poorly absorbed in the body. Additionally, chronic vomiting leads to a loss of water, minerals and electrolytes.

Finally, the findings of this study indicated that being diagnosed with HIV/AIDS was positively associated with...
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undernourishment. The AOR of undernourishment was higher among adults with HIV/AIDS than those without HIV/AIDS. This finding is similar with another study finding in Ethiopia.31 The majority of people with HIV/AIDS live in poverty and struggle with food insecurity. Moreover, people with HIV/AIDS experience loss of interest and appetite to take adequate meals, which may lead to undernourishment. Because of the frequent release of the pro-oxidant cytokines, HIV infection is associated with an increased risk of oxidative stress causing further damage to cells, proteins and enzymes.32

Oxidative stress and impaired immune functions mediate micronutrient deficiencies. Therefore, the higher nutritional requirement coupled with poor food intake could lead to higher risk of undernourishment.32

Limitations of the study

This study has several limitations and we suggest readers to cautiously interpret the results. First, the study did not assess the time of diagnosis and how long a participant has lived with MDD. Second, the study could have introduced social desirability bias that might have affected the

Table 2  Bivariable and multivariable analyses of factors associated with undernourishment among adults with major depressive disorder at two public hospitals in Northwest Ethiopia, N=396

| Characteristics     | Undernourishment |               |               |               |               |               |
|---------------------|------------------|---------------|---------------|---------------|---------------|---------------|
|                     | Yes (n) | No (n) | COR (95% CI) | AOR (95% CI) | P value       |               |
| Age in years        |          |          |              |               |               |               |
| 18–26               | 65      | 77      | 1.46 (0.72 to 2.99) | 2.39 (0.73 to 7.94) | 0.152         |               |
| 27–35               | 19      | 108     | 0.31 (0.14 to 0.68) | 0.52 (0.17 to 1.56) | 0.244         |               |
| 36–45               | 14      | 72      | 0.34 (0.14 to 0.79) | 0.30 (0.09 to 0.94) | 0.039         |               |
| ≥46                 | 15      | 26      |               |               | 1             |               |
| Sex                 |          |          |              |               |               |               |
| Female              | 74      | 132     | 2.17 (1.38 to 3.41) | 2.19 (1.21 to 3.97) | 0.010         |               |
| Male                | 39      | 151     |               |               | 1             |               |
| Religion            |          |          |              |               |               |               |
| Orthodox Christian  | 93      | 248     | 0.66 (0.36 to 1.19) | 0.46 (0.19 to 1.14) | 0.095         |               |
| Islam               | 20      | 35      |               |               | 1             |               |
| Marital status      |          |          |              |               |               |               |
| Married             | 30      | 116     |               |               | 1             |               |
| Single              | 58      | 111     | 2.02 (1.21 to 3.37) | 1.28 (0.55 to 2.98) | 0.567         |               |
| Divorced            | 15      | 46      | 1.26 (0.62 to 2.56) | 0.71 (0.25 to 1.98) | 0.510         |               |
| Widowed             | 10      | 10      | 3.87 (1.47 to 10.14) | 0.96 (0.24 to 3.82) | 0.955         |               |
| Educational status  |          |          |              |               |               |               |
| Illiterate          | 55      | 79      | 2.86 (1.56 to 5.25) | 2.85 (1.02 to 8.07) | 0.047         |               |
| Primary school      | 22      | 75      | 1.20 (0.60 to 2.40) | 0.98 (0.35 to 2.77) | 0.973         |               |
| Secondary school    | 17      | 51      | 1.37 (0.65 to 2.88) | 0.87 (0.33 to 2.30) | 0.780         |               |
| Higher education    | 19      | 78      |               |               | 1             |               |
| Residence           |          |          |              |               |               |               |
| Rural               | 75      | 113     | 2.97 (1.88 to 4.69) | 2.41 (1.24 to 4.70) | 0.010         |               |
| Urban               | 38      | 170     |               |               | 1             |               |
| Current tobacco use |          |          |              |               |               |               |
| Yes                 | 12      | 12      | 2.68 (1.17 to 6.17) | 1.49 (0.29 to 7.83) | 0.632         |               |
| No                  | 101     | 271     |               |               | 1             |               |
| Current alcohol use |          |          |              |               |               |               |
| Yes                 | 40      | 76      | 1.49 (0.94 to 2.38) | 0.95 (0.46 to 1.96) | 0.896         |               |
| No                  | 73      | 207     |               |               | 1             |               |
| Current khat use    |          |          |              |               |               |               |
| Yes                 | 22      | 28      | 2.20 (1.19 to 4.04) | 1.67 (0.49 to 5.71) | 0.418         |               |
| No                  | 91      | 255     |               |               | 1             |               |
| Antidepressant side effects |          |          |              |               |               |               |
| Yes                 | 77      | 130     | 2.52 (1.59 to 3.99) | 2.05 (1.08 to 3.88) | 0.028         |               |
| No                  | 36      | 153     |               |               | 1             |               |
| HIV/AIDS            |          |          |              |               |               |               |
| Unknown             | 41      | 110     | 1.26 (0.78 to 2.06) | 1.00 (0.53 to 1.88) | 0.999         |               |
| Positive            | 26      | 17      | 5.19 (2.59 to 10.38) | 4.12 (1.46 to 11.57) | 0.007         |               |
| Negative            | 46      | 156     |               |               | 1             |               |

Current use refers to the use of drugs/substances in the past 1 month. Bolded entries on the table indicate statistically significant tests. AOR, adjusted Odds Ratio; COR, Crude Odds Ratio.
accuracy of the data, particularly those related to alcohol and substance use. Third, this study used BMI, which may not be an accurate approach to measure undernourishment. We suggest future researchers triangulate BMI with more anthropometric measurements such as BMI with brachial circumference and ankle-brachial index, and/or with structured questionnaires including the Mini-Nutritional Assessment to assess nutritional status accurately. Fourth, the association of undernourishment with food insecurity and income was not examined in this study.

CONCLUSION

In this study, one-third of adults with MDD had undernourishment. Women, rural residents and those who had no formal education had higher prevalence of undernourishment than their counterparts. Furthermore, having antidepressant side effects and a comorbid HIV/AIDS had a significant association with undernourishment among adults with MDD. The result of this study indicated that attention should be given to people with MDD to prevent undernourishment in psychiatric facilities. It is important to integrate nutritional care with mental healthcare in Ethiopia. Therefore, nutrition assessment, counselling and support should be provided for people with MDD.

REFERENCES

1. Freijer K, Nuijten MJC, Schols JMG, et al. Nutritional supplements for disease related malnutrition in elderly in the community setting. *Front Pharmacol* 2012;3:78.
2. UNICEF, WHO, and World Bank Group. JointMalnutrition Estimates. May 2018 Edition:1993-2017.
3. Roberts SB. Effects of aging on energy requirements and the control of food intake in men. *J Gerontol A Biol Sci Med Sci* 1995;50 Spec No:101-6.
4. NCD Risk Factor Collaboration (NCD-RisQ). Trends in adult body-mass index in 200 countries from 1975 to 2014: a pooled analysis of 1698 population-based measurement studies with 19.2 million participants. *Lancet* 2016;387:1377-96.
5. Visvanathan R. Under-Nutrition in older people: a serious and growing global problem. 2003.
6. Bailey KV, Ferro-Luzzi A. Use of body mass index of adults in assessing individual and community nutritional status. 2014.
7. Ma L, Poulin P, Feldstain A, et al. The association between malnutrition and psychological distress in patients with advanced head-and-neck cancer. *Curr Oncol* 2013;20(5):534-60.
8. USAID. Undernutrition among Women in Ethiopia. USAID 2010.
9. Yisak H, Maru I, Abele M, et al. Determinants of undernutrition among older adults in South Gondar zone, Ethiopia: a community-based study. *BMJ Open* 2022;12:e069866.
10. Oumer B, Bolli N, Hussen S, et al. Prevalence of Undernutrition and associated factors among adults receiving first-line antiretroviral treatment in public health facilities of Arba Minch town, southern Ethiopia. *Hiv AIDS* 2019;11:313-20.
11. Assete T, Seid O, Tadesse F, et al. Nutritional status and associated factors among adult psychiatric patients in Dessie referral Hospital, northeast Ethiopia. *Psychiatry J* 2020;2020:1-9.
12. Wondmienen A, Gedefaw G, Getie A, et al. Prevalence of undernutrition among adult tuberculosis patients in Ethiopia: A systematic review and meta-analysis. *J Clin Tuberc Other Mycobact Dis* 2021;22:100211.
13. Kassie Tesema A, Liyew AM, Alem AZ, et al. Spatial distribution and determinants of undernutrition among reproductive age women of Ethiopia: a multilevel analysis. *PLoS One* 2021;16:e0257664.
14. Sparling TM, Cheng B, Deeney M, et al. Global mental health and nutrition: moving toward a convergent research agenda. *Front Public Health* 2021;9:722290.
15. Kvanme J-M, Grani O, Florholmen J, et al. Risk of malnutrition is associated with mental health symptoms in community living elderly women and men: the Tromsø study. *BMC Psychiatry* 2011;11:112.
16. Ghimire S, Baral BK, Pokhrel BR, et al. Depression, malnutrition, and health-related quality of life among Nepali older patients. *BMC Geriatr* 2018;18:191.
17. Al-Rasheed R, Arasheed R, Al Johani R, et al. Malnutrition in elderly and its relation to depression. *International Journal Of Community Medicine And Public Health* 2018;5:2156.
18. (NICE) NIHaCE.. Depression: the treatment and management of depression in adults (update). 2013.
19. Uğur Z,Hallı M, Kalan I, et al. Comprehensive assessment of malnutrition risk and related factors in a large group of community-dwelling older adults. *Clin Nutr* 2010;29:507-11.
20 Floriana S, MLMdW L, Bouvy PF, et al. Obesity, and Depression A Systematic Review and Meta-analysis of Longitudinal Studies 2010.
21 Ann CWBaM. Modern nutrition in health and disease. USA, 2014.
22 Gezahegn E, Edris M, Dachew BA. Prevalence and factors associated with undernutrition among adults with major depressive disorder in Northwest Ethiopia. Psychiatry J 2016;2016:1–7.
23 Molla GL, Sebhat HM, Hussen ZN, et al. Depression among Ethiopian adults: cross-sectional study. Psychiatry J 2016;2016:1–5.
24 Onyike CU, Crum RM, Lee HB, et al. Is obesity associated with major depression? results from the National Health and Nutrition Examination Survey. Am J Epidemiol 2003;158:139–47.
25 Payahoo L, Khaje-Bishak Y, Pourghassem Gargari B, et al. Assessment of nutritional and depression status in free-living elderly in Tabriz, northwest Iran. Health Promot Perspect 2013;3:288–93.
26 Sanchez-Villegas AVL, De Irala J. Dietary fat intake and the risk of depression, 2011.
27 Tsai AC, Chou Y-T, Chang T-L. Usefulness of the mini nutritional assessment (MNA) in predicting the nutritional status of people with mental disorders in Taiwan. J Clin Nurs 2011;20:341–50.
28 Sserwanja G, Mukunya D, Habumugisha T, et al. Factors associated with undernutrition among 20 to 49 year old women in Uganda: a secondary analysis of the Uganda demographic health survey 2016. BMC Public Health 2020;20:1644.
29 Group WB. Gender differences in poverty and household composition through the life-cycle 2018.
30 Pourghassem GB, Mahboob S, Pourafkari N. Nutritional status in patients with major depressive disorders: a pilot study in Tabriz, Iran 2012.
31 Ethiopian health and nutrition research Institute 2012.
32 Friis H. Micronutrients and HIV infection: a review of current evidence consultation on Nutrition and HIV/AIDS in Africa: Evidence, lessons and recommendations for action, Durban, South Africa. 10–13 April 2010.