HIV-positive children are: aged 6 months to 14 years; registered or transferred to the CTCs; attended with his/her caregiver; consent by the caregiver to voluntarily participate in the study. We will exclude children whose ART information is missing in the medical records and whose HIV sero-status has not been confirmed. An estimated 800 children currently attend the 16 selected CTCs. Because half of the CTCs will be selected for the intervention arm, approximately half of the potential participants (400) will be in the intervention group and a similar number for the control group.

Caregivers of the HIV-positive children

We will recruit caregivers of HIV-positive children for this study because our study involves children aged 6 months to 14 years, who cannot give consent themselves to participate in the study nor can they participate in the study alone. Furthermore, the nutrition counseling conducted by the MLPs will target the children's caregivers. We will therefore be recruiting a similar number of caregivers as there will be children. As in previous studies [3,20], we will use the definition of a caregiver as a child's parent, relative, guardian, or anyone else above 18 years old who takes care of the child, supervises their treatment, and accompanies the child to the CTC.

Sample size estimation

To calculate the minimum sample size for the intervention and control group, we assumed the inter-cluster coefficient to be as low as 0.01. Also, we assumed that 8 clusters (CTCs) would be included in the intervention arm and a similar number in the control arm. We could not find any other studies, based in sub-Saharan Africa, that estimated weight gain after implementing this type of intervention, and therefore we used a similar study conducted in China investigating children in the general population as a reference [21]. In this study, an estimated mean weight gain difference between children of the intervention and control arm was 0.3 kg in six months. To detect the mean difference of 0.3 kg weight gained in the intervention group compared to the control group over a 6-month duration, at a power of 80% and 5% significant level, 24 participants per cluster will be needed. In total, a minimum sample size of 192 participants for each arm will be required to produce the desired effect. To counteract the effect of loss to follow-up, deaths, a number of outcome variables, and missing data, we will attempt to recruit 400 HIV-positive children for the intervention arm and a similar number for the control arm. Therefore, an estimated 800 caregivers will also be recruited to participate in this study, with a similar distribution between the intervention and control groups (400 in each arm).

Randomization process

We will use the CTCs as the unit of randomization. A total of 32 CTCs provide care and treatment to about 1,800 HIV-positive children aged 0 to 14 years old in Tanga. We will exclude private CTCs, as well as CTCs with less than 20 HIV-positive children. A total of 16 CTCs in the area are public and have at least 20 HIV-positive children receiving care and/or treatment; they also represent all the districts of the region. Of the 16 CTCs, 4 are from the Tanga urban area; this is due to a high number of CTCs and HIV-positive patients attending them. All CTCs based in district hospitals will be selected in this study because they fulfill the selection criteria. These 16 CTCs will be eligible for the randomization process: a coin toss to assign 8 CTCs to the intervention arm and 8 to the control arm. A person who is not a member of the study research team will conduct the randomization process.

Measurements

Nutrition status

We chose the nutrition status of HIV-positive children as the outcome variable, including use of the categories underweight, wasting, and stunting. We will measure children's weight using a standardized hanging Salter® scale (UK) calibrated to 0.1 kg for children who cannot stand and a standardized Seka® digital scale (Brooklyn, USA) for children who can stand. Height will be measured for children aged 24 months and older using a Seka® measuring rod calibrated to 0.5 cm [22]. We will use a designated mark on a board to measure lengths of children younger than 24 months in a recumbent position [23].

After obtaining height and weight data, we will convert them to a height-for-age z-score, weight-for-age z-score, and weight-for-height z-score [24] using the Epi-Info ENA Ver. 3.5.1, 2008 (CDC, Atlanta, Georgia, USA) software and WHO reference values [25,26]. Low height-for-age, weight-for-height, and weight-for-age are measures of stunting, wasting, and underweight, respectively [27].

Dietary diversity

Dietary diversity is one of the measures of feeding practices and thus is one of our outcome variables. We will calculate a total dietary diversity score from a recalled list of food items consumed over the previous day. We will use a set list of 12 main food items found to be common in the formative research and the child questionnaire of the Tanzania Demographic and Health Survey [2,28]. We adopted this method as it has been used in previous studies among HIV-positive children in Tanzania [3,20].

Feeding frequency

Feeding frequency is also a measure of feeding practices and therefore one of our outcome variables. We will

assess the feeding frequency of HIV-positive children by asking the caregivers to recall the number of times they fed their children in the 24 hours preceding the interview. WHO recommends feeding frequency of five times per day for HIV-positive children [19]. We will consider a feeding frequency of below five to be a low feeding frequency.

Quantity of food and quality of food

Amount and quality of food consumed by a child is again one of the measures of feeding practices and therefore an outcome variable in our study. We will measure food quality (ingredients or composition) and quantity using Tanzania food composition tables [29]. Such food composition tables provide information on calories, protein, vitamins, and essential minerals per 100 g of the local food type.

Adequate energy intake for HIV-positive children with no infections or severe undernutrition is 10% more than the requirement of normal children of the same age [19]. For HIV-positive children with opportunistic infections, energy requirements are 20% to 30% above normal children of the same age [19]. HIV-positive children with severe undernutrition have energy requirements of 50% to 100% above the required energy intake of HIV-negative children of the same age [19]. We will estimate the foods consumed in the previous 24 hours and work out specific ingredients. We will measure the amount consumed using common feeding utensils, such as plates, bowls or cups. We will categorize the diet as being low quantity if the child consumed an amount below the recommended value for that age.

Household food insecurity

We will measure household food insecurity using the Household Food Insecurity Access Scale (HFIAS) [30]. This is because food insecurity was associated with both acute and chronic forms of undernutrition among ART-treated HIV-positive children in Tanzania [3]. This scale has nine items on food access experience. Options are ranked from 0 = 'no', 1 = 'rarely', 2 = 'sometimes', and 3 = 'often'. Score ranges from 0 to 27; higher scores reflect more severe food insecurity. The scale can continuously measure food insecurity, or it can be used categorically to identify food secure or insecure households. The recall duration is shorter compared to other scales; HFIAS uses a 30-day recalling period and has been used among the HIV-positive population in Kenya and Uganda [31-36].

HIV CTC related data

HIV clinical stage

Advanced HIV clinical stage is associated with chronic undernutrition in Tanzania [3,20]. Like in the previous studies, we will use WHO clinical staging to determine HIV/AIDS progression. The four-stage classification uses both medical history and physical examination to classify HIV/AIDS progression. The first two clinical HIV stages are regarded as 'early stages', whereas clinical HIV stages 3 and 4 are regarded as 'advanced stages' [37]. In this study, we will extract the highest reached WHO clinical stage from the medical file of each child attending the CTC. The CTC staff updates such information on a routine basis with each CTC visit.

ART treatment duration

ART halts HIV/AIDS progression for HIV-positive individuals, improves their immunity, reduces opportunistic infections, and improves appetite [38-40]. Thus, it may also serve to ameliorate the worsening of nutrition status among HIV-positive children. ART treatment duration has also been associated with improvement of underweight and stunting [41]. In this study, we will measure the ART treatment duration as months since initiation.

We will check and record the ART regimen used. According to the national guidelines [17], HIV-positive children in Tanzania are typically treated by combination therapy of three ARTs, referred to as 'highly active antiretroviral therapy'. The fixed combination may either be two nucleoside reverse transcriptase inhibitors and a non-nucleoside reverse transcriptase inhibitor, or two nucleoside reverse transcriptase inhibitors and boosted protease inhibitor. Appropriate combinations differ with child age, anemia status, liver enzymes, and side effects. Children aged up to 36 months are given a combination therapy that includes Zidovudine, Lamivudine and Niverapine. Older children receive a combination of Zidovudine, Lamivudine and Efavirenz. If the child was exposed to Nevirapine on prevention of mother-to-child transmission of HIV/AIDS intervention during pregnancy, Niverapine is usually substituted with Lopinavir boosted with Ritonavir. Stavudine is used in place of Zidovudine if the child is diagnosed with anemia.

Opportunistic infections

We will also assess the presentation of any common opportunistic infections. Previous studies showed an association of opportunistic infections with undernutrition among children living with HIV/AIDS in Tanzania [3,42], and other countries in sub-Saharan Africa [40,43,44]. Such opportunistic infections include diarrhea, malaria, tuberculosis, upper respiratory tract infections, and oral/esophageal candidiasis. Diarrhea is defined as the presence of three or more watery stools during the previous 24 hours [45]. Malaria is defined as a typical febrile illness characterized by fever, chills and sweating, and evidenced by parasitological examination [46]. We will assess other opportunistic infections based

on a medical history and medical records. We will also examine for intestinal helminthes among the children, as it is an important determinant of undernutrition, and in particular micronutrient deficits.

Socioeconomic position

We will assess economic status using a weighted wealth index. The index incorporates household durable assets ownership, such as owning a paraffin lamp, television, radio, telephone, flat iron, refrigerator, bicycle, motor car, farm and having electricity; housing and dwelling characteristics including main floor materials, house ownership, fuel for lighting and cooking, type of toilet, source of water, feeding characteristics, and household food satisfaction [2,28]. We will construct dichotomous variables for these items and carry out factor analysis using principle component analysis to reduce such variables into ones that will load as factor 1, which describe the socioeconomic position of the study population. We will use factor loadings as item weights, and sum them to yield the wealth index for each household [47-49]. We will divide the total weighted wealth index score into quartiles to designate levels of economic status.

Sociodemographic data

We will adopt other sociodemographic variables pertaining to children and their caregivers from the women and household questionnaires of the Tanzania Demographic and Health Survey [2,28]. Population surveys in Tanzania have already tested and used these variables both in 2005 and 2010. Such variables will include education level, orphanhood, religion, and marital status.

We will measure education level by years spent in school. We will also group religions into the common denominations found in Tanzania [50]. This includes Christians, Moslems, and non-religious. We will group marital status into either currently married or not currently married [2]. We will consider caregivers who are divorced or widowed at the time of data collection as 'not currently married'. We will measure child and caregiver's ages in months and years, respectively [2,3].

Data collection

Prior to data collection, we will train research assistants on the data collection and ethical procedures. We will translate the English questionnaire into Swahili and then back-translate it to English using two independent local researchers to check that is retains its original meaning. We will use the Swahili version of the questionnaire for data collection. The trained research assistants will conduct a pre-test for the questionnaire and the interview in the Swahili language. We will collect data from August 2013 and continue to do so monthly for a period of six months. To assess changes in the MLPs knowledge, we will use the questionnaire from the training manual to collect data before and after the nutrition training.

Data analysis

We will analyze the data based on the intention-to-treat principle. We will use both descriptive and regression analyses. For the descriptive analyses, we will conduct both χ^2 and Student's *t*-tests to examine the differences in characteristics of participants in the intervention and control groups. This study will have two types of outcome variables. First, nutrition status measured as underweight, wasting, and stunting. Second, feeding practices measured by feeding frequency, dietary diversity, and the quality and quantity of foods consumed. We will use multiple logistic regression analyses to examine the effectiveness of nutrition training on nutrition status and feeding practices of the two arms while adjusting for confounding variables. We will also conduct analyses to see monthly changes in feeding practices and nutrition status and to compare the intervention and control arms. To examine the independent association of nutrition counseling by trained MLPs on outcome variables, we will use repeated measures of ANOVA and Generalized Estimated Equation.

Ethical considerations

Before conducting interviews or allowing participation in the study, we will obtain written informed consent from the caregivers. Participants will be assured of the confidentiality and anonymity of reports and publications generated from this study. Participation will be voluntary and participants will be assured that there will be no implications for their care if they refuse to participate in the study. This study is approved by the Expedited Review Sub-Committee of the Senate Research and Publication Directorate of the Muhimbili University of Health and Allied Sciences in Tanzania and the Research Ethics Committee of the University of Tokyo in Japan.

Discussion and implications

Nutrition training of health workers has been shown to be effective in improving the nutrition status of HIV-negative children. In our recent systematic review [10], health workers who were given in-service nutrition training could transform feeding practices and the energy intake of children in the general population. However, we could not find studies that targeted HIV-positive children. This population bears a higher burden of undernutrition compared to the general population. It is thus important to understand the effectiveness of such an intervention among this population.

Tanzania, along with other developing countries, also faces a shortage of well-trained health workers [6,51]. MLPs are left with the high burden of taking care of

patients with minimum knowledge [8]. Our study will focus on the training of this health cadre and the examination of the efficacy of such training on management of undernutrition for HIV-positive children.

This study has the potential to directly transform the nutrition status and feeding practices of HIV-positive children in a region with a high burden of undernutrition. The findings of this study could support proposals to scale-up nutrition interventions using the available health infrastructure in semi-urban and rural areas of Tanzania, as well as in other countries with similar characteristics. We will also be able to better understand the local causes of undernutrition among HIV-positive children in an area that has adequate food production but a high toll of undernutrition.

The foreseen limitations of this study include differences in experiences and qualifications of targeted MLPs. Assistant medical officers have higher qualifications compared to clinical officers and assistant nurses. Their understanding of nutrition-related topics during the training might also be different. To minimize this limitation, we will use experienced trainers and both English and Swahili languages to emphasize the important points.

Trial status

This trial was in the formulation phase during the preparation of this manuscript.

Abbreviations

ART: Antiretroviral therapy; CTCs: Care and treatment centers; HFIAS: Household food insecurity access scale; MLPs: Mid-level providers; RCT: Randomized controlled trial.

Competing interests

All authors declare that they have no competing interests.

Authors' contributions

BFS conceived the research questions, designed the study, and prepared the first draft, and will also supervise the intervention and conduct data collection and analyses. KCP refined the research questions and helped to prepare the first protocol. LBM contributed to the study design and helped to prepare the first draft. DPU revised the study design, prepared the protocol, and will supervise the interventions and data collection. JY participated in the preparation of the protocol, first draft and revisions. MJ reviewed the study protocol, supervised the trial, prepared the manuscript, and approved the submission. All authors read and approved the final version of the manuscript for submission.

Acknowledgements

We would like to thank Prof. William Urassa (World Health Organization) and Dr. Honorath Massanja (Ifakara Health Institute) for their invaluable insight and support during preparation of the protocol. We also acknowledge the help of Dr. Adelheid Onyango and Maria Del Carmen Casanovas (Department of Nutrition-WHO) for the technical support and intervention materials that are being used in this study. Heartfelt regards also go to the Tanga regional administrators including Dr. Selemani Msangi (Regional AIDS Control Coordinator), Dr. Uredi Ally (Regional Medical Officer), Dr. Robert Kissanga (AIDS Relief), Dr. Joseph Mihayo (AIDS Relief-Tanga), District Medical Officers and CTC in-charges who agreed and helped to facilitate this study. We would also like to extend our gratitude to Dr. Omary Ubuguyu and Dr. Namala Mkopi of Muhimbili National Hospital who agreed to provide nutrition training and counseling lectures to the study participants. We would also like to thank Ms. Jessica Cope (Tokyo University) for the extensive English editing of this manuscript. Last but not least, we would like to thank Dr. Anna Kessy and Dr. Germana Leyna of Muhimbili University of Health and Allied Sciences who assisted with refining the protocol and made it possible to get ethical approval and operational grants to conduct this study.

Sources of funding

Dr. David Urassa (SPHSS-MUHAS) received a capacity building grant from the Directorate of Research and Publication of the Muhimbili University of Health and Allied Sciences (Ref. No.: MU/01/1022/0130/21). Prof. Masamine Jimba and Dr. Junko Yasuoka (Tokyo University) received a grant from the Ministry of Health, Labor and Welfare of Japan (Research Grant No.: H24-Chikyukibo-Ippan-008). The funding sources will not have any influence on the conduct and results of the study.

Author details

[1]Department of Community and Global Health, Graduate School of Medicine, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113-0033, Japan. [2]Department of Public Health, School of Public Health and Health Sciences, University of Massachusetts Amherst, Arnold House, 715 North Pleasant St, Amherst, MA 01003-9304, USA. [3]School of Public Health and Social Sciences, Muhimbili University of Health and Allied Sciences, P.O. Box 65489, Dar es Salaam, Tanzania.

Received: 3 July 2013 Accepted: 15 October 2013
Published: 25 October 2013

References

1. UNAIDS: *AIDS Epidemic Update.* Geneva: World Health Organization; 2009.
2. NBS, ORC-Macro: *Tanzania Demographic and Health Survey 2009–2010.* Dar es Salaam: National Bureau of Statistics and ORC Macro; 2010.
3. Sunguya BF, Poudel KC, Otsuka K, Yasuoka J, Mlunde LB, Urassa DP, Mkopi NP, Jimba M: **Undernutrition among HIV-positive children in Dar es Salaam, Tanzania: antiretroviral therapy alone is not enough.** *BMC Public Health* 2011, 11:869.
4. Santos I, Victora CG, Martines J, Gonçalves H, Gigante DP, Valle NJ, Pelto G: **Nutrition counseling increases weight gain among Brazilian children.** *J Nutr* 2001, 131(11):2866–2873.
5. Pelto GH, Santos I, Gonçalves H, Victora C, Martines J, Habicht JP: **Nutrition counseling training changes physician behavior and improves caregiver knowledge acquisition.** *J Nutr* 2004, 134(2):357–362.
6. *Global Atlas of the Health Workforce.* [http://apps.who.int/globalatlas/default.asp]
7. McDonald CM, Kupka R, Manji KP, Okuma J, Bosch RJ, Aboud S, Kisenge R, Spiegelman D, Fawzi WW, Duggan CP: **Predictors of stunting, wasting and underweight among Tanzanian children born to HIV-infected women.** *Eur J Clin Nutr* 2012, 66(11):1265–1276.
8. Global Health Workforce Alliance: *Mid-level Health Providers a Promising Resource to Achieve the Health Millennium Development Goals. Global Health Workforce Alliance, Report.* Geneva: World Health Organization; 2010.
9. WHO: *Midlevel Providers: A Promising Resource to Achieve the Health Millennium Development Goals.* Geneva: World Health Organization; 2010.
10. Sunguya BF, Poudel KC, Mlunde LB, Shakya P, Urassa DP, Jimba M, Yasuoka J: **Effectiveness of nutrition training of health workers toward improving caregivers' feeding practices for children aged six months to two years: a systematic review.** *Nutr J* 2013, 12:66.
11. Imdad A, Yakoob MY, Bhutta ZA: **Impact of maternal education about complementary feeding and provision of complementary foods on child growth in developing countries.** *BMC Public Health* 2011, 11(Suppl 3):S25.
12. Shi L, Zhang J: **Recent evidence of the effectiveness of educational interventions for improving complementary feeding practices in developing countries.** *J Trop Pediatr* 2011, 57(2):91–98.
13. Dewey KG, Adu-Afarwuah S: **Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries.** *Matern Child Nutr* 2008, 4(Suppl 1):24–85.
14. ICF-Macro NBS: *Micronutrients: Results of the 2010 Tanzania Demographic and Health Survey.* Dar es Salaam: NBS and ICF Macro; 2011.
15. NACP: *HIV/AIDS/STI Surveillance Report No. 21.* Dar es Salaam: Ministry of Health, Tanzania Mainland: National AIDS Control Programme (NACP); 2009.
16. TACAIDS, ZAC, NBS, OCGS, ICF-Macro: *Tanzania HIV/AIDS and Malaria Indicator Survey 2011–12.* Dar es Salaam: Tanzania Commission for AIDS (TACAIDS),

Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), and ICF International; 2013.
17. NACP, Ministry of Health: *National Guideline for Management of HIV/AIDS.* Dar es Salaam: Ministry of Health; 2009.
18. WHO: *Management of Childhood Illness, Counsel the Mother.* Geneva: WHO Division of Diarrhea and Acute Respiratory Disease Control; 1995.
19. WHO: *Guidelines for an Integrated Approach to the Nutritional Care of HIV-infected Children (6 months to 14 years).* Geneva: World Health Organization; 2009.
20. Sunguya BF, Poudel KC, Mlunde LB, Otsuka K, Yasuoka J, Urassa DP, Mkopi NP, Jimba M: **Ready to use therapeutic foods (RUTF) improves undernutrition among ART-treated, HIV-positive children in Dar es Salaam, Tanzania.** *Nutr J* 2012, **11**:60.
21. Shi L, Zhang J, Wang Y, Caulfield LE, Guyer B: **Effectiveness of an educational intervention on complementary feeding practices and growth in rural China: a cluster randomised controlled trial.** *Public Health Nutr* 2010, **13**(4):556–565.
22. De Onis M, Onyango AW, Van den Broeck J, Chumlea WC, Martorell R: **Measurement and standardization protocols for anthropometry used in the construction of a new international growth reference.** *Food Nutr Bull* 2004, **25**(1 Suppl):S27–S36.
23. Roche AF, Davila GH: **Differences between recumbent length and stature within individuals.** *Growth* 1974, **38**(3):313–320.
24. Dibley MJ, Staehling N, Nieburg P, Trowbridge FL: **Interpretation of Z-score anthropometric indicators derived from the international growth reference.** *Am J Clin Nutr* 1987, **46**(5):749–762.
25. WHO: *A Growth Chart for International Use in Maternal and Child Health Care.* Geneva: World Health Organization; 1978.
26. Van den Broeck J, Willie D, Younger N: **The World Health Organization child growth standards: expected implications for clinical and epidemiological research.** *Eur J Pediatr* 2009, **168**(2):247–251.
27. WHO: Multicenter Growth Reference Study Group: **WHO child growth standards based on length, weight and age.** *Acta Paediatr* 2006, **450**:76–84.
28. NBS, ORC-Macro: *Tanzania Demographic and Health Survey 2004–2005.* Dar es Salaam: National Bureau of Statistics (Tanzania) and ICF-Macro; 2005.
29. Lukmanji Z, Hertzmark E, Mlingi N, Assey V, Ndossi G, Fawzi W: *Tanzania Food Composition Tables.* Dar es Salaam: MUHAS-TFNC, HSPH; 2008.
30. Coates J, Swindale A, Bilinsky P: *Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide (v. 3).* Washington, D.C: Food and Nutrition Technical Assistance Project, Academy for Educational Development; 2007.
31. Kadiyala S, Rawat R: **Food access and diet quality independently predict nutritional status among people living with HIV in Uganda.** *Public Health Nutr* 2013, **16**(1):164–170.
32. Nagata JM, Magerenge RO, Young SL, Oguta JO, Weiser SD, Cohen CR: **Social determinants, lived experiences, and consequences of household food insecurity among persons living with HIV/AIDS on the shore of Lake Victoria.** *Kenya. AIDS Care* 2012, **24**(6):728–736.
33. Tsai AC, Bangsberg DR, Emenyonu N, Senkungu JK, Martin JN, Weiser SD: **The social context of food insecurity among persons living with HIV/AIDS in rural Uganda.** *Soc Sci Med* 2011, **73**(12):1717–1724.
34. Tsai AC, Bangsberg DR, Frongillo EA, Hunt PW, Muzoora C, Martin JN, Weiser SD: **Food insecurity, depression and the modifying role of social support among people living with HIV/AIDS in rural Uganda.** *Soc Sci Med* 2012, **74**(12):2012–2019.
35. Weiser SD, Young SL, Cohen CR, Kushel MB, Tsai AC, Tien PC, Hatcher AM, Frongillo EA, Bangsberg DR: **Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS.** *Am J Clin Nutr* 2011, **94**(6):1729S–1739S.
36. Weiser SD, Gupta R, Tsai AC, Frongillo EA, Grede N, Kumbakumba E, Kawuma A, Hunt PW, Martin JN, Bangsberg DR: **Changes in food insecurity, nutritional status, and physical health status after antiretroviral therapy initiation in rural Uganda.** *J Acquir Immune Defic Syndr* 2012, **61**(2):179–186.
37. WHO: *WHO Case Definitions of HIV for Surveillance and Revised Clinical Staging and Immunological Classification of HIV-related Disease in Adults and Children.* Geneva: World Health Organization; 2006.
38. Yeung S, Wilkinson D, Escott S, Gilks C: **Paediatric HIV infection in a rural South African district hospital.** *J Trop Pediatr* 2000, **46**(2):107–110.
39. Bachou H, Tylleskär T, Downing R, Tumwine J: **Severe malnutrition with and without HIV-1 infection in hospitalised children in Kampala, Uganda: differences in clinical features, haematological findings and CD4+ cell counts.** *Nutr J* 2006, **5**:27.
40. Berkley J, Bejon P, Mwangi T, Gwer S, Maitland K, Williams T, Mohammed S, Osier F, Kinyanjui S, Fegan G, Lowe BS, English M, Peshu N, Marsh K, Newton CR: **HIV infection, malnutrition, and invasive bacterial infection among children with severe malaria.** *Clin Infect Dis* 2009, **49**(3):336–343.
41. Weigel R, Phiri S, Chiputula F, Gumulira J, Brinkhof M, Gsponer T, Tweya H, Egger M, Keiser O: **Growth response to antiretroviral treatment in HIV-infected children: a cohort study from Lilongwe, Malawi.** *Trop Med Int Health* 2010, **15**(8):934–944.
42. Sunguya B, Koola J, Atkinson S: **Infections associated with severe malnutrition among hospitalised children in East Africa.** *Tanzan Health Res Bull* 2006, **8**(3):189–192.
43. Saloojee H, De Maayer T, Garenne M, Kahn K: **What's new? Investigating risk factors for severe childhood malnutrition in a high HIV prevalence South African setting.** *Scand J Public Health Suppl* 2007, **69**:96–106.
44. Biondi D, Kipp W, Jhangri GS, Alibhai A, Rubaale T, Saunders LD: **Risk factors and trends in childhood stunting in a district in Western Uganda.** *J Trop Pediatr* 2011, **57**(1):24–33.
45. Gibbons T, Fuchs GJ: *Nutrition Support for Infants and Children at Risk,* Volume 59. Basel: Karger; 2007.
46. Nyarango PM, Gebremeskel T, Mebrahtu G, Mufunda J, Abdulmumini U, Ogbamariam A, Kosia A, Gebremichael A, Gunawardena D, Ghebrat Y, Okbaldet Y: **A steep decline of malaria morbidity and mortality trends in Eritrea between 2000 and 2004: the effect of combination of control methods.** *Malar J* 2006, **5**:33.
47. Howe DL, Hargreaves RJ, Huttly RS: **Issues in the construction of wealth indices for the measurement of socio-economic position in low-income countries.** *Emerg Themes Epidemiol* 2008, **5**:3.
48. Gwatkin DR, Rutstein S, Johnson K, Pande RP, Wagstaff A: *Socio-economic Difference in Health, Nutrition and Population in Ghana: HNP/Poverty Thematic Group of the World Bank.* World Bank: Washington, D.C; 2000.
49. Vyas S, Kumaranayake L: **Constructing socio-economic status indices: how to use principal components analysis.** *Health Policy Plan* 2006, **21**(6):459–468.
50. Department of State: *International Religious Freedom Report 2007.* Washington, D.C.: US Department of State; 2007.
51. World Health Organization: *Global Atlas of the Health Workforce.* Geneva: WHO; 2011.

doi:10.1186/1745-6215-14-352
Cite this article as: Sunguya *et al.*: Efficacy of in-service nutrition training for mid-level providers to improve feeding practices among HIV-positive children in Tanga, Tanzania: study protocol for a cluster randomized controlled trial. *Trials* 2013 **14**:352.

2

Achieving the Millennium Development Goals

Relevance for low-income countries in Asia

Junko Yasuoka, Junko Saito, Yu Mon Saw, Bruno F. Sunguya, Rachel M. Amiya and Masamine Jimba

Introduction

Years of debate, effort and struggle went into setting specific goals to promote the economic and social development of the world's poorest countries. Antecedents of the development framework that ultimately emerged between 2000 and 2001 can be traced back to the Universal Declaration of Human Rights in 1948, the Development Decade of the 1960s and several United Nations (UN) summits held in the second half of the twentieth century [1].

At the Millennium Summit in 2000, 189 countries, represented by 147 heads of state and government, ratified the Millennium Declaration. Six fundamental values were presented to guide international relations in the twenty-first century: freedom, equality, solidarity, tolerance, respect for nature and shared responsibility. Seven key objectives were further identified to translate these values into action: peace, security and disarmament; development and poverty eradication; protection of our common environment; human rights, democracy and good governance; protection of vulnerable people; meeting of the special needs of Africa; and strengthening of the UN [2, 3].

To follow up the Millennium Declaration, the UN secretariat consulted its members, representatives of the World Bank, the International Monetary Fund (IMF), and the Organization for Economic Cooperation and Development (OECD). The resulting roadmap was contained in the September 2001 Report of the Secretary-General to the UN General Assembly. In 2001, the conceptual content of the Millennium Declaration was translated into eight Millennium Development Goals (MDGs). All the UN member states and at least 23 other international organizations have since agreed to achieve these goals by the year 2015.

The MDGs are framed as follows:

1 Increasing incomes and reducing hunger;
2 Achieving universal primary education;
3 Eliminating gender inequality;
4 Reducing child mortality rates;

Millennium Development Goals	
Goal 1 Eradicate extreme poverty and hunger	*Goal 2* Achieve universal primary education
Goal 3 Promote gender equality and empower women	*Goal 4* Reduce child mortality
Goal 5 Improve maternal health	*Goal 6* Combat HIV/AIDS, malaria and other diseases
Goal 7 Ensure environmental sustainability	*Goal 8* Global partnership for development

Figure 2.1 The eight Millennium Development Goals (MDGs)

5 Improving maternal health;
6 Reversing the spread of HIV/AIDS, tuberculosis, and malaria;
7 Reversing the loss of natural resources and biodiversity, and improving access to water, sanitation, and good housing; and
8 Establishing effective global partnerships [4] (see Figure 2.1).

Building upon this core agenda, several new targets have subsequently been added, including those arising from the World Summit in 2005. For example, a target of 'achieving universal access to reproductive health' was added. This target was excluded during the initial negotiation of the MDGs but eventually integrated into MDG 5 due to the efforts of the UN Population Fund (UNFPA) and several non-governmental organizations (NGOs) working in family planning and reproductive health [4–6].

This chapter provides an overview of the progress and challenges that low-income countries are facing to achieve the MDGs. First, we look at a case study from the Lao People's Democratic Republic (Lao PDR), which elucidates the meaning of being 'on track' or 'off track' in terms of achieving the MDGs. Then, we present a summary of the progress in achieving the MDGs in the South, East and Southeast Asian regions. Following this, we review the challenges experienced in these, and other, regions in working towards the MDGs and, finally, we propose a way forward as a post-2015 development agenda.

Gauging progress on the MDGs: off track, but not derailed, in Lao PDR

Since the MDGs were first established, great efforts have been made in many low- and middle-income countries to achieve the targets set. Lao PDR is no exception. However, this landlocked nation in mainland Southeast Asia has shown the least overall progress amongst the 13 countries in the South, East and Southeast Asian regions defined as low-income economies by the World Bank in 2000. In Lao PDR, 13 out of 22 targets were defined as being 'off-track' in 2011 (see Table 2.1), although being off track did not mean an utter lack of developmental progress.

Table 2.1 MDG progress in South, East and Southeast Asian countries

Goal		*1*		*2*			*3*			*4*		*5*			*6*			*7*					
		$1.25 per day poverty	*Underweight children*	*Primary enrolment*	*Reaching last grade*	*Primary completion*	*Gender primary*	*Gender secondary*	*Gender tertiary*	*Under-5 mortality*	*Infant mortality*	*Maternal mortality*	*Skilled birth attendance*	*Antenatal care (≥ 1 visit)*	*HIV prevalence*	*TB incidence*	*TB prevalence*	*Forest cover*	*Protected area*	*CO_2 emissions*	*ODP substance consumption*	*Safe drinking water*	*Basic sanitation*
East Asia	DPR Korea		▶							■	■	■	●	●		◀	●	◀	●	●	●	●	◀
	Mongolia	■	●	●	■	▶	●	●	●	●	▶	■	●	●	▶	●	●	◀	●	◀	●	▶	■
Southeast Asia	Cambodia	▶	▶	■	◀	▶	▶	▶	■	■	■	■	■	■	●	●	●	◀	●	◀	●	▶	■
	Indonesia	●	■	●	■	●	●	●	●	▶	■	■	▶	▶	◀	▶	●	◀	●	◀	●	■	■
	Lao PDR	▶	■	■	■	■	▶	■	▶	▶	■	■	■	■	◀	◀	●	◀	●	◀	●	■	▶
	Myanmar		■		■	●	●	●		■	■	■	■	■	●	▶	●	◀	●	◀	●	■	●
	Viet Nam	●	▶		▶		■		◀	■	■	▶	▶	▶	●	●	●	●	●	◀	●	●	●
South Asia	Afghanistan		▶				■	◀	◀	■	■	■	■	■		▶	●	▶	▶	◀	●	▶	■
	Bangladesh	■	▶	◀	■	◀	●	●	■	▶	▶	■	■	■	▶	▶	●	◀	●	◀	●	■	■
	Bhutan		■	■	■	▶	●	●	■	▶	■	●	▶	▶	◀	●	●	●	●	◀	●	■	■
	India	■	■	●	■	▶	●	▶	■	■	■	■	■	■	●	▶	◀	●	●	◀	●	●	■
	Nepal	■	■		■	■	▶	▶	■	▶	■	■	■	■	●	▶	◀	◀	●	●	●	●	■
	Pakistan	●	■	■	◀	■	▶	▶	■	■	■	■	■	■	◀	▶	●	◀	▶	◀	●	■	■

● Early achiever ▶ On track ■ Slow ◀ Regressing/no progress

Source: [39].

Lao PDR is one of the poorest countries in Southeast Asia, with an estimated population of 5.9 million. The country has a low population density and 71 per cent live in rural areas (see Figure 2.2). It is ethnically diverse and ethnic minorities live primarily in the highlands, where health services are sparse and the road infrastructure is poor [7]. The national health system is underfunded and private health expenditure made up nearly 70 per cent of the total health expenditure in 2010 [8]. Some of the many challenges faced by Lao PDR, in common with other low- and middle-income countries, are a lack of human resources, very low utilization rates for health facilities and limited skills among health professionals [9, 10].

Lao PDR is indeed 'off track' on many of the health-related MDGs, but this does not mean the country has failed in its pursuit of health development. For example, the maternal

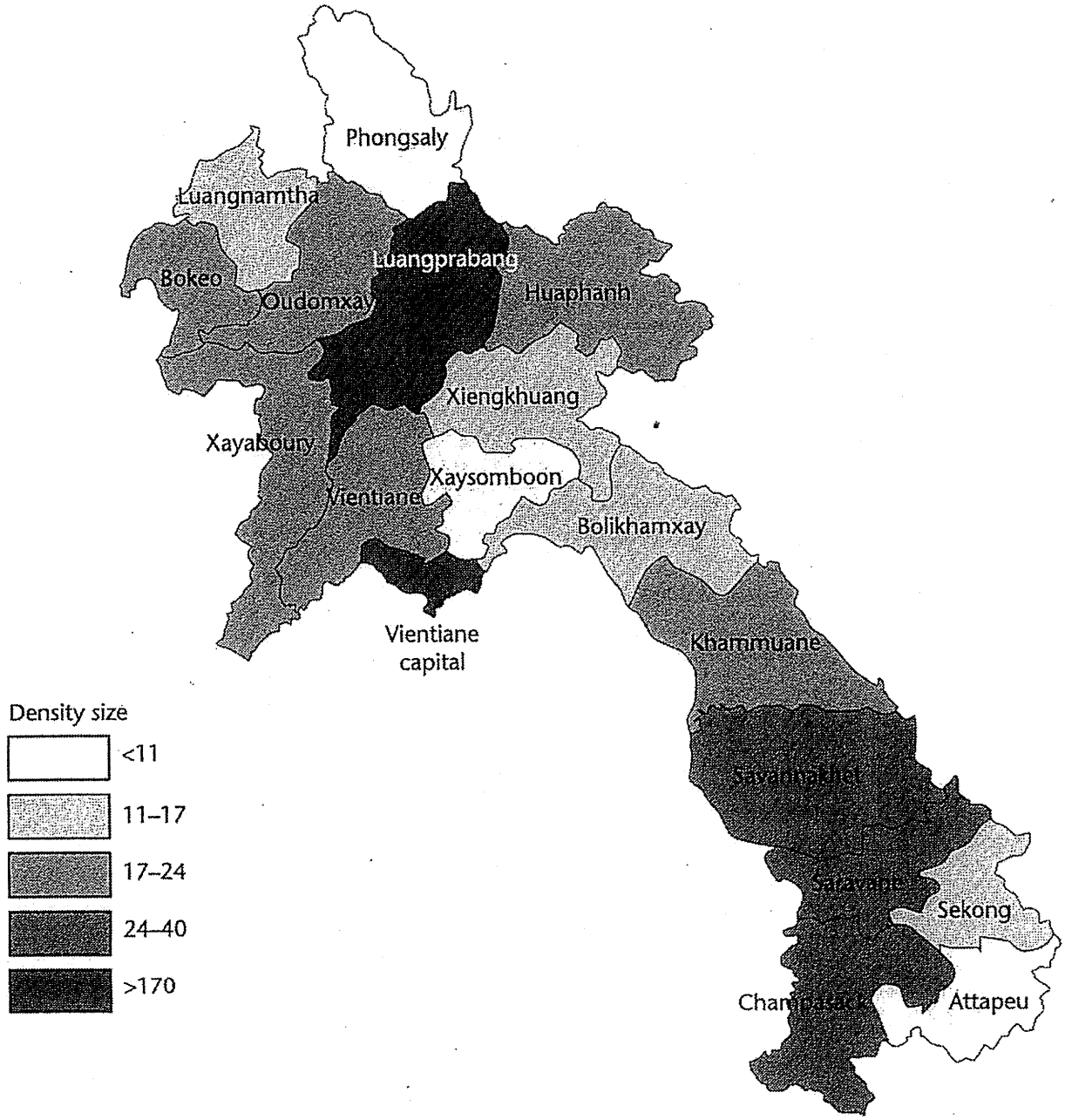

Figure 2.2 Density of population by province in Lao PDR (persons per square kilometre) [38]

mortality ratio (MMR, deaths per 100,000 live births) dropped from 1,200 to 580 in the period between 1990 and 2008. Despite this progress, Lao PDR has been labelled as exhibiting insufficient progress towards achieving MDG 5. Meanwhile, Vietnam, designated as the best performing country for MMR reduction in the region, has been widely applauded for being 'on track', with a fall in death rates from 170 in 1990 to 56 in 2008. Thus, whilst Lao PDR showed a 51.7 per cent MMR reduction, Vietnam showed a 67 per cent reduction, and this relatively small difference defines the dividing line for 'on track' versus 'off track' status between the two countries. In the context of evaluating progress towards the MDGs, this dichotomy is somehow considered reasonable.

In addition, some of the 'one-size-fits-all' indicators simply do not fit Lao PDR [11], as demonstrated by the HIV/AIDS-related target delineated in MDG 6. Lao PDR has been labelled as a country making no progress, or even regressing, on this front. Such a poor result is, however, a reflection of a slight increasing trend in low-level HIV prevalence (from 0.1 per cent in 2001 to 0.2 per cent in 2009) among the population aged 15 to 49 years since 2001. Because of this low general prevalence, MDG 6 is not included among the six priority areas in the national strategies of Lao PDR to accelerate MDG achievement. Instead, the national target for 2015, distinct from the MDG targets, is to maintain the national HIV prevalence at less than 1 per cent [9, 12]. In this regard, the lens of the MDGs, meaningful as it may be in context, is distorting. Thus the measurement of progress should be seen within the context of the national agenda and efforts must be made to understand the gap that exists between the MDGs and the unique, tailor-made targets set by national governments.

Similarly, some international programmes related to the MDGs are donor-driven and do not always match the priorities set by a given country. The Global Fund, for example, has strongly supported reducing communicable diseases as a key objective, while Lao PDR has prioritized maternal and child health [13]. Aid agencies tend to focus on predetermined agendas designed to show swift impacts. Such strategies, however, do not always lead to sustainable outcomes, as they have typically been enacted through programmes running parallel to, rather than integrated into, the existing healthcare systems [6, 14]. In Lao PDR, for example, the HIV and TB programmes generally remain vertical and mostly weakly integrated with the general health system, such as in the separate financing, governance and planning functions for these programmes [13]. Further progress will depend largely on developing medium-term and long-term strategies that pay more attention to the development of health systems [6].

Despite being labelled as an 'off-track' country, Lao PDR has been successful in achieving several of the health-related MDGs, albeit in a qualified manner. For example, the country is 'on track' for achieving the target for reducing child mortality, but the rate achieved (54 per 1,000 live births in 2010) remains exceptionally high relative to other neighbouring middle-income countries in the region, such as Thailand and Vietnam. Moreover, both skilled birth attendance and immunization coverage rates – indicators considered key to strategies aimed at accelerating reductions in child mortality, especially in remote areas – have hovered at low levels (20.3 per cent for skilled birth attendance in 2006 and 59.0 per cent for measles immunization in 2009) [9].

In summary, failures in achieving the MDGs do not always equate to failures of development. By the same token, successes in the MDG realm do not always mean successes in development. No stigma should be attached to those countries that find themselves 'off track' because the MDGs are not always sufficient to capture the full picture of the progress underway in a country.

Achievements of the MDGs in South, East and Southeast Asia

Although the MDG agenda does not always reflect or account for the unique development paths of individual countries, many lives have been saved or changed profoundly for the better in South, East and Southeast Asia since the establishment of the MDGs. This section focuses on thirteen case study countries (see Table 2.1) in the region defined in 2000 as low-income economies by the World Bank. Data without a corresponding citation are sourced from the UN MDG database.

The health-related MDGs

Of the eight MDGs, three are specifically related to health: MDG 4 (reducing child mortality), MDG 5 (improving maternal health) and MDG 6 (combating HIV/AIDS, malaria and other diseases).

MDG 4 – Reduce child mortality

Steady progress has been made in reducing the under-5 mortality rate (U5MR, deaths per 1,000 live births among children younger than 5 years of age) in the developing world, and the declines have been accelerated between 2000 and 2010 (annual rate of reduction: 2.4 per cent a year) as compared to the period between 1990 and 2000 (annual rate of reduction: 1.9 per cent a year). However, progress remains insufficient to reach the global target for MDG 4. Among the thirteen countries included in the case study, only Mongolia has already achieved the target, reducing its U5MR from 107 deaths in 1990 to 32 in 2010. The remaining countries vary in their level of progress: five (Bangladesh, Bhutan, Indonesia, Lao PDR and Nepal) are 'on track' to meet the target, while the progress of the other seven lags behind. All 'on-track' countries, except for Indonesia, have made striking progress, each going from nearly 150 deaths per 1,000 live births in 1990 to around 50 in 2010. However, Afghanistan's U5MR has remained remarkably high at 149 deaths per 1,000 live births in 2010, ranking it the eleventh worst in the world.

Although child mortality rates are generally decreasing in the region, the majority of deaths are now happening at an earlier age. In the thirteen countries studied, the percentage of infant deaths (those occurring between birth and 1 year of age) has increased from 68.8 per cent in 1990 to 78.7 per cent in 2010. Furthermore, progress has been slow on reducing mortality in the neonatal period (spanning the first four weeks of life), during which 41 per cent of child deaths occur globally. This is in part due to a lack of attention to neonatal deaths through international public health policies and programmes [15]. Within the case study countries, Afghanistan and Pakistan are among the fifteen countries globally with the highest neonatal mortality rates – 39 deaths per 1,000 live births in 2009 [15].

MDG 5 – Improve maternal health

Globally, the MDG 5 for maternal health has shown the worst progress compared with other goals. Whilst the target is an average annual decline in MMR of 5.5 per cent over the period from 1990 to 2015, the global average decline between 1990 and 2008 has been just 2.3 per cent [16]. Among the thirteen case study countries, MDG 5 indicators still lag far behind the MDG targets, despite some significant progress. The exceptions are Bhutan and Vietnam, each of which achieved an average annual decline of more than 5.5 per cent between 1990

and 2008. On the other end of the spectrum, the most inadequate progress, with rates of decline of less than 2 per cent, has been observed in Afghanistan and the Democratic People's Republic of Korea (DPR Korea) – 1.0 per cent and 0.4 per cent, respectively [16].

Two of the major determinants of a mother's survival are whether or not the birth is attended by a skilled health professional and whether or not antenatal care is accessible. Bhutan, the only early achiever of the target for skilled birth attendance, has made significant progress by increasing the rate of professionally attended births by nearly 60 per cent (from 14.9 per cent in 1994 to 71.4 per cent in 2007). However, in each of the four countries (Afghanistan, Bangladesh, Lao PDR and Nepal) with the highest estimated MMR (MMR ≥300), skilled health professionals attend less than one in four births and less than two in three births among expectant mothers who have received antenatal care at least once.

MDG 6 – Combat HIV/AIDS, malaria and other diseases

Since 2001, the global HIV incidence rate has declined steadily, reaching the targeted 25 per cent decline by 2009, with progress in Sub-Saharan Africa at the helm. Yet the number of people living with HIV continues to rise due to expanding antiretroviral treatment coverage. Among the case study countries, five (Cambodia, India, Myanmar, Nepal and Vietnam) have already achieved the target for HIV prevalence. However, rates of condom use at last high-risk sexual encounter among young people aged 15–24 is still quite low in some countries, including India (22 per cent among women and 37 per cent among men in 2006). Universal access to treatment for HIV/AIDS is unlikely to be achieved by 2015, though worldwide coverage has been significantly expanded. Rates of coverage remain quite variable among eleven of the thirteen countries (there are no data available for Afghanistan and DPR Korea). Cambodia has already achieved universal access, with antiretroviral therapy coverage of at least 80 per cent among the population in need, while two countries (Nepal and Pakistan) had coverage of less than 20 per cent in 2010.

Major progress has been made against malaria, too. An estimated 655,000 malaria deaths occurred in 2010, of which 91 per cent were from Africa and 86 per cent were children under 5 years of age. Globally, the estimated incidence of malaria has decreased by 17 per cent since 2000 [17]. Among the case study countries, except for Mongolia as a malaria-free country, five (Afghanistan, Bhutan, DPR Korea, Nepal and Vietnam) reported that malaria cases fell by more than half between 2000 and 2010. The remaining countries reported either little change (Cambodia, India, Indonesia and Lao PDR) or increasing case numbers (Bangladesh, Myanmar and Pakistan) [18].

In terms of other targeted infectious diseases, the burden of tuberculosis is gradually decreasing as well. Globally, the annual incidence rate has fallen to about 1 per cent and the world is 'on track' to achieve the corresponding MDG target if this trend continues. Among the case study countries, only DPR Korea and Lao PDR are exceptions to the pattern of reducing the tuberculosis incidence.

The other MDGs

The remaining MDGs to be addressed herein (MDG 1, MDG 2, MDG 3 and MDG 7) are not classified as directly related to health. Nevertheless, those goals play an important role towards achieving the health-related MDGs. Among the thirteen low-income countries, five have successfully increased incomes and reduced hunger, or are on track to do so (MDG 1), while only Vietnam is on track to achieve the full primary schooling coverage target contained

in MDG 2. Overall, the most significant successes have been in improving gender equity (MDG 3) and access to safe drinking water and better sanitation (MDG 7) in the thirteen case study countries.

MDG 1 – Eradicate extreme poverty and hunger

One of the greatest MDG successes worldwide has been in poverty reduction. The global poverty rate is expected to fall below 15 per cent by 2015. With this milestone, the world will have surpassed the MDG target, which is set at a 23 per cent decline. This is despite the global economic crisis, which could well have hindered progress and, in some cases, even increased the depth of poverty [19]. However, meeting the hunger-reduction target remains a difficult prospect in many regions of the developing world. The proportion of undernourished people remained at 16 per cent between 2005 and 2007, representing approximately 837 million people worldwide, and fell by only 2 per cent since the period 1990 to 1992 [4].

Among the thirteen low-income countries in focus, only five (Cambodia, Indonesia, Lao PDR, Pakistan and Vietnam) are early achievers, or 'on track', for reducing poverty, while four (Mongolia, Bangladesh, India and Nepal) are currently 'off track'. Meeting the target for reducing the prevalence of underweight children under 5 years of age will be achieved by six countries who are early achievers or 'on track' (Afghanistan, Bangladesh, Cambodia, DPR Korea, Mongolia and Vietnam), while seven countries are 'off track' for reaching this target (Bhutan, India, Indonesia, Lao PDR, Myanmar, Nepal and Pakistan). Thus, only Cambodia and Vietnam are early achievers, or 'on track', for both poverty and hunger reduction targets in South and Southeast Asia.

MDG 2 – Achieve universal primary education

In the developing world, the primary education net enrólment ratio (NER) is rising slowly (from 82 per cent in 1999 to 89 per cent in 2009). Among the case study countries, four have achieved an NER higher than 90 per cent (India, Indonesia, Mongolia and Vietnam). Especially notable is progress achieved in Bhutan, which increased its NER by more than 30 per cent over the period from 1999 to 2009 (from 55.9 per cent to 88.4 per cent).

In contrast, progress in increasing the ratio of pupils who complete a full course of primary education has seen less progress and is far from meeting the MDG target. On average, 72.5 out of 100 children in the eleven case study countries completed primary education, with specific rates ranging from 54.5 in Cambodia to 94.4 in Mongolia, based on available data as of 2008 (excluding Afghanistan and DPR Korea, for which available data were insufficient). The remaining challenges, along with universal primary school enrolment, are to improve the quality of primary education, improve retention of children in schools and properly adapt education for children living in conflict zones [4]. Impacts of conflict zones on achieving MDG targets may be felt both directly and indirectly. For example, poverty and hunger are caused by conflict (MDG 1). Conflict also creates barriers to accessing education that might affect MDG 2 [20].

MDG 3 – Promote gender equality and empower women

Female education rates are improving in the developing world. In 2009, for every 100 boys, there were 96 girls enrolled in primary and secondary schools across the developing world [4]. This is a significant improvement from 1999, especially in South Asia, where the ratio has

jumped from 83 to 95 girls per 100 boys in primary, and from 75 to 89 girls per 100 boys in secondary, education. The tertiary level of education, meanwhile, presents the highest ratio of female students among all levels of education, at 97 girls for every 100 boys, though there is a considerable difference across regions [4].

Twelve of the thirteen case study countries (excluding Afghanistan) have also achieved significant progress in terms of the Gender Parity Index (GPI) in primary education – especially India, where the GPI rose from 0.76 in 1991 to 0.97 in 2007. The GPI is designed to measure the ratio of girls to boys in primary, secondary and tertiary education. It is calculated by dividing the female Gross Enrolment Ratio for the given level of education by that same ratio for males. In Afghanistan, they are lagging far behind in terms of girls' access to education and are seriously 'off track' for achieving the related MDG target, with a GPI of 0.67 in 2009, but they are likely to meet the target by 2020, as the ratio has been steadily increasing since 2004 [4]. At the same time, cultural constraints must be mitigated, such as through teaching single sex classes and providing security for girls in conservative areas [19, 21, 22].

MDG 7 – Ensure environmental sustainability

Steady progress has been made towards improving access to safe drinking water and the global MDG target of 89 per cent coverage by 2015 will be met if this trend continues. In contrast, progress towards the goal for sanitation has been much slower, especially in South Asia, where almost two-thirds of the population practises open defecation. Among the thirteen case study countries, half (Afghanistan, Cambodia, India, DPR Korea, Mongolia, Nepal and Vietnam) are 'on track' to achieve the MDG target on safe drinking water, while only three countries (Lao PDR, Myanmar and Vietnam) are 'on track' to achieve the sanitation target. Other countries are making slow progress and require greater acceleration towards development on these fronts.

Linking the health-related and other MDGs

Whereas MDGs 4 to 6 are directly related to health, the other MDGs are linked to promoting health through development in various, more indirect ways. For instance, in as much as poverty remains a cause of hunger and, ultimately, undernutrition, hunger and undernutrition (MDG 1) are seen as underlying causes of many diseases [23]. To wit, food insecurity and hunger have been linked with rapid spread and progression of diseases including HIV/AIDS [24, 25]. Families suffering from such ailments have continued to fall into the vicious cycle of poverty leading to food insecurity and seguing into hunger, widening the gender equity gap (MDG 3) and affecting children's educational attainment (MDG 2).

Likewise, gender-based inequities (MDG 3) render women and their children more vulnerable to poor health. In particular, educated mothers (MDG 2) who are literate, well informed and empowered have a greater capacity to promote their children's health [23]. Along similar lines, better sanitation and safe drinking water (MDG 7) translate into fewer opportunities to acquire infections, especially among children and other high-risk groups such as people living with HIV/AIDS [9].

To improve global health in general, more global partnerships should be fostered (MDG 8). Such partnerships have been seen to have an appreciable impact on key health-related issues of global concern, including HIV/AIDS, malaria and TB (MDG 6). Through living examples of global initiatives like the Global Fund to Fight AIDS, TB and Malaria (GFATM), the Bill and Melinda Gates Foundation (BMGF), the Global Alliance for Vaccines and

Immunization (GAVI), the Clinton Foundation HIV/AIDS Initiative (CHAI), and other bilateral and multilateral organizations, more vertical programmes targeting specific health-related areas have been implemented. Given their complex interlinkages and interdependencies, the MDGs clearly cannot be implemented in isolation, but rather must be tackled through concerted multilateral, multifaceted interventions.

Limitations of the MDGs

Challenges in fully realizing the MDG vision notwithstanding, the framework they represent has undoubtedly facilitated notable successes and real progress in the field of international development. The MDGs have served effectively as a tool to generate discussion, focus attention and help assign accountability for leaders' pledges. The goals have helped to galvanize the aid community and reverse the aid declines after the end of the Cold War. Of particular note, the United States, the European Union, Canada, Norway and other regions promised in 2002 to substantially increase aid as a result of the MDG negotiations [12]. The MDG agenda has also had notable success in encouraging global political consensus, especially in terms of providing a focus for advocacy, improving the targeting and flow of aid, and refining the monitoring of development projects [3]. At the same time, the MDGs have been marked by a variety of common limitations, as summarized below.

Limited involvement of developing countries in formulating the MDG framework: The involvement of developing countries was limited in the process of formulating the MDG framework [3] and only 22 per cent of the world's national parliaments formally discussed the MDGs [5, 7]. This is one of the reasons why Lao PDR ended up establishing its own target for HIV control.

Conceptualization and execution: The very specific nature of the MDGs generated considerable gaps in coverage and failed to realize synergies that could arise across their implementation, such as synergies between education, health, poverty and gender. In addition, several targets present a measure of goal achievement that is too narrow or that might not identify a clear means of delivery [3].

Lack of clear ownership and leadership: In particular, new targets such as 'achieving universal access to reproductive health', added at a later stage, have not been very successful. This is attributable not only to their complexity, but also to the limited national ownership and/or lack of engagement by national governmental organizations [3].

Inequity: Issues of equity arise because many of the goals seek to attain specific minimum standards, e.g. of income, education or maternal/child survival. To bring people above this threshold might realistically mean a focus on those for whom least effort is required, neglecting groups that are more difficult to reach for geographical, ethnic or other reasons [3]. For example, MDG 4, aimed at reducing the U5MR by two-thirds, can be achieved by a variety of policy interventions, some of which could actually make children from poor communities worse off. Therefore, success in achieving MDG 4 cannot always be regarded as a success in the true spirit of the Millennium Declaration [26].

Limited accountability for failing: The MDGs might be reasonably expected to have diminished their effectiveness due to diffused accountability for failing to meet them [27]. In fact, the weakness of the monitoring and follow-up mechanisms is widely regarded as one of the major limitations of the MDG framework. This weakness has resulted in a lack of mutual accountability on the part of national governments, international institutions and other actors to achieve the MDGs.

Problems of design: Several studies have pointed out that it is impossible to meet the MDGs because of how they were originally designed, rather than due to a lack of policy effort, commitment or aid [26, 28, 29]. The MDGs are poorly and arbitrarily designed to measure progress against poverty and deprivation, and their design makes relative performance look worse than it really is. For example, in the case of MDG 4 (to reduce child mortality by two-thirds), the relationship between increased mortality reduction and initial mortality has made it more unlikely that a high-mortality region like Africa would attain the proportional goal [29].

As we approach 2015, there is considerable interest in assessing the present goals and in considering the future of the development goals after 2015 [3].

Overcoming MDG challenges in preparation for the post-MDG era

This section discusses possible pathways to achieve the health-related MDGs in preparation for the post-2015 era of development agenda setting.

To date, Asian countries have experienced varying degrees of both successes and failures in attempts to achieve the targets set for the health-related MDGs. In several countries, variations are observed by socio-economic strata and between urban and rural areas. For example in Lao PDR, MDGs present a useful global picture of development, but the interpretation of being 'on track' or 'off track' must be made very carefully. For instance, a status of 'off track' does not mean that all previous MDG-oriented interventions have categorically failed. Appreciating the history of development efforts requires the data gathered to be put to good use to assist policy making in order to move forward.

As highlighted in the thirteen case studies, the implied 'one-size-fits-all' approach constitutes an important flaw in the design of the MDG framework. For the purpose of sustainable development, any new agenda should consider each country's distinct needs, plans, levels of economic development, population size, culture, stability and overarching vision. For example, among the thirteen low-income countries in Asia, a more tailored approach is needed in regions facing special economic constraints, such as Myanmar, Lao PDR and Cambodia; in conflict and post-conflict countries, such as Afghanistan and Pakistan; and in population-dense countries, such as Indonesia, Bangladesh and India.

Achieving the health-related MDGs has generally entailed a heavy investment of capital. The push has, therefore, been especially difficult for the low-income Asian countries, largely dependent on external developmental aid such as Official Development Assistance (ODA) [30]. Countries receiving low shares of ODA funding, such as Myanmar [31], have correspondingly encountered greater obstacles in achieving the targets. Even with the somewhat meagre progress achieved, sustaining the pace is no easy proposition since it entails continued dependency on the ODA.

At the starting line of the MDG era, Asian countries naturally entered the 'race' with varied levels of economic development. Economic and development levels, in turn, determine the magnitude of health problems faced by a nation, and they also define the speed of progress to achieve the health-related MDG targets where comparisons of progress become a numbers game. Therefore, the Asian countries with comparably worse health indicators have been seen as making more progress than their counterparts. This is because it is comparatively easier to see progress for the countries that started with a higher burden of disease compared to those entering the MDG era with relatively better health indicators. Also, even with similar investments of capital, a significant reduction is naturally expected for countries with

a higher burden compared to those with a low burden of a similar disease. For example, Myanmar and Cambodia showed higher levels of progress towards MDG 6 than Lao PDR, Pakistan or Afghanistan. This is primarily because Myanmar and Cambodia had comparably high burdens of HIV and TB at the outset.

Close attention must also be paid to non-communicable diseases (NCDs), which have undermined the achievement of the MDGs in many settings. It is estimated that NCDs will continue to increase in developing countries and the greatest increases will be observed in Africa. The existing links between NCDs and HIV/AIDS, tuberculosis, and child and maternal health mean that NCDs need to be tackled if the MDG targets are to be achieved and if more progress is to be made in low-income countries in the post-MDG era [32].

Even if the time frame for the unmet MDG targets were to be extended beyond 2015, sustainable development in this region is unlikely to be realized under the current terms [33]. To achieve sustained development in health, a preferable strategy would be for low-income countries in the region to embrace the Sustainable Development Goals (SDGs) agenda proposed by UN Secretary-General Ban Ki-Moon's high-level global sustainability panel, convened in the lead-up to the Rio+20 summit in June 2012 [34]. The SDGs are built upon the so-called 'triple bottom line' approach to human wellbeing, incorporating social inclusion and health as core functions of the development agenda. Though the SDGs may encompass a vision for global development, the approach in each region should be tailored to suit national interests [34]. Moreover, specific policies should be formulated to yield cost-effective interventions relevant to the time, context and internal revenue of each country, necessitating minimal dependence on the ODA. For example, countries should be encouraged to use their own health plans to design and implement policies and interventions that are feasible using their national revenues first rather than acting according to the wishes of donors, who naturally provide funds for what they personally see as important.

On a practical level, ODA has been a key ingredient in the observed successes surrounding the health-related MDGs [35]. The strides made in attaining MDGs 4 and 6, for instance, were partly due to support from donor agencies, including the United States Agency for International Development (USAID), GFATM, the Presidential Malaria Initiative and GAVI [4]. On the other hand, over-reliance on ODA has arguably weakened countries' ownership of the health and development agenda [36]. The challenge of sustaining such expensive and donor-financed projects beyond the lifespan of the MDGs warrants serious consideration and financial reforms. Thus far, ODA would appear not to represent any sort of definitive answer for a sustainable international development agenda [37].

Conclusion

In the end, the real value of the MDGs is in the fodder they have provided for the public health and development community as a whole to continually think and act for promoting health and development in low-income countries. In this sense alone, they should be appreciated as an important stepping-stone. Such a limited framework, however, is just one element of the goals to be pursued in each country. Based on lessons learned in the MDG era, we need to rethink what 'development' means for low-income countries and to whom it is beneficial. Global aid communities may feel satisfied with the achievement of the MDGs, but if individuals in each country are still suffering from unreasonable pain or discomfort, achieving such targets is simply not enough. To go beyond this, we have to create a new paradigm of development goals – one that will truly improve the health and wellbeing of people living in underserved areas, especially in low-income countries.

References

1. Hulme, D. The making of the millennium development goals: human development meets results-based management in an imperfect world. Manchester, UK: Brooks World Poverty Institute, 2007.
2. UN. United Nations Millennium Declaration. Resolution adopted by the UN General Assembly. A/RES/55/2. New York: United Nations, 2000.
3. Waage, J., Banerji, R., Campbell, O., Chirwa, E., Collender, G., Dieltiens, V., *et al.* The Millennium Development Goals: a cross-sectoral analysis and principles for goal setting after 2015, Lancet and London International Development Centre Commission. *Lancet* 2010, 376(9745):991–1023.
4. UN. *Millennium Development Goals Report.* New York: United Nations, 2011.
5. UNDP. Public choices, private decisions: sexual and reproductive health and the Millennium Development Goals. New York: United Nations Millennium Development Group, 2011.
6. Richard, F., Hercot, D., Ouédraogo, C., Delvaux, T., Samaké, S., van Olmen, J., *et al.* Sub-Saharan Africa and the health MDGs: the need to move beyond the 'quick impact' model. *Reproductive Health Matters* 2011, 19(38):42–55.
7. Lao Statistics Bureau. Poverty in Lao PDR. Available at: http://www.nsc.gov.la/index.php?view=article&catid=9%3Alecs&id=55%3Apovertyin-lao-pdr-2008&format=pdf&option=com_content&Itemid=80
8. WHO. Global Health Observatory Data Repository 2012. Available at: http://apps.who.int/ghodata/?vid=1901
9. UNDP. Accelerating progress towards the MDGs: innovative options for reaching the unreached. Lao People's Democratic Republic. Lao PDR: United Nations Development Program, 2010.
10. Manithip, C., Edin, K., Sihavong, A., Wahlström, R., Wessel, H. Poor quality of antenatal care services: is lack of competence and support the reason? An observational and interview study in rural areas of Lao PDR. *Midwifery* 2012, Jul.
11. Vandemoortele, J. The MDG conundrum: meeting the targets without missing the point. *Development Policy Review* 2009, 27(4):355–71.
12. UNDP. What will it take to achieve the Millennium Development Goals? – An international assessment. New York: United Nations Development Programme, 2010.
13. Mounier-Jack, S., Rudge, J. W., Phetsouvanh, R., Chanthapadith, C., Coker, R. Critical interactions between Global Fund-supported programmes and health systems: a case study in Lao People's Democratic Republic. *Health Policy Plan* 2010, 25 Suppl 1:i37–42.
14. Ali, N., Hill, C., Kennedy, A., IJsselmuiden, C. What factors influence national health research agendas in low and middle income countries? New York: Council on Health Research for Development (COHRED), 2006. Available at: http://www.cohred.org/downloads/cohred_publications/rp5.pdf
15. Oestergaard, M. Z., Inoue, M., Yoshida, S., Mahanani, W. R., Gore, F. M., Cousens, S., *et al.* Neonatal mortality levels for 193 countries in 2009 with trends since 1990: a systematic analysis of progress, projections, and priorities. *PLoS Medicine* 2011, 8(8).
16. WHO. *Trends in Maternal Mortality: 1990 to 2008.* Geneva, Switzerland: World Health Organization, 2010.
17. UN. *Millennium Development Goals Report.* New York: United Nations, 2012.
18. WHO. *World Malaria Report.* Geneva, Switzerland: World Health Organization, 2011.
19. ADB. The key indicators for Asia and the Pacific 2011. Asian Development Bank. Available at: http://www.adb.org/key-indicators/2011/main
20. Hill, P. S., Mansoor, G. F., Claudio, F. Conflict in least-developed countries: challenging the Millennium Development Goals. *Bulletin of the World Health Organization* 2010, 88(8):562.
21. Jones, A. Afghanistan on the educational road to access and equity. *Asia Pacific Journal of Education* 2007, 28(3):277–90.
22. WHO. *Dying for Change. Poor people's experience of health and ill-health.* Geneva, Switzerland: World Health Organization, 2010.
23. Rogers, R. Understanding literacy development 'lifelong and life wide'. *Reading Research Quarterly* 2011, 46(1):86–96.
24. Weiser, S. D., Young, S. L., Cohen, C. R., Kushel, M. B., Tsai, A. C., Tien, P. C., *et al.* Conceptual framework for understanding the bidirectional links between food insecurity and HIV/AIDS. *American Journal of Clinical Nutrition* 2011, 94(6):1729S–39S.

25. Miller, C. L., Bangsberg, D. R., Tuller, D. M., Senkungu, J., Kawuma, A., Frongillo, E. A., *et al.* Food insecurity and sexual risk in an HIV endemic community in Uganda. *AIDS and Behavior* 2011, 15(7):1512–19.
26. Clemens, M., Kenny, C., Moss, T. The trouble with the MDGs: confronting expectations of aid and development success. *World Development* 2007, 35(5):735–51.
27. Reidpath, D. D., Morel, C. M., Mecaskey, J. W., Allotey, P. The Millennium Development Goals fail poor children: the case for equity-adjusted measures. *PLoS Medicine* 2009, 6(4).
28. White, H., Black, R. *Millennium Development Goals: a drop in the ocean?* New York: Routledge, 2004.
29. Easterly, W. How the Millennium Development Goals are unfair to Africa. *World Development* 2009, 37(1):26–35.
30. UN. *Investing in Development: a practical plan to achieve the Millennium Development Goals.* New York: United Nations Millennium Project, 2005.
31. UNDP. *Human Development Report 2011. Equity and sustainability: a better future for all.* New York: United Nations Development Programme, 2011.
32. WHO. *Accelerating the MDGs by Addressing NCDs.* New York: World Health Organization, 2010.
33. Koehler, G., Gasper, D., Jolly, R., Simane, M. *Human Security and the Next Generation of Comprehensive Human Development Goals.* Brighton: Institute of Development Studies, 2012.
34. Sachs, J. D. From Millennium Development Goals to sustainable development goals. *Lancet* 2012, 379(9832):2206–11.
35. Feeny, S., Clarke, M. *The Millennium Development Goals and Beyond: international assistance to the Asia-Pacific.* Basingstoke: Palgrave Macmillan, 2009.
36. Feeny, S., Clarke, M. Achieving the Millennium Development Goals in the Asia Pacific region: the role of international assistance. *Asia Pacific Viewpoint* 2008, 49(2):198–212.
37. Moyo, D. *Dead Aid: why aid is not working and how there is a better way for Africa.* New York: Allen Lane, 2009.
38. National Statistics Center of the Lao PDR. Population distribution and migration. 2007. Available at: http://www.nsc.gov.la/Products/Populationcensus2005/PopulationCensus2005_chaptr2.htm
39. ESCAP/ADB/UN. Accelerating equitable achievement of the MDGs: closing gaps in health and nutrition outcomes. 2011. Available at: http://www.unescap.ord/pdd/calendar/CSN-MDG-NewDelhi-Nov-2011/MDG-Report2011-12.pdf

Routledge Handbook of Global Public Health in Asia

Edited by Siân M. Griffiths, Jin Ling Tang and Eng Kiong Yeoh

Routledge
Taylor & Francis Group
LONDON AND NEW YORK