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Taking forward the World TB Day 2016 theme 'Unite to End Tuberculosis' for the WHO Africa Region

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SUMMARY

Tuberculosis (TB) remains a global emergency, with an estimated 9.6 million new TB cases worldwide reported in 2014. Twenty-eight percent of these cases were in the World Health Organization (WHO) Africa Region, where the annual case detection rate was 281 per 100 000 population—more than double the global average of 133 per 100 000. Of the 9.6 million people who developed TB, an estimated 1.2 million (12%) were HIV-positive, and the Africa Region accounted for 74% of these cases. Three million people with TB remain undiagnosed and untreated. Globally, an estimated 480 000 had multidrug-resistant TB (MDR-TB). Whilst of the African countries, only South Africa has reported a high prevalence of MDR-TB, it is likely that all of Sub-Saharan Africa has an unreported high load of drug-resistant TB. Tragically, in 2014, only 48% of individuals diagnosed with MDR-TB had successful treatment and an estimated 190 000 people died of MDR-TB. Of the global TB funding gap of US$ 0.8 billion, the largest funding gap was in the Africa Region, amounting to US$ 0.4 billion in 2015. The MDR-TB pandemic in particular now threatens to devastate entire regions and may fundamentally alter the life-expectancy and demographic profile of many countries in Sub-Saharan Africa. The theme designated for this year's World TB Day, March 24, 2016, is 'Unite to End TB'. From the Africa Region, there is an urgent need to seriously address the political, economic, and social factors that influence host–*Mycobacterium tuberculosis* interactions and result in disease. Recent political and funder initiatives that provide renewed hope for the alleviation of Africa's TB and TB/HIV problems are discussed.

Tuberculosis (TB) has remained a global emergency ever since it was declared as such by the World Health Organization (WHO) in 1993.[1] The theme designated for this year's World TB Day, March 24, 2016, is 'Unite to End TB'.[2] World TB Day is held to commemorate the day in 1882 when Professor Robert Koch announced his ground-breaking discovery of the cause of TB, the bacillus *Mycobacterium tuberculosis*.[3] At the time of Koch's announcement in Berlin, TB was widespread and rampaging through Europe and the Americas, causing the death of one out of every seven people.[4] Over the ensuing 60 years, TB rates in Europe

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and the USA started to decline, well before the advent of TB drugs and the bacillus Calmette–Guérin (BCG) vaccine, highlighting the fact that TB epidemics are driven by complex socio-economic factors and host–*M. tuberculosis* interactions.[4–11]

It has been 134 years since Professor Koch's discovery of *M. tuberculosis*, and yet today TB remains the most common cause of death from an infectious disease worldwide.[1] According to the 2015 WHO Annual TB Report, an estimated 1.5 million people died of TB out of 9.6 million people who developed active TB worldwide in 2014.[12] Of these 9.6 million TB cases, 28% were in the WHO Africa Region, where the incidence rate was 281 new TB cases per 100 000 population. This is more than double the global average rate of 133 per 100 000.[12] An estimated 1.2 million out of the 9.6 million TB cases (12%) were HIV-positive and the Africa Region accounted for 74% of them. It is important to note that in 2014, three million people with TB went undiagnosed and untreated, or unreported. A significant proportion of these were in Sub-Saharan African countries. Critical to reducing the global burden of TB and slowing down TB transmission rates is the identification and treatment of all active cases of pulmonary TB, rendering them non-infectious.[13] Furthermore, those individuals with a high risk of re-activation of latent TB infection need to be identified and treated.[12]

While the overall global incidence of TB has been declining slowly over the past decade, drug-resistant strains of *M. tuberculosis* have emerged worldwide. Tragically, in 2014, an estimated 190 000 people died of multidrug-resistant TB (MDR-TB),[12] and only 48% of the 480 000 people estimated by the WHO to have MDR-TB had received successful treatment. The number of MDR-TB cases in 2014 remained unchanged from the figure estimated in the previous year's 2013 WHO Annual TB Report. This may represent an underestimate, or could be explained by inadequate laboratory infrastructure and resources to correctly diagnose and report MDR-TB at the health facility and national levels. Whilst of the African countries, only South Africa has reported a high prevalence of MDR-TB, it is likely that all of Sub-Saharan Africa has a significant burden of unreported drug-resistant TB.

Over the past three decades the world has experienced the most profound of public health challenges with the appearance of new infectious pathogens with epidemic potential, such as Ebola virus (EBOV), severe acute respiratory syndrome coronavirus (SARS-CoV), Middle East respiratory syndrome coronavirus (MERS-CoV), and now Zika virus (ZIKV) and antibiotic-resistant bacteria. We have also seen the resurgence of malaria, TB, and other infectious diseases, which were being brought under control.[14] We have also witnessed the emergence of the devastating HIV pandemic, which has largely been responsible for the breakdown of TB control programs. Together, TB and HIV have imparted a huge toll on health services and the economies of Sub-Saharan African countries.[15] The MDR-TB pandemic in particular now threatens to devastate entire regions and may fundamentally alter the life-expectancy and demographic profile of many African countries.[16]

There is an urgent need to address priority needs for MDR-TB,[16] especially in Africa, where resources and capacity are limited. MDR-TB has relevance beyond the worst affected countries, since TB does not respect national or international borders. The number of people forced to flee their homeland due to conflicts or natural disasters in the past few years has reached an all-time high worldwide.[17] A large number of refugees are being cared for in low- and middle-income countries. Furthermore the large funding gap (difference between the actual funding needs of TB programs for TB prevention, diagnosis, and treatment and the actual amount of funds available) for the Africa Region was US$ 0.4 billion in 2015.[12]

The WHO post-2015 global TB strategy aims to reduce global TB incidence by 90% before 2035.[18] However, the data in the 2015 WHO Annual TB Report show a bleak global TB situation. Dr Lucica Ditiu, Executive Director of the Stop TB Partnership, aptly summarized the situation recently by stating "It is a global disgrace and human tragedy that TB—a curable disease—is killing around 1.5 million people per year and nobody speaks about ending it", and further "We know it can be done, we know how it can be done, we know how much it will cost us—we need to have the desire to do it and energy to move on. Ours can be the generation remembered as the one that turned the tide on this enormous yet treatable epidemic."[19]

The Global Plan to End TB 2016–2020 launched by the Stop TB Partnership has three fundamental targets called 90–(90)–90:[19]

- Aim 1 is to have 90% of all people with TB diagnosed and treated.
- Aim 2 (which is coupled to aim 1) is to ensure that 90% of the most vulnerable populations in all countries (high- and low-income) are diagnosed and treated; these populations would include children, people living with HIV, miners, addictive substance users, prisoners, the homeless, and migrants, as well as others – we would like to include healthcare workers and patient carers in this list.
- Aim 3 is to ensure that 90% of people diagnosed successfully complete treatment with services to ensure adherence and social support.

In addition, the Global Plan calls for an additional US $9 billion for research and development into improved diagnostics, treatment regimens, and vaccines that are highly effective and non-toxic. The current funding trends for TB research have been rather disappointing.[20] In the Africa Region, there is also an urgent need to seriously address the political, economic, and social factors, apart from HIV, that influence host–*M. tuberculosis* interactions and increase the risk of developing active TB, or re-activation of latent TB infection, and result in poor treatment outcomes.[7–9]

So what more can researchers, healthcare workers, community groups, governments, the private sector, non-governmental organizations (NGOs), and funders do to effect a major shift from the current status quo with regard to global TB and TB/HIV control efforts in Africa? To achieve the laudable and ambitious 90–(90)–90 aims, the global scientific, political, and funder communities seriously need to 'Unite to End TB',[21] and heed calls to action that have regularly been repeated on World TB Day[5–11] for the scaling up of TB services for the improved diagnosis, management, and control of TB.[22]

Recent political and funder initiatives have provided new hope for the WHO Africa Region to reduce the burden of TB and TB/HIV. Several novel and encouraging initiatives now present opportunities for the Sub-Saharan African scientific and political communities to engage more proactively in galvanizing resources, conducting priority scientific and operational research, and facilitating national TB program control efforts, and thereby to take forward boldly the aims of the Global Plan to End TB in Africa. Examples of these are the following:

(1) The European Union supported EDCTP2 program (European and Developing Countries Clinical Trials Partnership), which provides unique opportunities for developing equitable, European–African partnerships in clinical research, capacity development, and training on poverty-related diseases, including TB and TB/HIV.[23–25]
(2) The Global TB Caucus, a formidable network of parliamentarians and political representatives from over 100 countries.[26]
(3) An African network called WARN-TB, which works with the WHO Tropical Disease Research Program (WHO-TDR) and plans to develop new approaches that will increase the numbers of people diagnosed and treated, build capacity for TB operational research, and support resource mobilization for TB control.[27]

(4) A USA National Action Plan for combating MDR-TB, which aims to mobilize political will, financial commitments from donors, and governments of MDR-TB endemic countries.[28]
(5) The expansion of Africa-based grassroots community initiatives: (a) The ENGAGE-TB approach, where the five founder countries (the Democratic Republic of the Congo, Ethiopia, Kenya, South Africa, and the United Republic of Tanzania) have been joined by Burkina Faso, Côte d'Ivoire, Malawi, Namibia, and Zimbabwe.[29] (b) Increasing activities of community TB groups like TB Proof,[30] which was founded in 2012 by African health care workers and students after suffering multiple personal experiences with MDR-TB,[31,32] and increased the commitment of 90 non-governmental and other civil society organizations from 35 African countries to the WHO End TB Strategy.[33]
(6) The United States Agency for International Development (USAID) "Challenge TB Award" to fight TB, a 5-year cooperative agreement to implement the USAID global TB strategy.[34]

These, and other initiatives, now offer unique opportunities and motivation for African scientists, healthcare workers, and governments to 'Unite to End TB'. A recently published book entitled "African health leaders—making a change and claiming the future",[35] contains important and relevant messages for the TB and TB/HIV fraternity in Sub-Saharan Africa. This book was edited by Professor Francis Omaswa and Lord Nigel Crisp, Chairman of the UK All Party Parliamentary Group on Global Health, a tireless advocate for global health and international development issues and renowned for his commitment to improving health services in Africa. It contains chapters written by three generations of African leaders, including the ex-Prime Minister of Mozambique, Dr Pascoal Mocumbi, and Rwandan Minister of Health, Dr Agnes Binagwaho, among others who have led the transformation of health services in Africa. They detail their experiences and vision for Africa health systems, emphasizing that "African leaders and leadership in health have an enormous role to play in a new Africa, where Africans recognize that the responsibility for making Africa an equal player in the global community rests primarily with Africans." They address key global health issues and emphasize that there are lessons that other nations can learn from Africa. In addition, they challenge Africans to take up the mantle and lead from the front. This supports the repeated calls for Africa to become independent from the dominance of research in Africa by Western institutions,[36–38] and to build infrastructure and capability that can be sustained in the long term.

The second program of the European and Developing Countries Clinical Trials Partnership (EDCTP2)[23,38] now provides unique opportunities over the next 10 years for African scientists to take up leadership on poverty-related diseases including TB and to develop equitable north–south clinical trials research and training partnerships based on priority issues. EDCTP2 has substantial funding for clinical trials research, training, and capacity development on TB as one of the major poverty-related diseases in Sub-Saharan Africa.[25] Three funding schemes or 'actions' are supported under the EDCTP2 program:[38] (1) research and innovation actions (RIA), (2) coordination and support actions (CSA), and (3) training and mobility actions (TMA). RIAs are primarily clinical research activities and clinical trials conducted in partnership between European and Sub-Saharan African countries aimed at increasing the number of new or improved interventions for TB, HIV, malaria, and other poverty-related diseases. CSAs are primarily accompanying measures, such as activities to develop, strengthen, and extend clinical research capacities in Sub-Saharan Africa. They aim to maximize the public health impact of research results by promoting their translation and supporting their uptake in policy-making, health systems, and clinical practice at the local, national, regional, and international levels. TMAs are activities that foster career development (fellowships) of individual junior and senior researchers from Sub-Saharan Africa, support training and mentorship of researchers, and promote mobility of individual researchers. Between 2009 and 2014, EDCTP supported four African (South, East, West, and Central) regional networks of excellence,[39] which enabled African scientific leadership to develop and address capacity development and training needs, identify gaps for tackling TB, and develop locally relevant solutions. Progress made under the first EDCTP program requires consolidation, and the research capacity built needs to be strengthened further.

It is important that alongside EDCTP2 and other current donor initiatives, African governments seriously commit to, and set aside a specific budget for, TB research, capacity development, and control initiatives in their own countries. Furthermore, the conventional and longstanding focus on promoting the development of new TB drugs, diagnostics, and vaccines[40] must be supplemented by novel innovations that focus on the host factors responsible for and driving the poor treatment outcomes of MDR-TB treatment. This would include the neglected issue of long-term functional disability that arises from the permanent lung damage suffered by a significant proportion of TB patients, who recover after treatment but are unable to lead normal lives or go back to work.[41,42] A whole range of host-directed therapies are now becoming available. These will require evaluation in clinical trials for their impact when used as adjunct therapy, on shortening the duration of TB treatment, improving treatment outcomes of MDR-TB, and preventing pulmonary damage and functional disability.[43] This will be taken forward by a recently formed Host-Directed Therapies Network consortium (HDT-NET),[44] a consortium of partners from all regions of Africa in collaboration with institutions in Europe, Australia, and the USA.[45]

TB control programs in Sub-Saharan Africa can only succeed if appropriate mechanisms for close engagement of national scientists, healthcare workers, patient groups, governments, and policy-makers are put in place. Furthermore, scaling up sustainable interventions for TB care and treatment requires high-level political commitment and adequate financial and human resources.[46] Central coordination under the national government's stewardship will be essential. African governments must step up current efforts to further improve the quality of proactive TB screening and identification of all missed, sub-clinical and undiagnosed cases of TB,[47,48] improve health services to provide quality TB treatment, and provide follow-up care. Efforts must also be stepped up to improve capacity for rapidly diagnosing MDR-TB to address this deadly and growing epidemic in Africa.[12] We also re-iterate that it is only through the empowerment of the indigenous younger generation scientists, program managers, and healthcare workers that the current status quo can be changed significantly.

The only way forward to achieve the aims of The Global Plan to End TB 2016–2020 is for researchers, funders, national governments, industry, pharma, and community groups to 'Unite to End TB' and promote the four WHO sub-themes for World TB Day, March 24, 2016: (1) together we can better test, treat, and cure TB, (2) together we can end TB stigma and discrimination, (3) together we can drive TB research and innovation, and (4) together we can prevent TB by ending poverty. All national governments and funder and donor investments in TB in Africa should be aligned in parallel with international efforts to improve social and living conditions and with the 'one health' initiative, which provides a holistic approach to managing poverty-related diseases.[49] Only then will significant progress be made in achieving WHO post-2015 End TB Strategy goals, and gains in achieving TB control will be enhanced and sustained.

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References

1. World Health Organization. TB—a global emergency. WHO/TB/94.177. Geneva: WHO; 1994. Available at: http://apps.who.int/iris/bitstream/10665/58749/1/WHO_TB_94.177.pdf (accessed January 12, 2016).
2. World Health Organization. World TB Day 2016: Unite to End TB. Geneva: WHO; 2016. Available at: http://www.who.int/campaigns/tb-day/2016/event/en/ (accessed February 18, 2016).
3. Akkermans R. Robert Heinrich Herman Koch. *Lancet Respir Med* 2014;**2**:264–5.
4. Daniel TM. The history of tuberculosis. *Respir Med* 2006;**100**:1862–70.
5. Grange JM, Gandy M, Farmer P, Zumla A. Historical declines in tuberculosis: nature, nurture and the biosocial model. *Int J Tuberc Lung Dis* 2001;**5**:208–12.
6. Zumla A, Mwaba P, Huggett J, Kapata N, Chanda D, Grange J. Reflections on the white plague. *Lancet Infect Dis* 2009;**9**:197–202.
7. Grange JM, Zumla A. The global emergency of tuberculosis: what is the cause? *J R Soc Promot Health* 2002;**122**:78–81.
8. Grange J, Zumla A. Tuberculosis and the poverty-disease cycle. *J R Soc Med* 1999;**92**:105–7.
9. Grange JM, Kapata N, Chanda D, Mwaba P, Zumla A. The biosocial dynamics of tuberculosis. *Trop Med Int Health* 2009;**14**:124–30.
10. Zumla A, Grange JM. Doing something about tuberculosis. *BMJ* 1999;**318**:956.
11. Zumla A, Mwaba P, Squire SB, Grange JM. The tuberculosis pandemic—which way now? *J Infect* 1999;**38**:74–9.
12. World Health Organization. WHO Global tuberculosis report 2015. WHO/HTM/TB/2015.22. Geneva, Switzerland: WHO; 2015. Available at: http://who.int/tb/publications/global_report/en/ (accessed December 18, 2015).
13. Herbert N, George A. Baroness Masham of Ilton, Sharma V, Oliver M, Oxley A, et al. World TB Day 2014: finding the missing 3 million. *Lancet* 2014;**383**:1016–8.
14. Cutler SJ, Fooks AR, van der Poel WH. Public health threat of new, reemerging, and neglected zoonoses in the industrialized world. *Emerg Infect Dis* 2010;**16**:1–7.
15. Chaisson RE, Martinson NA. Tuberculosis in Africa—combating an HIV-driven crisis. *N Engl J Med* 2008;**358**:1089–99.
16. Zumla A, Abubakar I, Raviglione M, Hoelscher M, Ditiu L, McHugh TD, et al. Drug-resistant tuberculosis—current dilemmas, unanswered questions, challenges, and priority needs. *J Infect Dis* 2012;**205**(Suppl 2):228–40.
17. UN High Commissioner for Refugees. UNHCR global trends: forced displacement in 2014. UNHCR; 2014. Available at: http://unhcr.org/556725e69.html#_ga=1.225701913.2095888809.1417795315 (accessed January 29, 2016).
18. World Health Organization. The End TB Strategy. Geneva: WHO; 2014. Available at: http://www.who.int/tb/post2015_strategy/en/ (accessed January 23, 2016).
19. Global Plan to End TB. Paradigm shift 2016-2020. Geneva, Switzerland: STOP TB Partnership; 2014. Available at: http://www.stoptb.org/assets/documents/global/plan/plan2/ExecutiveSummary.pdf (accessed January 26, 2016).
20. Treatment Action Group. TAG 2015 report on tuberculosis research funding trends, 2005-2014: a decade of data. TAG; 2015. Available at: http://www.treatmentactiongroup.org/sites/g/files/g450272/f/201511/TB_FUNDING_2015_WEB.pdf (accessed January 23, 2016).
21. Zumla A, Davies P. Progress towards achieving global tuberculosis control: so near yet so far. *Int J Tuberc Lung Dis* 2016;**3**:285–6.
22. Marais BJ, Raviglione MC, Donald PR, Harries AD, Kritski AL, Graham SM, et al. Scale-up of services and research priorities for diagnosis, management, and control of tuberculosis: a call to action. *Lancet* 2010;**375**:2179–91.
23. Zumla A, Makanga M, Nyirenda T, Beattie P, Olesen OF, Breugelmans JG, et al. Genesis of EDCTP2. *Lancet Infect Dis* 2015;**15**:11–3.
24. Zumla A, Huggett J, Dheda K, Green C, Kapata N, Mwaba P. Trials and tribulations of an African-led research and capacity development programme: the case for EDCTP investments. *Trop Med Int Health* 2010;**15**:489–94.
25. Zumla A, Petersen E, Nyirenda T, Chakaya J. Tackling the tuberculosis epidemic in Sub-Saharan Africa—unique opportunities arising from the second European Developing Countries Clinical Trials Partnership (EDCTP) programme 2015–2024. *Int J Infect Dis* 2015;**32**:46–9.
26. The Global TB Caucus. London, UK: Al Party Parliamentary Group on Global Tuberculosis; 2015. Available at: http://www.globaltbcaucus.org (accessed January 5, 2016).
27. Special Programme for Research and Training in Tropical Diseases. West African regional network to develop national TB research agendas. TDR; 2015. Available at: http://www.who.int/tdr/news/2015/west-african-regional-network/en/ (accessed February 12, 2016).
28. National action plan for combating MDR-TB. Washington DC, USA; 2015. Available at: https://www.whitehouse.gov/sites/default/files/microsites/ostp/national_action_plan_for_tuberculosis_20151204_final.pdf (accessed January 25, 2016).
29. World Health Organization. Engage TB approach. Geneva: WHO; 2015. Available at: http://www.who.int/tdr/news/2015/west-african-regional-network/en/ (accessed January 24, 2016).
30. TB Proof. Available at: http://www.tbproof.org/ (accessed January 24, 2016).
31. von Delft A, Dramowski A, Khosa C, Kotze K, Lederer P, Mosidi T, et al. Why healthcare workers are sick of TB. *Int J Infect Dis* 2015;**32**:147–51.
32. Von Delft A, Dramowski A, Sifumba Z, Mosidi T, Ting TX, von Delft D, et al. Exposed but not protected: more is needed to prevent drug-resistant tuberculosis in healthcare workers and students. *Clin Infect Dis* 2016. in press.
33. World Health Organization. Statement of action to enhance the engagement of communities, non-governmental and other civil society organizations in the implementation of the End TB Strategy. Outcome of a WHO consultation meeting, November 11, 2015, Addis Ababa, Ethiopia. Geneva: WHO; 2015. Available at: http://www.who.int/tb/areas-of-work/community-engagement/Community_EndTB_Statement.pdf (accessed January 30, 2016).
34. Stop TB. USAID announces "Challenge TB" award to fight tuberculosis. Washington DC, USA; 2015. Available at: http://www.stoptb.org/news/stories/2014/ns14_066.asp (accessed February 14, 2016).
35. Omaswa F, Crisp N. African health leaders: making change and claiming the future. Oxford, UK: Oxford University Press; 2014.
36. Zumla A, Costello A. Ethics of healthcare research in developing countries. *J R Soc Med* 2002;**95**:275–6.
37. Costello A, Zumla A. Moving to research partnerships in developing countries. *BMJ* 2000;**321**:827–9.
38. European Developing Countries Clinical Trials Partnership. EDCTP, The Hague, Netherlands. Available at: http://www.edctp.org/ (accessed January 15, 2016).
39. Miiro GM, Oukem-Boyer OO, Sarr O, Rahmani M, Ntoumi F, Dheda K, et al. Networks of Excellence (NoEs) programme. EDCTP regional networks of excellence: initial merits for planned clinical trials in Africa. *BMC Public Health* 2013;**13**:258.
40. Zumla AI, Schito M, Maeurer M. Advancing the portfolio of tuberculosis diagnostics, drugs, biomarkers, and vaccines. *Lancet Infect Dis* 2014;**14**:267–9.
41. Pasipanodya JG, McNabb SJ, Hilsenrath P, Bae S, Lykens K, Vecino E, et al. Pulmonary impairment after tuberculosis and its contribution to TB burden. *BMC Public Health* 2010;**10**:259.
42. Hoger S, Lykens K, Beavers SF, Katz D, Miller TL. Longevity loss among cured tuberculosis patients and the potential value of prevention. *Int J Tuberc Lung Dis* 2014;**18**:1347–52.
43. Zumla A, Maeurer M, Chakaya J, Hoelscher M, Ntoumi F, Rustomjee R, et al. Towards host-directed therapies for tuberculosis. *Nat Rev Drug Discov* 2015;**14**:511–2.
44. UNZA-UCLMS Research and Training Programme: Host Directed Therapies TB Clinical Trials Network. 2015. Available at: http://www.unza-uclms.org/hdt-net (accessed April 24, 2015).
45. UNZA-UCLMS Research and Training Programme: HDT-NET partners. 2015. Available at: http://www.unza-uclms.org/hdt-net-partners (accessed February 12, 2016).
46. Marais B, Hoelscher M, Mwaba P, Dheda K, Zumla A. World TB Day 2010: eradicating tuberculosis in Sub-Saharan Africa needs effective and committed north–south partnerships. *S Afr Med J* 2010;**8**(100):153–4.
47. Mudenda V, Lucas S, Shibemba A, O'Grady J, Bates M, Kapata N, et al. Tuberculosis and tuberculosis/HIV/AIDS-associated mortality in Africa: the urgent need to expand and invest in routine and research autopsies. *J Infect Dis* 2012;**205**(Suppl 2):S340–6.
48. Kilale AM, Kimaro GD, Kahwa AM, Chilagwile M, Ngowi BJ, Muller W, et al. High prevalence of tuberculosis diagnosed during autopsy examination at Muhimbili National Hospital in Dar es Salaam, Tanzania. *Tanzan J Health Res* 2013;**15**:171–7.
49. Gesesew H, Tsehaineh B, Massa D, Tesfay A, Kahsay H, Mwanri L. The role of social determinants on tuberculosis/HIV co-infection mortality in southwest Ethiopia: a retrospective cohort study. *BMC Res Notes* 2016;**9**:89. http://dx.doi.org/10.1186/s13104-016-1905-x