Public Health Action

International Union Against Tuberculosis and Lung Disease
Health solutions for the poor

VOL 5 NO 1 PUBLISHED 21 MARCH 2015

Map the gap: missing children with drug-resistant tuberculosis

C. M. Yuen,[1,2] C. A. Rodriguez,[2] S. Keshavjee,[1,2,3] M. C. Becerra[1,2,3]

http://dx.doi.org/10.5588/pha.14.0100

Background: The lack of published information about children with multidrug-resistant tuberculosis (MDR-TB) is an obstacle to efforts to advocate for better diagnostics and treatment.

Objective: To describe the lack of recognition in the published literature of MDR-TB and extensively drug-resistant TB (XDR-TB) in children.

Design: We conducted a systematic search of the literature published in countries that reported any MDR- or XDR-TB case by 2012 to identify MDR- or XDR-TB cases in adults and in children.

Results: Of 184 countries and territories that reported any case of MDR-TB during 2005–2012, we identified adult MDR-TB cases in the published literature in 143 (78%) countries and pediatric MDR-TB cases in 78 (42%) countries. Of the 92 countries that reported any case of XDR-TB, we identified adult XDR-TB cases in the published literature in 55 (60%) countries and pediatric XDR-TB cases for 9 (10%) countries.

Conclusion: The absence of publications documenting child MDR- and XDR-TB cases in settings where MDR- and XDR-TB in adults have been reported indicates both exclusion of childhood disease from the public discourse on drug-resistant TB and likely underdetection of sick children. Our results highlight a large-scale lack of awareness about children with MDR- and XDR-TB.

Multidrug-resistant tuberculosis (MDR-TB, defined as TB resistant to at least both isoniazid and rifampin), among children is an unrecognized epidemic. Like drug-susceptible TB, MDR-TB is curable, but treatment requires the use of longer regimens with more toxic drugs, few of which are available in child-friendly formulations.[1] Although an estimated 32 000 children fall sick each year with MDR-TB,[2] few of these are diagnosed and treated. An analysis of age-disaggregated surveillance data collected in 85 countries during 1994–2011 found that 50 (59%) of these countries reported no child MDR-TB cases,[3] although many of them did report cases of MDR-TB, presumably in adults, during this period.[4] The microbiological diagnosis of drug-resistant TB in children is complicated by insensitive diagnostic tests, limited diagnostic capacity in many countries with high TB burdens[5] and the inability of young children to expectorate sputum.[6] These diagnostic challenges, as well as historic misperceptions that children are not likely to be important contributors to or victims of the global TB epidemic,[7] have contributed to the invisibility of the MDR-TB epidemic among children.[8]

The lack of published evidence documenting numbers of children treated for MDR-TB, as well as treatment practices and outcomes, is an obstacle to efforts to advocate for better diagnostics, treatments, and policies for children with MDR-TB. As publicly available data on numbers of MDR-TB cases reported by different countries are not disaggregated by age,[4] it is impossible to determine how many children are diagnosed with MDR-TB each year. A systematic review of studies reporting outcomes among children treated for MDR-TB found only eight studies, comprising a total of 315 children.[9] With such sparse published evidence on both the magnitude of the problem and its potential solutions, it is difficult to convince companies to invest in new diagnostics for drug-resistant disease in children, investigators to include children in clinical trials of second-line regimens and governments to reform policies that limit access to effective treatment for children with MDR-TB.

As global TB policies tend to focus on adults, there is a profound lack of awareness about the MDR-TB epidemic among children. In the present study, we sought to describe the current state of awareness about children with MDR-TB by comparing documentation of child and adult MDR-TB cases in the published literature.

METHODS

The numbers of MDR-TB cases reported each year by governments of individual countries and territories (referred to from here on as 'countries') are publicly available through the World Health Organization (WHO).[4] Based on these data, we compiled a list of countries that reported at least one notified MDR-TB case during 2005–2012.[4] We then used a systematic search of the published literature to identify child and adult MDR-TB cases in each country. We repeated this process to identify child and adult cases of extensively drug-resistant TB (XDR-TB), the subset of MDR-TB strains with additional resistance to fluoroquinolones and second-line injectable agents.

For each country, we attempted to identify a publication documenting at least one MDR-TB case in a child aged ⩽14 years, and one documenting at least one MDR-TB case in an adult aged >14 years (Figure 1). In our search for pediatric MDR-TB cases, we first referred to two publications documenting country-specific reports of MDR-TB in children: one based on WHO surveillance data[3] and the other a systematic review.[2] For countries in which no pediatric MDR-TB cases were indicated in either of these publications, we systematically searched for publications published through 1 July 2014 in PubMed, EMBASE, LILACS, Web of Science, BIOSIS and WHO regional databases. Together, these databases include citations for a vari-

AFFILIATIONS
1 Brigham and Women's Hospital, Boston, Massachusetts, USA
2 Harvard Medical School, Boston, Massachusetts, USA
3 Partners In Health, Boston, Massachusetts, USA

CORRESPONDENCE
Mercedes C Becerra
Department of Global Health and Social Medicine
Harvard Medical School
641 Huntington Avenue,
Boston, MA 02115 USA
e-mail: mbecerra@post.harvard.edu
Tel: (+1) 617 432 2540
Fax: (+1) 617 432 2565

ACKNOWLEDGEMENTS
This work was supported by funding from Janssen (Beerse, Belgium). The funder had no role in the study design, collection of data, analysis or interpretation of data, writing of the report, or decision to submit the paper for publication.
The authors would like to thank C GawneMark and B Liebenow for their help with data collection and P A Bain, Countway Library of Medicine, Harvard Medical School, Boston, MA, USA, for his help to develop the literature search strategy. We would also like to thank N Candia, H Cox, D Falzon, M Joloba, C Martinaud, J Millet, D L Molina, N Rastogi, L Nelson, R Noor, V Ritacco, P W Smit, E Talbot, A Trébucq, A Van Deun, T Vremeră, and I Živanović for kindly providing additional unpublished data in response to our requests.
Conflicts of interest: none declared.

KEY WORDS
tuberculosis; multidrug-resistant; extensively drug-resistant tuberculosis; pediatric

Received 13 November 2014
Accepted 8 January 2015

PHA 2015; 5(1): 45–58

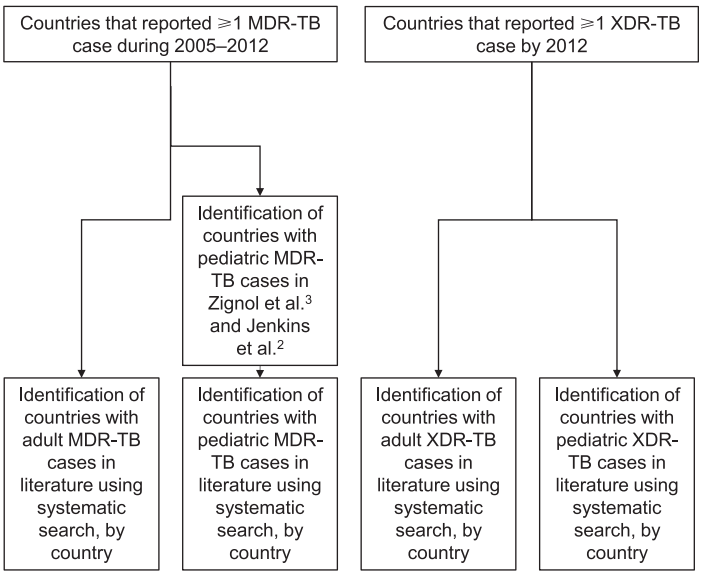

FIGURE 1 Search strategy for identifying publications, by country, for adult and pediatric MDR- and XDR-TB cases among countries that reported MDR- and XDR-TB cases. MDR-TB = multidrug-resistant tuberculosis; XDR-TB = extensively drug-resistant TB.

ety of published literature, including research publications, case reports, editorials and conference abstracts.

No reviews or surveillance summaries explicitly focused on adults with MDR-TB. We referred to the aforementioned systematic review of MDR-TB in children,[2] which also documented adult cases in some countries. For the remaining countries, we systematically searched the published literature for publications documenting adult MDR-TB cases. We used an analogous process to search for XDR-TB cases in both adults and children in all countries that had reported at least one XDR-TB case by 2012.[10]

We used search terms that included combinations intended to capture publications documenting MDR- and XDR-TB cases (e.g., 'multidrug resistant tuberculosis,' 'MDR-TB,' 'drug-resistant TB') and country names. In our search for child cases, we also included terms intended to capture children (e.g., 'child*,' 'pediatric'). The complete search strategy is documented in Appendix Table A.1. We did not restrict publications on the basis of language. For publications in English and Spanish, we contacted authors by e-mail for additional information if the publication identified MDR- or XDR-TB cases but we were unable to determine the age of subjects.

For each of the four categories of cases (child MDR-TB, adult MDR-TB, child XDR-TB, adult XDR-TB), we considered a single publication sufficient to document the presence of that type of case in a given country. If our search yielded multiple published reports for a country, we recorded only the most recent English-language report, or the most recent report in any language if no English-language report was found.

No ethics approval was required for this study, as the data used were publicly available and contained no personal identifying information.

RESULTS

Of the 216 national and territorial governments that reported TB case data, 184 (85%) reported at least one case of MDR-TB during 2005–2012.[4] Through our literature searches, we found publications documenting adult MDR-TB cases in 143 (78%) of the 184 countries (Table and Appendix Table A.2). By contrast, we found publications documenting pediatric MDR-TB cases in 78 (42%) of these countries. We were thus unable to identify any pediatric MDR-TB cases for 45% of the countries for which we were able to identify adult MDR-TB cases through our systematic literature search. There were no countries with publications documenting MDR-TB cases in children but not in adults.

Figure 2 shows the countries categorized according to whether any MDR-TB case was reported during 2005–2012, whether we identified any adult MDR-TB case through our literature search and whether we identified any pediatric MDR-TB case through our literature search. The proportion of countries for which we were able to find publications documenting adult MDR-TB cases but not pediatric MDR-TB cases was highest for the WHO African Region (69%) and lowest for the European region (19%) (Table). We found publications documenting adult MDR-TB cases for all of the 27 countries classified as having a high MDR-TB burden,[10] but found no publications documenting pediatric MDR-TB cases for 7 (26%) of these countries.

By 2012, XDR-TB cases had been reported in 92 countries.[10] We identified publications documenting adult XDR-TB cases for 55 (60%) of these countries, and publications documenting pediatric XDR-TB cases for 9 (10%) countries. We found no pediatric XDR-TB cases for 84% of the countries for which we identified adult XDR-TB cases through our literature search. Figure 3 shows the countries categorized according to whether any case of

TABLE Countries and territories with publications documenting MDR-TB cases in adults and children*

	Total *n*	AFR *n*	AMR *n*	EMR *n*	EUR *n*	SEAR *n*	WPR *n*	High MDR-TB burden *n*
Total countries and territories	216	47	46	21	53	11	35	27
Countries/territories that reported ⩾1 MDR-TB case during 2005–2012	184	43	34	21	51	11	24	27
Countries/territories with publications documenting adult MDR-TB cases	143	32	23	19	42	9	17	27
Countries/territories with publications documenting pediatric MDR-TB cases	78	10	10	9	34	4	11	20
Proportion of countries/territories with published adult cases but no published pediatric cases, %	45	69	57	53	19	56	35	26

*Publications were identified through systematic search of the published literature through 1 July 2014. Countries/territories are those listed on the WHO country profile database.

MDR-TB = multidrug-resistant tuberculosis; AFR = WHO African Region; AMR = WHO Americas Region; EMR = WHO Eastern Mediterranean Region; EUR = WHO European Region; SEAR = WHO South-East Asia Region; WPR = WHO Western Pacific Region; WHO = World Health Organization.

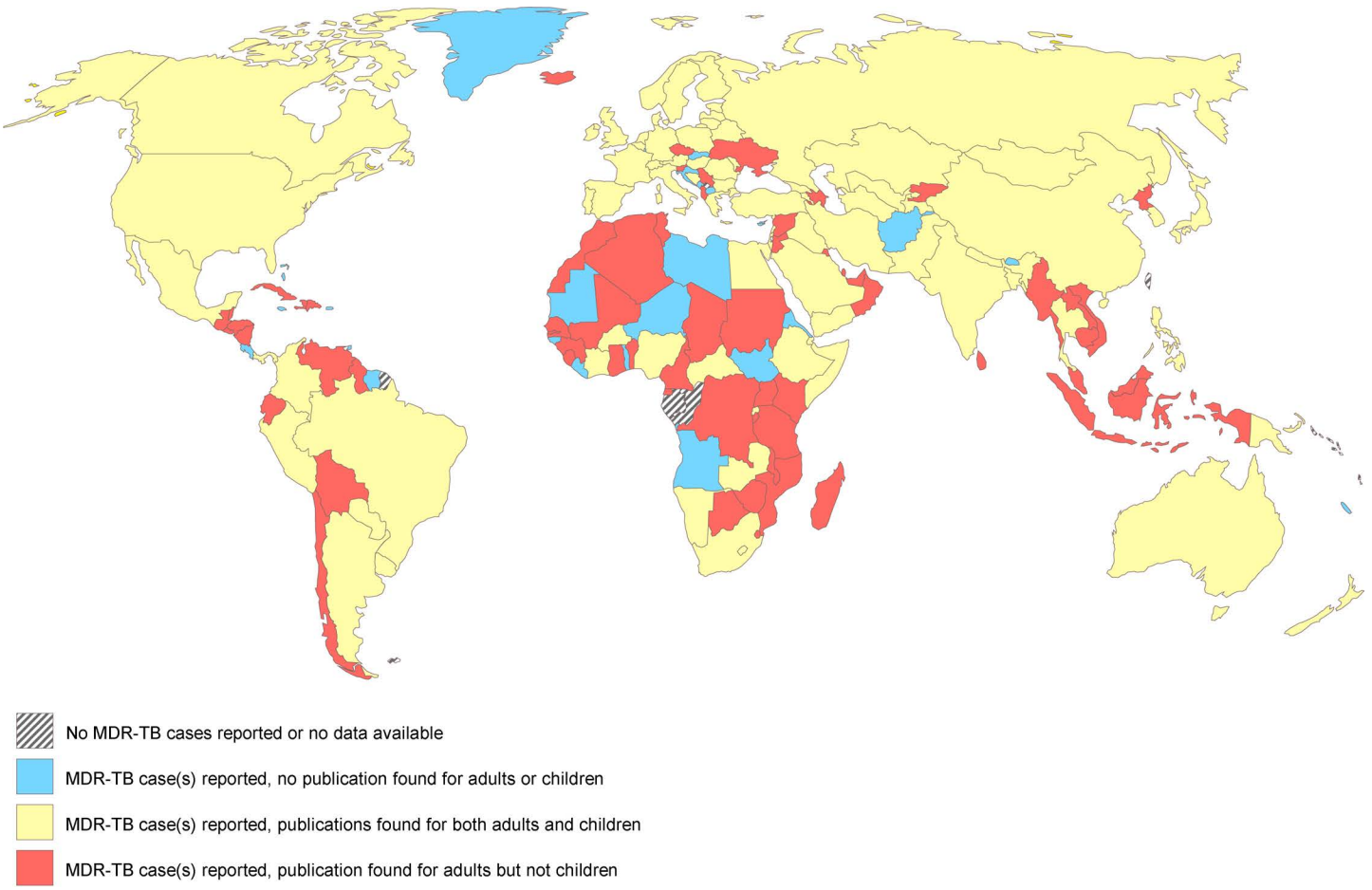

FIGURE 2 Adult vs. child MDR-TB cases in the published literature: documentation of adult vs. child MDR-TB cases in the published literature among countries reporting ⩾1 case of MDR-TB during 2005–2012. Note that some smaller countries and territories are not depicted. MDR-TB = multidrug-resistant tuberculosis.

XDR-TB was reported by 2012, whether we identified any adult XDR-TB case through our literature search and whether we identified any pediatric XDR-TB case through our literature search.

DISCUSSION

In almost every household where an adult has TB, children, who are even more susceptible than adults to developing TB disease,[11] are exposed. However, although we found documentation of MDR-TB cases in adults for over three quarters of the countries whose governments reported any case of MDR-TB by 2012 through systematic searches of published literature, we were unable to find published reports of MDR-TB in children for over half of these countries. We were unable even to find published reports of MDR-TB cases in children for a quarter of the countries with a high MDR-TB burden. The size of the discrepancy varied by geographic region, and was even greater in our search for XDR-TB cases. Our results are consistent with large-scale deficient disease awareness of children with MDR- and XDR-TB. This deficiency has major implications for national and global TB policies, as children (age ⩽14 years) make up approximately 25% of the global population and may comprise 20–40% of persons with TB in high TB incidence settings.[12]

The pronounced absence of childhood MDR-TB cases in the literature is worrying, as the published literature is an important forum for the dissemination of information, the discussion of public health policy, and the testing of new ideas. In a time when MDR- and XDR-TB are gaining worldwide attention, the absence of child cases in the published literature can only perpetuate the invisibility of children already suffering from these forms of TB. Of course, there may be reasons for this absence: research publications often exclude children, and publications are generally not a priority for resource-limited TB programs struggling to provide treatment. However, as programs strive to improve the diagnosis and treatment of children with MDR- and XDR-TB, the lack of published evidence in these areas may prove an obstacle.

While the absence of cases in the published literature may not indicate an actual absence of diagnosed cases, the magnitude of the discrepancy between published accounts of adult cases and published accounts of child cases raises strong suspicions about underdetection. Given the large number of adults worldwide with untreated or inadequately treated MDR-TB,[13] transmission to children in their households is inevitable, and child MDR-TB cases are to be expected wherever adult MDR-TB cases are reported.[8] Recent estimates have suggested that each year 600 000 children worldwide require evaluation for household exposure to MDR-TB,[8] and that 30 000–50 000 require treatment for MDR-TB.[2,8] However, many of these children are likely going undiagnosed. Although global data on children diagnosed with MDR- and XDR-TB are lacking, widespread underdetection of

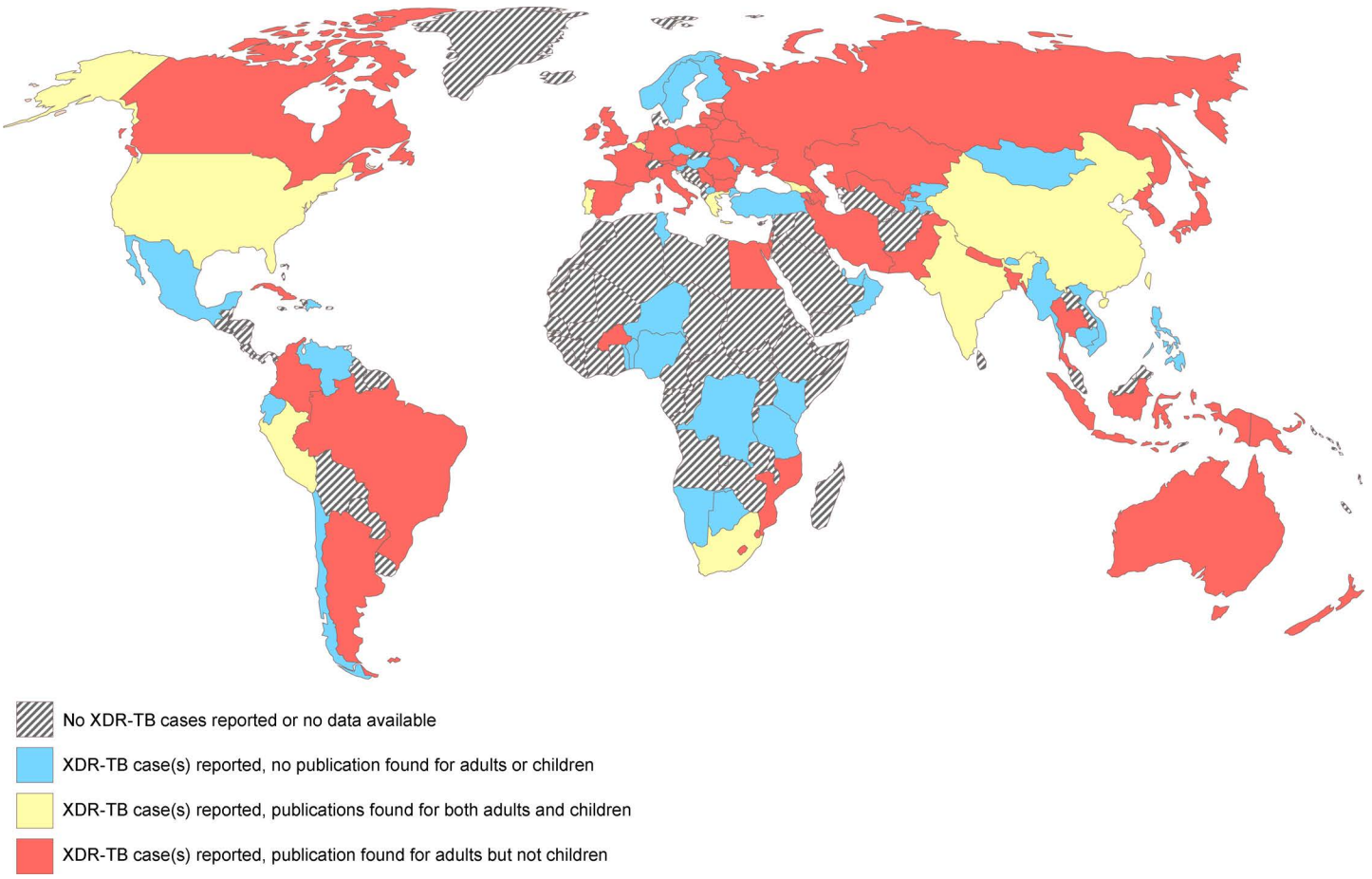

FIGURE 3 Adult vs. child XDR-TB cases in the published literature: documentation of adult vs. child XDR-TB cases in the published literature among countries reporting ⩾1 case of XDR-TB by 2012. Note that some smaller countries and territories are not depicted. XDR-TB = extensively drug-resistant tuberculosis.

child MDR-TB cases is suggested by the finding that 59% of the countries from which age-disaggregated surveillance data on MDR-TB were available reported no child MDR-TB cases,[3] although many of these countries did report MDR-TB cases, presumably in adults.[4]

The major limitation of the present analysis is that a review of published literature is unable to distinguish between the effect of underdetection of MDR- and XDR-TB in children and the effect of any publication disparities that may exist. Many factors could contribute to a publication bias against reports that include children with drug-resistant TB. For example, research studies often exclude children; analyses of routinely collected data on patients are frequently limited to patients with bacteriologically confirmed disease, which reduces the likelihood of children being included; and children are commonly excluded from drug resistance and prevalence surveys. In addition, countries with high TB burdens (and likely higher relative burdens of childhood TB cases[12]) are often poorly represented in the published literature; the ratio of TB publications to TB cases is orders of magnitude higher for Western Europe, the United States and Canada, than for Asia, Eastern Europe, Africa and Latin America.[14] Many countries for which we found no publications documenting any MDR-TB case were countries for which few TB publications existed. However, true underdetection of MDR-TB in children is also likely in many of these countries given the limitations in the current diagnostic capacities of their TB programs. Public availability of age-group-specific data on reported MDR- and XDR-TB cases would allow a more careful assessment of the relative contributions of underdetection and publication bias to our findings.

Another limitation is that our analysis only included publications that were indexed in a systematically searchable format; although available databases cover a variety of publications, including conference abstracts, bulletins and perspective pieces, some types of publications, such as advocacy materials and national tuberculosis program reports, are generally not included. While information on children with MDR- and XDR-TB may appear in these other types of publications, we had no way of systematically searching them. A recent advocacy effort to collect information about the experiences of children with drug-resistant TB found stories of children with MDR-TB from 10 of the countries for which we could not find any publications in our search.[15]

However, despite the limitations inherent in using published literature as an indicator of case detection, our results add weight to the suspicion of underdetection of MDR- and XDR-TB in children. Reasons for this underdetection are varied, but multiple steps can be taken to overcome existing obstacles to the recognition of child cases of drug-resistant disease. First, providers require more training to recognize the manifestations of TB disease in children, which can be diverse and non-specific.[16] In addition, as children frequently have paucibacillary disease and cannot

produce sputum, programs should employ child-focused methods of specimen collection and diagnostic technologies that are more sensitive than smear microscopy.[16] Even with these methods, however, cultured isolates for drug susceptibility testing (DST) will be unavailable for the majority of sick children.[6] Both individual providers and TB programs should therefore presumptively treat sick children who meet clinical criteria for TB disease and drug resistance in the absence of bacteriologic confirmation.[6,17] Finally, household contact investigations of adult MDR- and XDR-TB patients should be carried out to promptly identify and treat children with drug-resistant TB.[8]

Underdetection of childhood drug-resistant TB cases should be an indicator of weaknesses in TB programs, such as the failure to perform contact investigations or the underutilization of sensitive diagnostic techniques. To rigorously quantify underdetection, accurate counting of children with MDR- and XDR-TB will be necessary. If programs count and report only bacteriologically confirmed cases of drug-resistant TB, a substantial proportion of children with MDR- and XDR-TB will not be included, as the majority of children with TB will not have a bacterial culture available for DST.[6] Surveillance systems should therefore allow for the reporting of probable MDR-TB cases in children, with diagnosis based on clinical evidence of disease and exposure to an MDR- or XDR-TB case.[18] Furthermore, universal reporting of MDR- and XDR-TB cases by age group[19] and public accessibility of these surveillance data are necessary to broaden our understanding of the magnitude of the drug-resistant TB epidemic in children.

CONCLUSION

The absence of information about child MDR- and XDR-TB cases in countries where adult cases have been reported has major implications for national and global TB policies. Recognition of this large-scale deficiency in awareness should spur more systematic work to improve surveillance for and estimates of TB cases in children, which are necessary to allow programs to project unmet needs and allocate resources. In addition, it should serve as a warning that children with drug-resistant TB in these countries are going undiagnosed. Clinical awareness, aggressive methods of specimen collection, use of sensitive diagnostics and active case finding through contact investigation are all needed to ensure that children with TB—including those with MDR- and XDR-TB—are promptly recognized and treated.[20] Finally, policy makers, providers, investigators and advocates should all be aware that the discourse about how to end the toll of drug-resistant TB must include children to ensure that this vulnerable population is not neglected.

References

1 Seddon J A, Hesseling A C, Marais B J, et al. Paediatric use of second-line anti-tuberculosis agents: a review. Tuberculosis 2012; 92: 9–17.
2 Jenkins H E, Tolman A W, Yuen C M, et al. Incidence of multidrug-resistant tuberculosis disease in children: systematic review and global estimates. Lancet 2014; 383: 1572–1579.
3 Zignol M, Sismanidis C, Falzon D, Glaziou P, Dara M, Floyd K. Multidrug-resistant tuberculosis in children: evidence from global surveillance. Eur Respir J 2013; 42: 701–707.
4 World Health Organization. Country tuberculosis profiles. Geneva, Switzerland: WHO, 2015. https://extranet.who.int/sree/Reports?op=vs&path=/WHO_HQ_Reports/G2/PROD/EXT/MDRTB_Indicators_charts
5 Marais B J, Schaaf H S. Childhood tuberculosis: an emerging and previously neglected problem. Infect Dis Clin North Am 2010; 24: 727–749.
6 Reubenson G. Pediatric drug-resistant tuberculosis: a global perspective: a global perspective. Paediatr Drugs 2011; 13: 349–355.
7 Marais B J, Schaaf H S. Childhood tuberculosis: an emerging and previously neglected problem. Infect Dis Clin North Am 2010; 24: 727–749.
8 Becerra M C, Swaminathan S. A targets framework: dismantling the invisibility trap for children with drug-resistant tuberculosis. J Public Health Policy 2014; 35: 425–454.
9 Ettehad D, Schaaf H S, Seddon J A, Cooke G S, Ford N. Treatment outcomes for children with multidrug-resistant tuberculosis: a systematic review and meta-analysis. Lancet Infect Dis 2012; 12: 449–456.
10 World Health Organization. Global tuberculosis report, 2013. WHO/HTM/TB/2013.11. Geneva, Switzerland: WHO, 2013.
11 Lewinsohn D A, Gennaro M L, Scholvinck L, Lewinsohn D M. Tuberculosis immunology in children: diagnostic and therapeutic challenges and opportunities. Int J Tuberc Lung Dis 2004; 8: 658–674.
12 Donald P R. Childhood tuberculosis: out of control? Curr Opin Pulm Med 2002; 8: 178–182.
13 Keshavjee S, Farmer P E. Picking up the pace: scale-up of MDR tuberculosis treatment programs. N Engl J Med 2010; 363: 1781–1784.
14 Ramos J M, Padilla S, Masia M, Gutierrez F. A bibliometric analysis of tuberculosis research indexed in PubMed, 1997–2006. Int J Tuberc Lung Dis 2008; 12: 1461–1468.
15 Sentinel Project. Stories of children with drug-resistant TB. Boston, MA, USA: Sentinel Project, 2015. http://sentinel-project.org/stories/ Accessed January 2015.
16 Perez-Velez C M, Marais B J. Tuberculosis in children. N Engl J Med 2012; 367: 348–361.
17 Seddon J A, Furin J J, Gale M, et al. Caring for children with drug-resistant tuberculosis: practice-based recommendations. Am J Respir Crit Care Med 2012; 186: 953–964.
18 Seddon J A, Perez-Velez C M, Schaaf H S, et al. Consensus statement on research definitions for drug-resistant tuberculosis in children. J Pediatric Infect Dis Soc 2013; 2: 100–109.
19 World Health Organization. Guidance for national tuberculosis programmes on the management of tuberculosis in children. WHO/HTM/ TB/2006.371. WHO/FCH/CAH/2006.7. Geneva, Switzerland: WHO, 2006.
20 World Health Organization. Childhood TB subgroup of the Stop TB Partnership. Roadmap for childhood tuberculosis: towards zero deaths. WHO/HTM/TB/2013.12. Geneva, Switzerland: WHO, 2013.

APPENDIX

TABLE A.1 Terms used in systematic searches of published literature

Search	PubMed search terms	EMBASE search terms
Children with MDR-TB	'Tuberculosis, Multidrug-Resistant'[Mesh] OR 'multidrug resistant tuberculosis'[tiab] OR 'drug resistant tuberculosis'[tiab] OR 'multidrug resistant tb'[tiab] OR 'drug resistant tb' OR 'multi drug resistant tuberculosis'[tiab] OR 'multi drug resistant tb'[tiab] OR 'mdrtb'[tiab] OR 'DR TB'[tiab] AND Infant[MeSH Terms] OR Child[MeSH Terms] OR Adolescent[MeSH Terms] OR child*[tiab] OR adolescen*[tiab] OR infan*[tiab] OR neonate*[tiab] OR newborn*[tiab] OR new born*[tiab] OR baby[tiab] OR babies[tiab] OR toddler*[tiab] OR teen*[tiab] OR boy[tiab] OR boys[tiab] OR girl*[tiab] OR pediatric[tiab] OR 'paediatric'[tiab] OR puber*[tiab] OR pubescen*[tiab] OR prepubescen*[tiab] OR prepuberty*[tiab] AND '*COUNTRY NAME*'[MeSH Terms] OR '*COUNTRY NAME*'[tiab] where *COUNTRY NAME* was replaced with each individual country being searched.	'drug resistant tuberculosis'/exp OR 'multidrug resistant tuberculosis':ab,ti OR 'drug resistant tuberculosis':ab,ti OR 'multidrug resistant tb':ab,ti OR 'drug resistant tb':ab,ti OR 'multi drug resistant tuberculosis':ab,ti OR 'multi drug resistant tb':ab,ti OR 'mdrtb':ab,ti OR 'drtb':ab,ti AND 'child'/exp OR 'adolescent'/exp OR child*:ab,ti OR adolescen*:ab,ti OR infan*:ab,ti OR neonate*:ab,ti OR newborn*:ab,ti OR 'new born':ab,ti OR 'new borns':ab,ti OR baby:ab,ti OR 'babies':ab,ti OR toddler*:ab,ti OR teen*:ab,ti OR 'boy':ab,ti OR 'boys':ab,ti OR girl*:ab,ti OR pediatric:ab,ti OR paediatric:ab,ti OR puber*:ab,ti OR pubescen*:ab,ti OR prepubescen*:ab,ti OR prepuberty*:ab,ti AND '*COUNTRY NAME*'/exp OR '*COUNTRY NAME*':ab,ti where *COUNTRY NAME* was replaced with each individual country being searched.
Adults with MDR-TB	'Tuberculosis, Multidrug-Resistant'[Mesh] OR 'multidrug resistant tuberculosis'[tiab] OR 'drug resistant tuberculosis'[tiab] OR 'multidrug resistant tb'[tiab] OR 'drug resistant tb' OR 'multi drug resistant tuberculosis'[tiab] OR 'multi drug resistant tb'[tiab] OR 'mdrtb'[tiab] OR 'DR TB'[tiab] AND '*COUNTRY NAME*'[MeSH Terms] OR '*COUNTRY NAME*'[tiab] where *COUNTRY NAME* was replaced with each individual country being searched.	'drug resistant tuberculosis'/exp OR 'multidrug resistant tuberculosis':ab,ti OR 'drug resistant tuberculosis':ab,ti OR 'multidrug resistant tb':ab,ti OR 'drug resistant tb':ab,ti OR 'multi drug resistant tuberculosis':ab,ti OR 'multi drug resistant tb':ab,ti OR 'mdrtb':ab,ti OR 'drtb':ab,ti AND '*COUNTRY NAME* '/exp OR '*COUNTRY NAME* ':ab,ti where *COUNTRY NAME* was replaced with each individual country being searched.
Children with XDR-TB	'Extensively drug resistant tuberculosis'[Mesh] OR 'EXTENSIVELY drug resistant tuberculosis'[tiab] OR 'EXTENSIVELY drug resistant tb'[tiab] OR 'Xdrtb'[tiab] AND Infant[MeSH Terms] OR Child[MeSH Terms] OR Adolescent[MeSH Terms] OR child*[tiab] OR adolescen*[tiab] OR infan*[tiab] OR neonate*[tiab] OR newborn*[tiab] OR new born*[tiab] OR baby[tiab] OR babies[tiab] OR toddler*[tiab] OR teen*[tiab] OR boy[tiab] OR boys[tiab] OR girl*[tiab] OR pediatric[tiab] OR 'paediatric'[tiab] OR puber*[tiab] OR pubescen*[tiab] OR prepubescen*[tiab] OR prepuberty*[tiab] AND '*COUNTRY NAME*'[MeSH Terms] OR '*COUNTRY NAME*'[tiab] where *COUNTRY NAME* was replaced with each individual country being searched.	'EXTENSIVELY drug resistant tuberculosis':ab,ti OR 'EXTENSIVELY drug resistant tb':ab,ti OR 'Xdrtb':ab,ti AND 'child'/exp OR 'adolescent'/exp OR child*:ab,ti OR adolescen*:ab,ti OR infan*:ab,ti OR neonate*:ab,ti OR newborn*:ab,ti OR 'new born':ab,ti OR 'new borns':ab,ti OR baby:ab,ti OR 'babies':ab,ti OR toddler*:ab,ti OR teen*:ab,ti OR 'boy':ab,ti OR 'boys':ab,ti OR girl*:ab,ti OR pediatric:ab,ti OR paediatric:ab,ti OR puber*:ab,ti OR pubescen*:ab,ti OR prepubescen*:ab,ti OR prepuberty*:ab,ti AND 'insert country'/exp OR 'insert country':ab,ti
Adults with XDR-TB	'Extensively drug resistant tuberculosis'[Mesh] OR 'EXTENSIVELY drug resistant tuberculosis'[tiab] OR 'EXTENSIVELY drug resistant tb'[tiab] OR 'Xdrtb'[tiab] AND '*COUNTRY NAME*'[MeSH Terms] OR '*COUNTRY NAME*'[tiab] where *COUNTRY NAME* was replaced with each individual country being searched.	'EXTENSIVELY drug resistant tuberculosis':ab,ti OR 'EXTENSIVELY drug resistant tb':ab,ti OR 'Xdrtb':ab,ti AND '*COUNTRY NAME* '/exp OR '*COUNTRY NAME* ':ab,ti where *COUNTRY NAME* was replaced with each individual country being searched.

MDR-TB = multidrug-resistant tuberculosis; XDR-TB = extensively drug-resistant TB.

TABLE A.2 Table of identified references by country*

Country/territory	Reported MDR-TB case†	Reported XDR-TB case‡	Publication documenting adult MDR-TB case	Publication documenting child MDR-TB case	Publication documenting adult XDR-TB case	Publication documenting child XDR-TB case
Afghanistan	✓					
Albania	✓		1			
Algeria	✓		2			
American Samoa						
Andorra						
Angola	✓					
Anguilla						
Antigua and Barbuda						
Argentina	✓	✓	3	4,5	6	
Armenia	✓	✓	7	5	7	
Aruba						
Australia	✓	✓	8	4,5	9	
Austria	✓	✓	10	4,5	11	
Azerbaijan	✓	✓	12		13	
Bahamas	✓					
Bahrain	✓		14			
Bangladesh	✓	✓	15	5	16	
Barbados	✓		17			
Belarus	✓	✓	18	5	18	
Belgium	✓	✓	19	5	19	20
Belize	✓		17			
Benin	✓	✓	21			
Bermuda						
Bhutan	✓	✓				
Bolivia (Plurinational State of)	✓		22			
Bonaire, Saint Eustatius and Saba	✓	✓				
Bosnia and Herzegovina	✓		23	4		
Botswana	✓	✓	24			
Brazil	✓	✓	4	4	25	
British Virgin Islands						
Brunei Darussalam						
Bulgaria	✓	✓	26	5	27	
Burkina Faso	✓	✓	28	29	28	
Burundi	✓		4			
Cabo Verde						
Cambodia	✓	✓	30			
Cameroon	✓		31			
Canada	✓	✓	4	32	32	
Cayman Islands						
Central African Republic	✓		33	4		
Chad	✓		34			
Chile	✓	✓	35			
China	✓	✓	4	4	36	37
China, Hong Kong SAR	✓	✓	4	4	38	
China, Macao SAR	✓	✓	39			
Colombia	✓	✓	40	4	41	
Comoros	✓					
Congo						
Cook Islands	✓					
Costa Rica	✓					
Côte d'Ivoire	✓		42	4		
Croatia	✓					
Cuba	✓	✓	43		44	
Curacao						
Cyprus	✓					
Czech Republic	✓	✓	45			
Democratic People's Republic of Korea	✓	✓	46	47	46	

TABLE A.2 (continued)

Country/territory	Reported MDR-TB case†	Reported XDR-TB case‡	Publication documenting adult MDR-TB case	Publication documenting child MDR-TB case	Publication documenting adult XDR-TB case	Publication documenting child XDR-TB case
Democratic Republic of the Congo	✓	✓	48			
Denmark	✓		4	5		
Djibouti	✓		49	49		
Dominica						
Dominican Republic	✓	✓	4			
Ecuador	✓	✓	50			
Egypt	✓	✓	51	4	52	
El Salvador	✓		53			
Equatorial Guinea	✓		4			
Eritrea	✓					
Estonia	✓	✓	54	5	55	
Ethiopia	✓		4	56		
Fiji						
Finland	✓	✓	57	58	58	
France	✓	✓	59	60	61	
French Polynesia						
Gabon						
Gambia	✓		62			
Georgia	✓	✓	4	5	63	64
Germany	✓	✓	65	4,5	65	
Ghana	✓		66			
Greece	✓	✓	4	67	68	69
Greenland	✓					
Grenada						
Guam	✓					
Guatemala	✓		70			
Guinea	✓		71			
Guinea-Bissau	✓					
Guyana	✓		72			
Haiti	✓		4			
Honduras	✓		73			
Hungary	✓	✓	74	5		
Iceland	✓		75			
India	✓	✓	4	4	76	77
Indonesia	✓	✓	78		78	
Iran (Islamic Republic of)	✓	✓	4	4	79	
Iraq	✓		80			
Ireland	✓	✓	81	4,5	82	
Israel	✓	✓	83	84	85	
Italy	✓	✓	86	4,5	87	
Jamaica	✓					
Japan	✓	✓	4	88	89	
Jordan	✓		90			
Kazakhstan	✓	✓	91	5	91	
Kenya	✓	✓	92			
Kiribati	✓					
Kuwait	✓		93			
Kyrgyzstan	✓	✓	94			
Lao People's Democratic Republic	✓		95			
Latvia	✓	✓	96	5	97	
Lebanon	✓		4	4		
Lesotho	✓	✓	98	99	100	
Liberia	✓					
Libya	✓					
Lithuania	✓	✓	101	5	101	
Luxembourg	✓					
Madagascar	✓		4			

TABLE A.2 (continued)

Country/territory	Reported MDR-TB case†	Reported XDR-TB case‡	Publication documenting adult MDR-TB case	Publication documenting child MDR-TB case	Publication documenting adult XDR-TB case	Publication documenting child XDR-TB case
Malawi	✓		102			
Malaysia	✓		4			
Maldives	✓	✓				
Mali	✓		103			
Malta	✓					
Marshall Islands	✓		104	105		
Mauritania	✓					
Mauritius	✓					
Mexico	✓	✓	4	4		
Micronesia (Federated States of)	✓		106	107		
Monaco						
Mongolia	✓	✓	4	4		
Montenegro	✓					
Montserrat	✓					
Morocco	✓		4			
Mozambique	✓	✓	108		108	
Myanmar	✓	✓	109			
Namibia	✓	✓	110	5		
Nauru						
Nepal	✓	✓	111	112	113	
Netherlands	✓	✓	114	5	114	
New Caledonia	✓					
New Zealand	✓	✓	4	5	115	
Nicaragua	✓		116			
Niger	✓	✓				
Nigeria	✓	✓	117	118		
Niue						
Northern Mariana Islands	✓					
Norway	✓	✓	119	5		
Oman	✓	✓	120			
Pakistan	✓	✓	4	4	121	
Palau	✓					
Panama	✓		122	122		
Papua New Guinea	✓	✓	123	124	125	
Paraguay	✓		126	127		
Peru	✓	✓	4	4	128	129
Philippines	✓	✓	130	131		
Poland	✓	✓	4	5	132	
Portugal	✓	✓	133	5	134	135
Puerto Rico	✓					
Qatar	✓	✓	4			
Republic of Korea	✓	✓	136	137	136	
Republic of Moldova	✓	✓	4	5		
Romania	✓	✓	138	139	140	
Russian Federation	✓	✓	141	142	141	
Rwanda	✓		143	144		
Saint Kitts and Nevis						
Saint Lucia						
Saint Vincent and the Grenadines	✓					
Samoa						
San Marino						
Sao Tome and Principe	✓					
Saudi Arabia	✓		4	4,5		
Senegal	✓		145			
Serbia	✓	✓	146		147	
Seychelles						
Sierra Leone	✓		148			
Singapore	✓		4			

TABLE A.2 (continued)

Country/territory	Reported MDR-TB case†	Reported XDR-TB case‡	Publication documenting adult MDR-TB case	Publication documenting child MDR-TB case	Publication documenting adult XDR-TB case	Publication documenting child XDR-TB case
Sint Maarten (Dutch part)						
Slovakia	✓					
Slovenia	✓	✓	149			
Solomon Islands						
Somalia	✓		5	5		
South Africa	✓	✓	150	4,5	151	152
South Sudan	✓					
Spain	✓	✓	4	4	153	
Sri Lanka	✓		154			
Sudan	✓		155			
Surinam	✓					
Swaziland	✓	✓	156		156	
Sweden	✓	✓	157	5		
Switzerland	✓		158	5		
Syrian Arab Republic	✓		159			
Tajikistan	✓	✓	160	160		
Thailand	✓	✓	4	4	161	
The Former Yugoslav Republic of Macedonia	✓	✓				
Timor-Leste	✓		162			
Togo	✓	✓				
Tokelau						
Tonga						
Trinidad and Tobago	✓					
Tunisia	✓	✓	163			
Turkey	✓	✓	4	5		
Turkmenistan	✓		4			
Turks and Caicos Islands	✓					
Tuvalu	✓					
Uganda	✓		164			
Ukraine	✓	✓	165		166	
United Arab Emirates	✓	✓	167			
United Kingdom of Great Britain and Northern Ireland	✓	✓	4	4,5		
United Republic of Tanzania	✓	✓	168			
United States of America	✓	✓	4	4,5	169	170
Uruguay	✓			127		
Uzbekistan	✓	✓	4	5	171	
Vanuatu						
Venezuela (Bolivian Republic of)	✓	✓	172			
Viet Nam	✓	✓	173			
Wallis and Futuna Islands						
West Bank and Gaza Strip						
Yemen	✓		4	4,5		
Zambia	✓		174	174		
Zimbabwe	✓		175			

*Numbers in the table indicate the reference number in the list that follows the table. We recorded only the most recent English-language report, or the most recent report in any language if no English-language report was found.
†Reported by 2012 in: World Health Organization. Country tuberculosis profiles. Geneva, Switzerland: WHO, 2015. https://extranet.who.int/sree/Reports?op=vs&path=/WHO_HQ_Reports/G2/PROD/EXT/MDRTB_Indicators_charts
‡Reported by 2012 in World Health Organization. Global tuberculosis report 2013. WHO/HTM/TB/2013.11. Geneva, Switzerland: WHO, 2013.
MDR-TB = multidrug-resistant tuberculosis; XDR-TB = extensively drug-resistant TB.

References

1 Tafaj S, Zhang J, Hauck Y, et al. First insight into genetic diversity of the *Mycobacterium tuberculosis* complex in Albania obtained by multilocus variable-number tandem-repeat analysis and spoligotyping reveals the presence of beijing multidrug-resistant isolates. J Clin Microbiol 2009; 47: 1581–1584.

2 Ifticene M, Gacem F Z, Yala D, Boulahbal F. *Mycobacterium tuberculosis* genotype Beijing: about 15 strains and their part in MDR-TB outbreaks in Algeria. Int J Mycobacteriol 2012; 1: 196–200.

3 Reniero A, Beltran M, de Kantor I N, Ritacco V. AIDS patient's long-term battle with multiply recurrent tuberculosis: reinfection or reactivation? Rev Argent Microbiol 2010; 42: 271–273.

4 Jenkins H E, Tolman A W, Yuen C M, et al. Incidence of multidrug-resistant tuberculosis disease in children: systematic review and global estimates. Lancet 2014; 383: 1572–1579.

5 Zignol M, Sismanidis C, Falzon D, Glaziou P, Dara M, Floyd K. Multidrug-resistant tuberculosis in children: evidence from global surveillance. Eur Respir J 2013; 42: 701–707.

6 Abbate E, Vescovo M, Natiello M, et al. Successful alternative treatment of extensively drug-resistant tuberculosis in Argentina with a combination of linezolid, moxifloxacin and thioridazine. J Antimicrob Chemother 2012; 67: 473–477.

7 Sanchez E. Treatment outcome of a cohort of drug-resistant tuberculosis patients in Yerevan (Armenia). Trop Med Int Health 2009; 14: 41.

8 Francis J R, Blyth C C, Colby S, Fagan J M, Waring J. Multidrug-resistant tuberculosis in Western Australia, 1998–2012. Med J Aust 2014; 200: 328–332.

9 Lumb R, Bastian I, Carter R, Jelfs P, Keehner T, Sievers A. Tuberculosis in Australia: bacteriologically confirmed cases and drug resistance, 2010. A report of the Australian Mycobacterium Reference Laboratory Network. Commun Dis Intell Q Rep 2013; 37: E40–E46.

10 Schmid D, Fretz R, Kuo H W, et al. An outbreak of multidrug-resistant tuberculosis among refugees in Austria, 2005–2006. Int J Tuberc Lung Dis 2008; 12: 1190–1195.

11 Indra A, Rowhani M, Rumetshofer R, et al. Extensively drug-resistant tuberculosis: first report of a case in Austria, May 2008. Euro Surveill 2008; 13: 18940.

12 Pfyffer G E, Strassle A, van Gorkum T, et al. Multidrug-resistant tuberculosis in prison inmates, Azerbaijan. Emerg Infect Dis 2001; 7: 855–861.

13 Gkaravela L, Foka A, Athanassiou M, et al. The genetic diversity of *Mycobacterium tuberculosis* complex in Azerbaijan by 24 MIRU-VNTR loci genotyping in association with susceptibility testing by conventional and molecular methods. Clin Microbiol Infect 2012; 18: 829.

14 Elhassan M, Saeed S, Elmekki M, Al-Jarie A, Hamid M. Detection of multidrug-resistant tuberculosis using PCR compared to the conventional proportional method. Bahrain Med Bull 2012; 34: 11–15.

15 Flora M S, Amin M N, Karim M R, et al. Risk factors of multidrug-resistant tuberculosis in Bangladeshi population: a case control study. Bangladesh Med Res Counc Bull 2013; 39: 34–41.

16 Noor R, Akhter S, Rahman F, Munshi S, Kamal S M M, Feroz F. Frequency of extensively drug-resistant tuberculosis (XDR-TB) among re-treatment cases in NIDCH, Dhaka, Bangladesh. J Infect Chemother 2013; 19: 243–248.

17 Millet J, Baboolal S, Streit E, Akpaka P E, Rastogi N. A first assessment of *Mycobacterium tuberculosis* genetic diversity and drug-resistance patterns in twelve caribbean territories. Biomed Res Int 2014; 2014: 718496.

18 Skrahin A, Ahmed R K, Ferrara G, et al. Autologous mesenchymal stromal cell infusion as adjunct treatment in patients with multidrug and extensively drug-resistant tuberculosis: an open-label phase 1 safety trial. Lancet Respir Med 2014; 2: 108–122.

19 Stoffels K, Allix-Beguec C, Groenen G, et al. From multidrug- to extensively drug-resistant tuberculosis: upward trends as seen from a 15-year nationwide study. PLOS ONE 2013; 8: e63128.

20 Dauby N, Muylle I, Mouchet F, Sergysels R, Payen M C. Meropenem/clavulanate and linezolid treatment for extensively drug-resistant tuberculosis. Pediatr Infect Dis J 2011; 30: 812–813.

21 Trébucq A, Anagonou S, Gninafon M, Lambregts K, Boulahbal F. Prevalence of primary and acquired resistance of *Mycobacterium tuberculosis* to antituberculosis drugs in Benin after 12 years of short-course chemotherapy. Int J Tuberc Lung Dis 1999; 3: 466–470.

22 Monteserin J, Camacho M, Barrera L, Palomino J C, Ritacco V, Martin A. Genotypes of *Mycobacterium tuberculosis* in patients at risk of drug resistance in Bolivia. Infect Genet Evol 2013; 17: 195–201.

23 Spiric N, Marinkovic T, Milakovic D, Kecman R. Case report of hyperuricemia caused by pyrazinamide in the clinical centre Banja Luka. Int J Clin Pharmacy 2012; 34: 792–793.

24 Hafkin J, Modongo C, Newcomb C, et al. Impact of the human immunodeficiency virus on early multidrug-resistant tuberculosis treatment outcomes in Botswana. Int J Tuberc Lung Dis 2013; 17: 348–353.

25 Araujo-Filho J A, Vasconcelos-Jr A C, Sousa E M, et al. Extensively drug-resistant tuberculosis: a case report and literature review. Brazilian J Infect Dis 2008; 12: 447–452.

26 Valcheva V, Mokrousov I, Narvskaya O, Rastogi N, Markova N. Molecular snapshot of drug-resistant and drug-susceptible *Mycobacterium tuberculosis* strains circulating in Bulgaria. Infect Genet Evol 2008; 8: 657–663.

27 Yordanova S, Bachiyska E, Atanasova Y, Todorova Y, Baikova A, Kantardjiev T. Multidrug-resistant tuberculosis in Bulgaria: microbiological aspects. Problems Infectious Parasitic Dis 2013; 41: 5–8.

28 Saleri N, Badoum G, Ouedraogo M, et al. Extensively drug-resistant tuberculosis, Burkina Faso. Emerg Infect Dis 2010; 16: 840–842.

29 Diande S, Sangare L, Kouanda S, et al. Risk factors for multidrug-resistant tuberculosis in four centers in Burkina Faso, West Africa. Microb Drug Resist 2009; 15: 217–221.

30 Khann S, Mao E T, Rajendra Y P, Satyanarayana S, Nagaraja S B, Kumar A M. Linkage of presumptive multidrug resistant tuberculosis (MDR-TB) patients to diagnostic and treatment services in Cambodia. PLOS ONE 2013; 8: e59903.

31 Sidze L K, Mouafo Tekwu E, Kuaban C, et al. Strong decrease in streptomycin-resistance and absence of XDR 12 years after the reorganization of the National Tuberculosis Control Program in the central region of Cameroon. PLOS ONE 2014; 9: e98374.

32 Minion J, Gallant V, Wolfe J, Jamieson F, Long R. Multidrug and extensively drug-resistant tuberculosis in Canada 1997–2008: demographic disease characteristics. PLOS ONE 2013; 8: e53466.

33 Garin B, Glaziou P, Kassa-Kelembho E, Yassibanda S, Mbelesso P, Morvan J. High mortality rates among patients with tuberculosis in Bangui, Central African Republic. Lancet 1997; 350: 1298.

34 Abdelhadi O, Ndokain J, Ali M M, Friocourt V, Mortier E, Heym B. [Drug resistance testing of *Mycobacterium tuberculosis* isolates from sputum in Chad]. Bull Soc Pathol Exot 2012; 105: 16–22. [French]

35 Yáñez del V. Á. Tuberculosis en inmigrantes: situación Chile-Peru. Rev Chil Enf Respir 2010; 26: 161–164. [Spanish]

36 Tang S, Tan S, Yao L, et al. Risk factors for poor treatment outcomes in patients with MDR-TB and XDR-TB in China: retrospective multi-center investigation. PLOS ONE 2013; 8: e82943.

37 Liu C H, Li L, Chen Z, et al. Characteristics and treatment outcomes of patients with MDR and XDR tuberculosis in a TB referral hospital in Beijing: a 13-year experience. PLOS ONE 2011; 6: e19399.

38 Leung E C, Leung C C, Kam K M, et al. Transmission of multidrug-resistant and extensively drug-resistant tuberculosis in a metropolitan city. Eur Respir J 2013; 41: 901–908.

39 Cheong S V, Lao U L. [Epidemiological survey on the trend of drug resistance of *Mycobacterium tuberculosis* complex in Macao during 2001 to 2005]. Zhonghua Jie He He Hu Xi Za Zhi 2007; 30: 411–414. [Chinese]

40 Villegas S L, Ferro B E, Perez-Velez C M, et al. High initial multidrug-resistant tuberculosis rate in Buenaventura, Colombia: a public-private initiative. Eur Respir J 2012; 40: 1569–1572.

41 Nieto L M, Ferro B E, Villegas S L, et al. Characterization of extensively drug-resistant tuberculosis cases from Valle del Cauca, Colombia. J Clin Microbiol 2012; 50: 4185–4187.

42 Ahui B J, Horo K, Bakayoko A S, et al. [Evaluation of multidrug-resistant tuberculosis treatment in Ivory Coast from 2008 to 2010]. Rev Pneumol Clin 2013; 69: 315–319. [French]

43 Suarez-Mendez R, Garia-Garcia I, Fernandez-Olivera N, et al. Adjuvant interferon-gamma in patients with drug-resistant pulmonary tuberculosis: a pilot study. BMC Infect Dis 2004; 4: 44.

44 Lemus D, Echemendía M, Díaz R, Llop A, Llanes M J. Vigilancia de la resistencia a los medicamentos antituberculosos en Cuba, 2010–2011. Biomédica 2014; 34: 108–113. [Spanish]

45 Bartu V, Kopecka E, Havelkova M. Factors associated with multidrug-resistant tuberculosis: comparison of patients born inside and outside of the Czech Republic. J Int Med Res 2010; 38: 1156–1163.

46 Seung K J, Linton S W. The growing problem of multidrug-resistant tuberculosis in North Korea. PLOS MED 2013; 10: e1001486.

47 Kim H-R, Hwang S S, Kim H J, et al. Impact of extensive drug resistance on treatment outcomes in non-HIV-infected patients with multidrug-resistant tuberculosis. Clin Infect Dis 2007; 45: 1290–1295.

48 Kaswa M K, Bisuta S, Kabuya G, et al. Multidrug-resistant tuberculosis in Mosango, a rural area in the Democratic Republic of Congo. PLOS ONE 2014; 9: e94618.

49 Boyer-Cazajous G, Martinaud C, Dehan C, et al. High prevalence of multidrug resistant tuberculosis in Djibouti: a retrospective study. J Infect Dev Ctries 2014; 8: 233–236.

50 Rouzier V A, Oxlade O, Verduga R, Gresely L, Menzies D. Patient and family costs associated with tuberculosis, including multidrug-resistant tuberculosis, in Ecuador. Int J Tuberc Lung Dis 2010; 14: 1316–1322.

51 Rasslan O, Hafez S F, Hashem M, et al. Microscopic observation drug susceptibility assay in the diagnosis of multidrug-resistant tuberculosis. Int J Tuberc Lung Dis 2012; 16: 941–946.

52 Hafez S A, Elhefnawy A M, Hatata E A, El Ganady A A, Ibrahiem M I. Detection of extensively drug resistant pulmonary tuberculosis. Egyptian J Chest Dis Tuberc 2013; 62: 635–646.

53 Aguilar R, Garay J, Villatoro M, et al. Results of a national study on anti-mycobacterial drug resistance in El Salvador. Int J Tuberc Lung Dis 2005; 9: 514–520.
54 Blondal K, Rahu K, Altraja A, Viiklepp P, Rahu M. Overall and cause-specific mortality among patients with tuberculosis and multidrug-resistant tuberculosis. Int J Tuberc Lung Dis 2013; 17: 961–968.
55 Blondal K, Viiklepp P, Guethmundsson L J, Altraja A. Predictors of recurrence of multidrug-resistant and extensively drug-resistant tuberculosis. Int J Tuberc Lung Dis 2012; 16: 1228–1233.
56 Abate D, Taye B, Abseno M, Biadgilign S. Epidemiology of anti-tuberculosis drug resistance patterns and trends in tuberculosis referral hospital in Addis Ababa, Ethiopia. BMC Res Notes 2012; 5: 462.
57 Vasankari T, Soini H, Liippo K, Ruutu P. MDR-TB in Finland: still rare despite the situation in our neighbouring countries. Clin Respir J 2012; 6: 35–39.
58 National Institute for Health and Welfare. Infectious diseases in Finland 2011. Helsinki, Finland: NIHW, 2012.
59 Bernard C, Brossier F, Sougakoff W, et al. A surge of MDR and XDR tuberculosis in France among patients born in the Former Soviet Union. Euro Surveill 2013; 18: 20555.
60 Chauny J V, Lorrot M, Prot-Labarthe S, et al. Treatment of tuberculosis with levofloxacin or moxifloxacin: report of 6 pediatric cases. Pediatr Infect Dis J 2012; 31: 1309–1311.
61 Haustraete E, Campbell K, Magnier R, Zalcman G, Bergot E. [Interest of collapse therapy in pulmonary extensively drug-resistant tuberculosis.]. Rev Pneumol Clin 2014; 70: 240–244. [French]
62 Adegbola R A, Hill P, Baldeh I, et al. Surveillance of drug-resistant *Mycobacterium tuberculosis* in The Gambia. Int J Tuberc Lung Dis 2003; 7: 390–393.
63 Vashakidze S, Gogishvili S, Nikolaishvili K, et al. Favorable outcomes for multidrug and extensively drug resistant tuberculosis patients undergoing surgery. Ann Thoracic Surg 2013; 95: 1892–1898.
64 Gegia M, Jenkins H E, Kalandadze I, Furin J. Outcomes of children treated for tuberculosis with second-line medications in Georgia, 2009–2011. Int J Tuberc Lung Dis 2013; 17: 624–629.
65 Eker B, Ortmann J, Migliori G B, et al. Multidrug- and extensively drug-resistant tuberculosis, Germany. Emerg Infect Dis 2008; 14: 1700–1706.
66 Kato T, Addo K K, Nartey N, Nyarko A K, Bonsu F A, Mitarai S. First susceptibility testing of *Mycobacterium tuberculosis* for second-line anti-tuberculosis drugs in Ghana. Trop Med Health 2014; 42: 53–55.
67 Syridou G, Mavrikou M, Amanatidou V, et al. Trends in the epidemiology of childhood tuberculosis in Greece. Int J Tuberc Lung Dis 2012; 16: 749–755.
68 Leuow K, Papaventsis D, Kourkoundi S, et al. Fatal case of extensively drug-resistant *Mycobacterium tuberculosis* Beijing genotype infection in an injecting drug user, Athens, Greece, 2012. Euro Surveill 2013; 18: 20430.
69 Katragkou A, Antachopoulos C, Hatziagorou E, Sdougka M, Roilides E, Tsanakas J. Drug-resistant tuberculosis in two children in Greece: report of the first extensively drug-resistant case. Eur J Pediatr 2013; 172: 563–567.
70 Harrow E M, Rangel J M, Arriega J M, et al. Epidemiology and clinical consequences of drug-resistant tuberculosis in a Guatemalan hospital. Chest 1998; 113: 1452–1458.
71 Bah H, Cisse F A, Camara L M, Diallo O H, Diallo M, Sow O Y. [Prevalence of tuberculosis in the prison population of Conakry, Guinea Republic.] Rev Med Légale 2012; 3: 146–150. [French]
72 Menner N, Gunther I, Orawa H, et al. High frequency of multidrug-resistant *Mycobacterium tuberculosis* isolates in Georgetown, Guyana. Trop Med Int Health 2005; 10: 1215–1218.
73 Pineda-Garcia L, Ferrera A, Galvez C A, Hoffner S E. Drug-resistant *Mycobacterium tuberculosis* and atypical mycobacteria isolated from patients with suspected pulmonary tuberculosis in Honduras. Chest 1997; 111: 148–153.
74 Kodmon C, Niemann S, Lukacs J, Sor E, David S, Somoskovi A. Molecular epidemiology of drug-resistant tuberculosis in Hungary. J Clin Microbiol 2006; 44: 4258–4261.
75 Asgeirsson H, Blondal K, Blondal T, Gottfredsson M. [Multidrug-resistant tuberculosis in Iceland: case series and review of the literature]. Laeknabladid 2009; 95: 499–507. [Icelandic]
76 Salvo F, Dorjee K, Dierberg K, et al. Survey of tuberculosis drug resistance among Tibetan refugees in India. Int J Tuberc Lung Dis 2014; 18: 655–662.
77 Kulkarni K, Singh M, Soneja P, Mathew J, Marwaha R K. Extensively drug resistant tuberculosis in a 7-year-old child with interferon-gamma and interleukin-12 deficiency. BMJ Case Rep 2009; 2009.
78 Putri F A, Burhan E, Nawas A, et al. Body mass index predictive of sputum culture conversion among MDR-TB patients in Indonesia. Int J Tuberc Lung Dis 2014; 18: 564–570.
79 Masjedi M R, Tabarsi P, Baghaei P, et al. Extensively drug-resistant tuberculosis treatment outcome in Iran: a case series of seven patients. Int J Infect Dis 2010; 14: e399–402.
80 Ahmed M, Mohammed S, Nasurallah H. Mutation in *kat*G315 is, possibly, a good prognostic marker for treatment with second-line drugs in multi-drug resistant tuberculosis: A preliminary study. Indian J Med Microbiol 2013; 31: 394–400.
81 Bradshaw L, Davies E, Devine M, et al. The role of the interferon gamma release assay in assessing recent tuberculosis transmission in a hospital incident. PLOS ONE 2011; 6: e20770.
82 Kennedy B, Lyons O, McLoughlin A M, Gibbons N, O'Flanagan D, Keane J. Extensively drug-resistant tuberculosis: first report of a case in Ireland. Euro Surveill 2008; 13: 18935.
83 Papiashvili M, Barmd I, Sasson L, et al. Pulmonary resection for multidrug-resistant tuberculosis: the Israeli experience (1998–2011). Israel Med Assoc J 2012; 14: 733–736.
84 Mor Z, Cedar N, Pinsker G, Bibi H, Grotto I. Childhood tuberculosis in Israel: epidemiological trends and treatment outcomes, 1999–2010. Eur Respir J 2013; 41: 1157–1162.
85 Bendayan D, Hendler A, Polansky V, Weinberger M. Outcome of hospitalized MDR-TB patients: Israel 2000–2005. Eur J Clin Microbiol Infect Dis 2011; 30: 375–379.
86 Fattorini L, Mustazzolu A, Piccaro G, et al. Drug-resistant tuberculosis among foreign-born persons in Italy. Eur Respir J 2012; 40: 497–500.
87 Migliori G B, De Iaco G, Besozzi G, Centis R, Cirillo D M. First tuberculosis cases in Italy resistant to all tested drugs. Euro Surveill 2007; 12: E070517.1.
88 Sasaki Y, Yamagishi F, Yagi T. [Current situation of contacts examination and chemoprophylaxis for persons exposed to multidrug-resistant tuberculosis in ordinance designated cities in Japan]. Kekkaku 2005; 80: 637–642. [Japanese]
89 Shiraishi Y, Katsuragi N, Kita H, Toishi M, Onda T. Experience with pulmonary resection for extensively drug-resistant tuberculosis. Interact Cardiovasc Thorac Surg 2008; 7: 1075–1078.
90 Nimri L, Samara H, Batchoun R. Detection of mutations associated with multidrug-resistant *Mycobacterium tuberculosis* clinical isolates. FEMS Immunol Med Microbiol 2011; 62: 321–327.
91 Maimakov T, Sadykova L, Kalmataeva Z, Kurakpaev K, Smigelskas K. Treatment of tuberculosis in South Kazakhstan: clinical and economical aspects. Medicina (Kaunas, Lithuania) 2013; 49: 335–340.
92 Ndung'u P W, Kariuki S, Ng'ang'a Z, Revathi G. Resistance patterns of *Mycobacterium tuberculosis* isolates from pulmonary tuberculosis patients in Nairobi. J Infect Dev Ctries 2012; 6: 33–39.
93 Al-Mutairi N M, Ahmad S, Mokaddas E. First report of molecular detection of fluoroquinolone resistance-associated *gyr*A mutations in multidrug-resistant clinical *Mycobacterium tuberculosis* isolates in Kuwait. BMC Res Notes 2011; 4: 123.
94 Mokrousov I, Isakova J, Valcheva V, Aldashev A, Rastogi N. Molecular snapshot of *Mycobacterium tuberculosis* population structure and drug-resistance in Kyrgyzstan. Tuberculosis (Edinburgh, Scotland) 2013; 93: 501–507.
95 Iem V, Somphavong S, Buisson Y, et al. Resistance of *Mycobacterium tuberculosis* to antibiotics in Lao PDR: first multicentric study conducted in 3 hospitals. BMC Infect Dis 2013; 13: 275.
96 Miller T L, Cirule A, Wilson F A, et al. The value of effective public tuberculosis treatment: an analysis of opportunity costs associated with multidrug resistant tuberculosis in Latvia. Cost Eff Resour Alloc 2013; 11: 9.
97 Leimane V, Dravniece G, Riekstina V, et al. Treatment outcome of multidrug/extensively drug-resistant tuberculosis in Latvia, 2000–2004. Eur Respir J 2010; 36: 584–593.
98 Satti H, McLaughlin M M, Seung K J. Drug-resistant tuberculosis treatment complicated by antiretroviral resistance in HIV coinfected patients: a report of six cases in Lesotho. Am J Trop Med Hyg 2013; 89: 174–177.
99 Satti H, McLaughlin M M, Omotayo D B, et al. Outcomes of comprehensive care for children empirically treated for multidrug-resistant tuberculosis in a setting of high HIV prevalence. PLOS ONE 2012; 7: e37114.
100 Satti H, Seung K, Keshavjee S, Furin J. Extensively drug-resistant tuberculosis, Lesotho. Emerg Infect Dis 2008; 14: 992–993.
101 Balabanova Y, Radiulyte B, Davidaviciene E, et al. Risk factors for drug-resistant tuberculosis patients in Lithuania, 2002–2008. Eur Respir J 2012; 39: 1266–1269.
102 Vorkas C, Kayira D, van der Horst C, et al. Tuberculosis drug resistance and outcomes among tuberculosis inpatients in Lilongwe, Malawi. Malawi Med J 2012; 24: 21–24.
103 Traore B, Diarra B, Dembele B P, et al. Molecular strain typing of *Mycobacterium tuberculosis* complex in Bamako, Mali. Int J Tuberc Lung Dis 2012; 16: 911–916.
104 Powell K, Briand K, Pavlin B, Bamrah S. Emergence of multidrug-resistant tuberculosis in the republic of the Marshall Islands, 2004–2010. Am J Respir Crit Care Med 2011; 183: A1823.
105 Gonzalez D, Mase S, Jereb J, et al. Population pharmacokinetics of levofloxacin in children treated for, or exposed to, multidrug resistant tuberculosis in the federated states of Micronesia and Republic of Marshall Islands. J Pharmacokinet Pharmacodyn 2013; 40: S47–S48.
106 Brostrom R, Fred D, Heetderks A, et al. Islands of hope: building local capacity to manage an outbreak of multidrug-resistant tuberculosis in the Pacific. Am J Public Health 2011; 101: 14–18.
107 Two simultaneous outbreaks of multidrug-resistant tuberculosis—Federated States of Micronesia, 2007-2009. MMWR Morb Mortal Wkly Rep 2009; 58: 253–256.

108 Pires G M, Folgosa E, Nquobile N, Gitta S, Cadir N. *Mycobacterium tuberculosis* resistance to antituberculosis drugs in Mozambique. J Bras Pneumol 2014; 40: 142–147.
109 Aung W W, Ti T, Than K K, et al. Study of drug resistant cases among new pulmonary tuberculosis patients attending a tuberculosis center, Yangon, Myanmar. Southeast Asian J Trop Med Public Health 2007; 38: 104–110.
110 Ricks P M, Mavhunga F, Modi S, et al. Characteristics of multidrug-resistant tuberculosis in Namibia. BMC Infect Dis 2012; 12: 385.
111 Malla P, Kanitz E E, Akhtar M, et al. Ambulatory-based standardized therapy for multidrug-resistant tuberculosis: experience from Nepal, 2005–2006. PLOS ONE 2009; 4: e8313.
112 Yoshiyama T, Shrestha B, Maharjan B. Risk of relapse and failure after retreatment with the Category II regimen in Nepal. Int J Tuberc Lung Dis 2010; 14: 1418–1423.
113 Poudel A, Maharjan B, Nakajima C, et al. Characterization of extensively drug-resistant *Mycobacterium tuberculosis* in Nepal. Tuberculosis (Edinburgh, Scotland) 2013; 93: 84–88.
114 van Ingen J, Boeree M J, Wright A, van der Laan T, Dekhuijzen P N, van Soolingen D. Second-line drug resistance in multidrug-resistant tuberculosis cases of various origins in the Netherlands. Int J Tuberc Lung Dis 2008; 12: 1295–1299.
115 Goh T L, Towns C R, Jones K L, Freeman J T, Wong C S. Extensively drug-resistant tuberculosis: New Zealand's first case and the challenges of management in a low-prevalence country. Medical J Austr 2011; 194: 602–604.
116 Chacon L, Lainez M, Rosales E, Mercado M, Caminero JA. Evolution in the resistance of *Mycobacterium tuberculosis* to anti-tuberculosis drugs in Nicaragua. Int J Tuberc Lung Dis 2009; 13: 62–67.
117 Oladimeji O, Isaakidis P, Obasanya O J, et al. Intensive-phase treatment outcomes among hospitalized multidrug-resistant tuberculosis patients: results from a nationwide cohort in Nigeria. PLOS ONE 2014; 9: e94393.
118 Nwokeukwu H I, Okafor P N, Okorie O, Ukpabi I K. Paediatric multidrug-resistant tuberculosis with HIV coinfection: a case report. Case Rep Med 2013; 2013: 756152.
119 von der Lippe B, Sandven P, Brubakk O. Efficacy and safety of linezolid in multidrug resistant tuberculosis (MDR-TB): a report of ten cases. J Infect 2006; 52: 92–96.
120 Mohammadi A, Nassor Z S, Behlim T, et al. Epidemiological and cost analysis of multidrug-resistant tuberculosis in Oman. Eastern Mediterranean Health J 2008; 14: 1240–1245.
121 Ali A, Hasan R, Jabeen K, Jabeen N, Qadeer E, Hasan Z. Characterization of mutations conferring extensive drug resistance to *Mycobacterium tuberculosis* isolates in Pakistan. Antimicrob Agents Chemother 2011; 55: 5654–5659.
122 Lanzas F, Karakousis P C, Sacchettini J C, Ioerger T R. Multidrug-resistant tuberculosis in panama is driven by clonal expansion of a multidrug-resistant *Mycobacterium tuberculosis* strain related to the KZN extensively drug-resistant *M. tuberculosis* strain from South Africa. J Clin Microbiol 2013; 51: 3277–3285.
123 Ballif M, Harino P, Ley S, et al. Genetic diversity of *Mycobacterium tuberculosis* in Madang, Papua New Guinea. Int J Tuberc Lung Dis 2012; 16: 1100–1107.
124 McIver L J, Parish S T, Jones S P, Kippin A N, Furlong T J. Acute glomerulonephritis in a child with multidrug-resistant tuberculosis and multibacillary leprosy. Med J Austr 2011; 195: 150–152.
125 Kirby T. Extensively drug-resistant tuberculosis hovers threateningly at Australia's door. Med J Austr 2013; 198: 1–2.
126 Candia N, Lopez B, Zozio T, et al. First insight into *Mycobacterium tuberculosis* genetic diversity in Paraguay. BMC Microbiol 2007; 7: 75.
127 Institute of Medicine of the National Academies & Russian Academy of Medical Sciences. The new profile of drug-resistant tuberculosis in Russia: a global and local perspective: summary of a joint workshop. Washington, DC, USA: National Academies Press, 2011.
128 Becerra M C, Appleton S C, Franke M F, et al. Tuberculosis burden in households of patients with multidrug-resistant and extensively drug-resistant tuberculosis: a retrospective cohort study. Lancet 2011; 377: 147–152.
129 Del Castillo H, Mendoza-Ticona A, Saravia J C, Somocurcio J G. Epidemia de tuberculosis multidrogo resistente y extensivamente resistente a drogas (TB MDR/XDR) en el Peru: situacion u propuestas para su control. Rev Peru Med Exp Salud Publica 2009; 26: 380–386.
130 Gler M T, Guilatco R, Caoili J C, Ershova J, Cegielski P, Johnson J L. Weight gain and response to treatment for multidrug-resistant tuberculosis. Am J Trop Med Hyg 2013; 89: 943–949.
131 Gler M T, Podewils L J, Munez N, Galipot M, Quelapio M I, Tupasi T E. Impact of patient and program factors on default during treatment of multidrug-resistant tuberculosis. Int J Tuberc Lung Dis 2012; 16: 955–960.
132 Kozinska M, Brzostek A, Krawiecka D, Rybczynska M, Zwolska Z, Augustynowicz-Kopec E. [MDR, pre-XDR and XDR drug-resistant tuberculosis in Poland in 2000–2009]. Pneumonologia i Alergologia Polska 2011; 79: 278–287. [Polish]
133 Oliveira O, Gaio R, Villar M, Duarte R. Predictors of treatment outcome in multidrug-resistant tuberculosis in Portugal. Eur Respir J 2013; 42: 1747–1749.
134 Villar M, Sotgiu G, D'Ambrosio L, et al. Linezolid safety, tolerability and efficacy to treat multidrug- And extensively drug-resistant tuberculosis. Eur Respir J 2011; 38: 730–733.
135 Kjöllerström P, Brito M J, Gouveia C, Ferreira G, Varandas L. Linezolid in the treatment of multidrug-resistant/extensively drug-resistant tuberculosis in paediatric patients: experience of a paediatric infectious diseases unit. Scand J Infect Dis 2011; 43: 556–559.
136 Jo K W, Lee S D, Kim W S, Kim D S, Shim T S. Treatment outcomes and moxifloxacin susceptibility in ofloxacin-resistant multidrug-resistant tuberculosis. Int J Tuberc Lung Dis 2014; 18: 39–43.
137 Kim D H, Kim H J, Park S K, et al. Treatment outcomes and survival based on drug resistance patterns in multidrug-resistant tuberculosis. Am J Respir Crit Care Med 2010; 182: 113–119.
138 Rugina S, Dumitru I M, Resul G, Cernat R C, Petcu A E. Disseminated tuberculosis in HIV-infected patients from the Regional HIV/AIDS Center Constanta, Romania. Germs 2014; 4: 16–21.
139 Brinza N, Mihaescu T. [Difficulties in the treatment of pulmonary tuberculosis in children]. Rev Med Chir Soc Med Nat Iasi 2007; 111: 852–855. [Romanian]
140 Lunca C, Dorneanu O S, Diculencu D, et al. Molecular detection of rifampicin resistance in multidrug-resistant *Mycobacterium tuberculosis* strains from North-Eastern Romania. Romanian Rev Labor Med 2013; 21: 293–299.
141 Kontsevaya I, Ignatyeva O, Nikolayevskyy V, et al. Diagnostic accuracy of the genotype MTBDRsl assay for rapid diagnosis of extensively drug-resistant tuberculosis in HIV-coinfected patients. J Clin Microbiol 2013; 51: 243–248.
142 Panova L V, Ovsiankina E S, Stakheeva l B. [The epidemic drug-resistant tuberculosis situation among the children and adolescents of Moscow]. Problemy Tuberkuleza i Boleznei Legkikh 2006: 21–22. [Russian]
143 Umubyeyi A, Rigouts L, Shamputa I C, Dediste A, Struelens M, Portaels F. Low levels of second-line drug resistance among multidrug-resistant *Mycobacterium tuberculosis* isolates from Rwanda. Int J Infect Dis 2008; 12: 152–156.
144 Levin R. Lessons from Rwanda. Minn Med 2007; 90: 32–35.
145 Chevalier B, Margery J, Sane M, et al. [Epidemiology of the resistance of *Mycobacterium tuberculosis* to anti-tuberculosis drugs at the main hospital in Dakar, Senegal. A 4-year retrospective study (2000–2003)]. Rev Pneumol Clin 2010; 66: 266–271. [French]
146 Vukovic D, Rüsch-Gerdes S, Savic B, Niemann S. Molecular epidemiology of pulmonary tuberculosis in Belgrade, Central Serbia. J Clin Microbiol 2003; 41: 4372–4377.
147 Živanović I, Vukovi D, Dević I, Stefanović G, Savić B. Detection of drug-resistant mycobacterium tuberculosis strains isolated in Servia by the genotype MTBDRSL assay. Arch Biol Sci 2012; 64: 1311–1318.
148 Gibson J. Drug-resistant tuberculosis in Sierra Leone. Tubercle 1986; 67: 119–124.
149 Falzon D, Infuso A, Ait-Belghiti F. In the European Union, TB patients from former Soviet countries have a high risk of multidrug resistance. Int J Tuberc Lung Dis 2006; 10: 954–958.
150 Cox H, Hughes J, Daniels J, et al. Community-based treatment of drug-resistant tuberculosis in Khayelitsha, South Africa. Int J Tuberc Lung Dis 2014; 18: 441–448.
151 Padayatchi N, Gopal M, Naidoo R, et al. Clofazimine in the treatment of extensively drug-resistant tuberculosis with HIV coinfection in South Africa: a retrospective cohort study. J Antimicrob Chemother 2014.
152 Thomas T A, Shenoi S V, Heysell S K, et al. Extensively drug-resistant tuberculosis in children with human immunodeficiency virus in rural South Africa. Int J Tuberc Lung Dis 2010; 14: 1244–1251.
153 Ramirez Lapausa M, Pascual Pareja J F, Amer Lopez M, Vidal Perez J L, Noguerado Asensio A. [Outcome and treatment among patients with multidrug-resistant tuberculosis]. Medicina Clinica 2012; 138: 643–649. [Spanish]
154 Senaratne W V. Outcome of treatment of multidrug resistant tuberculosis. The Ceylon Med J 2004; 49: 86–87.
155 Sharaf Eldin G S, Fadl-Elmula I, Ali M S, et al. Tuberculosis in Sudan: a study of *Mycobacterium tuberculosis* strain genotype and susceptibility to anti-tuberculosis drugs. BMC Infect Dis 2011; 11: 219.
156 Sanchez-Padilla E, Dlamini T, Ascorra A, et al. High prevalence of multidrug-resistant tuberculosis, Swaziland, 2009-2010. Emerg Infect Dis 2012; 18: 29–37.
157 Ghebremichael S, Petersson R, Koivula T, et al. Molecular epidemiology of drug-resistant tuberculosis in Sweden. Microbes Infect 2008; 10: 699–705.
158 Somoskovi A, Helbling P, Deggim V, Homke R, Ritter C, Bottger E C. Transmission of multidrug-resistant tuberculosis in a low-incidence setting, Switzerland, 2006 to 2012. Euro Surveill 2014; 19: 20736.
159 Rahmo A H, Hamze M. Characterization of *Mycobacterium tuberculosis* in Syrian patients by double-repetitive-element polymerase chain reaction. East Mediterr Health J 2010; 16: 820–830.
160 Gibb C. Treating TB in Tajikistan. Nurs N Z 2012; 18: 31.
161 Reechaipichitkul W, Tubtim S, Chaimanee P. Drug susceptibility patterns of *Mycobacterium tuberculosis* and clinical outcomes of drug-resistant tuberculo-

sis at Srinagarind Hospital, a tertiary care center in northeastern Thailand. Southeast Asian J Trop Med Public Health 2011; 42: 1154–1162.
162 Kelly P M, Lumb R, Pinto A, da Costa G, Sarmento J, Bastian I. Analysis of *Mycobacterium tuberculosis* isolates from treatment failure patients living in East Timor. Int J Tuberc Lung Dis 2005; 9: 81–86.
163 Mardassi H, Namouchi A, Haltiti R, et al. Tuberculosis due to resistant Haarlem strain, Tunisia. Emerg Infect Dis 2005; 11: 957–961.
164 Muwonge A, Malama S, Bronsvoort B M, Biffa D, Ssengooba W, Skjerve E. A comparison of tools used for tuberculosis diagnosis in resource-limited settings: a case study at Mubende Referral Hospital, Uganda. PLOS ONE 2014; 9: e100720.
165 Dymova M A, Liashenko O O, Poteiko P I, Krutko V S, Khrapov E A, Filipenko M L. Genetic variation of *Mycobacterium tuberculosis* circulating in Kharkiv Oblast, Ukraine. BMC Infect Dis 2011; 11: 77.
166 Abubakar I, Moore J, Drobniewski F, et al. Extensively drug-resistant tuberculosis in the UK: 1995 to 2007. Thorax 2009; 64: 512–515.
167 Al-Zarouni M, Dash N, Al Ali M, Al-Shehhi F, Panigrahi D. Tuberculosis and MDR-TB in the northern emirates of United Arab Emirates: a 5-year study. Southeast Asian J Trop Med Public Health 2010; 41: 163–168.
168 Mpagama S G, Ndusilo N, Stroup S, et al. Plasma drug activity in patients on treatment for multidrug-resistant tuberculosis. Antimicrob Agents Chemother 2014; 58: 782–788.
169 Anger H A, Dworkin F, Sharma S, Munsiff S S, Nilsen D M, Ahuja S D. Linezolid use for treatment of multidrug-resistant and extensively drug-resistant tuberculosis, New York City, 2000–06. J Antimicrobial Chemother 2010; 65: 775–783.
170 Banerjee R, Allen J, Westenhouse J, et al. Extensively drug-resistant tuberculosis in California, 1993–2006. Clin Infect Dis 2008; 47: 450–457.
171 Lalor M K, Greig J, Allamuratova S, et al. Risk factors associated with default from multi- and extensively drug-resistant tuberculosis treatment, Uzbekistan: a retrospective cohort analysis. PLOS ONE 2013; 8: e78364.
172 Ritacco V, Iglesias M-J, Ferrazoli L, et al. Conspicuous multidrug-resistant *Mycobacterium tuberculosis* cluster strains do not trespass country borders in Latin America and Spain. Infect Genet Evol 2012; 12: 711–717.
173 Buu T N, Huyen M N, Lan N T N, et al. The Beijing genotype is associated with young age and multidrug-resistant tuberculosis in rural Viet Nam. Int J Tuberc Lung Dis 2009; 13: 900–906.
174 Kapata N, Chanda-Kapata P, Bates M, et al. Multidrug-resistant TB in Zambia: review of national data from 2000 to 2011. Trop Med Int Health 2013; 18: 1386–1391.
175 Makombe R R, Easterbrook P J, Lowe O, et al. Epidemiological features of drug resistant tuberculosis in Harare, 1994 to 1996. Cent Afr J Med 1999; 45: 282–287.

Cadre : La pénurie d'informations publiées sur la tuberculose multirésistante (TB-MDR) de l'enfant entrave les efforts visant à en améliorer le diagnostic et le traitement.
Objectif : Décrire le manque de reconnaissance de la TB-MDR et de la TB ultra-résistante (TB-XDR) de l'enfant dans la littérature publiée.
Schéma : Nous avons réalisé une recherche systématique de la littérature publiée dans les pays qui ont déclaré au moins un cas de TB-MDR ou -XDR avant 2012 afin d'identifier des cas de TB-MDR ou -XDR chez des adultes et des enfants.
Résultats : Sur les 184 pays et territoires qui ont déclaré des cas de TB-MDR entre 2005 et 2012, nous avons identifié des cas de TB-MDR de l'adulte dans la littérature dans 143 (78%) pays et des cas de TB-MDR pédiatrique dans 78 (42%) pays. Sur les pays qui ont déclaré des cas de TB-XDR, nous avons identifié des cas adultes dans la littérature dans 55 (60%) pays et des cas pédiatriques dans 9 (10%) pays.
Conclusion : L'absence de publications documentant les cas de TB-MDR et -XDR chez l'enfant dans des régions où la TB-MDR et la TB-XDR ont été déclarées chez les adultes témoigne à la fois d'une exclusion de la maladie de l'enfant du discours public sur la TB pharmacorésistante et probablement d'une sous-détection des enfants malades. Nos résultats mettent en évidence un manque de connaissance à grande échelle de la TB-MDR et de la TB-XDR de l'enfant.

Marco de referencia: La falta de información publicada sobre los niños con tuberculosis multidrogo-resistente (TB-MDR) es un obstáculo a los esfuerzos para abogar por mejores diagnósticos y tratamientos.
Objetivos: Describir la falta de reconocimiento en la literatura publicada de la TB-MDR y la TB extremadamente resistente (TB-XDR) en los niños.
Métodos: Para los países que hasta 2012 habían informado de algún caso de TB-MDR o TB-XDR, realizamos una búsqueda sistemática de la literatura publicada para identificar casos de TB-MDR o TB-XDR en adultos y en niños.
Resultados: De los 184 países y territorios que informaron algún caso de TB-MDR durante 2005–2012, encontramos reportes de casos de TB-MDR en adultos en la literatura publicada para 143 (78%) países, y reportes de casos de TB-MDR pediátricos para 78 (42%) países. De los 92 países que informaron algún caso de TB-XDR, encontramos reportes de casos de TB-XDR en adultos en la literatura publicada para 55 (60%) países y reportes de casos de TB-XDR pediátricos para 9 (10%) países.
Conclusión: La ausencia de publicaciones que documentan casos de TB-MDR y TB-XDR pediátricos en lugares donde casos de TB-MDR y TB-XDR en adultos han sido reportados indica tanto la exclusión de enfermedad infantil del discurso público sobre la TB drogo-resistente y la probable sub-detección de niños enfermos. Nuestros resultados recalcan la falta de reconocimiento a gran escala de los niños con TB-MDR y TB-XDR.

Public Health Action (PHA) The voice for operational research.
Published by The Union (www.theunion.org), PHA provides a platform to fulfil its mission, 'Health solutions for the poor'. PHA publishes high-quality scientific research that provides new knowledge to improve the accessibility, equity, quality and efficiency of health systems and services.

e-ISSN 2220-8372
Editor-in-Chief: Dermot Maher, MD, Switzerland
Contact: pha@theunion.org
PHA website: http://www.theunion.org/index.php/en/journals/pha
Article submission: http://mc.manuscriptcentral.com/pha