Commentary: Tuberculosis, diabetes and smoking: a burden greater than the sum of its parts

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The article by Remais and colleagues elegantly summarizes the emerging, concurrent burden of non-communicable diseases (NCDs) and infectious diseases in low- and middle-income countries (LMICs), its significant human impact, and its consequent social, economic, and political effects.1 We explore further their described ‘worst of two worlds’ scenario, with particular respect to a new, paradigm of epidemiologic transition, involving the three-way interaction between communicable tuberculosis (TB), non-communicable type 2 diabetes mellitus, and the ‘lifestyle’ risk factor for both tuberculosis and diabetes of tobacco smoking.

An evolving triple threat

Data describing the prevalence of TB, diabetes and tobacco smoking in LMICs is striking. Although the number of persons treated for it is now numbered in the millions, through the systematic implementation of guidelines such as the ‘Stop TB’ strategy of the World Health Organization (WHO), TB remains a significant cause of morbidity and mortality globally, especially in persons with concurrent human immunodeficiency virus (HIV) infection or acquired immune deficiency syndrome (AIDS) or both.2–4 It is also known that over the next 20 years, the prevalence of diabetes is projected to increase by 69% in LMICs.5 Adding fuel to this (already considerable) fire, tobacco sales and consumption in LMICs appear to be accelerating, especially in young males,6 and tobacco-caused deaths in LMICs are projected to nearly double by 2030.2 The evidence for an increased risk of TB in active smokers is well established.3,4 Similarly, the co-morbid presentation of diabetes and TB is associated with worse outcomes and excess mortality, and is most detrimental in poorly controlled diabetes (which are likely to represent the majority of cases in LMICs).3,7,8 Also, along with the ‘clustered risk’ apparent for both diabetes and smoking (e.g. lower socio-economic position, sedentary behaviour, heavy alcohol intake, poor diet, etc.), meta-analyses describe an independently increased risk for diabetes in smokers that follows a predominantly dose–response relationship.9

Shared pathways to future morbidity and mortality

The highly complex etiopathological mechanisms by which diabetes, TB, and smoking could potentially converge are slowly being recognized, and relate primarily to disordered activation of inflammatory pathways that increase oxidative stress and impair immunity.4,7,8 Furthermore, the evolution of multi-drug–resistant TB,3 and the multifaceted treatment required to successfully manage diabetes3 and smoking cessation, speak to the challenges inherent to treating concurrent infectious and NCDs.

However, teasing out the causal mechanisms that contribute to this intersecting risk, although critical to improving pharmacological treatment, especially with respect to possible drug interactions, is extraneous when one considers the underlying economic, political, and cultural factors that drive an increased prevalence of diabetes, TB, and smoking on an individual and societal level.3,5–7,10 Also, in identifying the division that currently exists between the epidemiology of infectious and NCD (and the divisions in health research in general), Remais and colleagues have revealed a truism that requires redress. At present, the quality data required to identify high-burden areas of both infectious and NCD is limited. In a setting contemporaneous to the substantial crises of civil
conflict, mass displacement of inhabitants, famine, and natural disasters, epidemiological surveys are inevitably given lower priority. Nonetheless, such events alter patterns of migration and promote the high-density contact that drives the transmission of TB. These dynamic population changes can then eventually foster the myriad processes of urbanization that contribute to type 2 diabetes and uptake of tobacco use.

With respect to diabetes, TB, and smoking, all are to a certain extent within the domain of ‘modifiable’ risk: all are potentially amenable to prevention if addressed with appropriate strategies. However, the ‘vectors’ of these conditions present in remarkably different ways, with prevention of the onward transmission of Mycobacterium tuberculosis requiring an entirely different strategy and target than the tobacco lobby!

The transforming role of health policy
Remais and colleagues are correct in highlighting a problem of an ‘unprecedented nature.’ The TB and diabetes has simply not occurred in more affluent settings, from which most historical epidemiological as well as interventional data are derived. We argue that beyond academic research, politicians and policy makers will also need to be included in any model that attempts to address this triple burden. Efforts to enshrine and enact public health programs are weakened by political climates that do not deter transnational corporations from attempting to tap into the huge emerging market of LMICs. This is an essential argument: it is known that strategies that include taxation, the regulation of advertising and mass-media campaigns are successful in limiting access to tobacco, which will have positive implications beyond TB and diabetes (namely for chronic lung disease and tobacco-related cancers). The active regulation of highly processed food would perhaps go some way in curbing the epidemic rise in antecedents of diabetes, particularly obesity, as well as mitigating the associated risks of other NCDs, such as cardiovascular disease.

However, positive signs of progress in this direction are apparent, and despite an outlook that may have once been seen as particularly dire, some promising and pragmatic initiatives are emerging. For example, the very fact that the International Union Against Tuberculosis and Lung Disease and WHO have recently joined forces in providing a collaborative framework for the care and control of diabetes and TB is indicative of the recognition of this significant challenge, and represents a unique opportunity to capture persons presenting with either of these two conditions as potential targets for screening and treatment. Such examples of strategic, community-based initiatives that identify emerging needs, address gaps in capacity, improve service delivery, and prioritize follow-up evaluation are vital.

Conclusions
Moving from polycentric governance to a streamlined and co-ordinated effort as this convergent burden unfolds is perhaps the greatest challenge in meeting the triple threat of TB, diabetes, and smoking, especially in view of its multifactorial nature; the challenge is not simply one of mitigating the risk of, or controlling, each condition alone. Comprehensive effort is required, and will undoubtedly be onerous. However, the opportunity to alleviate this unprecedented burden in so many people at risk in LMICs can only reveal new opportunities for advocacy, empowerment, and innovation.

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References
Commentary: The global health multiplier: targeting common social causes of infectious and non-communicable diseases

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In this issue, Remais et al. renew earlier challenges to the ‘false dichotomy’ that has emerged between non-communicable diseases (NCDs) and infectious disease in low- and middle-income countries (LMICs) that are now facing a ‘double burden’ of disease.1 Although they note that the role played by social change, such as rural-to-urban migration, their focus is primarily upon the biological mechanisms accounting for the associations of NCDs and infectious diseases. For example, diabetes and tobacco smoking increase susceptibility to tuberculosis (TB),2 and about one in three cancers has infectious origins. Remais et al. make sensible recommendations about the need for improved surveillance, more effective prevention, and better co-ordination of clinical care for NCDs and infectious diseases. However, it will also be necessary to look upstream to tackle the social determinants that are driving both groups of conditions. The long-established social determinants of infectious diseases, such as inadequate housing, poor nutrition, and poverty, also increase the risks for chronic diseases.

An optimal public health response will target all of these common causes, with investment in what we term ‘global health multipliers’, or interventions that address the causes underlying both infectious and NCDs. The rationale for this term is that by addressing these common social causes, governments can multiply the return on their investment in interventions.

How potentially significant are these common causes? Using the World Health Organization (WHO) Global Burden of Disease data for 2009 (covering 190 countries, excluding the two outliers of war-torn Afghanistan and Zimbabwe, which have the highest death rates in the world from infectious diseases), we find that there is a moderate and significant correlation of age-standardised infectious and chronic diseases (r = 0.53, P < 0.001; r = 0.54, P < 0.001) (Figure 1).

When this correlation is quantified, each reduction of 100 infectious disease deaths per 100 000 population is associated with a ‘multiplicative impact’ of reducing chronic disease deaths by 26.2 per 100 000. Similarly, each reduction of NCD deaths per 100 000...