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Cardiovascular Disease Research and the Development Agenda in Low- and Middle-Income Countries

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Although cardiovascular disease (CVD) incidence and mortality are on the decline in high-income countries, globally, the burden of CVD continues to rise due to the increasing incidence of CVD in low- and middle-income countries (LMIC). Eighty percent of all CVD-related deaths occur in LMIC, yet the amount of global health spending on noncommunicable diseases prevention and treatment remains disproportionately low when compared to the global burden of these diseases [1]. In response to this alarming global trend in CVD and other non-communicable diseases, in 2011, a U.N. high-level meeting convened in order to highlight the impact of non-communicable diseases on public health and human development. Poverty exacerbates the epidemic of CVD in LMIC, and CVD in turn perpetuates social and economic inequality. CVD is inextricably linked to human development, and research aimed to reduce the burden of CVD in developing countries should be prioritized on the development agenda for LMIC.

CVD WORSENS POVERTY

Millions of people fall into poverty every year due to illness. Although the “medical poverty trap” is not unique to LMIC, its impact is greatest on the poorest of the global poor who face expenditures for CVD-related hospitalizations, clinic visits, medications, and procedures. The financial burden of CVD hospitalization hits low-income patients harder as demonstrated in China and India where low-income patients paid a larger proportion of their income on CVD-related expenditures than high-income patients did, and in India and Tanzania where 92% of patients experience catastrophic spending (40% of total annual out-of-pocket expenditures devoted to health) after a CVD hospitalization [2]. Stroke-related hospitalizations also worsen poverty. In a survey of stroke patients in China, 39% of patients living above the poverty line (\$2 per day) moved below the poverty line after an acute stroke [3]. In addition to direct household expenditures, CVD-related hospitalizations and disability also decrease future income for low-income individuals. Moreover, in LMIC, CVD often strike at a younger age, thus having a greater effect on loss of income during productive years [4]. However, high-income countries are not immune to this issue. In Australian adults, among unemployed participants, individuals without chronic illness were 93% less likely to be impoverished than individuals with CVD [5]. Vulnerability to impoverishment for people living with CVD is a global phenomenon.

In addition to the economic effects, CVD also affects poverty and human development via social and environmental pathways [6]. Stigma and discrimination associated with chronic illness weaken social cohesion. Chronic care burdens of the individual such as transportation to rehabilitation or clinic visits are also burdens for impoverished families, as chronic care for individuals with CVD is often provided by women and girls who may have to forego educational opportunities.

POVERTY WORSENS CVD

Global trends in development in LMIC have had negative consequences for cardiovascular health in low-income communities, thus widening disparities in CVD outcomes within LMIC. Employment and better access to public and private services have driven massive urbanization in LMIC, leading to lifestyle changes that contribute to the growing burden of CVD. Moreover, globalization fueled by foreign direct investment and liberalized trade has led to an abundance of processed and unhealthy food in urban areas in LMIC [7]. In addition to changes in diet, opportunities to participate in leisure-time physical activity are often limited in low-income communities and slum dwellings. The lack of parks and recreational space for physical activity are often the result of the absence of city-planning and municipal engagement in poor, urban communities [8]. Moreover, low-income, urban communities are often located near large roads and industrial complexes, thus increasing exposure to air pollution, which is associated with poor CVD outcomes [9].

Residents of urban slums also face decreased access to health services and social stigma. Market-oriented health reform strategies have weakened the ability of health systems to effectively reach low-income individuals. The privatization of health care accompanied by a reduction in public spending on health and user fees for health have decreased access to health care for the poor [10]. Market-based strategies appear to have an inconsistent effect in LMIC [3,10]. Therefore, despite poorer health outcomes, the urban poor often have fewer resources for CVD treatment.

ADDRESSING CVD IN RESOURCE-POOR SETTINGS

Given the high morbidity and mortality from CVD in LMIC and the disproportionate health and economic impact on low-income communities within LMIC, cost-effective, evidenced-based interventions are especially critical. The World Health Organization has identified “best buys” in cardiovascular risk reduction at both the population and individual level. Among the best buys are tobacco control policy, reduction of sodium consumption, mass media campaigns to increase physical activity and fruit and vegetable intake, and multidrug therapy for individuals at the highest risk for CVD. However, although evidence suggests that individual interventions in clinical trials can increase healthy lifestyle behaviors [11], there is less evidence to support and/or guide the implementation of many of the recommended CVD prevention programs to improve healthy behaviors and outcomes at the population level. Given the limited availability of public and private funding for CVD prevention in many LMIC, it is even more important that evidence is generated on the efficacy and effectiveness of public health interventions in LMIC before resources are invested in large-scale programs [12]. Examining the gaps in evidence and prioritizing

investment in post-clinical translational cardiovascular research is therefore critical for achieving health equity worldwide and support development in LMIC.

One example of a best buy for which additional research is required before large-scale implementation is the recommendation for population-level reduction in sodium consumption. Sodium reduction policies in the United Kingdom, implemented in cooperation with industry, have been associated with lower mean blood pressure in the British population [13]. Several LMIC, including Argentina, have also formed commissions to partner with food industries to reduce the sodium content of the foods that most greatly contribute to sodium consumption in those countries [14]. However, even on the individual level, the efficacy of sodium reduction in decreasing cardiovascular outcomes continues to be debated. A Cochrane review of sodium reduction interventions concluded that clinical trials have yet to demonstrate a mortality benefit [15]. Evidence regarding the efficacy of specific sodium reduction interventions in reducing hard CVD outcomes in LMIC is needed.

The challenges in the adoption of World Health Organization best buy recommendations also highlight the need for better understanding of the financial and regulatory environment in which health policies are implemented. In the case of tobacco consumption, the reduced demand for tobacco products in high-income countries has resulted in increased marketing and promotion of tobacco in LMIC. In response to the high tobacco consumption in LMIC, the World Health Organization Framework Convention on Tobacco Control was created in 2003 in order to create a binding treaty to commit countries to tobacco control policies [16–18]. Policies included in the Framework Convention on Tobacco Control are health warnings on cigarette packaging, tax increases, establishment of smoke-free environments, education campaigns, restrictions on tobacco advertising, and restrictions on youth access. However, transnational tobacco companies have undermined tobacco control policy by enacting ineffective youth tobacco reduction campaigns with the purpose of convincing LMIC that the stricter policies endorsed in the Framework Convention on Tobacco Control are not necessary [17]. Disentangling the relationship between governments and tobacco companies is necessary to allow for the full implementation of tobacco control policy.

There are a number of diagnostic, preventive, and therapeutic interventions for CVD at the individual level in resource-poor settings that can be considered. For example, community health worker programs for the control of hypertension have been successful in providing quality care in low-income communities [19]. Adapting lessons learned from human immunodeficiency virus (HIV) public health interventions, CVD can be addressed by leveraging the health care infrastructure that currently exists for primary and acute care. Though there are key differences between CVD and HIV, the similarities present a compelling case to avoid “reinventing the wheel” in countries that have benefitted from the global response to the HIV epidemic [20]. Strengthening health systems to facilitate the diagnosis and treatment of CVD is a critical component of the World Health Organization recommendation to provide evidence-based medications for CVD prevention in high-risk individuals. Yet, the key components of an optimal patient-centered health system that can meet the needs of acute and chronic disease management in underserved communities in LMIC have yet to be defined. With respect to CVD management, access to primary care and tertiary care at a low cost or no cost is critical for risk factor control and effective CVD

diagnosis and treatment. However, universal health care alone is not sufficient. The gap in the quality of chronic disease care is thought to contribute to the persistent socioeconomic disparity in CVD outcomes in Brazil even after the implementation of universal health care [21]. Additionally, given the household financial impact of CVD, creative solutions that not only reduce the incidence and severity of CVD but also control individual health care costs are needed. Approaches that link health care delivery with personal income generation and investment via microfinance groups for individuals with CVD can address the demand for high quality CVD care and limited access to disposable capital in rural settings (see <http://www.purdue.edu/globalaffairs/videos/index.html> for example). Evidence supporting the use of other innovative models of financing cardiovascular health care services, including mobile phone-based applications, is also sorely needed. Given the entangled relationship between CVD and economic development, it is necessary to develop programs and policies that directly address this relationship while acknowledging that engagement with both the public and private sectors will be critical in generating research evidence for implementation of sustainable treatment and prevention programs.

SUMMARY

CVD and development in LMIC have a reciprocal relationship that has real consequences for both the human development and economic development of these nations. The lifestyle and environmental exposures associated with globalization and urbanization have increased CVD risk for all income strata, with greater consequences for low-income individuals who lack sufficient access to high-quality medical care. Although intervention is necessary for both the prevention and treatment of CVD, evidence on the efficacy, effectiveness, cost benefits of public health, and health system interventions is needed in order to prudently implement programs. Therefore, the acquisition of resources for both research and intervention for the prevention and treatment of CVD should be prioritized on the development agenda for LMIC.

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REFERENCES

1. Sridhar D, Batniji R. Misfinancing global health: a case for transparency in disbursements and decision making. *Lancet*. 2008; 372:1185–91. [PubMed: 18926279]
2. Huffman MD, Rao KD, Pichon-Riviere A, et al. A cross-sectional study of the microeconomic impact of cardiovascular disease hospitalization in four low- and middle-income countries. *PLoS One*. 2011; 6:e20821. [PubMed: 21695127]
3. Heeley E, Anderson CS, Huang Y, et al. for the ChinaQUEST Investigators. Role of health insurance in averting economic hardship in families after acute stroke in China. *Stroke*. 2009; 40:2149–56. [PubMed: 19359646]
4. Vedanthan R, Seligman B, Fuster V. Global perspective on acute coronary syndrome: a burden on the young and poor. *Circ Res*. 2014; 114:1959–75. [PubMed: 24902978]

5. Schofield DJ, Callander EJ, Shrestha RN, Percival R, Kelly SJ, Passey ME. Labour force participation and the influence of having CVD on income poverty of older workers. *Int J Cardiol.* 2012; 156:80–3. [PubMed: 21492949]
6. Alleyne G, Binagwaho A, Haines A, et al. for the Lancet NCD Action Group. Embedding non-communicable diseases in the post-2015 development agenda. *Lancet.* 2013; 381:566–74. [PubMed: 23410606]
7. Stuckler D, Basu S, McKee M, Suhrcke M. Responding to the economic crisis: a primer for public health professionals. *J Public Health (Oxf).* 2010; 32:298–306. [PubMed: 20729376]
8. WHO. A Billion Voices: Listening and Responding to the Health Needs of Slum Dwellers and Informal Settlers in New Urban Settings. World Health Organization; Kobe, Japan: 2005.
9. Brook RD, Rajagopalan S, Pope CA 3rd, et al. for the American Heart Association Council on Epidemiology and Prevention. Council on the Kidney in Cardiovascular Disease, Council on Nutrition, Physical Activity, and Metabolism. Particulate matter air pollution and cardiovascular disease: an update to the scientific statement from the American Heart Association. *Circulation.* 2010; 121:2331–78. [PubMed: 20458016]
10. Whitehead M, Dahlgren G, Evans T. Equity and health sector reforms: can low-income countries escape the medical poverty trap? *Lancet.* 2001; 358:833–6. [PubMed: 11564510]
11. Spring B, Duncan JM, Janke EA, et al. Integrating technology into standard weight loss treatment: a randomized controlled trial. *JAMA Intern Med.* 2013; 173:105–11. [PubMed: 23229890]
12. Yamey G, Feachem R. Evidence-based policymaking in global health — the payoffs and pitfalls. *Evid Based Med.* 2011; 16:97–9. [PubMed: 21693456]
13. Millett C, Laverty AA, Stylianou N, Bibbins-Domingo K, Pape UJ. Impacts of a national strategy to reduce population salt intake in England: serial cross sectional study. *PLoS One.* 2012; 7:e29836. [PubMed: 22238665]
14. Legowski B, Legetic B. How three countries in the Americas are fortifying dietary salt reduction: a north and south perspective. *Health Policy.* 2011; 102:26–33. [PubMed: 21764474]
15. Taylor RS, Ashton KE, Moxham T, Hooper L, Ebrahim S. Reduced dietary salt for the prevention of cardiovascular disease. *Cochrane Database Syst Rev.* 2011; (7):CD009217. [PubMed: 21735439]
16. Thrasher JF, Chaloupka F, Hammond D, et al. Evaluating tobacco control policy in Latin American countries during the era of the Framework Convention on Tobacco Control. *Salud Publica Mex.* 2006; 48(Suppl 1):S155–66. [PubMed: 17684678]
17. Sebríe EM, Glantz SA. Attempts to undermine tobacco control: tobacco industry “youth smoking prevention” programs to undermine meaningful tobacco control in Latin America. *Am J Public Health.* 2007; 97:1357–67. [PubMed: 17600260]
18. WHO. WHO Framework Convention on Tobacco Control. World Health Organization; Geneva, Switzerland: 2003.
19. Jafar TH, Islam M, Bux R, et al. for the Hypertension Research Group. Cost-effectiveness of community-based strategies for blood pressure control in a low-income developing country: findings from a cluster-randomized, factorial-controlled trial. *Circulation.* 2011; 124:1615–25. [PubMed: 21931077]
20. Rabkin M, El-Sadr WM. Why reinvent the wheel? Leveraging the lessons of HIV scale-up to confront non-communicable diseases. *Glob Public Health.* 2011; 6:247–56. [PubMed: 21390970]
21. Soares GP, Brum JD, Oliveira GM, Klein CH, Souza e Silva NA. Evolution of socioeconomic indicators and cardiovascular mortality in three Brazilian states. *Arq Bras Cardiol.* 2013; 100:147–56. [PubMed: 23503824]