

Ryan and colleagues<sup>4</sup> initial analysis suggests that the Quality and Outcomes Framework was associated with small reductions in a composite measure of mortality and mortality for ischaemic heart disease, and with small increases in mortality for non-targeted conditions—consistent with previous research showing improvements in process measures and the reverse for non-targeted conditions.<sup>7,8</sup> However, Ryan and coworkers<sup>4</sup> found that their initial result was biased by non-parallel trends in mortality between the UK and comparator countries and an extensive set of sensitivity analyses suggests that none of the differences in mortality were statistically significant.

So, does pay-for-performance improve health or save lives? Studies of such schemes are generally restricted to changes in process measures and most show either a small positive effect or no effect. The effect of pay-for-performance on its own is therefore modest, often less than payers hope for, with findings from only a few studies suggesting that pay-for-performance improves outcomes.<sup>9</sup> A review<sup>10</sup> identifies features of pay-for-performance schemes which are most likely to make them successful. Societal changes remain very important to improvements in health, with population-wide secular changes in blood pressure and cholesterol still numerically more important in reducing coronary deaths in the UK than medications prescribed in primary care.<sup>11</sup> This fact emphasises the importance of a primary care system that provides universal

coverage with a strong preventive component and the important role of doctors in advocating for measures to reduce behaviours that lead to ill health and premature death.

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- 1 Hunink M, Goldman L, Tosteson A, et al. The recent decline in mortality from coronary heart disease, 1980–1990. *JAMA* 1997; **277**: 535–42.
- 2 Hotchkiss JW, Davies CA, Dundas R, et al. Explaining trends in Scottish coronary heart disease mortality between 2000 and 2010 using IMPACTSEC model: retrospective analysis using routine data. *BMJ* 2014; **348**: g1088.
- 3 Pereira Gray D. Role reversal between primary and secondary care. *Med Educ* 2003; **37**: 754–55.
- 4 Ryan AM, Krinsky S, Kontopantelis E, Doran T. Long-term evidence for the effect of pay-for-performance in primary care on mortality in the UK: a population study. *Lancet* 2016; published online May 17. [http://dx.doi.org/10.1016/S0140-6736\(16\)00276-2](http://dx.doi.org/10.1016/S0140-6736(16)00276-2).
- 5 Roland M. Linking physician pay to quality of care: a major experiment in the UK. *N Engl J Med* 2004; **351**: 1448–54.
- 6 Roland M, Campbell S. Successes and failures of the United Kingdom's pay for performance program. *N Engl J Med* 2014; **370**: 1944–49.
- 7 Campbell SM, Reeves D, Kontopantelis E, Sibbald B, Roland M. Effects of pay-for-performance on the quality of primary care in England. *N Engl J Med* 2009; **361**: 368–78.
- 8 Doran T, Kontopantelis E, Valderas J, et al. The effect of financial incentives on incentivized and non-incentivized clinical activities. Evidence from the UK's Quality and Outcomes Framework. *BMJ* 2011; **342**: d3590.
- 9 Eijkenaar F, Emmert M, Scheppach M, Schoffski O. Effects of pay for performance in health care: a systematic review of systematic reviews. *Health Policy* 2013; **110**: 115–30.
- 10 Roland M, Dudley RA. How financial and reputational incentives can be used to improve medical care. *Health Serv Res* 2015; **50** (suppl 2): 2090–115.
- 11 Guzman-Castillo M, Ahmed R, Hawkins N, et al. The contribution of primary prevention medication and dietary change in coronary mortality reduction in England between 2000 and 2007: a modelling study. *BMJ Open* 2015; **55**: e006070.

## UN High-Level Meeting on antimicrobials—what do we need?

Global access to effective antimicrobials is under threat.<sup>1</sup> Over 700 000 deaths worldwide, including 214 000 neonatal sepsis deaths, are attributable to resistant bacterial pathogens each year.<sup>2,3</sup> Currently, insufficient access and delays in access to antibiotics cause more deaths than antibiotic resistance, but more resistance-related deaths are being reported in all countries irrespective of income level.<sup>3</sup> The key is to promote universal provision of antimicrobials while ensuring continued effectiveness. The UN General Assembly High-Level Meeting of Heads of State will discuss sustainable access to effective antimicrobials in

September, 2016. The meeting must develop realistic goals, stimulate political will, mobilise resources, and agree on an accountability mechanism for global collective action on this issue.

Providing sustainable access to effective antimicrobials is a prerequisite for achieving several of the Sustainable Development Goals (SDGs)<sup>4</sup> and requires global collective action within and across countries and among sectors that deal with health, agriculture, environment, animal husbandry, and trade.<sup>5</sup> The elements of effective country-level action are described in WHO's Global Action Plan on Antimicrobial Resistance,<sup>6</sup> which has

been ratified by the World Health Assembly and is supported by the Food and Agricultural Organization of the United Nations and the World Organisation for Animal Health (OIE). Yet, antimicrobial resistance transcends the capabilities of these organisations and requires the involvement of UNICEF, UNDP, UNEP, UNESCO, the World Bank, and other multilateral agencies as part of a globally coordinated plan.

We believe that the UN General Assembly High-Level Meeting should establish a UN High-Level Coordinating Mechanism on Antimicrobial Resistance (HLCM) with four core functions (panel), which are similar to those of UNAIDS when it was first established in 1996.

First, **advocacy** is needed to raise awareness about lack of access to antibiotics and drug resistance. The **primary goal** of a global campaign should be to **change attitudes and norms towards antibiotics** to enable health-care and veterinary professionals and the public understand the **value and potential side-effects** of antibiotics.

Second, **robust monitoring and evaluation** is needed on **global and national enforceable targets** for antimicrobial **access, appropriate use, policies implemented, and resistance rates** in human, **agricultural, veterinary, and environmental sectors**. The **HLCM should achieve consensus on strategies and targets across the animal and human health sectors**, which encompass interventions proposed by the WHO Global Action Plan<sup>6</sup> and others that would move towards sustainable access to antimicrobials.<sup>7</sup> The HLCM should **agree on targets to reduce both the global burden of deaths** avertable by effective antimicrobials **and inappropriate consumption** of antimicrobials in human and animal sectors. A **global monitoring and review platform is needed** to assess **progress** on these goals. The **platform should track key indicators** related to: public health; **burden of bacterial infections caused by resistant pathogens; proportion of populations without access** to antimicrobials (including number of children younger than 5 years dying from pneumonia due to lack of access to antibiotics) **as a global indicator; and volume of therapeutic and non-therapeutic antimicrobial consumption in human, environmental, and animal sectors**. Tracking is also needed to measure progress on **innovation in vaccines, alternatives to antimicrobials, and the pipeline** for new antimicrobials. Support for

low-income and middle-income countries is needed to build **capacity for surveillance and data collection**. An independent, transparent, expert-led process in which the performance of countries, donors, and non-state actors is analysed, appraised, and reported to identify shortfalls in performance should be part of the global monitoring and review platform.

The third function of the HLCM is **mobilisation of resources**. The HLCM would encourage **financial commitments** from donors, aid agencies, and countries to **finance the implementation of global and national level action plans, as well as a global coordination and monitoring platform**. Global financing should be targeted to goals that benefit the global public good. **Goals are needed to: support HLCM functions; enable existing global financing mechanisms** (eg, the Global Fund to Fight AIDS, Tuberculosis and Malaria, GAVI, the Vaccine Alliance, and UNITAID) **to expand their mandate to assist countries in expanding access to antibiotics, diagnostics, and vaccines; assist low-income and lower-middle-income countries with planning and implementing national action plans, including on improving surveillance, pharmaceutical regulation, and public health; and support a global innovation fund to stimulate a pipeline of vaccines, diagnostics, alternatives to antimicrobials, and new antimicrobials in a way that encourages delinkage and conservation of effectiveness**. The HLCM affords the opportunity to expand from the donor-driven model and link the mobilisation of financial resources to overall global financing needs that have been proposed for achieving universal health coverage.

#### Panel: Functions of a UN High-Level Coordinating Mechanism on Antimicrobial Resistance

- Advocacy: raise awareness about lack of access to antibiotics and drug resistance
- Monitoring and evaluation: establish, monitor, and report on global and national enforceable targets
- Resource mobilisation: finance implementation of global and national level action plans and a global coordination and monitoring platform
- Coordination of multisectoral action: support member states to pursue national level, multisectoral action for implementation of WHO's Global Action Plan on Antimicrobial Resistance alongside national efforts to improve access to effective antimicrobials

The fourth function is multisectoral domestic coordination. The HLCM can support member states to pursue national level, multisectoral action involving non-governmental organisations, civil society, and the private sector for the implementation of WHO's Global Action Plan alongside national efforts to improve access to effective antimicrobials. Such multisectoral action should be supported technically by the HLCM. Although targets should be set through the HLCM, country level strategies should be country specific rather than centrally mandated. Countries should develop a robust stewardship framework that promotes appropriate use of antimicrobials within the context of sustainable access to effective antimicrobials.

The HLCM structure could select elements from the Framework Convention on Tobacco Control,<sup>8</sup> the Intergovernmental Panel on Climate Change,<sup>9</sup> or other specific international agreements or initiatives to solve problems that require global cooperation across sectors. The HLCM must include UN organisations and key countries representing their regions, civil society, industry, and development agencies that periodically report to the UN Secretary General and to the UN General Assembly on progress towards achieving sustainable access to effective antimicrobials goals.

Sustainable access to effective antimicrobials is a key development issue and the September 2016 UN General Assembly High-Level Meeting is a rare opportunity to change how we as a global community use the only currently feasible method to treat bacterial infections. It is an opportunity that should not be squandered because of lack of ambition.

## Human resources for health: time to move out of crisis mode

For the past decade, attention on the global health workforce has been characterised by crisis. Advocacy efforts persistently frame this issue as a global emergency, with more than 50 countries identified to be facing "critical shortages" of health workers with "immediate action" required to "overcome the crisis".<sup>1,2</sup> In light of the new global strategy on human resources for health presented at the 2016 World Health Assembly,<sup>3</sup> we call for an end to this cataclysmic framing of the health workforce agenda. Instead, the discourse needs to move towards promotion of long-term local

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- 1 Laxminarayan R, Duse A, Wattal C, et al. Antibiotic resistance—the need for global solutions. *Lancet Infect Dis* 2013; **13**: 1057–98.
- 2 O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. London: H M Government/Wellcome Trust, 2016.
- 3 Laxminarayan R, Matsoso P, Pant S, et al. Access to effective antimicrobials: a worldwide challenge. *Lancet* 2016; **387**: 168–75.
- 4 Jasovsky D, Littmann J, Zorzet A, Cars O. Antimicrobial resistance—a threat to the world's sustainable development. *Uppsala J Med Sci* 2016; **121**: 159–64.
- 5 Ardal C, Utterson K, Hoffman SJ, et al. International cooperation to improve access to and sustain effectiveness of antimicrobials. *Lancet* 2016; **387**: 296–307.
- 6 WHO. Global action plan on antimicrobial resistance. Geneva: World Health Organization, 2015.
- 7 Mendelson M, Røttingen JA, Gopinathan U, et al. Maximising access to achieve appropriate human antimicrobial use in low-income and middle-income countries. *Lancet* 2016; **387**: 188–98.
- 8 Heymann DL. What to do about antimicrobial resistance. *BMJ* 2016; **353**: i3087.
- 9 Woolhouse M, Ward M, van Bunnik B, Farrar J. Antimicrobial resistance in humans, livestock and the wider environment. *Philos Trans R Soc Lond B Biol Sci* 2015; **370**: 20140083.

responses aligned with available evidence and resources. Moving out of crisis mode will have three key benefits for the global health workforce.

The first is sustainable funding. Warnings of imminent disaster focus political attention on an issue, but such interest wanes with the emergence of the next inevitable crisis. For example, funds allocated by the US Government to post-Ebola health-system strengthening in west Africa, which included health worker training, have been reallocated to the Zika virus response.<sup>4</sup> An alternative