

Notes for the lecture on health and economic development

The paper on the curriculum reviews the literature that estimate the effect of different health interventions in developing countries. You are of course not required to remember all the studies that are mentioned. But you should know the main lines of this research (what are they testing) and how they do it, and the main findings. Many individuals in low income countries live short and disease filled life. That is tragic. What makes it extra tragic is that there appear to be medical preventions and treatments available that could reduce mortality and morbidity in poor countries. So why are they not used?

Is the problem on the demand side? Are individuals not willing to buy preventive medicines and curable treatments? Is demand low because individuals are so poor, or, or because they lack information of what works and what does not work, or do they discount the future so hard that they they are not willing to pay a small cost today for benefits that come in the future. Are they discounting in an irrational manner?

Or is the problem on the supply side? Are health workers not doing their job in a proper way, and if not, why not? Do they lack essential equipment and medicine (cannot do a professional job), do they lack knowledge, or do they lack motivation (will not do a professional job)?

The paper by Kremer and Glennerster (K&G) is oriented towards testing policy interventions; what works and what does not. Lots of interesting studies are reviewed, you are of course not expected to remember each of them at exam but be able to discuss critically the how the use of RCT can help design better health interventions. This note look at health and development more from a birds view.

Economics ↔ Health

There is a positive association between health indicators and income, both at a country level and individual level: Richer countries tend to have a more healthy population, and within a country

richer families tend to have better health than the poorer families (this is well documented by the health inequality project run by Raj Chetty at Stanford).

Better health can increase both the quantity and quality of labour and therefore production. Robert Fogel (Nobel lecture), quantified the contribution of better nutrition to economic growth in the UK between 1780 and 1980. In 1780, 20% of the adults were unable to do any work because of malnutrition. In 1980, this was no longer an issue. He also calculated that production per worker increased (over these 200 years) with 56 % due to better nutrition. All in all he concludes that improved health (nutrition) explains almost half of the growth in production over this period.

Better health may also improve the quality of labour, the quality of human capital: better health \rightarrow longer lives \rightarrow more incentives to invest in education \rightarrow more production.

The causal link will probably not only go from health to production (income) but also the other way. More economic resources will improve health outcomes by bettering sanitation, nutrition and medication. The observation that health both influences and is influenced by the income level in a society (family) is important. Reverse causality – and also the possibility that there are confounding variables, things that cause both good health and high income (especially at the individual level, please find an example) – implies that we need some kind of research design to isolate the causal effect of income on health outcomes (or health has on income) - probably - influenced by income (economic development).

The complementarity between health and production will also lead to a multiplier effects. Suppose health h has a causal effect on income y that is equal to β and that the causal effect of income on health is α . We assume that both α and β are positive but less than one to get a stable system. We have these two equations

$$h = \alpha y + u_h \tag{1}$$

$$y = \beta h + u_y \tag{2}$$

The reduced form for the health equation is given by $h = \frac{\alpha}{1-\alpha\beta}u_y + \frac{1}{1-\alpha\beta}u_h$. Hence, if health increases by one unit for non-income reasons (medical innovation) the new equilibrium implies that health increases with more than one unit (the initial effect on health increases income which

increases health, ...). How would you proceed to estimate how income affects health (to estimate α)?

Measure health

One measure that is often used to capture health is life expectancy at birth. There has also been a strong focus on child and maternal health (millennium development goals). Maternal and under five mortality rates are often listed as relevant health outcome measures in developing countries. A more comprehensive measure of health is DALY (disability adjusted life year). A DALY is a year lost due to ill health, either because you die one year earlier than “normal” or live with a disease that does not reduce your life length, but decrease your life quality, your ability to live a full life (say you have a disease that make you go blind the last four years of your life): $\text{DALY} = \text{years lost due to illness} + \text{years lost due to living with a disease that reduce your ability to live a full life}$. DALY gives a more comprehensive measure of health burden; makes it possible to compare mortality and morbidity (and hence the intervention A that prevents early death and B that only reduces suffering from a disease; we can use this measure to calculate and compare the cost effectiveness of different interventions (\$ per DALY reduced).

Demand: Health investment decisions

The disease picture - the main killers - are different in poor and rich country (check the figures presented at the lecture). Many individuals in poor countries suffer and die from diseases that are contagious, that are possible to prevent or can be treated at a relatively low cost (malaria, diarrhea, parasites, ...). There are several interesting questions related to preventive care.

1. How efficient are different treatments (taking account of all the effect, i.e. those who accrue to the person who takes the preventive action and also external effects - deworming will benefit the person who takes the pill but also the local community (since this persons body will not be used by the parasites to spread to other individuals). The effectiveness question boils

down to what it costs to reduce DALY with one unit with some kind of treatment A. K&G argue that there appear to be many low hanging fruits in developing countries.

2. Why are they not picked. Why do not poor individuals invest in their health by taking preventive actions (purify water, use bed-net, vaccinate, ...). Why are take-up rates so low? Does the take up rate change radically with a small fee for treatment? Can incentives be used to increase the take up rate? Which incentives work best?

To answer 1 (to assess cost effectiveness) one can use RCT to measure the effect and costs of different interventions. A classic example is the deworming study by Miguel & Kremer 2004. Miguel and Kremer evaluate a large deworming intervention in Kenya. They argue that in phase 1 of this program *25 randomly chosen* schools were given tablets to kill intestinal parasites. They later compare with control schools (not yet treated with a deworming program), they measure many things, for example different health outcomes and school attendance. They find both direct and indirect effects. Positive effects, better health and better school attendance, the most surprising effect is the external effects (non-treated schools close to treated schools also have positive effects (presumably, by interrupting worm transmission from one child to the next). All in all they find that treating one child with a deworming pill will increase schooling with 0.14 years. (Note that these findings are contested and a re-analysis of the data find less strong effects (<https://www.buzzfeed.com/bengoldacre>)).

There is also a paper that use community-wide experimental variation in a deworming program for children in Kenyan primary schools, combined with a longitudinal data set tracking these children into adulthood, to causally identify the effect of improved child health on later life outcomes (Baird et al 2016). They find that the long term effect of deworming is more consumption (0.1 meal per day) and higher labour supply (12%).

According to this research deworming is highly efficient. Still there are lots of individuals suffering and dying from intestinal parasites. The same is true for other major killers in poor countries. Two million die due to water born diseases (relatively cheap to purify water). One million die due to malaria (relatively cheap to reduce exposure by using bed-nets). Immunization coverage is still relatively low. Why are these “low hanging fruits” not picked?

We need empirical research to investigate different explanations, but it is of course very useful to have a theoretical framework to generate hypothesis and interpret results. KG develop a small model where households can take a costly action today to reduce the probability that one will have a utility reducing disease in the future. It is a basic human capital investment model with one behavioral twist; hyperbolic discounting of the future. Seen from today (period 0) a future stream of utility u_t is worth $\beta \sum_{t=1}^T \delta^t u_t$. If $\beta = 1$ this is the standard exponential discounting of the future. If $\beta < 1$ there is a permanent present bias that may lead individuals to postpone (slightly) costly actions that have (large future gains): Plan to take the action tomorrow, but when tomorrow becomes present one finds it better to delay to the next day ...).

The behavioral aspect is important, both as providing a framework for understanding why certain appealingly irrational decisions are made, but it also has important implications for normative policy analysis. In standard economics we are used to rational decision makers that take appropriate (utility maximizing) decisions given their preferences and constraints. Within that framework policy interventions are legitimized if decisions have external effects, or if the price system dose not work because we cannot individualize property rights (public goods). But if individuals are irrational - if they have behavioral biases - we may argue in favor of policy interventions because they correct individual biases. The general point is that individuals may have decision utility that guide their choices that differs from the preferences that captures the actual long term well being of a choice. One of the issues that are discussed in *KG* is to what extent behavioral biases can explain the patterns we observe in preventive health care investments in poor countries.

I am not gone repeat all the studies that KG refers to; but the very robust finding that a small cost (time or money) leads to a sharp reduction in demand for “prevention” indicates very hard (irrational) discounting of the future.

The Supply of health care services. Health care systems

KG paints a gloomy picture. The quality and quantity of health care services is low in many poor countries. Too few patients are treated (low utilization) and those who are treated are often given low quality services (inadequate examination, no or malfunctioning medicine little advice of how

families can take preventive actions to improve their health). Why?

We need to understand the bottlenecks in the health service system in order to improve it. The quality and quantity of services (y) are determined by a number of critical factors

$$y = f(\text{demand}, \text{equipment}, \text{medicaments}, \text{staff}, \text{knowledge}, \text{motivation})$$

We can divide these factors into different categories

1. Factors that are not controlled by the health care workers; the quality of the facility, the equipment, medicines available, health system factors (staffing, fee for service etc.)
2. Factors that are to some extent controlled by the health workers; their knowledge and skills, demand (they can probably increase utilization of health care system by delivering high quality services).
3. Factors that are directly controlled by the health workers; their motivation, their will to treat patients as well as they can (given the other constraints).

It is the motivation factor that has received most attention in recent research and policy reforms on health care systems. Probably for two reasons (i) motivation seem to be a critical factor (there is evidence that health care workers can work better and harder; they lack motivation) and (ii) there appear to be a quick fix to low motivation, provide incentives for better performance. In economics incentives often (always) mean performance pay; make remuneration contingent on achievements as this will induce workers to work smarter and harder to obtain the bonus. (For a nice discussion of different ways (than paying money) to motivate workers (pay attention, pay respect, ..) check out Ellingsen & Johanneson (2007)).

Signs of low motivation

High absence rates. Surprise visits to health facilities reviews very high absence rates among health care workers. In rural areas small facilities or dispensaries are often closed at times when they should be open. Absence rates can be as high as 40 to 50 %.

A know-do gap. There is also a lot of evidence that health care workers do not treat their patients according to the guidelines when they are at work. Is this skill or will? To answer, researchers first measure knowledge through the use of a vignette. Thereafter they (using an expert, a medical doctor) observe the health worker in patient work and note what the health workers do. (Or one can also use exit interviews with patients to get at what health workers do). Using this approach researchers have documented a substantial know-do gap. Health workers do not follow the guidelines, even though they know the guidelines: they carry out few of the procedures they should follow to diagnose or treat diseases, they do not spend much time talking to the patients, they do not give appropriate health advice etc.

Several studies have documented that the health workers spend very little time with each patient (2 to 3 minutes) and asks very few questions (3 to 4). Brief and inadequate treatment could be caused not by low motivation but by a very high case load: They have so much to do, so many patients to attend, that they do not have time to do an adequate job. In some places this is probably the explanation, but we did a study in rural Tanzania where we found that health workers had a lot of idle time (there was not a line of patients outside the door). Furthermore we did not find the effect that a higher caseload lead to lower performance. Hence we concluded that it could not be “too many patients” that explained the know-do gap.

One thing that is important to convey in this gloomy picture is that the health workers in Tanzania, and in other poor countries, are made of the same stuff as you and me; they are not inherently lazy, bad people. They just work in a system that give them very few reasons to do as good as they can. Good performance is not rewarded; not with money or status (career opportunities), not with recognition, not with respect etc. Maybe one could say that many health care providers in poor countries are trapped in a low effort equilibrium (low effort, low rewards, low expectations).

Performance incentives

One idea that has got a lot of attention, both in research but also in policy, is a system reform towards paying for performance: Health facilities - and health workers - should be financed based

on the output they produce rather on the staffing and other inputs. Performance-based incentive schemes and reforms are receiving growing attention from governments, aid agencies, donors and researchers. As for Africa alone, 29 countries are today at least piloting a RBF scheme; three of them (Rwanda, Burundi and Sierra Leone) have adopted performance-based financing as a core component of the funding of their whole health system. A major impact evaluation program led by the World Bank assesses the rapid expansion of performance-based financing of health care.

In KG several studies assessing the effect of paying for performance is reviewed, I am not gone repeat them here. The general picture is that performance financing (RBF - result based financing) have a positive impact on the activities that are rewarded (if a facility and the health workers working there get 4 \$ per pregnant women that gives birth at the facility more women will give birth at the facility). There are few studies of the long term effects of RBF. Critics have argued that it will undermine the intrinsic motivation for performing well at work, but if this motivation is low at the outset there is much motivation to crowd out.

Assessments of financial incentives in health care often leave the underlying mechanisms connecting monetary incentives and health outcomes in the dark. They measure what monetary incentives do to the quantity of health care, few studies ask how and why the change came about. This is unfortunate since the impact of performance-based financing may depend critically on particular attributes of the design of the incentive scheme, and may also depend on a number of contextual variables. Furthermore, changing from input to output-based financing of health care will bring about additional organizational changes that may affect health workers incentives to perform in separate ways, making it hard to isolate the effect of monetary incentives.

To be more concrete, suppose performance-based financing provides health facilities with a fixed sum of money for every woman that gives birth at the clinic. A “what” assessment measures (hopefully by using credible controls) a $y\%$ increase in birth attendance in the performance financed facilities. This is certainly important information, but we should also make an attempt to find out how the increase in attendance came about: Did health workers increase the clinical quality of their work which then attracted more patients to seek assistance at the facility (and if so, did a higher quality maternity care work reduce the quality provided to other patients); did they become more

friendly and responsive towards patients; did they reduce informal or formal user fees; did they take active steps to recruit more pregnant women (and how did they do that, by spreading information, by threatening them or by offering incentives?); or did more patients attend because of improved management – more and better drugs, cleaner sites etc.

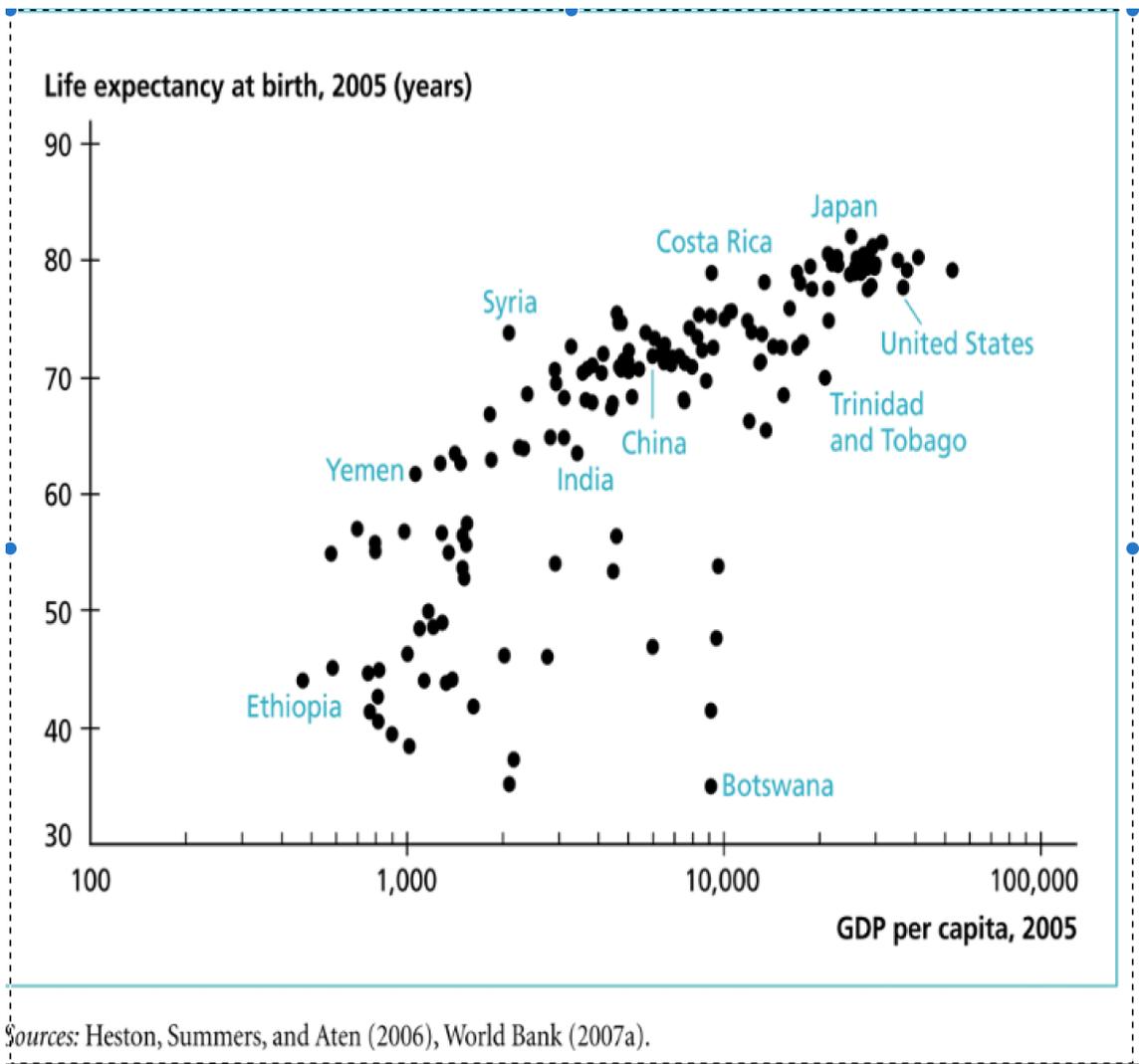
In addition to addressing how behavior responds to financial incentives, it is important to disclose a second question: why did behavior changed? At the outset the answer may seem too obvious to be worth reflecting on. It is not. Introducing performance-based pay does not only make health worker financially accountable for their performance, performance based financing may also affect the level of supervision and community monitoring of health workers. Enhanced levels of recognition and appraisal of the work that is done may in itself motivate health workers to perform. Furthermore if incentives are based on team achievements, it has been documented elsewhere that workers tend to make an extra effort to avoid letting the team down. In addition there is now a large literature examining how monetary incentives interact with other extrinsic or intrinsic work motivations. Together this means that even if we observe that the introduction of performance-based financing makes the health workers more attentive and diligent, it is far from obvious why this is the case.

Answering the how and why questions regarding the health workers behavioral response to performance based financing is also a relevant question for RBF experts. More knowledge on this will indeed improve their understanding of the endurance and external validity of the measured impact. It will also enable them to improve the design of RBF schemes.

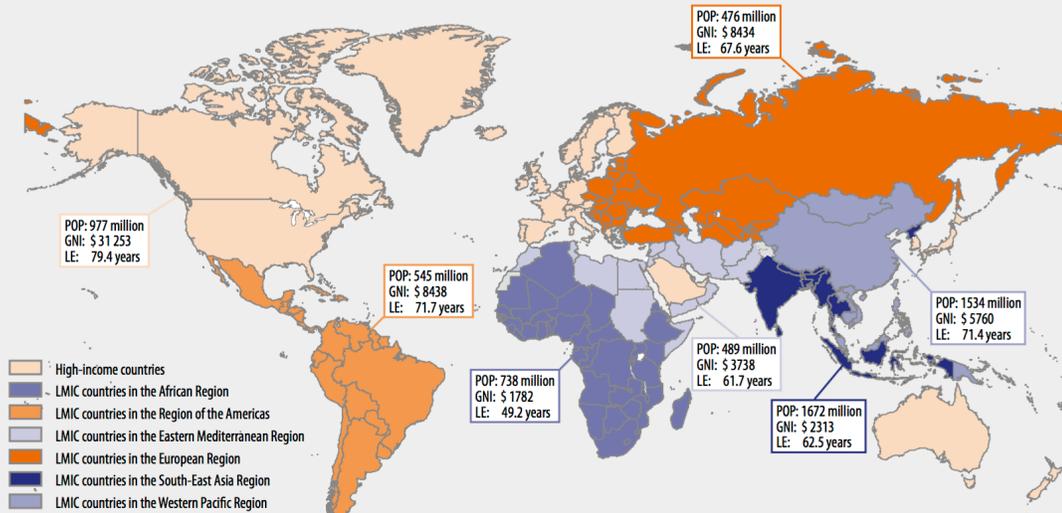
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the presence of treatment externalities." *Econometrica* 72.1 (2004): 159-217.



Map 1: Low- and middle-income countries grouped by WHO region, 2004



POP = population; **GNI** = gross national income per capita (international dollars); **LE** = life expectancy at birth;
LMIC = low- and middle-income countries

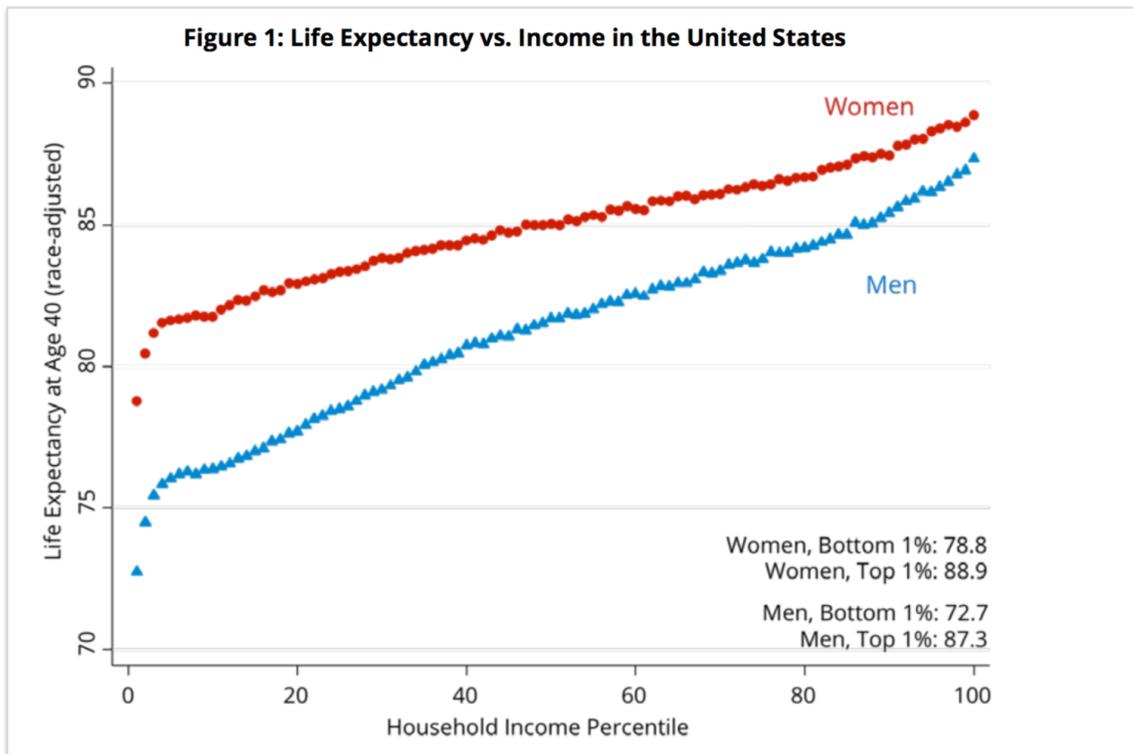
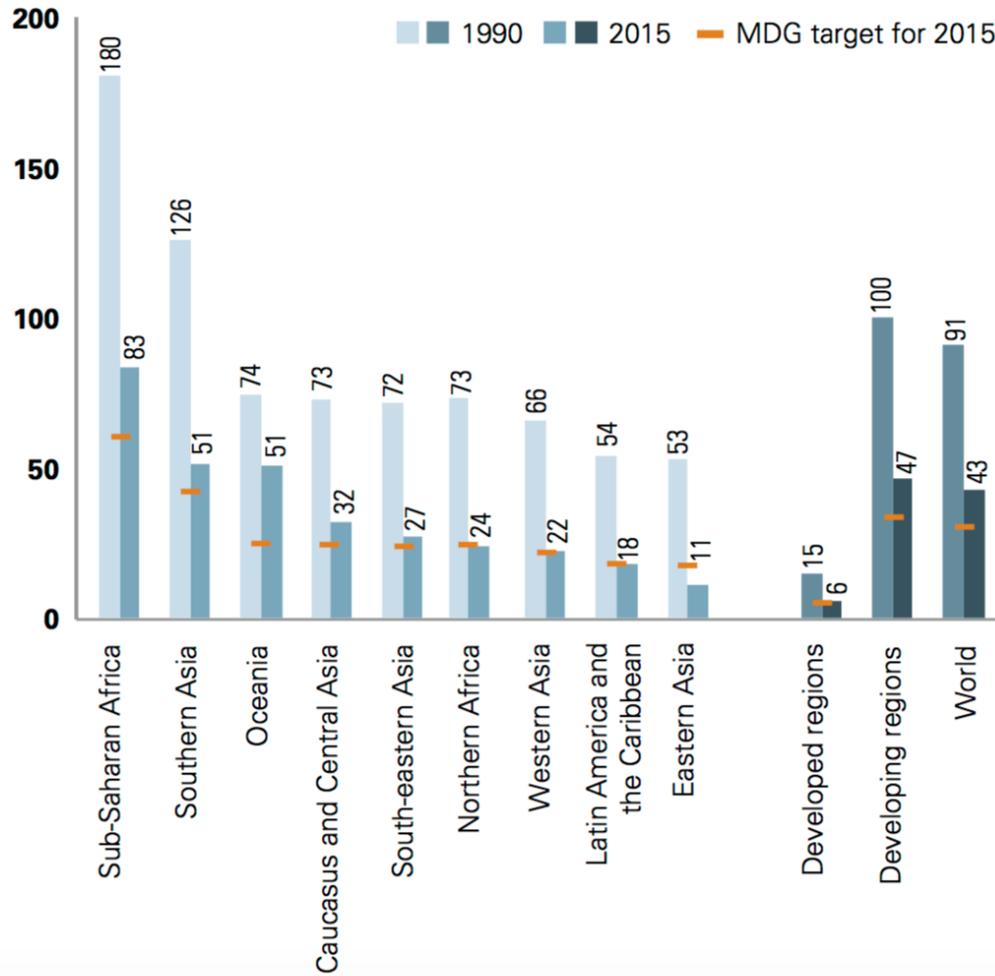


FIGURE 1 Under-five mortality declined in all regions between 1990 and 2015

Under-five mortality rate by Millennium Development Goal region, 1990 and 2015 (deaths per 1,000 live births)



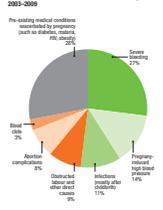
MATERNAL MORTALITY
 SDG Target 3.1
 By 2030, reduce the global maternal mortality ratio to less than 70 per 100 000 live births
 Indicator 3.1.1: Maternal mortality ratio

SITUATION

In 2015, the maternal mortality ratio (MMR) – defined as the number of maternal deaths per 100 000 live births – was estimated at 216 globally.¹ This translates into approximately 850 women dying every single day due to the complications of pregnancy and childbirth. Almost all of these deaths occurred in low-resource settings, and most could have been prevented. The WHO African Region bore the highest burden with almost two thirds of global maternal deaths occurring in the region (Fig. A.1.2). The probability of a 15-year-old girl in the region eventually dying from a maternal cause was as high as 1 in 37 – compared to 1 in 3400 in the WHO European Region.

The primary causes of maternal deaths are haemorrhage (mostly bleeding after childbirth), hypertension during pregnancy (pre-eclampsia and eclampsia), sepsis or infections, and indirect causes mostly due to interaction between pre-existing medical conditions and pregnancy (Fig. A.1.1).²

Figure A.1.1. Data estimates for causes of maternal mortality 2005–2009



Most maternal deaths are preventable as the health-care solutions for preventing or managing the complications of pregnancy and childbirth are well known. All women need access to good-quality antenatal, childbirth and postnatal care. It is also crucially important to ensure access to contraception in order to prevent unintended pregnancies. Factors that prevent women from receiving adequate health care during pregnancy and childbirth include limited availability and poor quality of health services, a lack of information on available services, certain cultural beliefs and attitudes, and poverty.

ACHIEVING THE 2030 TARGET

During the course of the MDG era the global MMR declined by 46% – equating to an average annual reduction of 2.2% between 1990 and 2015. Accelerated progress is now needed as achieving the SDG Target 3.1 will require a global annual rate of reduction of at least 7.3%. Countries with an MMR of less than 432 deaths per 100 000 live births in 2015 will need to achieve an annual continuous rate of reduction of 7.5%. For the 30 countries with MMRs greater than 432 deaths per 100 000 live births in 2015, even higher annual continuous rates of reduction are needed to reduce the MMR to less than 140 deaths per 100 000 live births in 2030.³

The SDG target on maternal mortality forms an integral part of the Global Strategy for Women's, Children's and Adolescents' Health, 2016–2030.⁴ The required acceleration in reducing maternal mortality will not be possible without clinical and non-clinical interventions, as well as political and policy action. Although each country will be different, the Strategies toward ending preventable maternal mortality (EPMM) initiative suggests adaptive and highly effective interventions to improve women's health before, during and after pregnancy. Key EPMM strategic objectives are:

- to address inequalities in access to and quality of sexual, reproductive, maternal and newborn health information and services;
- to ensure LANC for comprehensive sexual, reproductive, maternal and newborn health care;
- to address all causes of maternal mortality, reproductive and maternal morbidities, and related disabilities;
- to strengthen health systems to respond to the needs and priorities of women and girls; and
- to ensure accountability to improve quality of care and equity.

EQUITY

Maternal mortality is a health indicator that shows very wide variations between rich and poor, and between urban and rural areas – both between countries and within them. Poor women in remote areas are the least likely to receive adequate health care.

DATA GAPS

Maternal mortality is a relatively rare event and therefore difficult to measure. Civil registration systems in most developing countries – where most maternal deaths occur – are weak and cannot therefore provide an accurate assessment of maternal mortality. Even estimates derived

from complete civil registration systems, such as those in developed countries, may not be accurate, for example due to the misclassification of maternal deaths.

Furthermore, although the 2015 MMR estimates made by the United Nations Maternal Mortality Estimation Inter-Agency Group were based on data available for 171 countries, no data had been provided since 2010 from 55 of these countries, or since 2005 in the case of nine others.⁵

REFERENCES

¹ WHO (2015). *World Health Statistics Quarterly*, 68(4), 2015. <http://www.who.int/mediacentre/factsheets/fs434/en/>

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³ Alkumayh, O., Choudhury, S., Wang, L., Miller, A.L., Swaminathan, S., et al. Global regional and national trends in maternal mortality between 1990 and 2013, with scenario-based projections to 2030: a systematic analysis for the Global Burden of Disease Collaborative Group. *Lancet Global Health* 2015;3(10):e685–694. [http://dx.doi.org/10.1016/S2468-2667\(15\)00146-1](http://dx.doi.org/10.1016/S2468-2667(15)00146-1)

⁴ The Global Strategy for Women's, Children's and Adolescents' Health, 2016–2030. http://www.un.org/womenwatch/osag/files/osag_20160909_strategy_for_women_childrens_and_adolescents_health_2016-2030.pdf

⁵ Strategies toward ending preventable maternal mortality (EPMM). http://www.un.org/womenwatch/osag/files/osag_20160909_strategy_for_women_childrens_and_adolescents_health_2016-2030.pdf

Figure A.1.2. Maternal deaths, by WHO region, 2015



Table A.1.1. Maternal mortality ratio (per 100 000 live births), 2015^a

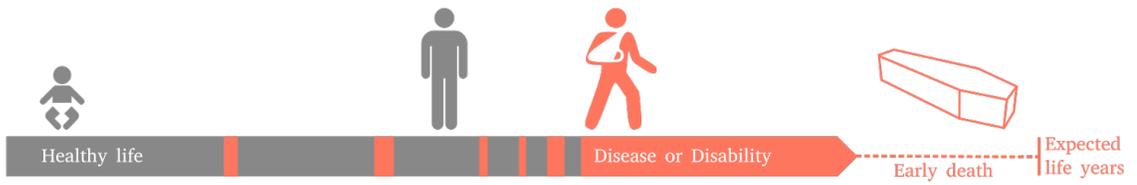
Region	Country	MMR
AFR	Comoros	1 020
	Guinea	1 000
	Sierra Leone	950
	Chad	900
	Equatorial Guinea	850
	Guinea-Bissau	800
	Senegal	750
	Sierra Leone	700
	Guinea	650
	Sierra Leone	600
	Sierra Leone	550
	Sierra Leone	500
	Sierra Leone	450
	Sierra Leone	400
	Sierra Leone	350
AMR	Argentina	0.5
	Brazil	0.5
	Chile	0.5
	Colombia	0.5
	Costa Rica	0.5
	Cuba	0.5
	Ecuador	0.5
	El Salvador	0.5
	Guatemala	0.5
	Honduras	0.5
	Paraguay	0.5
	Puerto Rico	0.5
	Uruguay	0.5
	Venezuela	0.5
	EUR	Albania
Armenia		0.5
Azerbaijan		0.5
Belarus		0.5
Bulgaria		0.5
Cyprus		0.5
Czechia		0.5
Denmark		0.5
Estonia		0.5
Finland		0.5
France		0.5
Germany		0.5
Greece		0.5
Ireland		0.5
EMR		Algeria
	Angola	0.5
	Benin	0.5
	Burkina Faso	0.5
	Burundi	0.5
	Cameroon	0.5
	Central African Republic	0.5
	Cote d'Ivoire	0.5
	DRC	0.5
	Egypt	0.5
	Ghana	0.5
	Guinea	0.5
	Kenya	0.5
	Madagascar	0.5
	WPR	Algeria
Algeria		0.5

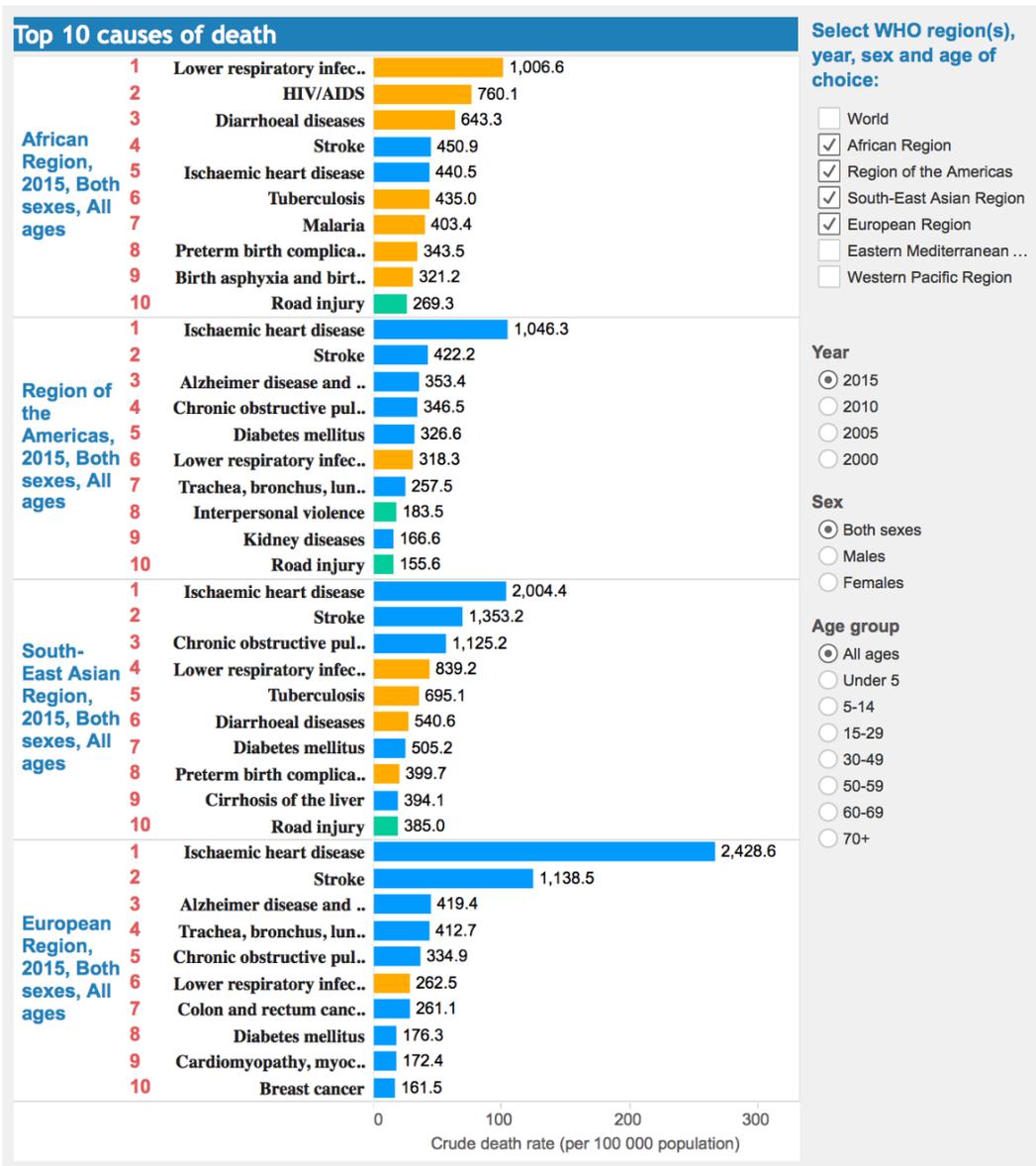
DALY

Disability Adjusted Life Year is a measure of overall disease burden, expressed as the cumulative number of years lost due to ill-health, disability or early death

$$= \text{YLD} + \text{YLL}$$

Years Lived with Disability + Years of Life Lost





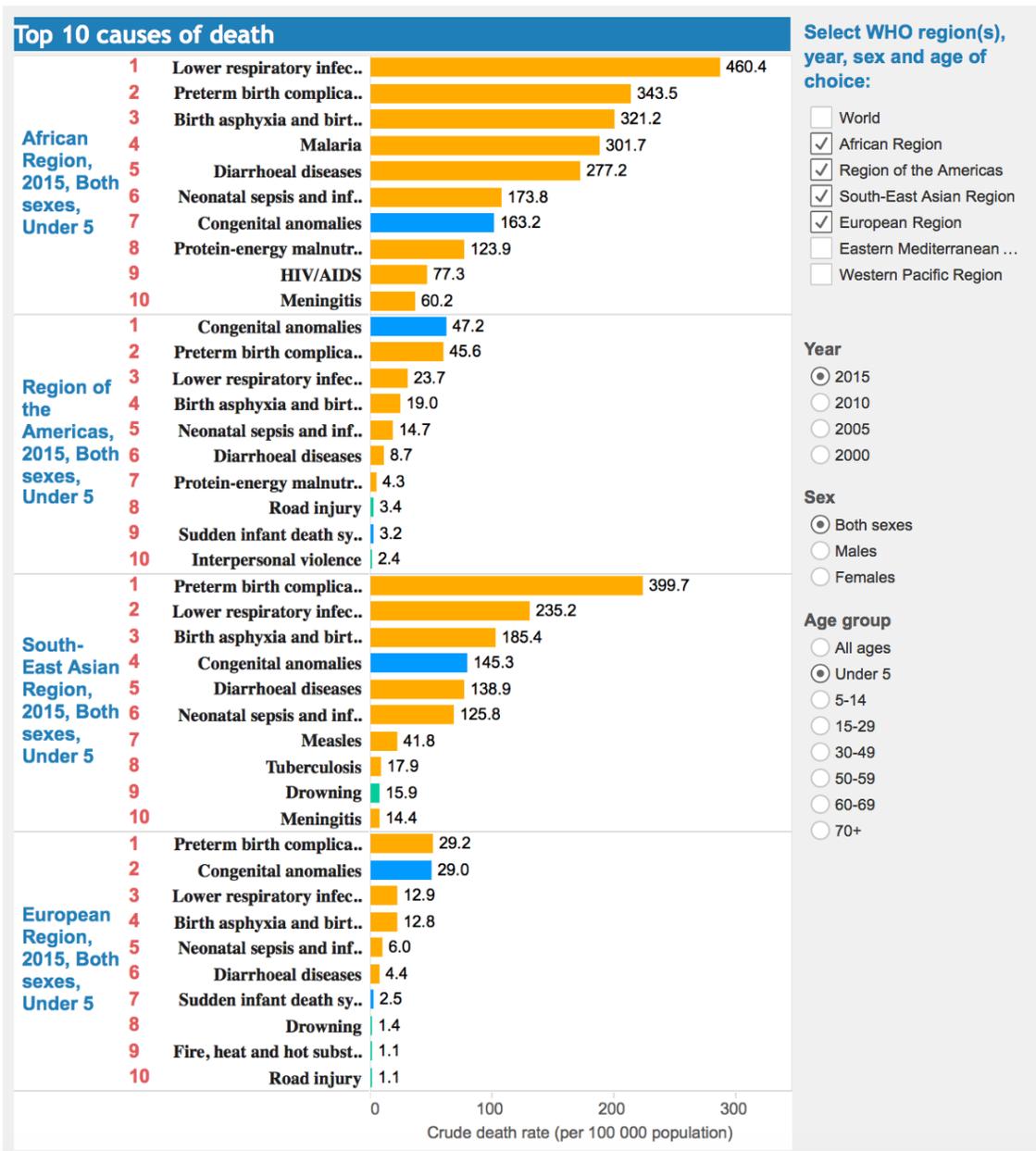


Table 1.1 Global health workforce, by density

WHO region	Total health workforce		Health service providers		Health management and support workers	
	Number	Density (per 1000 population)	Number	Percentage of total health workforce	Number	Percentage of total health workforce
Africa	1 640 000	2.3	1 360 000	83	280 000	17
Eastern Mediterranean	2 100 000	4.0	1 580 000	75	520 000	25
South-East Asia	7 040 000	4.3	4 730 000	67	2 300 000	33
Western Pacific	10 070 000	5.8	7 810 000	78	2 260 000	23
Europe	16 630 000	18.9	11 540 000	69	5 090 000	31
Americas	21 740 000	24.8	12 460 000	57	9 280 000	43
World	59 220 000	9.3	39 470 000	67	19 750 000	33

Note: All data for latest available year. For countries where data on the number of health management and support workers were not available, estimates have been made based on regional averages for countries with complete data.

Data source: (3).

Figure 1.2 Distribution of health workers by level of health expenditure and burden of disease, by WHO region

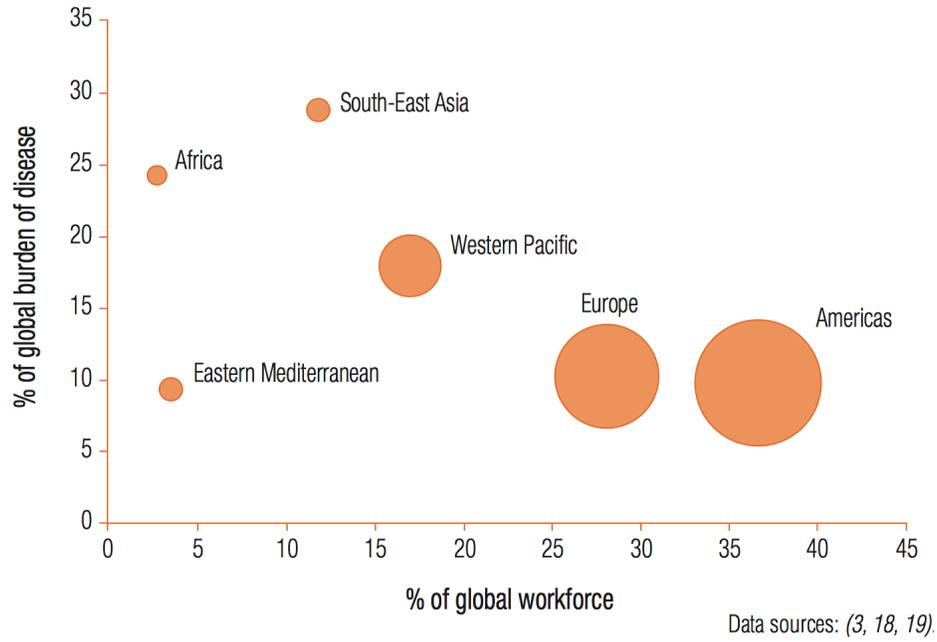


Figure 1: Africa 2013: Scaling up RBF Programs

