

Global Health and the New Bottom Billion

What Do Shifts in Global Poverty and the Global Disease Burden Mean for GAVI and the Global Fund?

**Amanda Glassman, Denizhan Duran,
and Andy Sumner**

Abstract

After a decade of rapid growth in average incomes, many countries have attained middle-income country (MIC) status. At the same time, the total number of poor people hasn't fallen as much as one might expect and, as a result, most of the world's poor now live in MICs. In fact, there are up to a billion poor people or a 'new bottom billion' living not in the world's poorest countries but in MICs. Not only has the global distribution of poverty shifted to MICs, so has the global disease burden. This paper examines the implications of this 'new bottom billion' for global health efforts and recommends a tailored middle-income strategy for the Global Fund and GAVI. The paper describes trends in the global distribution of poverty, preventable infectious diseases, and health aid response to date; revisits the rationale for health aid through agencies like GAVI and the Global Fund; and proposes a new MIC strategy and components, concluding with recommendations.

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Keywords: aid, global health, middle income countries, GAVI, Global Fund

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1. INTRODUCTION

After a decade of rapid growth in average incomes many countries have attained middle-income country (MIC) status. At the same time the total number of poor people hasn't fallen as much as one might expect and as a result most of the world's poor now live in MIC. In fact, there are up to a billion poor people or a 'new bottom billion' living not in the world's poorest countries but in MIC.

Not only has the global distribution of poverty shifted to MIC, so has the global disease burden.

This paper examines the implications of this 'new bottom billion' – the fact that up to a billion of the world's poorest people now live in MIC - for global health efforts and recommends a tailored middle-income strategy for global health funders.

The paper is structured as follows: Section 2 describes trends in the global distribution of poverty, preventable infectious diseases, and health aid response to date. Section 3 revisits the rationale for health aid through agencies like GAVI and the Global Fund. Section 4 proposes a MIC strategy and components. Section 5 concludes with recommendations.

2. THE GLOBAL DISTRIBUTION OF POVERTY AND DISEASE

2a. The global distribution of world poverty

Data presented in Sumner (2010; 2011a; 2011b) and Kanbur and Sumner (2011) demonstrates that there has been a change in the global distribution of poverty from low-income countries to middle-income countries. This shift raises all sorts of questions for aid and the ways aid agencies identify eligible countries (see in particular, Sumner, 2011c).

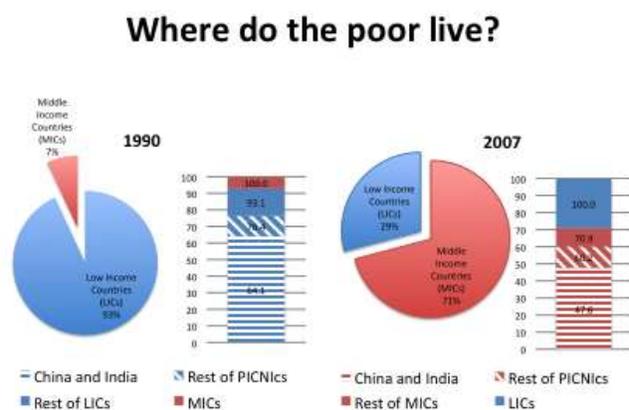
In 1990, 93% of the world's poor lived in LIC. Now, more than 70% – up to a billion of the world's poorest people or a “new bottom billion” -- live in middle-income countries, and most of them in stable, non-fragile middle-income countries (see Figures 1 and 2). The total number of low-income countries (LIC) has fallen and will fall drastically further (Moss and Leo, 2011) (see Figure 2); however, global poverty defined as the total number of people living under US\$1.25 or \$2 per day has remained around 1bn and 2bn respectively (1990-2007), if China is excluded.

Further, most of the world's poor live in countries that have moved from low to middle-income country status since 1999 when China graduated to MIC status - notably Pakistan (2008), India (2007), Nigeria (2008), and Indonesia (2003) (henceforth, with China, the PINCI). China is now an upper MIC as of July 2011.

This concentration of the world's poor in relatively few countries is a key part of the story: Although 28 countries have transitioned from LIC to MIC since 2000, about 60% of the world's poor now live in just 5 populous new MIC countries – the PINCI noted above. Indeed, of the top 10 countries by contribution to global poverty, only 4 are LIC among the top 10 -- Bangladesh, DRC, Tanzania and Ethiopia. See Figure 3 below.

Is the trend of concentration of world poverty in new MIC likely to continue? Chandy and Gertz (2011) estimate the proportion of the world's poor in MIC at slightly below 70% (about 66%) and project that this proportion of the world's poor in MIC will still be 55% in 2015. This projected fall of the share of the world's income poor in the MIC is based on an assumption of static inequality and thus fast falling poverty in the MIC especially so in India and China. However, Kanbur and Sumner (2011) have suggested this may be overly optimistic view of poverty reduction in the MIC given trends on inequality in fast growing economies. Furthermore, Moss and Leo's (2011) projections of GNI per capita suggest that the number of LIC may well fall to around 20 in 2025, moving even more of world poverty towards the MIC over time (see Figure 2).¹

Graph 1. Where do the income poor live?



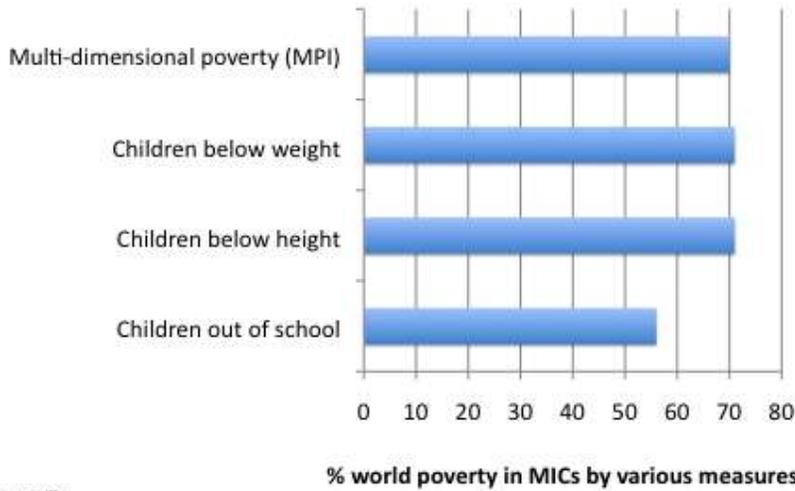
Global distribution of world poverty (% of world's poor, \$1.25/day)

Source: PovCal

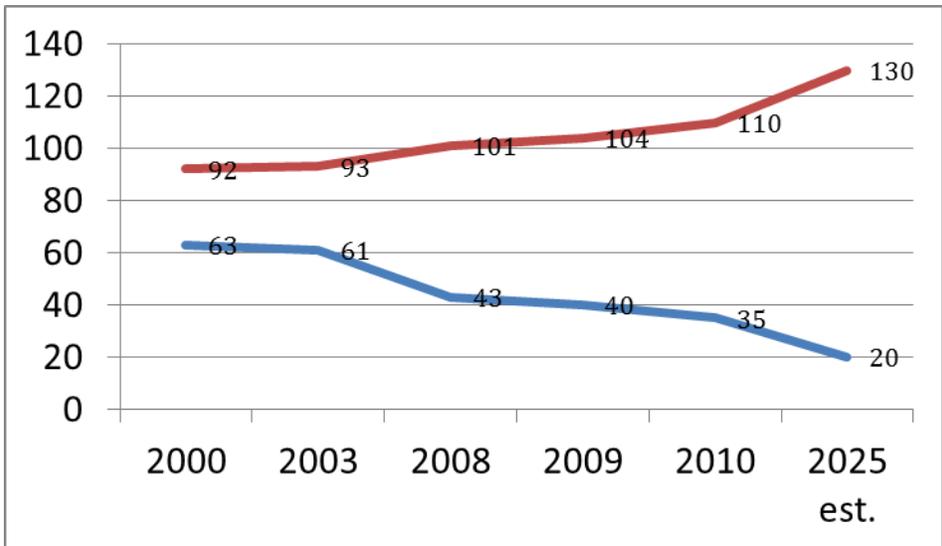
¹ A further issue arising is that of the mismatch of "poor countries" or country classifications (measured by the Atlas measure – an exchange rate conversion) and "poor people" or poverty measures (measured by PPP conversion). Any threshold is arbitrary. The question is the sensitivity of the findings to the threshold chosen. Both matters are discussed in-depth in Sumner (2011c).

Graph 2. Where do the multi-dimensional poor live?

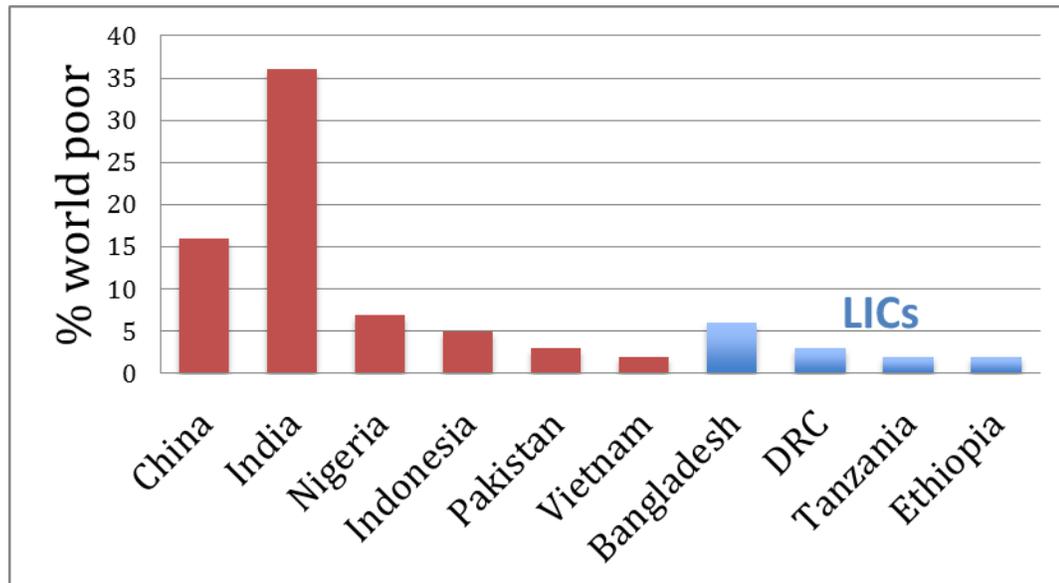
And it's not just income poverty...



Graph 3. Actual and projected numbers of LIC and MIC, 2000-2025



Graph 4. Concentration of the world's poor, top 10 countries, \$1.25 a day, 2007
MIC in red, LIC in blue



Sources: Kanbur and Sumner (2011)

So are MIC just poor countries by another name? Overall, it is evident that MIC (Lower and Upper MIC) have higher standards of living than LIC and are far less aid dependent (see table 1). The average, population weighted, GNI per capita – by Atlas or PPP - in lower MIC is quadruple that of LIC; the average human development score is significantly better in LMIC compared to LIC (including and excluding non-income components) and the average poverty headcount (% population) in LMIC is half that of LIC. Further, the removal of China and India or the PINCIs group of 5 countries from LMIC does not make much difference to human development indicators for the LMIC. However, the removal of the PINCIs substantially reduces the average poverty headcount in the LMIC. Further, measures of inequality – the Gini and proportion of GNI to the poorest - are somewhat similar in LIC and LMIC (and more unequal in UMIC). The removal of China and India or the PINCIs does not make a large difference.

Finally, LMIC have much lower ODA dependency data than LICs. The removal of China and India or the PINCI raises aid dependency indicators but to levels still far lower than that of the LIC group.

In the discussion so far the emphasis has been on MIC as a similar grouping of countries. Within this grouping, however, there are clear differences, particularly in regards to the need for official development assistance (ODA). For example, there are “emerging” powers, such as India and Indonesia that have little need for ODA but still have substantial poor populations. Large fragile MIC, such as Nigeria and Pakistan, also have large numbers of poor people and may have limited need for ODA, but state capacity for poverty reduction

and public health programs are a significant constraint. Stagnant, non-fragile MICs may need ODA to support productive capacities, including human capital investments in health and education, and there are also fast growing LIC, which will graduate to MIC status soon. One example of the contradictions is Angola - a MIC, who will soon also pass the \$1,500 per capita threshold implying graduation from GAVI assistance but still has low immunization rates and health outcomes, suggesting that having a higher average income does not necessarily translate into better health outcomes. This heterogeneity suggests that approaches to reduce health inequities in MIC countries will need to be tailored to types of MIC as well as differ from those adopted in LIC.

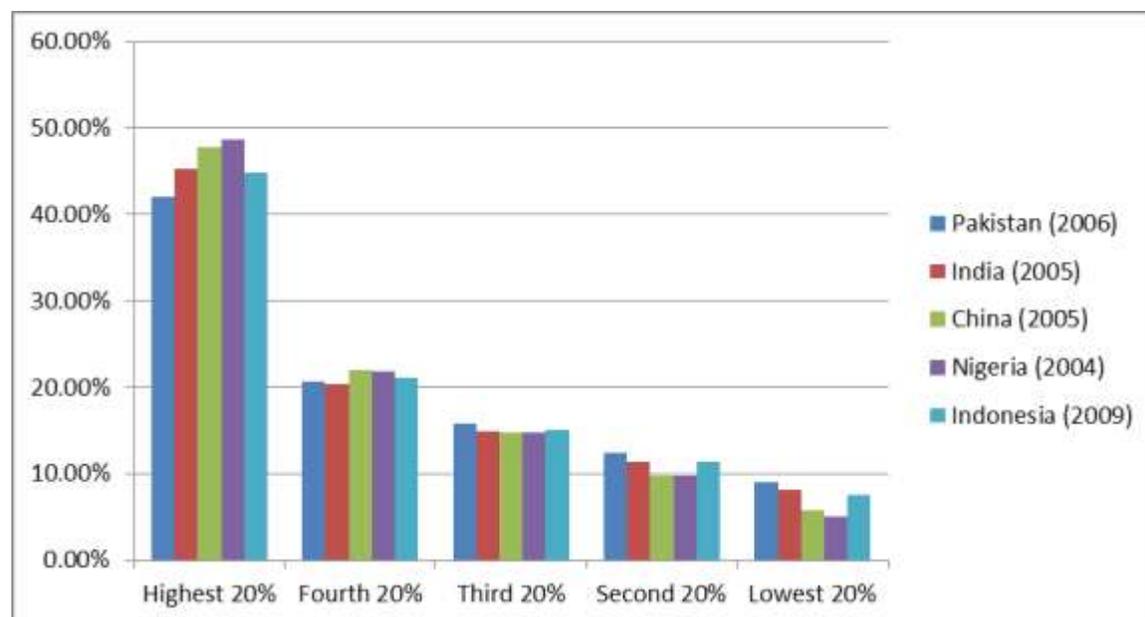
Table 1. Human development indicators in LIC, LMIC and UMIC (population weighted)

| Indicator | Data periods | LIC | LMIC | LMIC minus China and India | LMIC minus China, India, Pakistan, Nigeria and Indonesia | UMIC |
|--|--------------|--------|--------|----------------------------|--|---------|
| GNI per capita (Atlas, current US\$) | 2009 | 494.5 | 2276.3 | 1851.4 | 2112.7 | 7480.3 |
| GNI per capita (PPP, current int'l \$) | 2009 | 1156.5 | 4703.6 | 3769.0 | 4370.0 | 12494.9 |
| Human Development Index | 2010 | 0.39 | 0.58 | 0.55 | 0.58 | 0.71 |
| Non-Income HDI | 2010 | 0.46 | 0.62 | 0.60 | 0.63 | 0.74 |
| Poverty headcount (% population, US\$1.25) (non-adjusted base years) | 2000-2007 | 52.4 | 27.1 | 25.4 | 15.6 | 5.2 |
| Gini | 2000-2007 | 38.8 | 39.3 | 39.1 | 40.8 | 47.1 |
| GNI to poorest 20% (%) | 2000-2007 | 7.1 | 6.8 | 6.8 | 6.4 | 4.7 |
| Net ODA received (% of GNI) | 2008 | 12.3 | 0.6 | 1.5 | 2.2 | 0.2 |

| Indicator | Data periods | LIC | LMIC | LMIC minus China and India | LMIC minus China, India, Pakistan, Nigeria and Indonesia | UMIC |
|--|--------------|------|------|----------------------------|--|------|
| Net ODA received (% of gross capital formation) | 2008 | 51.3 | 2.0 | 5.8 | 7.8 | 0.9 |
| Per capita public health expenditures US\$ (PPP) | 2009 | 26 | 120 | | | 516 |

Source: Sumner (2011c, forthcoming) and health expenditures from WHO; Notes: * insufficient LIC data for 2007-2009; Data refer to the most recent available data within that period and if there is no data between those periods, then that data point (for a particular country, for a particular indicator) is ignored; all table lines are population weighted as follows: (sum of (indicator x country population))/total population of countries with data on that indicator); correlations use the most recent data in the periods stated (Atlas GNI pc, 2009; HDI 2010; Non-HDI 2010; Poverty headcount 2000-2007).

Graph 5. PINCI Income Distribution (GNI % by quintile expenditure groups)

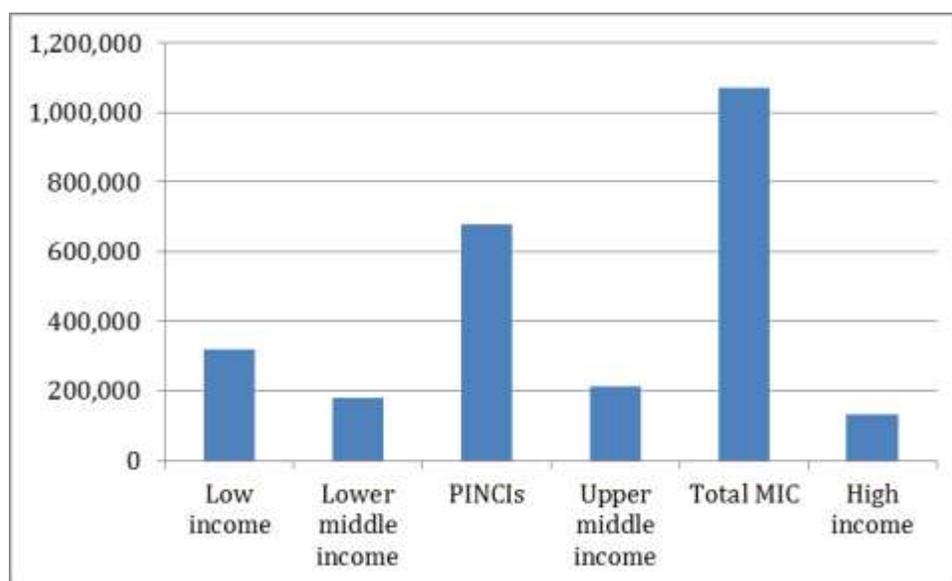


Source: World Bank, World Development Indicators

2b. The distribution of the global disease burden

The distribution of the burden of disease has also shifted to the MIC. MIC as a group has larger disease burdens than LIC related to vaccine-preventable disease, HIV and tuberculosis. Disease burden is concentrated among the PINCI but with still significant numbers in the non-PINCI lower MIC as well as –more surprisingly- the upper MIC in the case of HIV/AIDS. Particularly, in the case of vaccine-preventable diseases, middle-income countries, particularly PINCI, have a much higher burden than low-income countries.

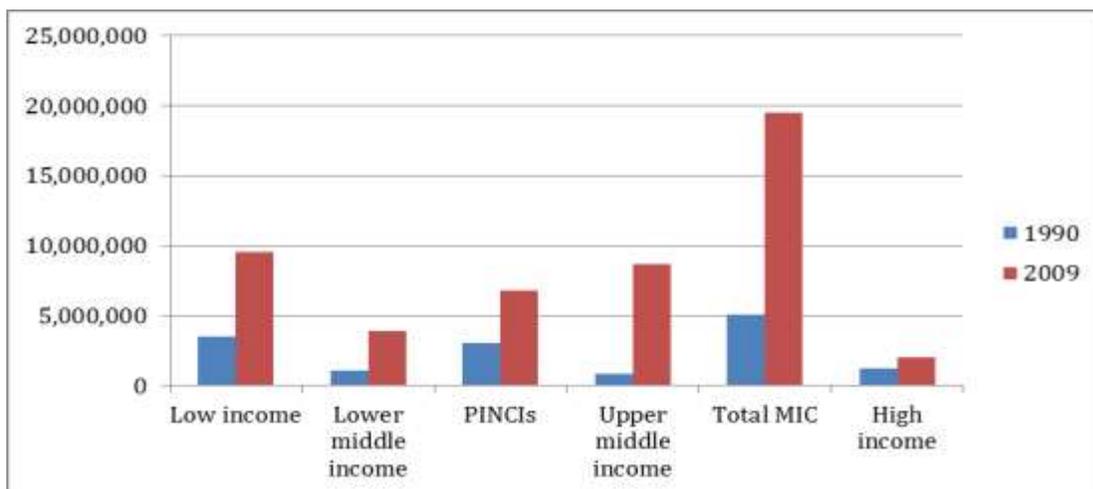
Graph 6. Total burden of disease (DALY), all causes (*000), 2004



Source: World Health Organization Global Disease Burden Database, 2008

Note: “Lower middle income” and “upper middle income” categories do not include PINCI, which are shown separately. “Total MIC” includes all categories: “lower middle income”, “upper middle income” and “PINCIs”.

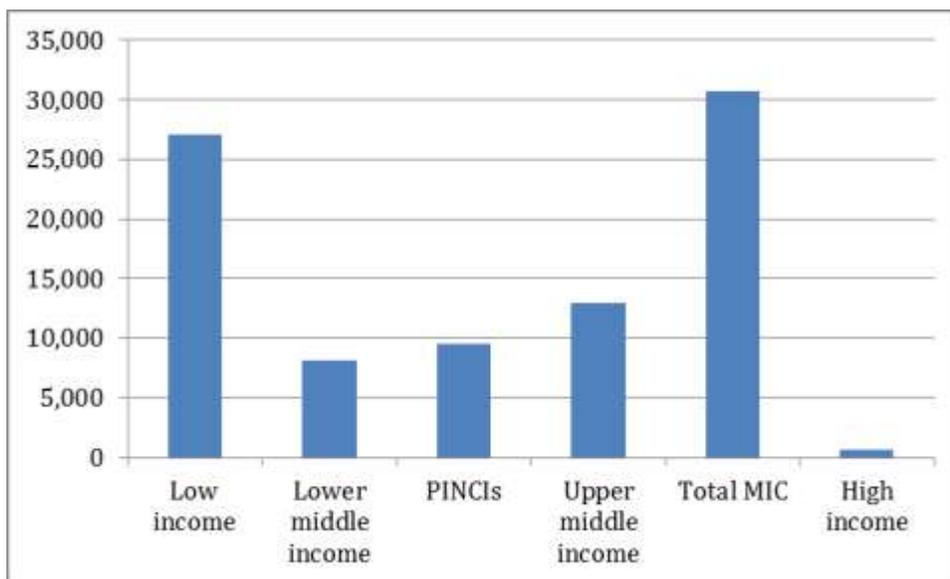
Graph 7. Number of people living with HIV, 1990-2009



Source: World Health Organization Statistical Information System (WHOSIS) 2011.

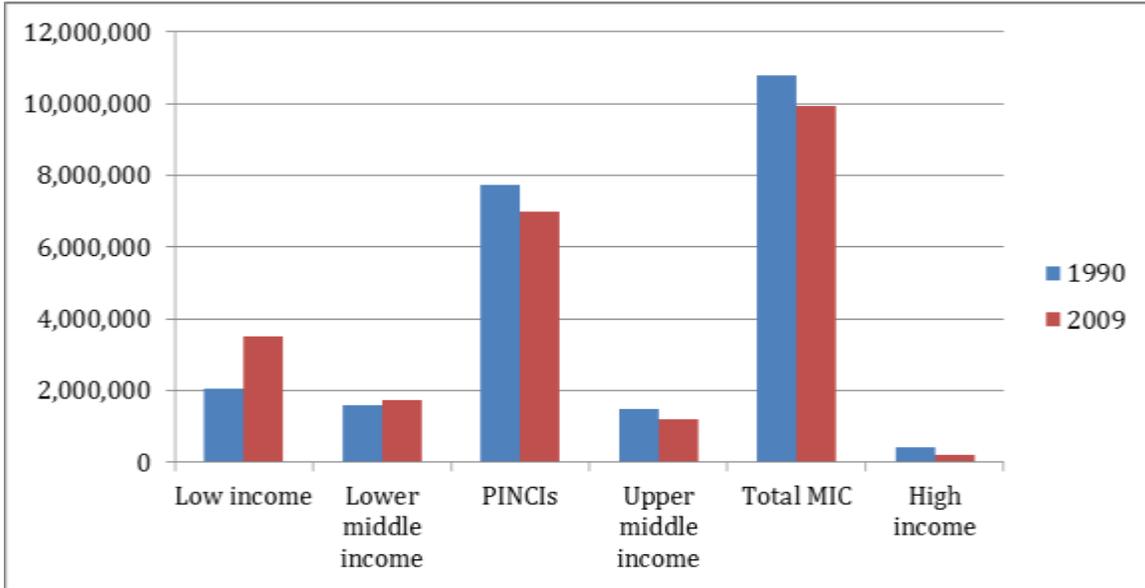
Note: See explanation of categories in Graph 6.

Graph 8. Burden of disease associated with HIV/AIDS (DALY) ('000), 2004



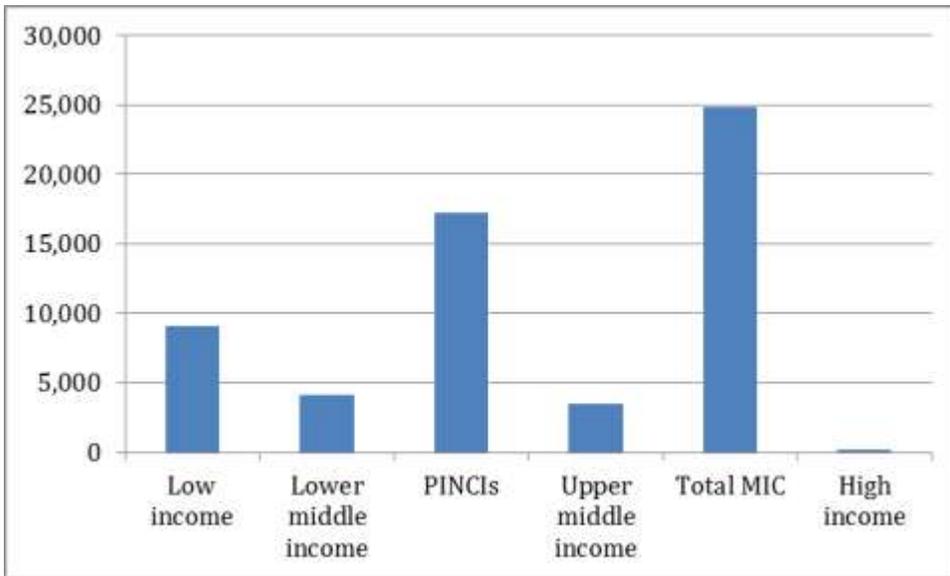
Source: World Health Organization Global Disease Burden Database, 2008

Graph 9. Number of cases of tuberculosis, 1990-2009



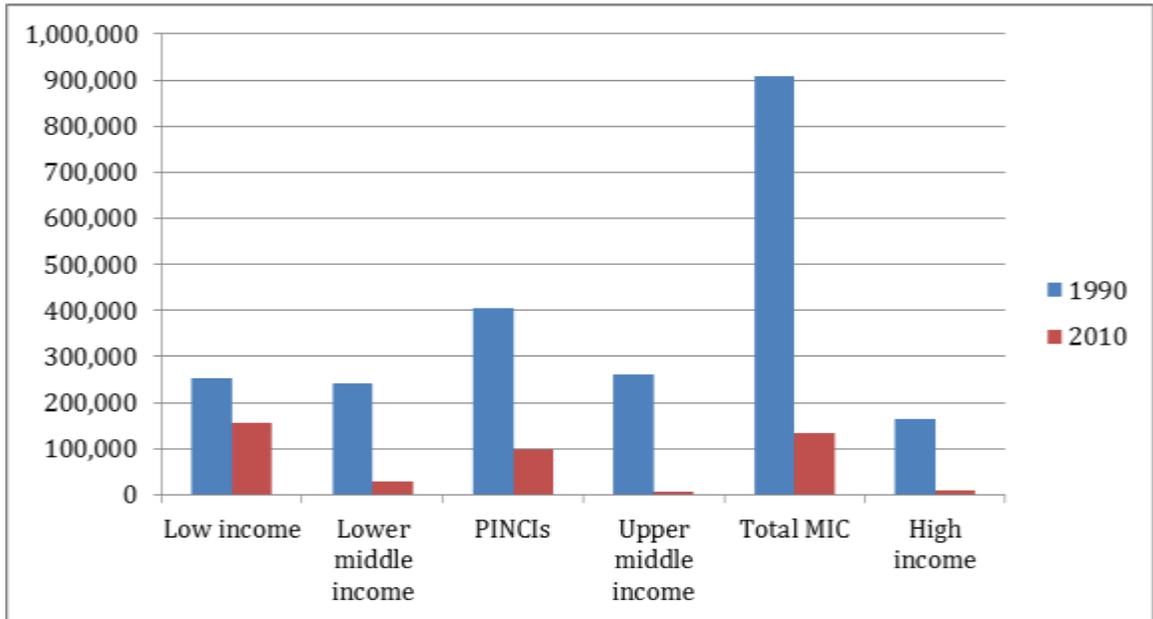
Source: World Health Organization Statistical Information System (WHOSIS) 2011

Graph 10. Burden of disease associated with tuberculosis (DALY) ('000), 2004



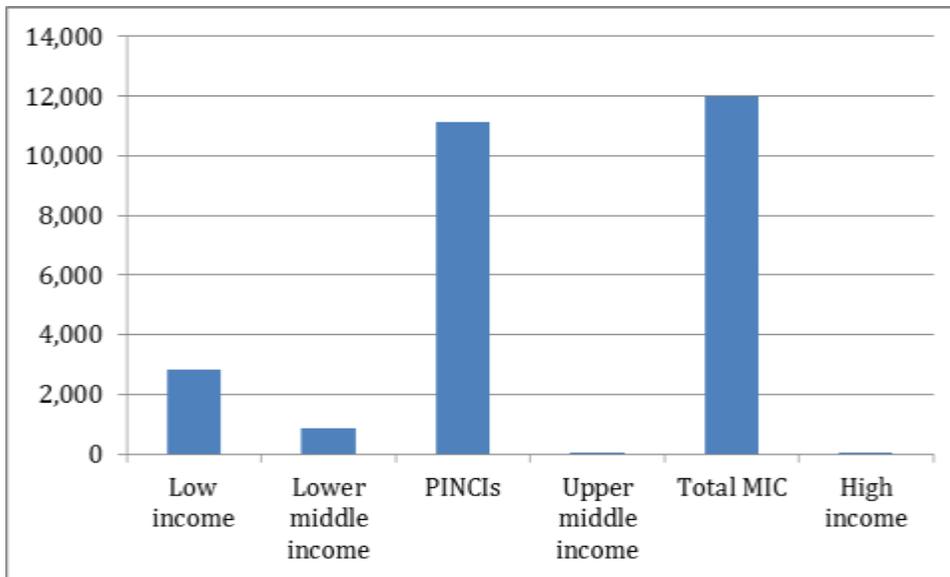
Source: World Health Organization Global Disease Burden Database, 2008

Graph 11. Number of cases of measles, 1990 and 2010



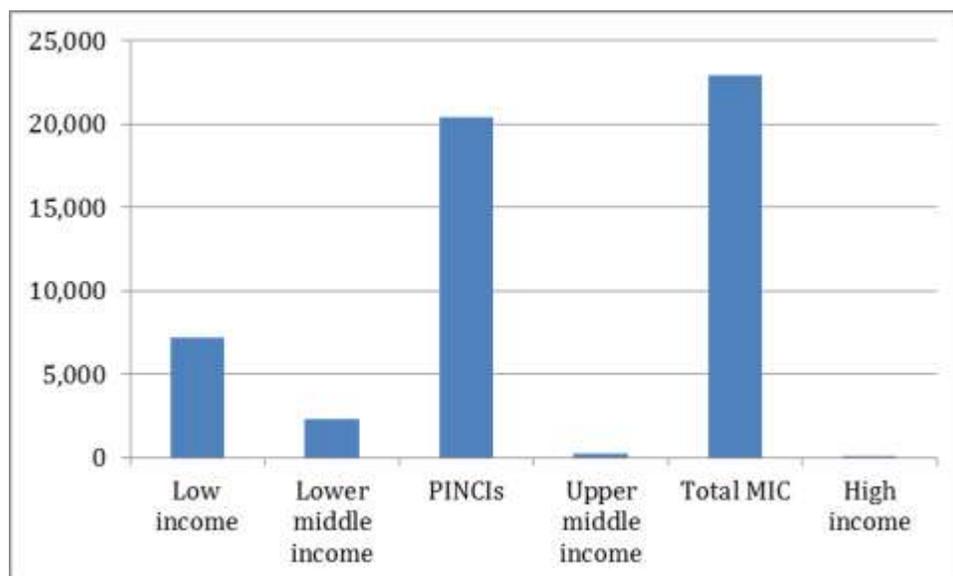
Source: World Health Organization Statistical Information System (WHOSIS) 2011

Graph 12. Burden of disease associated with measles (DALY) ('000), 2004



Source: World Health Organization Global Disease Burden Database, 2008

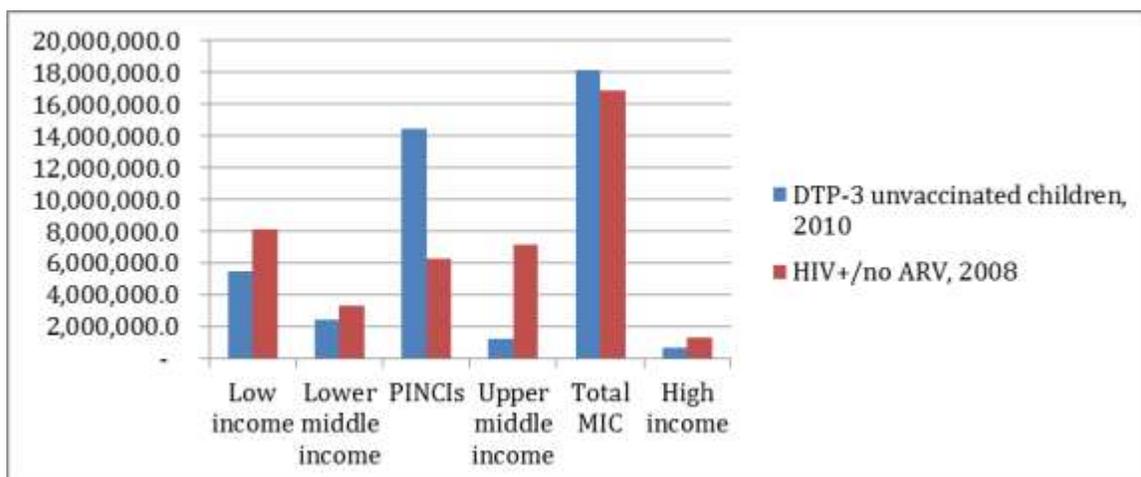
Graph 13. Total burden of disease associated with vaccine-preventable diseases (DALY) ('000), 2004



Source: World Health Organization Global Disease Burden Database, 2008

The shift in disease burden to MIC is driven mainly by population size but also by lagging effort on the public health programs that can prevent or control disease. Complete vaccination rates are lower in MIC than LIC: according to household survey data in 20 LIC and 17 lower MIC, on average, 42% of children under age five are fully vaccinated in lower MIC versus 55% in LIC. This same household survey data is depicted in the scatter plot in graph 14, looking only at DTP-3 coverage, illustrating that many MIC, particularly India and Nigeria, have very poor vaccination performance. That performance is also considerably lower than would be suggested by their level of income per capita. Administrative data – generally considered to be of poorer quality than household survey data (see box 5 on China)- provides a more encouraging picture but is still consistent with the patterns observed in household data. Beyond this, new vaccines, such as vaccines against rotavirus, pneumococcal disease and Haemophilus Influenza B (Hib), are not yet introduced in many MIC (WHO 2008). MIC of all types fare worse than LIC on ARV coverage of HIV positive people.

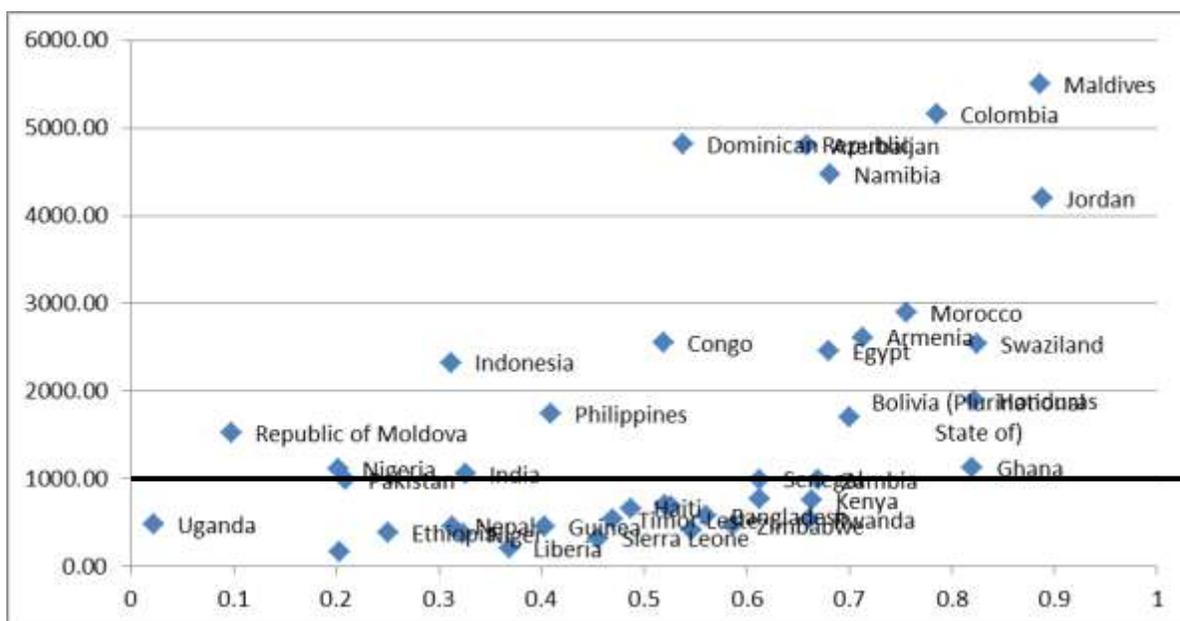
Graph 14. Number of DTP-3 unvaccinated children (2010) and number of people infected with HIV and not receiving ARV treatment (2008)



Source: World Health Organization Statistical Information System (WHOSIS) 2011.

Note: DTP-3 vaccination rate pertains to 1 year olds, calculated by multiplying the crude birth rate, life table survivors at the age of one, and the total population, divided by 100. The period is 2005-2010.

Graph 15. DTP-3 Vaccination Coverage and GDP per capita in LIC and MIC



Source: World Health Organization Statistical Information System (WHOSIS) 2011; household surveys on vaccination.

Note: Line represents the income per capita threshold between LIC and MIC, which is \$1,006 according to the most recent World Bank definition.

Global health agencies have perhaps accentuated these patterns by favoring LIC in their funding allocations. In 2009, 46% of total health aid from Development Assistance Committee (DAC) donors was directed to LIC (CRS 2009 database; own calculation), whereas 39% was directed to LMIC and 14% was directed to UMIC. Further, health aid correlates poorly to disease burden. Some global health agencies, such as the GAVI Alliance, have set eligibility thresholds that progressively graduate the lower middle-incomes that are currently eligible (see Box 2). While some LIC and LMIC may not reach this threshold² given their current economic growth projections, many former low-income countries have graduated from GAVI. In 2000, 72 countries were eligible for GAVI assistance; currently there are 56. By 2020, under GAVI's current policy, only 42 countries, representing half of the currently eligible population, will qualify for GAVI support (See Table A.2).³ Further, caps have been placed on the amount of funding to large countries, such as India.

The decision to target most funding to LIC is based on the idea that MIC have fiscal capacity to spend “enough” on health in general and can reallocate to disease control priorities. Yet prospects for large increases or reallocation in public spending on health are modest. Saxenian et al (2011) analyzed GAVI-eligible countries' fiscal space, finding low levels of government spending on health overall. Although the lower middle-income graduating countries have higher per capita spending on health compared to LIC, health spending constitutes a smaller share of their government spending and prospects for expanding that share are limited. Currently, none of the lower MIC countries receiving support from the GAVI Alliance for new vaccines are currently paying full costs from domestic resources; under an optimistic scenario, Saxenian et al find that “assuming the full costs [of existing and new vaccines and their delivery] would put many at the outer limit” of the maximum recorded share of vaccine spending in more wealthy Latin American countries (used as a reference point given absence of other normative estimates for spending requirements as a share of total budget). As lower MIC have an average per capita health expenditure of \$36 - \$107 in 2008, it will be challenging to significantly increase the share of vaccine spending in their health budgets. Given the limited fiscal space, many of the GAVI eligible lower MIC – and recently graduated - countries will need to rigorously assess the cost-effectiveness and affordability of new vaccines, undertake substantial reallocation within health budgets or seek external grant financing to scale up vaccination and incorporate relevant new vaccines.

² The threshold is defined according to the World Bank's income classifications, which is adjusted every year and accounts for ‘international inflation’.

³ GAVI's eligible population drops from 328.6m in 2010 to 155.9m in 2020 (UN Population Forecasts, own analysis). We base our per capita income analysis on the IMF World Economic Outlook report until 2015, and extrapolate until 2020, the end of the decade of vaccines, by using the average predicted economic growth rate over 2010-2015.

Box 1: Global Fund eligibility criteria

A recently published decision of the Global Fund Board puts more restrictive eligibility criteria in place for funding in MIC, similar though somewhat less restrictive than the GAVI policy:

“Low-income countries (LIC) shall be eligible without specific restriction. Lower middle income countries (LMIC) shall be split into two income groups using as a cut-off the midpoint of the range of GNI per capita for LMIC as reported by the World Bank. Countries at the midpoint or below the midpoint shall, for the purposes of this Policy, be described as —Lower LMIC and those above the midpoint as —Upper LMIC. Upper middle-income countries (UMIC) will be evaluated for eligibility based upon their respective disease burden... All Lower and Upper LMICs may submit proposals for HIV and AIDS, tuberculosis, malaria and/or Cross-cutting HSS but must focus at least 50 percent of the proposal’s budget on Special Groups and/or Interventions for applications to the General Funding Pool and 100 percent on Special Groups and/or Interventions for applications to the Targeted Funding Pool.”

The change in eligibility policy was “designed to ensure that available resources are allocated to countries and regions with the highest disease burden and least ability to bring financial resources to address these health problems, while giving due priority to communities and subpopulations at high risk of disease.”

The Global Fund’s historical, less restrictive eligibility criteria led to a high correlation of size of grants with relevant disease burden (0.84). Within disease priority areas, however, there have been major discrepancies between need and allocation. A study by Snow et al (2008) found that specific high population density countries receive disproportionately less support per capita to scale up malaria control, in spite of comparable disease burden.

It is unclear how the new eligibility policy will help or hurt the Fund’s potential disease-specific targets such as an AIDS transition or the elimination of malaria nor its efforts to assure greater sustainability in disease response.

Box 2: GAVI eligibility criteria

Eligibility for GAVI support is determined by national income, All countries with a GNI per capita below US\$1,500 qualify for support, according to the most recent World Bank GNI Atlas method data. The threshold will be adjusted annually for inflation.

Made official in January 2011, the threshold currently covers 85% of the population of DTP3-unvaccinated children. However, as populous lower MIC continue to grow economically, they will lose GAVI eligibility despite large cohorts with low levels of vaccination: Nigeria, India and Uzbekistan are all approaching the threshold, and are expected to graduate in the next few years (see annex for a complete list of projected graduates, as well as the population projection of GAVI countries).

Once the threshold is crossed, the country enters into a “graduation process” where existing commitments are honored but no new proposals can be submitted or funded. Countries graduating in 2011 are exceptionally allowed to apply for new and underused vaccine support in the June 2011 proposal round.

In 2010, GAVI grants are negatively correlated with the number of unvaccinated children (-0.24) and not at all correlated with cases of vaccine-preventable disease, suggesting that actual burden is not taken into account and/or that GAVI has been successful in supporting LIC in the reduction of VPD burden. Historically, funding for India was capped at US\$250 million. Since 2000, GAVI has disbursed a total of \$1.8b to low-income countries, and \$1b to lower- and upper-middle income countries.

To examine the issue of fiscal capacity to increase public spending from another perspective, Ravallion (2010) has estimated the marginal tax rates on the “rich” (those earning more than \$13 per day) required in order to bring the entire population up to a minimum standard of consumption, eliminating extreme poverty (US\$1.25 per capita). In many ‘old’ MIC, the amount of redistribution required to end poverty is often very small. Ravallion (2010) has argued that most countries with an average per capita income over \$4,000 PPP per capita would require very small additional taxation to end poverty.⁴

However, in many new MICs, the marginal tax rates would have to be much higher. This is due to large populations of poor relative to the number of “rich” people in many new MIC. In India, for example, the poverty gap would require a marginal tax rate on the “rich” of over 100%. In short, the capacity to redistribute or to spend significantly more on health may be limited even at higher per capita incomes, meaning that, at least for the near future,

⁴ As an example, Brazil’s *Bolsa Familia* which distributes US\$50/month to 11 million families cost about 0.5% of GDP in 2005 (Fiori, 2008)

public spending on health in at least the lower middle-income countries may require some kind of shared endeavor between donors and new MIC.⁵

Although reallocation towards more cost-effective preventive health interventions is often advocated for MIC, this effort has evidently been difficult if coverage rates or introduction of cost-effective new technologies are the metric. While the cost of the technologies themselves has clearly been a major obstacle to scaling up (RDI, 2011), there are equally important political economy considerations. Public funding is usually allocated on a historical basis by inputs and as a response to population demand for curative care in urban areas. Public spending is highly concentrated on salaries and pensions, and there is little “flexible” funding to reallocate to specific disease control uses. Few countries have budgetary priority-setting mechanisms that allow for the systematic analysis and incorporation of new technologies. Several large LMIC such as China and India have national purchasing requirements that essentially rule out the possibility of importing a new technology, donor-financed or not. Finally, prevention is an inherently unattractive expenditure target from a politician’s short-term point of view; there are few tangible benefits and there is little population demand for preventive care.

In addition, the worst lower MIC performers are also fragile states; *The Economist* has recently termed Nigeria, Pakistan and Sudan “middle-income but failed or fragile states” (or MIFFs). Most challenges in these settings relate to weak governance and corruption. Transparency International’s 2010 index classifies Pakistan and Sudan among the highest fifth of countries in corruption perceptions. However, a study of Global Fund grant data found that its grants performed well in fragile states, but were mainly channeled to non-governmental entities making a strong case to pursue this modality (Bornemisza et al 2010). Recent events in Nigeria are less encouraging; the Global Fund recently froze its disbursements to one of its non-governmental principal recipient on the basis of audit findings. In Pakistan, a major issue is the loss of territorial control and the recent total decentralization of its ministry of health.

Finally, there is also a political optics issue; it is easier to defend aid spending when it is obviously targeted to extremely poor countries. The recent discussion and parliamentary hearing on DFID’s decision to continue to provide aid to India is an example of the difficulties facing donors when considering MIC funding. India’s establishment of its own aid agency with a budget of US\$1.5-2bn/year is likely to raise further questions – what if most of the world’s poor live in countries that are new foreign aid donors themselves?⁶

⁵ An important question for donors will be the new middle classes in MICs and their preferences for redistribution. OECD (2011) discusses in some considerable detail this issue of middle class preferences for the amount and type of income redistribution and redistributive fiscal policy.

⁶ See report at Economist (2011).

3. AID, HEALTH AID AND MIC: WHY ARE WE PROVIDING HEALTH AID IN THE FIRST PLACE?

Kanbur and Sumner (2011) outline three general reasons to continue aid to MIC on a case-by-case basis: First, donors with poverty reduction and equity objectives have no choice but to work in MIC if most of the world's poor are in these countries. Second, spillover effects of MIC growth, such as climate change, that may negatively affect LICs and their poor provide an argument for directing development assistance toward public goods and aid flows to countries that are part of the solution to the underlying negative externalities. Third, by engaging with MIC, aid agencies gain knowledge that can then be useful for development assistance to LIC, such as implementing social safety nets.

Many of the arguments that support continued aid engagement with MIC in general also apply to health aid in particular, with some nuance.

First, donors with health equity improvement objectives have no choice but to work in MIC if most of the world's at-risk populations are in these countries. As with aid targeted to poverty reduction, health aid funding should conceptually respond to need, defined as burden of disease or at-risk populations, adjusted for the fiscal capacity of the recipient. However, there is a nuance to this equity objective – global health funders also seek to assure that cost-effective health technologies reach the poor. Yet as we have seen, the LIC category is no longer a good proxy for the poor, nor is average income a good measure on which to base decisions about affordability or differential pricing structures since there is an extremely high concentration of wealth in MIC (Yadav, 2010).

Second, supporting public goods in MIC and limiting negative spillovers to LIC should be central for global health donors. Particularly for agencies like GAVI and the Global Fund, the control and elimination of preventable infectious diseases is a global public good, given its benefits that are universal in terms of countries and people. Klepac et al (2011) find that local and global incentives to vaccinate may be diminished in a more interconnected world, as costs for vaccination strategies are determined by the relative costs of infection and control as opposed to transmission rates. Control and elimination in MIC will also limit negative spillovers in LIC, as when for example the DR Congo, a LIC that was polio-free since 1990, had to cope with an imported outbreak of polio in late 2010 from Angola, a MIC. Reducing negative spillovers and their costs would benefit donor countries as well.

Third, there is a clear opportunity for cooperation in the scale up of basic health programs. Since LIC have arguably done better than MIC on public health coverage under more difficult circumstances, there is much know-how to exchange in all directions. On the other hand, MIC have interesting experience in targeting safety net programs that could be relevant to improving equity in health. Further, the wealthiest countries in the world now experience significant challenges in reaching the entire population with vaccination and public health prevention messages; for example, much could be learned in the U.S. from public health programs abroad.

One-size-fits-all solutions are not feasible; however, a dedicated and tailored MIC eligibility and allocation strategy is needed if both equity and disease objectives are to be met.

One reason behind donor reluctance to support MIC is that funding directed to MIC necessarily implies less funding for LICs. Yet the costs associated with this modest shift in resources could be offset, given the efficiency of investing in MIC: the case for vaccination is relatively clear.

Expanding the market for newer vaccines could both increase competition and decrease prices rapidly for new and existing vaccines, and the disparity between immunization rates of LICs and MICs could be reduced. Because most of the costs to produce a vaccine are fixed, the more vaccines are produced, the lower the unit cost of a vaccine. As bulk purchasing and market shaping help drive prices down, expanding GAVI eligibility, or letting MIC use GAVI or a new tier of MIC prices with higher co-financing could help lower-income countries as well.⁷

Working in MIC could also allow for efficiency gains; MIC have most capacity to introduce a new vaccine and assume its financing over time, benefiting a large number of children at a lower cost – while LIC have lower capacity health systems, will need longer-term external funding, and may benefit fewer children (Glassman and Sumner 2011).

Further, "herd immunity" (the threshold for vaccination rates above which disease cases become highly infrequent) against most vaccine-preventable diseases benefits all countries by reducing the frequency of imported outbreaks.

In addition to cost offsets, funds invested in the middle-incomes will have most impact on health. Vaccines are among the most cost-effective public health interventions; and the economic rationale for investing in vaccines is that its immediate benefits of lives and treatment costs saved outweigh the costs.⁸ A method to calculate the effectiveness of vaccines in a specific country setting is to use a value-of-statistical-life approach, which looks at the trade-offs people make between risks of death and income; generated from how much a typical individual is willing to pay to reduce the risk of death. With this method, Ozawa et al (2011) calculated that vaccines have the highest impact (value-of-statistical-life) in India, Angola, Nigeria, Indonesia, Pakistan and Sudan, all of which are lower middle-income countries; India, for example, had 181,300 vaccine-preventable child deaths, and Nigeria had 91,100.

Finally, as countries and global health funders are successful at extending coverage of interventions such that their target diseases are no longer problems of public health

⁷ For a breakdown of vaccine costs, see

https://extranet.who.int/aim_elearning/en/finance/market/market/factors/2.html

⁸ See for discussion on the economic benefits of vaccination and related debates: Bloom et al., (2005) and Maxwell (2011).

significance, the relative cost-effectiveness of the intervention from a national perspective decreases, while the cost-effectiveness of the intervention from a global perspective increases. Klepac et al., (2011) model this mismatch to better understand the incentives facing local versus global policy-makers in the context of vaccine-preventable disease control. Where there is considerable movement of population between and among countries and regions, the authors' model finds that this inter-connectedness promotes free-riding in vaccination and results in lower levels of vaccination in each subpopulation relative to the global optimum. The authors conclude that coordination of vaccination efforts will be required to achieve global elimination, and that long-term optimal strategies will focus on reaching herd immunity. Since all countries will benefit from disease control and elimination, now and in the future, the arguments behind the economics of elimination and global public goods apply; to realize the human and financial benefits from any of the investment in control and elimination, costs associated with elimination should be globalized and the global health funds have a role to play.

4. COMPONENTS OF A MIC STRATEGY

It is important to distinguish between the different kinds of support for LIC and MIC. For LIC, direct resource transfers are necessary given the very low per capita health spending. For MIC, however, international support and partnerships can take many different forms, many of which are not directly about resource flows. That said, there is still a role for a modest amount of global funding and facilitation that could leverage greater financing and better results in the MIC (and further new MIC might themselves contribute to GAVI and the Global Fund, noting India's proposed foreign aid budget of \$1.5-\$2bn/year).

The components of a MIC strategy fall into four sub-groups: global public goods; pricing and procurement; knowledge transfer; and accountability mechanisms.

1. Global public goods:

- a. Reaffirm that the control and elimination of infectious disease is a global public good.

As a global public good, costs for the prevention and control of infectious disease of public health significance should be shared according to the net benefits that would be generated by their control and elimination, or lacking this information, cost sharing according to ability to pay is reasonable. Wealthier MIC have begun to contribute to GAVI and the Global Fund, but are far from contributing their "fair share" if measured as equivalent to their GDP. Further, aid-giving governments still spend substantially less on these and other public goods in favor of country-specific spending programs (Birdsall and Leo 2011). Similarly, most developed countries are contributing lower than their fair share to organizations like WHO.

Given current economic realities, Birdsall and Leo recommend a new collective financing mechanism that is specifically designed to address global public

Box 3. Defining disease elimination versus disease control

Elimination refers to the “reduction to zero of the incidence of a specified disease...continued intervention measures are required.”

Control has been defined as “reduction of disease incidence, prevalence, morbidity or mortality to a locally acceptable level as a result of deliberate efforts...continued intervention measures are required to maintain the reduction.” (Molyneux, Hopkins and Zagaria 2004)

goods. While GAVI and the Global Fund are in themselves collective financing mechanisms and GAVI has led on the International Finance Facility for Immunization, both organizations continue to lack revenue streams that are long-term, sufficient and predictable to accomplish the tasks they are assigned. Therefore any effort to build out Global Public Good funding via innovative financing should include both GAVI and the Global Fund.

- b. Eliminate the country income threshold or classification as an across-the-board eligibility criterion for global health funding, recognizing that both equity and disease control objectives are best met by an objective-based approach to allocating aid.

From an elimination perspective, an allocation mechanism or strategy should aim to reach and impact those countries that concentrate cases of disease or at-risk population.

From a control perspective, where the goal is to minimize the overall incidence of infection in a situation of constrained resources, the best strategy may be to deploy resources preferentially to populations with the highest proportions of susceptible individuals (Rowthorn, Laxminarayan and Gilligan 2009), adjusting for a country’s fiscal capacity to spend in the health sector, while creating all kinds of incentives for reduced input prices and greater domestic investment in and delivery of cost-effective interventions.

For both perspectives, allocation decisions should build off the objectives set for each disease control priority and use “epidemonomics” models such as PneuMOD⁹, that combine the methods of epidemiology, demography and economics to determine optimal allocation of scarce resources between and within countries. The Global Fund has developed a prioritization model which looks at the Technical Review Panel (TRP) results, income and disease burden: similarly, allocation decisions could be made according to an index which combines disease burden and income level, which would benefit LMIC with worse health outcomes.

⁹ For more information about PneuMOD, visit

http://www.cddep.org/projects/pneumococcal_modeling_project_pneumod

We believe that this is the most important solution to the current problem: donor activity should not only be based on income thresholds, but incorporate the real objective of health aid, which is to improve health outcomes.

- c. Develop a “big 5” strategy that reflect the specific barriers to change in the large populous MICs – the PINCIs; recognizing that many states or provinces within the PINCIs would be classified as low-income countries if they were independent (for example, certain Indian states and Chinese regions). The “big 5” merit their own dedicated strategies given their importance to the global disease control effort. Many studies have been done that can be synthesized for this purpose, but bringing it together with an eye on the objectives of the support is needed. For disease control and elimination objectives, epidemiological models can help determine the optimal allocation of scarce resources *within* a country. For equity objectives, building on safety net programs, geographic poverty targeting instruments and poverty-targeted demand-side financing to identify the poor and reduce barriers to access offer promise to overcome access obstacles. The Global Fund already requires poverty-targeted investments in its eligibility criteria, yet it has not established relevant tools or measures that would allow this poverty focus within MICs to be tracked and evaluated. Identifying the poor may also help to introduce a sliding scale of co-pays for ARV, for example.

Adjusting operational modalities and activities to deal with the unique governance and political economy challenges in the “big 5” is a next step once allocation in support of control and elimination are made clear. Box 4 illustrates the variety and complexity of issues facing India.

- d. Create incentives for blended multilateral development bank (MDB) lending with grant financing to leverage on-budget spending on public health priorities and results.

Since straight-out aid is only appropriate for a sub-set of the poorer MIC, blended financing arrangements that use very modest grant resources to leverage or inform multilateral lending for infectious disease control may make sense. As debt taken on by borrower governments, MDB lending is demand-driven and necessarily reflects borrower priorities. However, MDB routinely support government decision-making on priorities via policy dialogue and analytical work. Further, instruments such as performance-based debt buy-downs can generate both visibility and commitment from borrower governments. MDB operations’ disbursements are also on-budget, contributing to establish a permanent line item to fund vaccination or other infectious disease control programs.

Box 4: The Case of India

India is an example of a lower middle-income country about to cross the GAVI threshold: a dynamic and growing economy with considerable inequality and social exclusion, most of the population still lives under the US\$2 poverty line. About 5% of India's GDP goes to healthcare, only 0.9% of which is by the government (public health expenditures in India are \$43 per capita); consequently, out-of-pocket expenditures form a majority of health spending. To change this, India has recently started an initiative called the National Rural Health Mission, which hopes to increase public spending on health gradually to 2-3% of Indian GDP. Another characteristic of India is that state governments have a larger role in health financing than the central government, and the NRHM plans to increase the central government's health spending from less than 30% to 40% by 2012, and oblige the states to increase their own health spending by at least 10% every year. However, the World Bank judges this target as unlikely, given the current fiscal capacity of both states and the central government, as increasing overall public health spending to 2-3% of GDP would translate as states increasing spending by 22-38% per year (Berman et al, 2010).

India currently has one of the world's largest immunization programs, yet the results of the program are poor: 4.7% of all deaths in India among children under 5 years of age are due to childhood-cluster diseases. Furthermore, vaccination programs constitute only 2.1% of the national government's health budget, and fewer than 44% of Indian children are fully immunized. Pneumonia is a leading source of death among Indian children, but vaccines for Hib and pneumonia are not distributed widely in India.¹ India has been focusing on eradicating polio and introducing the monovalent vaccine. However, despite a decline, polio has not been eradicated yet: 14% of NRHM spending is made on polio vaccination, compared to 3% spent on routine immunizations, and the emphasis on polio campaign may have detracted from other immunization programs (Laxminarayan 2009).

India has the capacity to invest in its own public health programs, but the challenge is to set priorities, invest in programs that would make a difference, and leverage sub-national performance and spending. Analysis shows that vaccines are the most cost-effective intervention to improve health in India: devoting one percent of Indian GDP to vaccination could save as many as 480 million healthy years of life. The additional cost per capita each year to sustain a 90% immunization rate with 6 basic vaccinations that are already included in the national immunization program (diphtheria, tetanus, pertussis, tuberculosis, polio and measles) would be less than 3 rupees (80 cents) per child in the poorest states, and even less in others (Laxminarayan 2009).

According to its GDP per capita forecasts, India will graduate from GAVI eligibility in 2015, and would have support for another 5 years. With this, the population of 0-4 year olds in GAVI eligible countries will drop by 50%. Given these projections, India

exemplifies a challenge for GAVI: it is the most populous LMIC, but not the only one, that could use further assistance from GAVI.

2. Pricing and procurement:

- a. Set up regional pooled procurement schemes or negotiate a GAVI/Global Fund MIC public sector price within existing procurement mechanisms. As mentioned above, Saxenian et al. (2011) have argued that new vaccines may be unaffordable in GAVI-eligible lower MICs, even under optimistic assumptions on price, growth and priority to health. National budgets in these countries may not be able to absorb the costs of new vaccines without continued GAVI support. One of GAVI's benefits has been its market-making; increasing the volume of vaccines procured alongside greater certainty in available finance, which may have contributed to drive prices down. Including MIC, especially the populous PINCI, could help LIC benefit from lower prices as well.

Further, lower both GAVI-eligible and –ineligible MIC report that price is a major obstacle to adoption of new vaccines, according to a Results for Development Institute study. Therefore, facilitating public sector access to a lower-than-market price for key vaccines and medicines is a major challenge. The Pan American Health Organization's (PAHO) Revolving Fund¹⁰ for the purchase of vaccines is a good example for MIC in other regions and has obtained affordable prices for its participating countries. All participating Member States contribute 3% of the net purchase price to a common fund that is used entirely as working capital, which offers a line of credit to participating Member States that may need it due to intra-year fiscal constraints. This line of credit enables a Member State to pay the Revolving Fund within 60 days of receipt of the products. The Revolving Fund handles the planning and consolidation of demand, negotiations with producers, the placement of purchase orders, coordination with suppliers, and the monitoring of shipments, as well as financial aspects involving paying suppliers and billing countries. However, the PAHO Fund's lowest possible price clause could potentially subvert efforts to assure the very lowest prices in LIC – Brazil obtains the same price as Haiti. Outside the Fund itself, the clause prohibits participating companies from providing a lower price to the GAVI Alliance for LIC. For a PAHO-type fund to work in other regions or via GAVI, it will be necessary to

¹⁰ For more information about the PAHO revolving fund, visit

http://new.paho.org/hq/index.php?option=com_content&task=view&id=1864&Itemid=2234&lang=en

convince MIC governments –in Latin America and elsewhere- that while they will obtain a lower than market price, it will not be the lowest possible price in the name of supporting the global public good of infectious disease control and elimination, from which they also stand to benefit.

The UNITAID-organized Medicines Patent Pool is also an interesting model for reduced prices in MIC. The Pool negotiates with pharmaceutical companies to share intellectual property and license the generic production of HIV medicines. The Pool recently announced it had begun negotiations with Boehringer-Ingelheim and Bristol-Myers Squibb for patents on HIV medicines essential to treating people living with HIV in the developing world. The Pool was already in negotiation with five other patent holders and concluded its first licensing agreement with a leading pharmaceutical company, Gilead Sciences in July 2011. However, to date, these negotiations have included only HIV-related medications, for which there is a large and vocal international lobby. While a small-scale effort for neglected tropical diseases was also launched by GSK, it is unclear whether the same conditions would hold for other disease priorities and related vaccines and medicines.

Some pharmaceutical firms have committed to reduced rotavirus and HPV vaccine prices for GAVI eligible and graduates, however, this agreement remains verbal and GAVI should make efforts to formalize these commitments for GAVI graduates.

- b. Encourage the pharmaceutical industry to deepen differentiated pricing strategies within MICs.

Pointing out the highly segmented within-country markets for rich and poor in MIC, Yadav (2010) sets out a compelling theoretical and empirical argument for greater use of differentiated pricing by industry that could lead to both increased affordability for low-income populations and higher profits for pharmaceutical companies. Yet differentiated pricing will only be interesting to industry if MIC governments can show that these markets are indeed segmented. Global health agencies can help by supporting the use of poverty targeting instruments to obtain eligibility for health services by poor populations thus allowing the public sector to effectively reach the poor, as well as strengthening and improving accountability in the public sector supply chain in order to minimize product diversion to non-poor internal markets.

- c. Help establish MIC-based Advance Market or Purchasing Commitments (AMC/APC), for infectious disease prevention, diagnosis and treatment. There are a number of infectious diseases that are geographically concentrated and affect MIC, such as TB, dengue, *P. vivax* malaria and Chagas disease. The

wealthier MIC remain affected by frequent outbreaks, over-prescription of anti-malarials and antibiotics, and surveillance requirements would benefit from new preventive and diagnostic technologies.

MIC like China and India, among others, have developed drug manufacturing capacity and emerged in the last decade as important sources of inexpensive generic medicines for both domestic and international markets. Hafner and Popp (2011) find that Chinese and Indian imports have a significant effect on the average cost of pharmaceutical imports from high-income trading partners in developing countries. Other MIC producer countries are found to be less competitive. To enhance competitiveness, a government-sponsored AMC or APC could support local manufacturing capacity while addressing major disease burden, or strains focused in those countries.

Know-how gained from the development of the AMC at GAVI could be shared with affected governments. Brazil would be a particularly good candidate to employ an AMC for Chagas or an APC for a dengue vaccine that is nearing the end of third stage clinical trials.

3. Build evidence-based priority-setting institutions

- a. Provide support and build economies of scale to support national evidence-based priority-setting processes and institutions.

While the World Health Organization “helps developing countries with limited policy capacity or expertise by critically reviewing vaccines and establishing evidence-based policies for vaccine use, it is not in a position to rank or prioritize use of many vaccines in a given country.” (Levine et al 2011) Neither GAVI nor the Global Fund require countries to conduct economic evaluation and assessment of budget impact/affordability on technologies ahead of funding, in spite of its critical importance to the sustainability of the disease prevention and control programs that they support. While basic vaccines may be relatively uncontroversial and low cost, new vaccines and the interventions in HIV/AIDS –for example- demand more rigorous assessment, that could feed into value-based pricing and reimbursement decisions, and would help transition countries from the use of external reference pricing in public or social insurance systems to value-based pricing.¹¹ Yadav (2010) suggests that

¹¹ External reference pricing as done by countries generally “has insufficient adjustments for quality variations; uses price ratios rather than price levels; artificially measures countries’ wealth (for example, using a country’s lowest-paid unskilled government worker as a benchmark); disregards patents; is too slow in adjusting to changes in prices, inflation, and exchange rates; and requires difficult-to-obtain procurement prices.” See:

economic evaluation –if used to take public spending decisions- “would (also) help untangle the complex web of interrelationships in price that exist between countries and that make manufacturers wary of changing price in any country due to the resulting cascading effects” in other country markets. An example of the potential for priority-setting institutions comes from Thailand’s Health Intervention and Technology Assessment Program (HITAP), which decided against adoption of the costly HPV vaccine in favor of a less expensive but equally effective screening and treatment approach that subsequently resulted in a more favorable price for HPV being offered to government.

Support for priority-setting is evidently important, particularly in the PINCI. China was GAVI-eligible between 2002-2006, yet still has low vaccination rates as evidenced by household surveys. Similarly, India is soon to be phased out, but has lower vaccination rates than many LIC. On the macro level, PINCI possess the resources; which is why supporting evidence-based decision-making is required.

4. Accountability mechanisms:

a. Pilot and evaluate results-based ex-post aid or debt buy-downs

Since the problems related to prevention and control in MIC are more related to priorities and incentives than financial constraints, aid instruments that create positive incentives for improved or sustained performance are a possible solution. COD Aid –which conditions aid disbursements on independently verified improvements in performance-, is one aid instrument that merits piloting and evaluation (Birdsall, Mahgoub and Savedoff 2010). Performance-based debt buy-downs, such as those used to buy down World Bank IDA loans for polio vaccination coverage, also merit attention but have not been formally evaluated. However, it is important to recognize that the amount of the aid transfer will be less of an incentive in the relatively wealthy MIC than the visibility associated with the agreement and its measurement.

COD Aid may be particularly relevant in settings where disease elimination is imminent, where surveillance must be maintained in order to realize the benefits of years of investment in control by governments and aid agencies, and where the mismatch between cost-effectiveness at the global and local levels is large.

b. Name and shame for increased global accountability and more accurate data.

The global health community has done much to define the characteristics of “good” vaccination and infectious disease control programs. Yet country performance on financial and programmatic results is piecemeal, dependent on

Box 5: China and Survey Data

Although official statistics usually present a better picture on vaccination rates, such statistics do not accurately represent the scale of the problem. The World Health Organization's official statistics for China, for example, show 99% coverage of the BCG vaccine, 99% coverage of the DTP-3 vaccine, and 92% coverage of the Hepatitis B vaccine. However, the Chinese National Health Survey, a representative sample survey conducted by the Carolina Population Center at the University of North Carolina and the Chinese Center for Disease Control and Prevention in 9 provinces, finds much lower rates. In 9 provinces, BCG vaccination stands at 33%, DTP-3 at 48% and Hepatitis B at 46%. These discrepancies between official data and survey data suggest that it is important to keep these disparities in mind when evaluating vaccination rates.

Box 6. MCC: A Model for Global Health?

The Millennium Challenge Corporation (MCC) presents a model for looking ahead for GAVI and the Global Fund, and the need to adopt a case and region-specific approach as opposed to broad income categorizations and cutoffs. The MCC works with eligible poor countries through project-specific compacts. Eligibility is based on a number of criteria, including governance, human development indicators and income level. MCC works with governments, but can work with local as well as central governments: MCC worked on projects in middle-income countries such as Georgia, Armenia and Ukraine.

The MCC example brings two implications for health aid in middle-income countries: first, instead of simply looking at income per capita, GAVI and other organizations can expand their scope and work with middle-incomes by funding individual projects or compacts. Secondly, given the nature of regional inequality in middle-income countries, GAVI could think of partnering individually with regions, at the sub-national level.

self-reported administrative data, and has limited public visibility. More could be done to create reputational incentives (like the Human Development Report's league tables where neighboring countries are compared or countries at same income per capita but different poverty outcomes) for better performance on key public health priorities. More attention to independent and rigorous measurement of program outputs and outcomes will benefit program managers and donors, while an annual ranking of composite performance could be used by local and international civil society to pressure for improvements. Rankings also serve to encourage completeness and accuracy in financial and programmatic data.

- c. Pilot and evaluate civil society investments that leverage public sector investment.

Using their unique capacities as public-private partnerships, in countries with major governance and capacity constraints, GAVI and the Global Fund could rethink their roles as mainly national government counterparts to work directly with sub-national governments and non-governmental organizations to increase intervention coverage among the poor – or create new civil society accountability mechanisms that ask bigger questions about why, if a country has the financial means, its government is not delivering for the poor.

GAVI has a civil society window that provides limited cash-based support to CSO, but does not enable these groups to directly provide vaccines. Yet much successful work in fragile states such as Afghanistan, Cambodia, Haiti, Liberia and elsewhere has been accomplished through the performance-based contracting of non-governmental providers.

The Global Fund has experimented with funding to civil society organizations, with mixed success. A grant to China was frozen because of corruption among implementing organizations – although this freeze was recently lifted. Grants to organizations in Russia for prevention and care of HIV among intravenous drug users has failed to leverage government support to scale up. On the other hand, in Ukraine, grants that have been targeted towards civil society organizations were deemed to be performing well and have leveraged government response.

5. CONCLUSIONS

The distribution of global poverty and disease has changed. Global health agencies will need to adjust their outlook to remain effective, looking at their approaches to eligibility, partnerships and staffing to run more complex and highly co-financed MIC programs.

A worry among donors has been moral hazard. Based on the fungibility of aid with other sources of funding of the public budget (Lu et al 2010), there is the risk that providing aid financing to middle-incomes will decrease their own spending on health. However, it is important to recognize that we are experiencing the counterfactual situation today; low and under-investment in cost-effective interventions to eliminate infectious diseases as problems of public health significance. This reality argues for implementation and evaluation of the four strategies, with a focus on leveraging public budgets. While remaining vigilant for moral hazard, graduation should be based on objectives achieved; such as increases in full immunization rate or decreases in vaccine preventable disease burden, not the passing of an arbitrary income per capita threshold.

In sum, global health funders are thus at a crossroads. In one direction, they could maintain the current model, phasing out countries and allocating funds based on average per capita income. This appeals to financially strapped donors, but fails to meet the global public health objectives that were the rationale for their creation. In another direction, global health donors could develop targeted engagement with MIC, using some of the strategies suggested here.

REFERENCES

- AllAfrica.com (2011) 'Global Fund Freezes Disbursements to Nigerian Principal Recipient', July 25, 2011. <http://allafrica.com/stories/201107270836.html> Accessed August 2011.
- Berman, P., Ahuja, R., Tandon, A., Sparkes, S., Gottret, P. (2010) "Government Health Financing in India: Challenges in Achieving Ambitious Goals" HNP Discussion Paper, World Bank: Washington, DC
- Birdsall, N. and Leo, B. (2011), 'Find Me the Money: Financing Climate and Other Global Public Goods', *Center for Global Development, Working Paper 248*. CGD: Washington, DC
- Birdsall, N., Mahgoub, A. and Savedoff, W. D. (2010), 'Cash on Delivery: A New Approach to Foreign Aid', *Center for Global Development Brief*. CGD: Washington, DC
- Bloom, D., Canning, D. Weston, M. (2005) The Value of Vaccination. http://www.sabin.org/files/attachment/value_vaccination_bloom_canning_weston.pdf Accessed August 2011.
- Bornemisza, O., Bridge, J., Olszak-Olszewski, M., Sakvarelidze, G. and Lazarus, J. (2010) 'Health aid governance in fragile states: The Global Fund experience.' *Global Health Governance*, 4(1), p. 1-18
- Center for Global Development (2007) 'A Risky Business: Saving money and improving global health through better demand forecasts', Center for Global Development Global Health Forecasting Working Group. CGD: Washington, DC
- Chandy, L. and Gertz, G. (2011) *Poverty in Numbers: The Changing State of Global Poverty from 2005 to 2015*. Brookings Institute: Washington, D.C
- The Economist (2011) Aid 2.0. <http://www.economist.com/node/21525899> Accessed 13 August 2011.
- Gatt, B. and Gale, J. (2011) 'Glaxo, Merck Support Effort to Boost Vaccine Access', *Bloomberg*, June 6, 2011. <http://www.bloomberg.com/news/2011-06-05/drugmakers-pledge-to-supply-vaccines-at-reduced-prices-to-gavi.html> Accessed August 2011.
- GAVI Alliance (2011), 'Country Eligibility Policy' <http://www.gavialliance.org/about/governance/programme-policies/country-eligibility> Accessed August 2011.
- Glassman, A. and Sumner, A. (2011) 'Vaccines need to reach the poor in middle-income countries too', *Guardian Global Development Blog*, <http://www.guardian.co.uk/global-development/poverty-matters/2011/jun/13/vaccines-need-to-reach-middle-income-countries-gavi> Accessed June 2011.
- GlaxoSmithKline (2010) 'Pool for Open Innovation Against Neglected Tropical Diseases.' <http://www.gsk.com/collaborations/patentpool.htm> Accessed July 2011.
- Hafner, T. and Popp, D. (2011) 'China and India as Suppliers of Affordable Medicines to Developing Countries' NBER Working Papers 17249, National Bureau of Economic Research, Inc.
- IMF (2011) *World Economic Outlook Database, 2011*. International Monetary Fund: Washington, DC.
- Kanbur, R. and Sumner, A. (2011) 'Poor Countries or Poor People? Development Assistance and The New Geography of Global Poverty', *Charles H. Dyson School of*

- Applied Economics and Management Working Paper*, Ithaca, NY: Cornell University
- Klepac, P., Laxminarayan, R., Grenfell, B. T. (2011) ‘Synthesizing epidemiological and economic optima for control of immunizing infections.’ *Proceedings of the National Academy of Sciences*, Berkeley, California.
- Levine, O. S, Bloom, D. E., Cherian, T., de Quadros, C., Sow, S., Wecker, J., Duclos, P. and Greenwood, B. (2011) “The future of immunisation policy, implementation, and financing” *The Lancet*, 378 (9789), p.439-448
- Lu, C., Schneider, M.T, Gubbins, P., Leach-Kemon, K., Jamison, D. and Murray, C. (2010) ‘Public financing of health in developing countries: a cross-national systematic analysis.’ *The Lancet* 375 (9723), p1375-1387
- Makinen, M (2011), ‘Obstacles to new vaccine adoption in LMICs’, *Synthesis report, Results in Development Institute* Retrieved from:
http://www.who.int/immunization_financing/analyses/Obstacles_to_New_Vaccine_Adoption_in_LMICs.pdf Accessed July 2011.
- Maxwell, S. (2011) Is vaccination good economics as well as good politics? *Simon Maxwell: Bringing Research & Policy in International Development*.
<http://www.simonmaxwell.eu/blog/is-vaccination-good-economics-as-well-as-good-politics.html>. Accessed October 2011
- Medicines Patent Pool. <http://www.medicinespatentpool.org/> Accessed August 2011.
- Medicines Transparency Alliance. <http://www.medicinestransparency.org/> Accessed August 2011.
- Millennium Challenge Corporation. ‘Selection Criteria’,
<http://www.mcc.gov/pages/selection> Accessed August 2011.
- Molyneux, D.H., Hopkins D.R., Zagaria N. (2004), ‘Disease eradication, elimination and control: the need for accurate and consistent usage’. *Trends Parasitol*, 20(8), p347-51
- Moss, T. and Leo, B. (2011) ‘IDA at 65: Heading Toward Retirement or a Fragile Lease on Life?’ *Center for Global Development, Working Paper 246*. CGD: Washington, DC
- O’Connor, L. and Moen, C. (2011) ‘DR Congo girds up for polio fight.’
<http://www.polioeradication.org/Mediaram/NewsletterPolioNews/No37Quarter122011.aspx#Dr>. Accessed August 2011.
- OECD (2011) *OECD CRS Database*. OECD: Paris.
- Ozawa, S., Stack, M. L., Bishal, D. M., Mirelman, A., Friberg, I. K., Niessen, L., Walker, D.G., Levine, O. S. (2011) ‘During the ‘Decade of Vaccines,’ the Lives of 6.4 Million Children Valued at \$231 Billion Could Be Saved’. *Health Affairs*, 30(6), p. 1010-1020
- PAHO Revolving Fund.
http://new.paho.org/hq/index.php?option=com_content&task=view&id=1864&Itemid=2234&lang=en Accessed August 2011.
- Ravallion, M. (2010) ‘Do Poorer Countries Have Less Capacity for Redistribution?’ *Journal of Globalization and Development*, 1 (2), Article 1.
<http://www.bepress.com/jgd/vol1/iss2/art1> Accessed August 2011.
- RDI (2011) *Synthesis Report: New Vaccine Adoption in Lower-Middle-Income Countries* . Retrieved from:
http://www.who.int/immunization_financing/analyses/Obstacles_to_New_Vaccine_A

- [doption in LMICs.pdf](#) Accessed July 2011.
- Rowthorn, R. E, Laxminarayan, R.; Gilligan, C. A. (2009) 'Optimal control of epidemics in metapopulations' *Journal of the Royal Society*, March 2009
- Saxenian, H., Cornejo, S., Thorien, K., Hecht, R. and Schwalbe, N.. (2011) 'An Analysis of How the GAVI Alliance and Low-and Middle-Income Countries can Share Costs of New Vaccines', *Health Affairs*, 30(6), p. 1122-1133
- Snow, R. W., Guerra, C. A., Mutheu, J. J., Hay, S. I. (2008) 'International Funding for Malaria Control in Relation to Populations at Risk of Stable Plasmodium Falciparum Transmission', *PLoS Medicine* 5(7), e142. Retrieved from <http://www.plosmedicine.org/article/info:doi/10.1371/journal.pmed.0050142>, accessed July 2011
- Sumner, A. (2010) 'Global Poverty and the New Bottom Billion: Three-quarters of the World's Poor Live in Middle income Countries', *IDS Working Paper 349*, Brighton: IDS
- Sumner, A. (2011a) 'The New Bottom Billion: What if Most of the World's Poor Live in Middle-Income Countries?' *Center for Global Development, Policy Brief*. CGD: Washington, DC
- Sumner, A. (2011b) 'Where do the Poor live?' *An update*. IDS: Brighton.
- Sumner, A. (2011c, forthcoming) 'What is a poor country if the world's poor live in middle-income countries?' IDS: Sussex
- Sumner, A. (2011c) Tatem, A., Smith, D.L., Gething, P.W., Kabaria, C. W., Snow, R. W., Hay, S. I. (2010) 'Ranking of elimination feasibility between malaria-endemic countries', *The Lancet*, 376 (9752), p. 1579-1591
- The Center for Disease Dynamics, Economics & Policy. *Pneumococcal Modeling Project* (PneuMOD). Researchers Smith, D. L. and Megiddo, I. http://www.cddep.org/projects/pneumococcal_modeling_project_pneumod. Accessed August 2011.
- The Commonwealth Fund (2009) 'The Path to a High Performance U.S Health System: A 2020 Vision and the Policies to Pave the Way', The Commonwealth Fund Commission on a High Performance Health System. Accessed July 2011.
- The Economist (2011), 'MIFFed by misrule' <http://www.economist.com/node/18986470?frsc=dg|a> Accessed July 2011.
- The Global Fund, Annual Report (2010) <http://www.theglobalfund.org/en/library/publications/annualreports/> Accessed July 2011
- The Global Fund, *Eligibility Criteria*. <http://www.theglobalfund.org/en/application/process/eligibility/> Accessed July 2011
- The World Bank (2011) 'Nigeria Takes One More Step towards Polio Eradication' <http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/AFRICAEXT/NIGERIAEXTN/0,,contentMDK:22862346~menuPK:50003484~pagePK:2865066~piPK:2865079~theSitePK:368896,00.html> Accessed July 2011.
- UNAIDS (2010) *2011-2015 Strategy: Getting to Zero*, http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2010/JC2034_UNAIDS_Strategy_en.pdf Accessed July 2011

- UNFPA (2011) *United Nations Population Division Database*. UNPFA: New York.
- United Nations Development Programme, 'Global Public Goods'
<http://www.undp.org/globalpublicgoods/> Accessed July 2011.
- University of North Carolina, *China Health and Nutrition Survey*.
<http://www.cpc.unc.edu/projects/china> Accessed June 2011.
- WHO (2008) *World Health Organization Global Burden of Disease Database*. WHO: Geneva.
- WHO (2011) *World Health Organization Statistical Information System (WHOSIS)*. WHO: Geneva. <http://www.who.int/whosis/en/> Accessed June 2011.
- WHO (2011), 'What makes up the cost?' *World Health Organization Advanced immunization management*
https://extranet.who.int/aim_elearning/en/finance/market/market/factors/2.html
Accessed July 2011.
- WHO, *New and under-utilized vaccines implementation (NUVI)*'
http://www.who.int/nuvi/2008_meeting_summary_LMICs/en/index.html. 2008
Accessed June 2011.
- Yadav, P. (2010) *Differential pricing for pharmaceuticals*, DFID: London.
<http://www.dfid.gov.uk/Documents/publications1/prd/diff-pricing-pharma.pdf>.
Accessed August 2011.
- Yothasamut, J., Putchong, C., Sirisamutr, T., Teerawattananon, Y., Tantivess, S. (2010)
'Scaling up cervical cancer screening in the midst of human papillomavirus vaccination
advocacy in Thailand.' *Health Intervention and Technology Assessment Program*, retrieved from:
http://www.hitap.net/backoffice/report/reports_display2_en.php?id=268 Accessed
July 2011

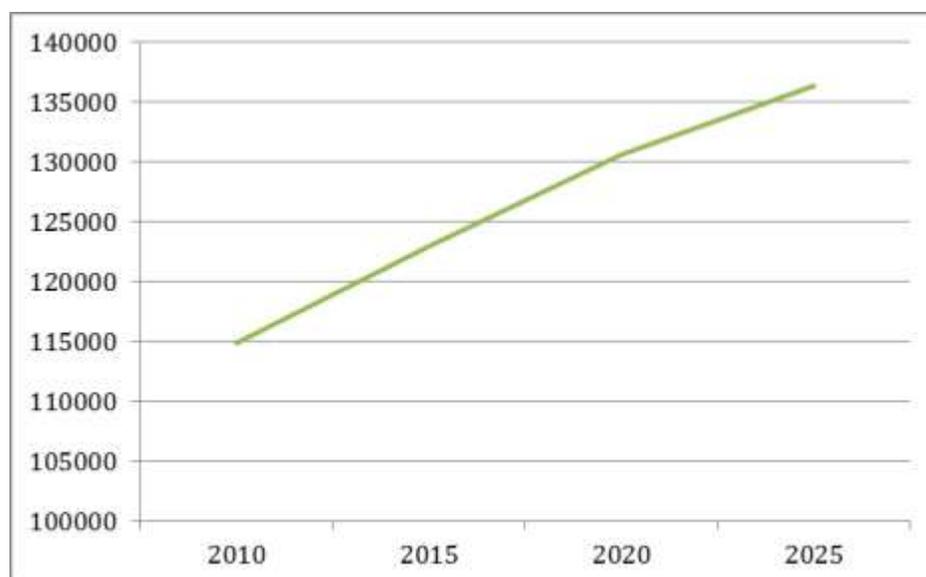
Annex

Table A.1. Income groups and unvaccinated children

| Income Group | Population under 1 year | | | Percentage of unvaccinated children | | |
|---------------------|-------------------------|-------------|-------------|-------------------------------------|-----------|-----------|
| | 1995-2000 | 2000-2005 | 2005-2010 | 1995-2000 | 2000-2005 | 2005-2010 |
| High income | 12,291,397 | 12,191,928 | 12,456,729 | 3.00% | 2.17% | 2.08% |
| Low income | 19,912,420 | 21,316,118 | 22,822,768 | 22.60% | 20.95% | 17.28% |
| Lower middle income | 28,415,452 | 29,917,254 | 30,466,497 | 29.91% | 31.06% | 43.34% |
| Upper middle income | 16,292,047 | 16,339,442 | 16,118,425 | 7.08% | 4.95% | 4.14% |
| China and India | 43,911,026 | 42,409,224 | 41,859,980 | 37.41% | 40.87% | 33.15% |
| Total | 120,822,341 | 121,820,365 | 124,158,821 | | | |

Source UNFPA World Population Data (2011); WHOSIS (2011)

Graph A.1. Population aged 0-4 in GAVI eligible LIC, thousands



Source: UNFPA World Population Estimates, 2011

Table A.2. Countries graduating from GAVI, according to income forecasts, and population aged 0-4 (thousands)

| | 2010 | 2015 | 2020 | Graduates in |
|-----------------------|---------------|---------------|---------------|-------------------------|
| Cote d'Ivoire | 2969 | 3154 | 3361 | 2020 |
| India | 127979 | 127332 | 125290 | 2015 |
| Kenya | 6664 | 7460 | 7986 | 2020 |
| Lao | 683 | 668 | 665 | 2018 |
| Lesotho | 274 | 281 | 281 | 2019 |
| Nigeria | 26569 | 29669 | 32762 | 2012 |
| Papua New Guinea | 962 | 999 | 1046 | 2019 |
| Sao Tome and Principe | 23 | 24 | 25 | 2015 |
| Solomon Islands | 80 | 84 | 88 | 2014 |
| Sudan | 6391 | 6868 | 7300 | 2011 |
| Uzbekistan | 2738 | 2783 | 2751 | 2012 |
| Vietnam | 7186 | 7022 | 6526 | 2014 |
| Yemen | 4057 | 4603 | 4926 | 2018 |
| Zambia | 2412 | 2966 | 3492 | 2015 |
| TOTAL | 188987 | 193913 | 196499 | |

Source: UNFPA World Population Estimates, 2011; Income forecasts from IMF World Economic Outlook