

Global Support for New Vaccine Implementation in Middle-Income Countries

Miloud Kaddar^a, Sarah Schmitt^b, Marty Makinen^c, Julie Milstien^d

^aCorresponding Author

World Health Organization
20 Avenue Appia
1211 Geneva 27, Switzerland
Telephone: +41 22 791 1436
Email: kaddarm@who.int

^bWHO Consultant

World Health Organization
20 Avenue Appia
1211 Geneva 27, Switzerland
Telephone: +41 78 838 4573
Email: sarahlschmitt@hotmail.com

^cResults for Development Institute

1100 15th St NW, Suite 400
Washington, DC 20005, USA
Telephone: +1-202-470-5724
Email: mmakinen@resultsfordevelopment.org

^dUniversity of Maryland School of Medicine

3 bis rue des Coronilles Batiment C
34070 Montpellier, France
Telephone: +334 6706 5779
Email: milstien@medicine.umaryland.edu

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ABSTRACT

Middle-income countries (MICs) as a group are not only characterized by a wide range of gross national income (GNI) per capita (US\$1,026 to \$12,475), but also by diversity in size, geography, governance, and infrastructure. They include the largest and smallest countries of the world—including 16 landlocked developing countries, 27 small island developing states, and 17 least developed countries—and have a significant diversity in burden of vaccine-preventable diseases. Given the growth in the number of MICs and their considerable domestic income disparities, they are now home to the greatest proportion of the world's poor, having more inhabitants below the poverty line than low-income countries (LICs). However, they have little or no access to external funding for the implementation of new vaccines, nor are they benefiting from an enabling global environment. The MICs are thus not sustainably introducing new life-saving vaccines at the same rate as donor-funded LICs or wealthier countries. The global community, through World Health Assembly resolutions and the inclusion of MIC issues in several recent studies and important documents—including the Global Vaccine Action Plan (GVAP) for the Decade of Vaccines—has acknowledged the sub-optimal situations in some MICs and is actively seeking to enhance the situation by expanding support to these countries. This report documents some of the activities already going on in a subset of MICs, including strengthening of national regulatory authorities and national immunization technical advisory groups, and development of comprehensive multi-year plans. However, some additional tools developed for LICs could prove useful to MICs and thus should be adapted for use by them. In addition, new approaches need to be developed to support MIC-specific needs. It is clear that no one solution will address the needs of this diverse group. We suggest tailored interventions in the four categories of evidence and capacity-building, policy and advocacy, financing, and procurement and supply chain. For MICs to have comparable rates of introduction as other wealthier countries and to contribute to the global fight against vaccine-preventable diseases, global partners must implement a coordinated and pragmatic intervention strategy in accord with their competitive advantage. This will require political will, joint planning, and additional modest funding.

INTRODUCTION

Middle-income countries (MICs)¹ determined by the World Bank classification based on gross national income (GNI) per capita, are more than ever on the global public health agenda because 1) the number of low-income countries (LICs) is declining, 2) most of those living in poverty now reside in the 111 MICs, 3) these countries have a slower uptake of new and priority vaccines against diseases of public health importance, and 4) the prices available to MICs for new vaccines differ significantly and may affect the rate of new vaccine introduction in some cases.

Since 2000, the GAVI Alliance has provided effective support to poorer countries, including 40 of the 111 MICs, to assist them with improving immunization infrastructure and introduce these new vaccines. Eligible countries pay only a fraction of the GAVI price for new vaccines obtained by the UNICEF Supply Division (SD) as a co-financing amount to complement GAVI's support.

Countries with a per capita GNI less than \$1,000 were eligible for GAVI support from its start to 2011, when the threshold was raised to \$1,500. Countries with a per capita GNI that rises above the threshold lose eligibility for additional GAVI support (and are referred to as "graduating countries"). Of the 111 MICs, 3 MICs have already graduated and 16 more are graduating in 2015 and will need continued assistance in the transition phase to immunization self-sufficiency.

The focus of donors and activities of global partners on the poorest countries with little extension to the MICs poses equity and ethical questions. There are several additional reasons why it makes good public health sense to address the uptake of new vaccines in MICs:

1. Public health impact: failure to introduce priority vaccines leaves these countries vulnerable to infectious diseases which can then threaten neighboring countries even if they have been able to begin immunization.
2. Immunization equity: with the changes in economic growth rates and levels leading to the emergence of a "new bottom billion" [1] in MICs, the poorest populations are again losing out.
3. A healthy vaccine market: MICs could provide a large stable demand volume for vaccine supply promoting competition and a healthy vaccine market to the benefit of both recipient countries and suppliers. Because of the competing priorities, MICs are burdened fiscally by the vaccine prices paid by high-income countries and do not have the access to the lower prices paid by LICs and donors. A more rapid uptake of new vaccines in MICs will increase the predictability of demand and level of funding available and, in the case of pooled procurement, reduce transaction costs to suppliers. In combination, these two factors could make the production investment less risky.
4. The threat of inappropriate decision-making: because of inadequate information, capacity, or support, MICs may (1) wait to adopt and put their populations at avoidable risk or (2) choose to adopt but pay unsustainably high prices to access these new vaccines and then could be forced to discontinue or reconsider their use, with deleterious consequences for the vaccine market and the health of their populations.

¹ Abbreviations: cMYP = comprehensive, multi-year plan for immunization, EMRO = WHO Eastern Mediterranean Regional Office, GNI = gross national income, GVAP = Global Vaccine Action Plan, Hib = *Haemophilus influenzae* type B, HPV = human papillomavirus, LIC = low-income country, LMIC = lower-middle-income country, MIC = middle-income country, NRA = national regulatory agency, ODA = official development assistance, PAHO = Pan American Health Organization, PCV = pneumococcal conjugate vaccine, R4D = Results for Development Institute, RF = revolving fund, RV = rotavirus vaccine, SAGE = strategic advisory group of experts on immunization, SIVAC = Supporting National Independent Immunization and Vaccine Advisory Committees, UMIC = upper-middle-income country, UNICEF SD = United Nations Children's Fund Supply Division, V3P = Vaccine Product, Price, and Procurement Project, WHA = World Health Assembly, WHO = World Health Organization.

Many partners are now beginning to intervene, but the vision so far has been limited. A coordinated effort is needed to accelerate sustainable new vaccine implementation by MICs.

The objective of this paper, one of the companion papers to the Global Vaccine Action Plan (GVAP) [2], is to bring attention to this issue. Section 1 deals with the MICs, who they are, and why they are important; Section 2 considers actions taken to date at the global level as part of this focus on MICs; Section 3 describes new vaccine implementation in MICs; Section 4 details specific partner initiatives to gain information and provide support to MICs; and Section 5 provides a way forward to a coordinated global immunization policy for MICs.

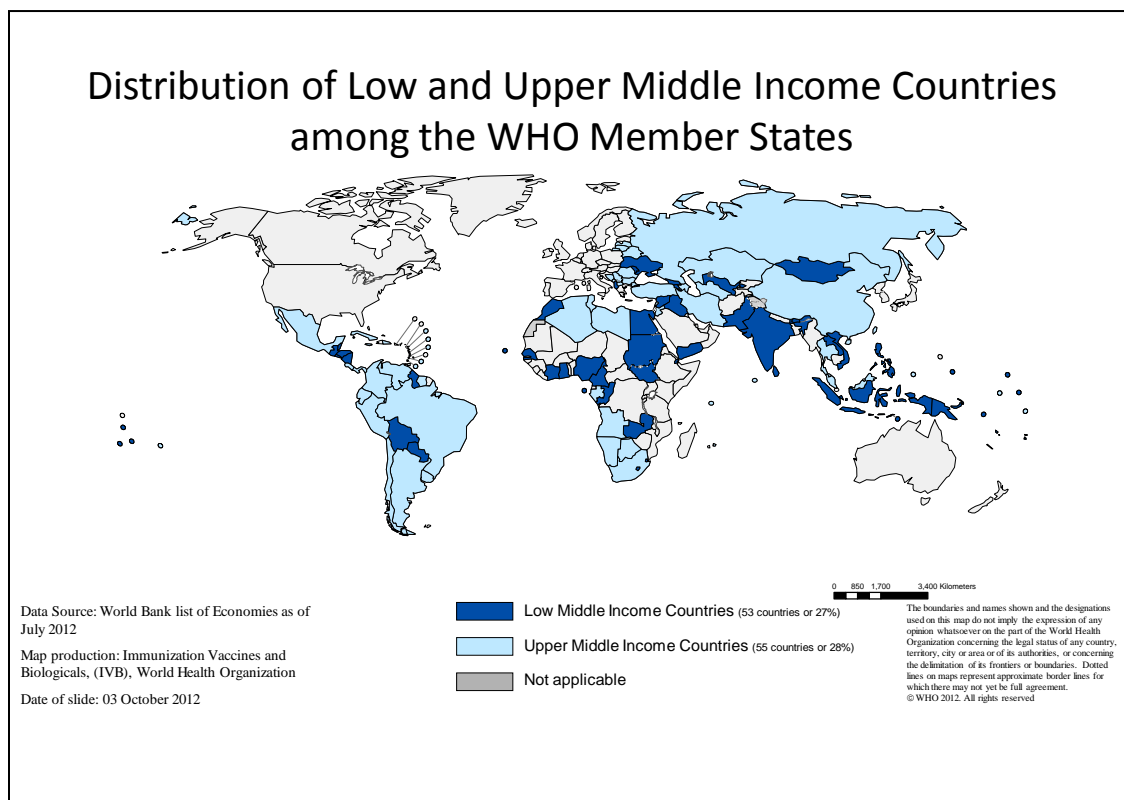
1. THE MIDDLE-INCOME COUNTRIES

Who are the middle-income countries?

The World Bank classifies 111 countries in all regions of the world as lower- (55) or upper- (56) middle-income countries (LMICs or UMICs). Selected data on the MICs (the LMICs and UMICs grouped together—a formulation that we use throughout this paper) are shown in Annex 1. As of July 1, 2012, the World Bank income classifications by GNI per capita are as follows:

- Lower-middle-income: \$1,026 to \$4,035.
- Upper-middle-income: \$4,036 to \$12,475.

Figure 1. World map highlighting location of middle-income countries², 2012.



² Source: <http://data.worldbank.org/data-catalog/GNI-per-capita-Atlas-and-PPP-table>

It is of note that:

- GNI figures for some countries are estimated and allocated to classification of LMICs or UMICs on this basis.
- The World Bank classifies only countries with a population greater than 30,000.
- There are discrepancies in the number of countries and availability of data between the World Bank and United Nations organizations.

Where possible, all available data have been included and referenced.

Basic data about the MICs compared to LICs are shown in Table 1. The MICs have a population of about 5 billion compared to about 0.8 billion in LICs, a mean GNI per capita of \$6,751 and a life expectancy of 69 years in 2010, compared to \$302 and 56 years in LICs. LICs receive official development assistance (ODA) equal to 10% of their GNI; LMICs receive ODA equal to 1% of their GNI, and UMICs receive no ODA at all.

Table 1. Summary of characteristics of lower- and upper-middle-income countries as subsets of total middle-income countries and compared to low-income countries³

Item	Year	MIC	UMIC	LMIC	LIC
Total population (millions)	2010	4,970	2,452	2,518	796
GNI per capita (US\$)	2010	\$6,751 (\$1,026- \$12,475)	\$6,247 (\$4,036- \$12,475)	\$1,716 (\$1,026- \$4,035)	\$302 (under \$1026)
Life expectancy at birth (years)	2010	69	73	65	56
Infant mortality rate (per 1,000 live births)	2010	27	16	39	70
Under-five mortality rate (per 1,000 live births)	2010	35	19	52	109
Official development assistance/GDP (%)	2010	0	0	1	10
Population living on less than \$2 per day (%)	2008	10.6	5.2	15.8	67.7
Population living on less than \$2 per day (millions)	2008	526	128	398	539
Population living on less than \$1.25 per day (%)	2008	4.3	1.8	6.7	41.9
Population living on less than \$1.25 per day (millions)	2008	213	44	169	333
Landlocked developing countries		16	5	11	
Small island developing states		25	13	12	
Birth cohort (millions)	2010	74.7	34.3	60.4	26.3
DTP3 coverage (%)	2009	89	91	86	78
Total health expenditure per capita (US\$)	2009	\$295	\$471	\$120	\$29
Government health expenditure as share of total government expenditure (%)	2009	10.8	11.5	10.0	9.6

Despite MICs having a lower poverty rate (10.5% of MIC populations lived on less than \$2 per day in 2008, compared to 67.7% of LIC populations) [3], they had nearly as many poor people within their populations as did LICs in 2008. Since 2008 more poor people live in MICs than in LICs, a trend that is projected to increase [1], while the numbers of LICs are projected to decrease as incomes grow, from 63 in 2000 to 20 in 2025 [4]. In particular, five large MICs—Pakistan, India, Nigeria, China, and Indonesia—are home to 60% of the world's poor [1].

Although grouped as MICs this set of countries is very diverse in terms of size, economy, health status, governance, infrastructure, and development [5]. The highest-income MICs have more than ten times the GNI per capita than the lowest-income MICs (for example, compare Chile at \$12,000 to Vietnam at

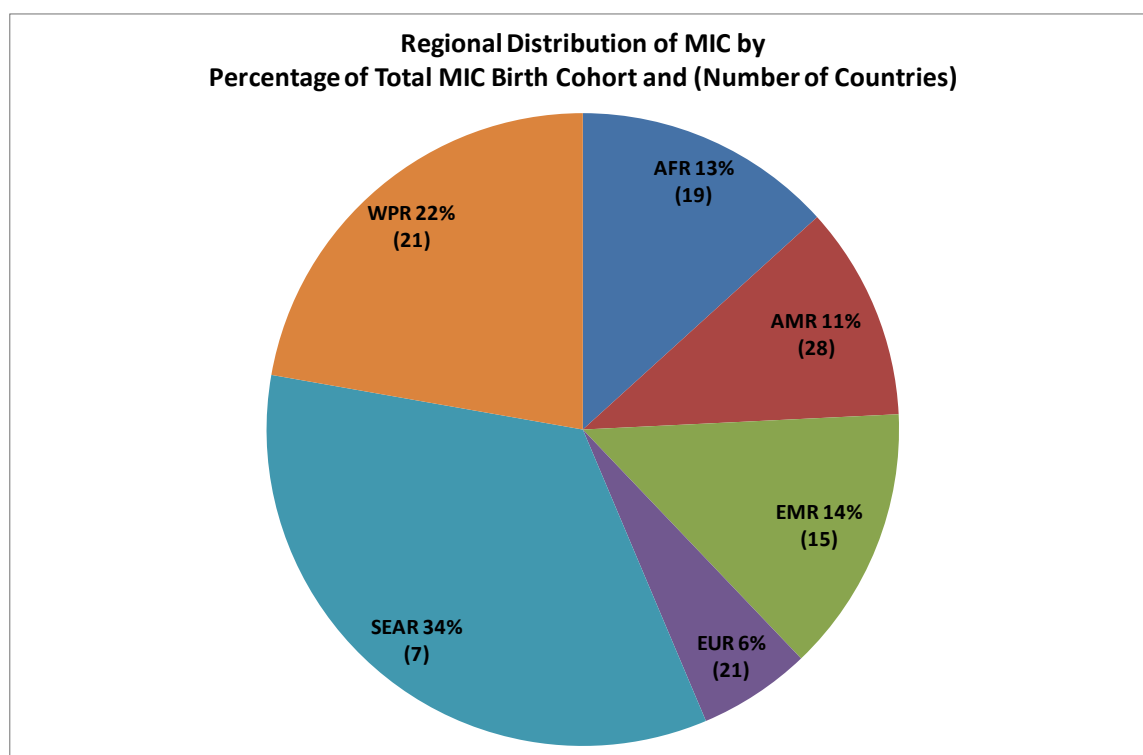
³ Sources : Figures were obtained using the database at <http://iresearch.worldbank.org/PovcalNet/index.htm>, accessed 27 July, 2012 or http://www.who.int/immunization_monitoring/data/en/, accessed 29 July, 2012

\$1,300) and similarly varying health indicators and disease burdens (for example, compare Malaysia's infant mortality rate of 5 to Egypt's 19 and Congo Republic's 61). Some UMICs even have begun providing development assistance to LICs. However some MICs face similar issues to LICs and the distinction based solely on GNI separating the two groups does not indicate an ability to reduce social disparities and to sustainably implement new vaccines.

In terms of potential vaccine uptake, the MICs 2011 birth cohort (approximately 95 million) was almost three times that in the LICs (due for the most part to the graduation of large countries such as India, China, Nigeria, and Indonesia to the MIC group). In 2009, the MICs reached immunization coverage for the third dose of DTP vaccine (DTP3) of 89% compared to 78% in LICs [6].

Figure 2 shows the geographical distribution of the MICs and LMICs in terms of birth cohort and number of countries in WHO regions (Africa, Americas, Eastern Mediterranean, Europe, South East Asia, and Western Pacific). The Americas Region has the most MICs (28) while the birth cohort of the seven MICs in the South East Asian region is the largest with 34% of the total MIC birth cohort.

Figure 2. Regional distribution of middle-income countries in WHO regions by birth cohort and number of countries.⁴



Abbreviations: WPR = Western Pacific Region, AFR = Africa Region, AMR = Americas Region, EMR = Eastern Mediterranean Region, EUR = Europe Region, SEAR = South-East Asia Region.

⁴ Birth Cohort Data from WHO/UNICEF JRF 2012

Why should the global community be considering middle-income countries?

Those MICs with a GNI per capita of less than \$1,520 (adjusted from \$1,500 due to inflation in July 2012) are eligible for assistance with the introduction of new vaccines and other forms of support from the GAVI Alliance. Those countries that begin with a GNI per capita of less than \$1,520 benefit from economic growth that pushes them above this threshold but they lose their eligibility for GAVI assistance. Nevertheless, these GAVI-graduating countries still have the opportunity to buy some priority vaccines at special GAVI prices. Prior to graduation they pay an increasing percentage of this price (co-financing). Post-graduation they will have access to pay the full GAVI price, while some of the 71 MICs that have never been eligible for GAVI but have similar per capita incomes must pay higher prices (i.e., market prices).

Some of the GAVI graduating countries that have had rapid economic growth have higher per capita GNI than a number of countries that were never eligible for GAVI support. Twenty-eight countries that have never been eligible for GAVI support have a GNI lower than the highest GNI graduating country (Azerbaijan had a \$5,290 per capita GNI in 2011).

In addition, as shown in Table 1, other forms of ODA beyond immunizations also drop off quickly once the MIC threshold is passed, so the higher incomes earned can be, in some cases, counterbalanced by lost external assistance. MICs not eligible for GAVI assistance get almost no specific technical and financial assistance for immunization. Donors and technical agencies see this group of countries having the technical capabilities to manage their immunization programs well and sufficient financial resources to pay for vaccines and related costs of delivery. The MICs national immunization programs overall are managed well, without external help, and are quite successful in reaching high coverage with traditional vaccines, but this masks weaknesses in the capability to assess whether, how, and when to add new vaccines to the program. MICs have no problem in funding the traditional vaccine programs, but the addition of newer vaccines, especially when purchasing them on the open global market, means that large increments of funding must be mobilized for vaccines compared to the amounts needed for traditional vaccines. However, the increments are small relative to overall health budgets in MICs. Thus, MICs do not generally require financial help to adopt new vaccines but are in need of technical assistance and appropriate information given the increasing complexity and sophistication of the vaccine pipeline.

Of the 111 MICs, 41 have benefited from eligibility for funding support from the GAVI Alliance of which 36 are currently still receiving support and 21 can apply for new programmes. These 21 countries equate to 49% of the total birth cohort of the MICs and include large population countries such as India and Nigeria. Figure 3 below indicates the GAVI eligibility of the MICs in terms of percentage of total MIC birth cohort and number of countries.

Figure 3. GAVI eligibility status⁵ in middle-income countries⁶, 2012.

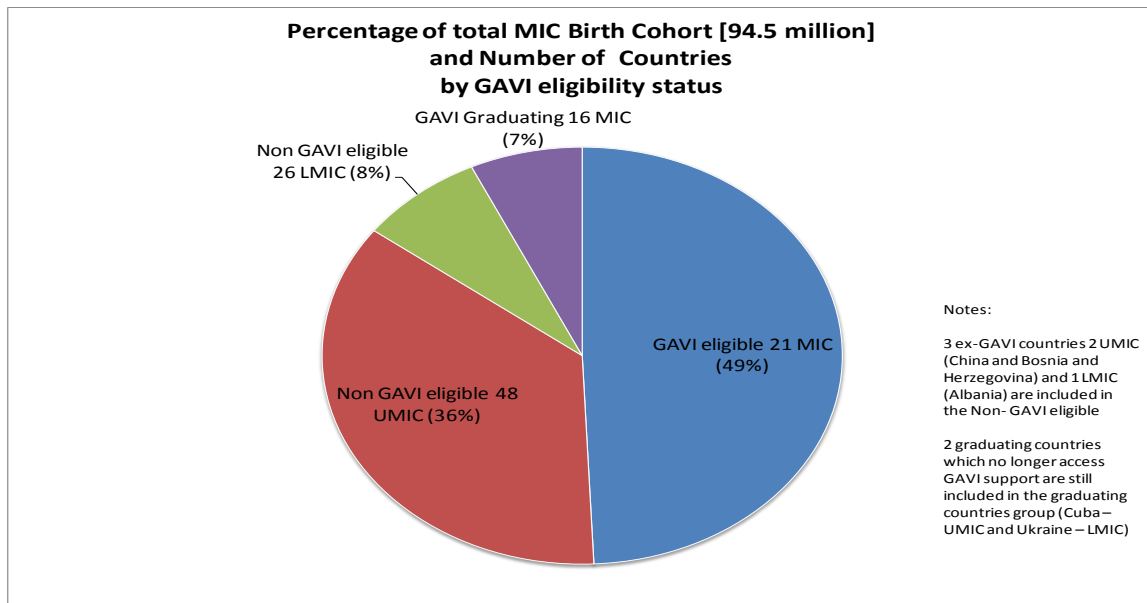
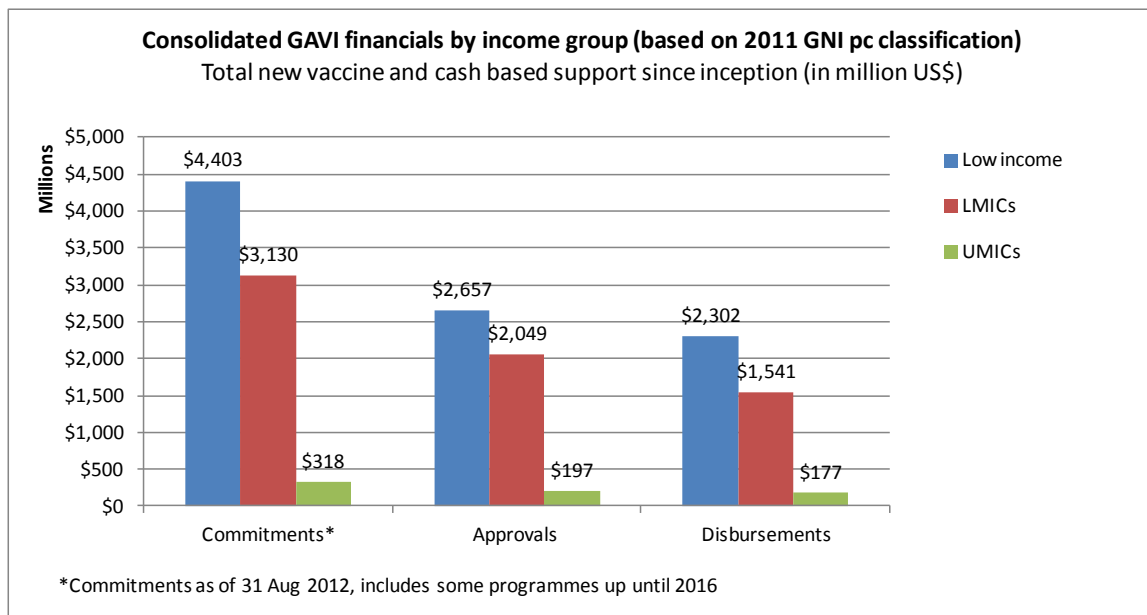


Figure 4 indicates the funds committed, approved, and disbursed by GAVI to eligible countries since 2000 for new vaccine support and cash-based support.

Figure 4. GAVI financial commitments, approvals, and disbursements by lower-income, lower-middle-income, and upper-middle-income countries⁷.



⁵ Source: <http://www.gavialliance.org/support/apply/countries-eligible-for-support/> accessed June 2012

⁶ Source: WHO Regional Updates, WHO/UNICEF Joint Reporting Form 2012

Source: <http://data.worldbank.org/data-catalog/GNI-per-capita-Atlas-and-PPP-table>

⁷ GAVI Secretariat Data provided September 2012

GAVI-graduating countries are a priority group for activities by GAVI Alliance partners. These countries will progressively take over the funding of vaccines with, in principle, domestic resources replacing the subsidies provided through GAVI support. GAVI and its partners are working together to individually assess the needs of these countries during and after graduation to develop transition plans and secure the immunization gains made during the period of GAVI eligibility. These countries include a range of GNI per capita from \$1,970 to \$5,290, and cover a total population of approximately 383 million with a birth cohort of 7.1 million.

Table 2. GAVI-graduating countries, 2012

Country	World Bank Category ²	GNI 2011 ²	WHO Region	UN Population Estimate 2010 (000) ³	Birth Cohort ⁴	Priority Activity Country 2012
Angola	UMIC	4,060	AFR	19,082	803,274	YES
Armenia	LMIC	3,360	EUR	3,092	47,148	
Azerbaijan	UMIC	5,290	EUR	9,188	183,787	
Bhutan	LMIC	2,070	SEAR	726	14,832	YES
Bolivia	LMIC	2,040	AMR	9,930	264,140	
Congo, Republic	LMIC	2,270	AFR	4,043	144,632	YES
Cuba ^{1,5}	UMIC	No Data	AMR	11,258	109,642	
Georgia	LMIC	2,860	EUR	4,352	50,850	YES
Guyana ¹	LMIC	No Data	AMR	754	13,466	
Honduras	LMIC	1,970	AMR	7,601	204,512	
Indonesia	LMIC	2,940	SEAR	239,871	4,331,100	
Kiribati	LMIC	2,110	WPR	100	2,047	
Moldova	LMIC	1,980	EUR	3,573	43,549	YES
Mongolia	LMIC	2,320	WPR	2,756	65,221	YES
Sri Lanka	LMIC	2,580	SEAR	20,860	373,262	
Ukraine ⁵	LMIC	3,120	EUR	45,448	494,153	

¹ Estimated WB Category without GNI Listed² <http://data.worldbank.org/data-catalog/GNI-per-capita-Atlas-and-PPP-table>.

³ <http://esa.un.org/unpd/wpp/Excel-Data/population.htm>.

⁴ WHO/UNICEF Joint Reporting Form Data 2011.

⁵ No longer accessing GAVI financial support for new vaccines.

All 111 MICs are listed in Annex 1 which shows some key official data points including WHO region, GNI status, GAVI eligibility, birth cohort, and current partner projects conducted in each country.

The characteristics of the six priority countries selected by the GAVI immunization financing and sustainability task team for assessment and transition planning in 2012 (indicated in Table 2) have demonstrated that the needs in relation to technical and financial preparedness for graduation differ significantly between the countries.

The infant and under-five mortality rates (Table 1) in MICs are lower than in LICs, but those in the LMICs in particular still lead to concern about the health of young children in these countries. To address child mortality, MICs have had—in addition to other health interventions—strong immunization programs with DTP3 coverage that is at or near 90% using the “traditional” vaccines. LMICs have been slower to adopt new vaccines, such as *Haemophilus influenzae* type b (Hib)-containing, pneumococcal conjugate (PCV), or rotavirus (RV) vaccines, into their national programs than either high-income countries or LICs [7]. Using a systematic analysis of global, regional, and national child mortality in 2008 [8] to provide data on the burden of disease in MICs that is preventable by RV, PCV, and Hib-containing vaccines, it is observed that pneumonia represents 18.4%, rotavirus 2.4%, and meningitis 2% of all causes of mortality for all MICs not eligible for GAVI support.

The Results for Development Institute (R4D) study [13] conducted an analysis of the rates of adoption of hepatitis B and Hib-containing vaccines by LICs, LMICs, and UMICs. The study constructed step-wise Kaplan-Meier curves on the percentage of countries in each category that had adopted each vaccine annually from the year of first adoption to 2010. Statistical tests showed the following relationships:

- LMICs and UMICs adopted hepatitis B vaccines at statistically similar rates that were about twice as fast as (and statistically different from) LICs.
- LICs and LMICs adopted Hib vaccines at statistically similar rates that were about 30% slower (statistically significant) than UMICs.

The difference in the rates of adoption indicates that LMICs adoption of Hib vaccines has been slower compared to UMICs and similar to the rate of adoption by LICs. This is a change from the pattern of adoption of hepatitis B vaccines, where LMICs kept up with UMICs and were well ahead of LICs. Thus, LMICs seem to have slowed in their adoption of Hib vaccines compared to hepatitis B vaccines.

Further data in relation to inclusion of new vaccines into national immunization schedules are provided in section 3 on new vaccine implementation.

Where the vaccines are neither publicly funded nor included in the national immunization schedule, they are available and used by small percentages (usually less than 10%) of the MIC populations mainly through private purchases.

The 74 MICs not eligible for any GAVI support must buy their vaccines on open international markets, with the exception of those 21 in the Americas Region that are able to use the Pan American Health Organization's (PAHO) Revolving Fund (RF) and the 19 that utilize UNICEF SD either partially or for all vaccine procurement.

GAVI has arranged for those 16 countries graduating from its support to continue to access some of the GAVI-eligible country prices for certain vaccines after graduation, but only for procurement made through UNICEF SD. These arrangements (as reported by GAVI Secretariat) include:

- The ability to purchase PCV under the terms and conditions of the Advance Market Commitment until 2020. Countries will therefore pay a maximum of \$3.5 per dose.
- Countries approved for support for the GlaxoSmithKline RV will continue to benefit from the current GAVI price (\$2.50 per dose for a two-dose course) after graduation.
- Countries receiving pentavalent vaccine from Crucell can access the GAVI-eligible price until 2020.
- Access to prices provided to GAVI-eligible countries through UNICEF for all products supplied by Sanofi Pasteur and its affiliated manufacturer in India, Shantha Biotech.
- For other manufacturers and vaccines, including human papillomavirus (HPV), discussions are ongoing and further price commitments by manufacturers will be communicated to countries once agreed.

Other newer vaccines available to MICs on the open market are available at a much higher price per dose than those offered to GAVI-eligible and GAVI-graduating countries. Even if MICs that never had GAVI support could obtain the GAVI price per dose for PCV as the GAVI graduating countries can, this price is much higher than the per-dose prices of traditional vaccines (typically a few cents to less than \$1 per

dose), meaning that the budgets assigned by MICs to vaccine purchases must be increased dramatically if the newer vaccines are adopted for national programs.

MICs have at least the beginnings of the bodies and procedures to make evidence-based decisions about whether and when to adopt new vaccines for their national programs, including national regulatory authorities (NRAs) for drugs and biologicals and national immunization technical advisory groups. In many instances, however, these institutions and procedures are relatively new, sometimes uncoordinated and unpracticed, so they function with uneven efficiency and speed. Further, external technical help from bilateral partners, WHO and UNICEF, abundantly offered for immunization programs in LICs and GAVI-eligible countries, is relatively absent for most MICs. The great majority of bilateral aid is provided to LICs. WHO and UNICEF tend to focus on other important issues in MICs—WHO responds to health agendas that MICs set themselves that often prioritize systems issues and emerging demands to address non-communicable diseases, and UNICEF focuses on child rights and education issues. This leaves MICs largely on their own concerning the question of adopting and sustaining newer vaccines.

2. A MIDDLE-INCOME COUNTRY FOCUS IN NEW VACCINE IMPLEMENTATION AND PRIORITIZATION OF IMMUNIZATION

The primary impetus for an MIC focus has been the concern that MICs are relatively lagging behind other income groupings in the introduction of new and priority vaccines. The one exception to lagging adoption by MICs is the Americas region which has moved forward with a package of enabling interventions in combination with high political commitment and allocation of domestic resources with successful outcomes. The Americas region does not prioritize technical assistance to its countries on the basis of GNI level [9].

In response to lagging adoption, the regions of Europe and the Eastern Mediterranean have championed the cause of MICs. In 2007, following the first global meeting on implementing new and under-utilized vaccines [10], a “WHO plan of action for new and under-utilized vaccines implementation: 2007–2010” was developed, including a specific work area to “develop an approach to assist middle income countries with new vaccines implementation.”

During its November 2008 session, the Strategic Advisory Group of Experts (SAGE) [11] advisory to the WHO Director General on immunization considered the issues raised and requested that “WHO conduct further situation analysis of financial challenges for low and middle-income countries and consultation with countries concerned and partners to distill issues to more actionable activities.” The same year, in its resolution regarding immunization, the 61st World Health Assembly (WHA) [12] requested the Director General “to collaborate with international partners, donors as well as vaccine producers to mobilize necessary resources to support low income and middle income countries with the aim of increasing supply of affordable vaccines of assured quality.”

In response to calls from the WHA and SAGE, WHO initiated, with the support of the Bill & Melinda Gates Foundation, a study on new vaccine adoption by LMICs. The study [13] was undertaken by R4D and overseen by an advisory group consisting of vaccination experts, representatives of vaccine producers, WHO, UNICEF SD, and the Gates Foundation, which assisted and provided input to the project team.

The R4D report identified barriers to new vaccine adoption by MICs and formulated recommendations for improvements to decision-making at the country, regional, and global levels under the following themes:

- Evidence and capacity-building.

- Policy and advocacy.
- Financing.
- Procurement and supply [7].

The study and its recommendations were presented to SAGE in November 2010 [14]. SAGE then made the following recommendation: “Noting the high number of poor households in lower to-middle-income countries and the need for these households to have equitable access to low-priced vaccines, SAGE supports the study’s high priority recommendations, many of which have utility beyond lower middle-income countries.” The current paper builds upon the R4D study endorsed by SAGE to try to take forward the recommended agenda for improving decision-making.

In 2012 SAGE reviewed and endorsed the Global Vaccine Action Plan (GVAP) elaborated for the Decade of Vaccines [2], which was endorsed during the May 2012 WHA. The GVAP states, in Paragraph 72 that:

Innovations [innovative pricing and procurement mechanisms] will be particularly important for those lower-middle-income countries that do not have access to the PAHO, UNICEF and GAVI Alliance pricing and procurement mechanisms. Mechanisms to explore include differential pricing using new approaches to define price tiers and pooled negotiation or procurement methods for lower-middle-income countries. . . One example is the PAHO revolving fund pooled procurement and short-term credit mechanism. This and other models could be assessed and modified to best suit the needs of the lower-middle-income countries and the individual vaccine markets.

Along with these efforts, the publication of the paper identifying the new bottom billion [1] has heightened the urgency.

With this increased focus immunization partners have begun to consider the MIC issues and extend activities and projects to determine MIC-specific needs and identify possible interventions.

3. NEW VACCINE IMPLEMENTATION IN MIDDLE-INCOME COUNTRIES

Table 3 shows data on the introduction of new vaccines, specifically Hib, PCV, RV, and HPV. The data come from the WHO/UNICEF Joint Reporting Form, an annual reporting system issued to all member states collecting data on a number of immunization indicators. The data were further validated by WHO through its communications with regions and countries. These data indicate the degree of reduced implementation of new vaccines in the MICs despite the efforts made since 2007, and they illustrate the impact of GAVI eligibility and access on new vaccine implementation.

The assumptions utilized in these analyses include:

- The total MIC birth cohort of 94.5 million.
- One hundred and eight countries are included in this analysis as no data are available for West Bank and Gaza, American Samoa, and Kosovo.
- Birth cohort data are not available for South Sudan so it is included only in reference to the number of countries but not as part of the birth cohort calculations.

Table 3. New vaccine introduction status in middle-income countries, September 2012⁸

New Vaccine Introduction Status	Number of Middle-Income Countries	% of Total MIC Birth Cohort
Hib		
Introduced	96	37%
Partially introduced	4	38%
Not introduced	8	26%
PCV		
Introduced	28	14%
Partially introduced	4	2%
Not introduced	76	84%
RV		
Introduced	25	15%
Partially introduced	4	5%
Not introduced	79	80%
HPV		
Introduced	10	N/A
Partially introduced	3	N/A
Not introduced and no reported plan to introduce	67	N/A
Pilot study	12	N/A
Suspended introduction	2	N/A
Planned or interested in introducing	14	N/A

Summary of new vaccine implementation in middle-income countries, as of September 2012:

- 96 MICs, 37% of the total MIC birth cohort, have fully implemented Hib vaccine into their national immunization schedule, 32 of which have done so with GAVI support.
- 28 countries, 14% of the total MIC birth cohort, have fully implemented PCV, 6 of which have done so with GAVI support.
- 25 MICs, 15% of the total MIC birth cohort, have implemented RV, 8 of which have done so with GAVI support.
- 10 MICs have fully introduced HPV and a further 12 are currently conducting pilot studies.

Hib introduction

Ninety-six MICs have fully implemented Hib into their national immunization schedules. While commendable as a percentage of the total number of countries, these 96 countries make up only 37% of the total MIC birth cohort as several large-population countries have yet to implement (China, Indonesia, Thailand, Iran, and Egypt).

Partial introduction has begun in two GAVI-eligible countries (India and Nigeria) and two non-GAVI-eligible countries (Philippines and Belarus). These countries make up a further total of 38% of the birth cohort. Scale-up to cover all children within these countries would have a significant impact on mortality or morbidity reduction due to pneumonia and meningitis.

Of the 26% of the birth cohort (eight countries) that have yet to introduce Hib vaccine, two are GAVI eligible (Timor Leste and South Sudan), one is GAVI graduating (Indonesia), one is no longer GAVI eligible (China), and four have never been GAVI eligible (Egypt, Maldives, Iran, and Thailand). While some of these countries indicate a plan to introduce Hib, the introduction process has yet to begin.

⁸ WHO Regional Updates, WHO/UNICEF Joint Reporting Form 2011.

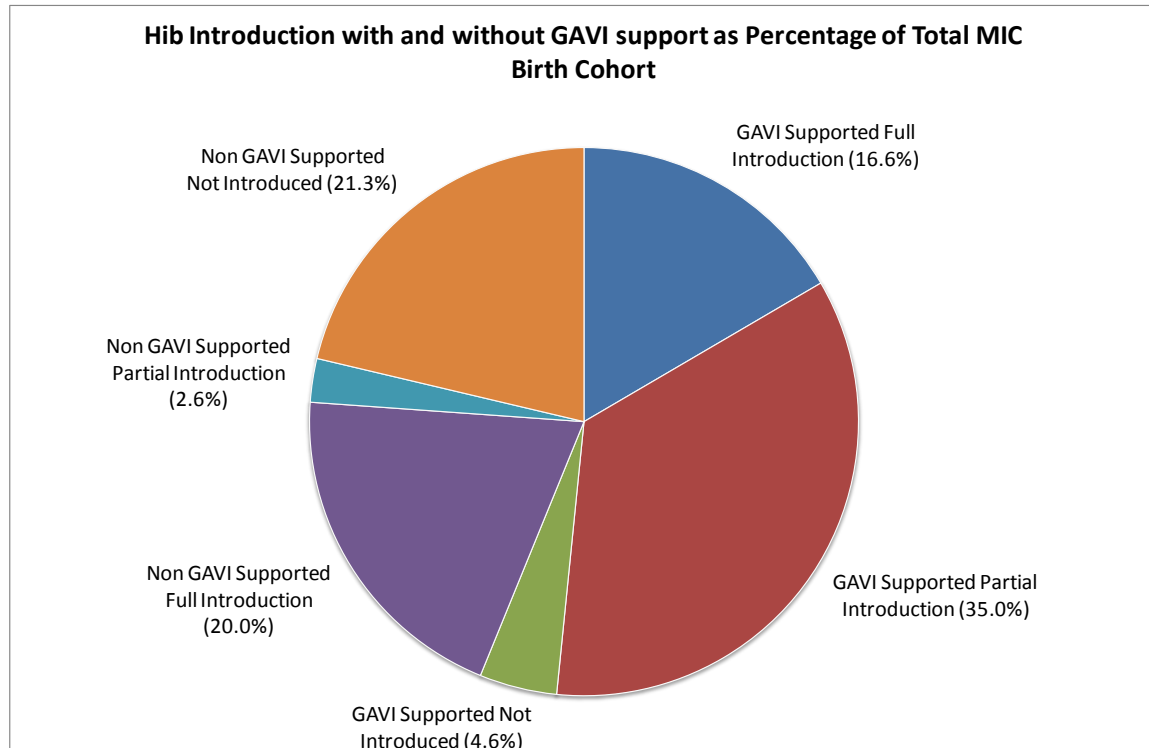
From Figure 5 below it can be seen that 17% of the birth cohort has been fully covered with assistance from GAVI for Hib introduction, a further 35% could be covered if the eligible countries continue to implement Hib, and a further 5% of the birth cohort that are currently GAVI eligible have yet to implement Hib.

All 49 MICs in the Americas and European regions have implemented or started to implement (Belarus only) Hib-containing vaccines.

Of the 43.8% of the MIC birth cohort not eligible for GAVI support:

- 20% of the MIC birth cohort is covered by the introduction of Hib.
- 2.6% of the MIC birth cohort resides in a country that has partially implemented Hib.
- 21.3% of the MIC birth cohort resides in a country which has not yet implemented Hib.

Figure 5. Hib vaccine introduction⁹ in middle-income countries, September 2012.



PCV introduction

Of the 108 countries providing data, 28 countries (14% of the total MIC birth cohort) have fully implemented PCV, and 6 countries (3% of the MIC birth cohort) have implemented PCV with GAVI support—4 of which are GAVI eligible and 2 are GAVI-graduating countries. Of the 28 countries that have implemented PCV, 14 countries are from the Americas.

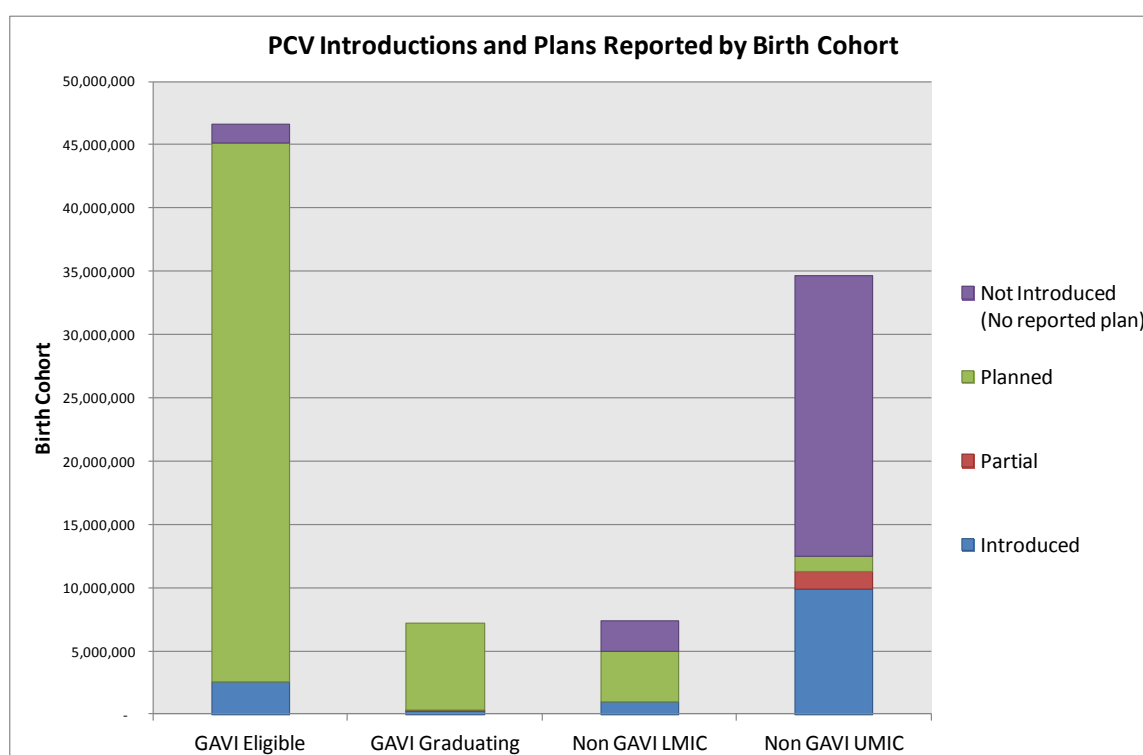
⁹ Source: WHO Regional Updates until September 2012, WHO/UNICEF Joint Reporting Form 2011

An additional 4 countries (2% of the MIC birth cohort) have partially implemented PCV. One of these is a GAVI-graduating country (Mongolia) and the remaining 3 are non-eligible (Kazakhstan, Colombia, and Dominican Republic).

A total of 76 countries (86% of the MIC birth cohort) have not yet implemented PCV. Although 39 countries (57% of the total MIC birth cohort) have indicated a plan or interest in implementing PCV in the future, 12 of these are not eligible for GAVI support (6 LMICs and 6 UMICs), 13 are GAVI-graduating countries (including Indonesia), and 14 are GAVI eligible (including India, Pakistan, and Nigeria).

The 16 GAVI-graduating countries were given the opportunity to apply for support for the implementation of PCV and RV in 2011. Most of them took up this opportunity, were approved, and have indicated plans to implement in the coming years.

Figure 6. PCV introduction¹⁰ in middle-income countries, September 2012.



RV introduction

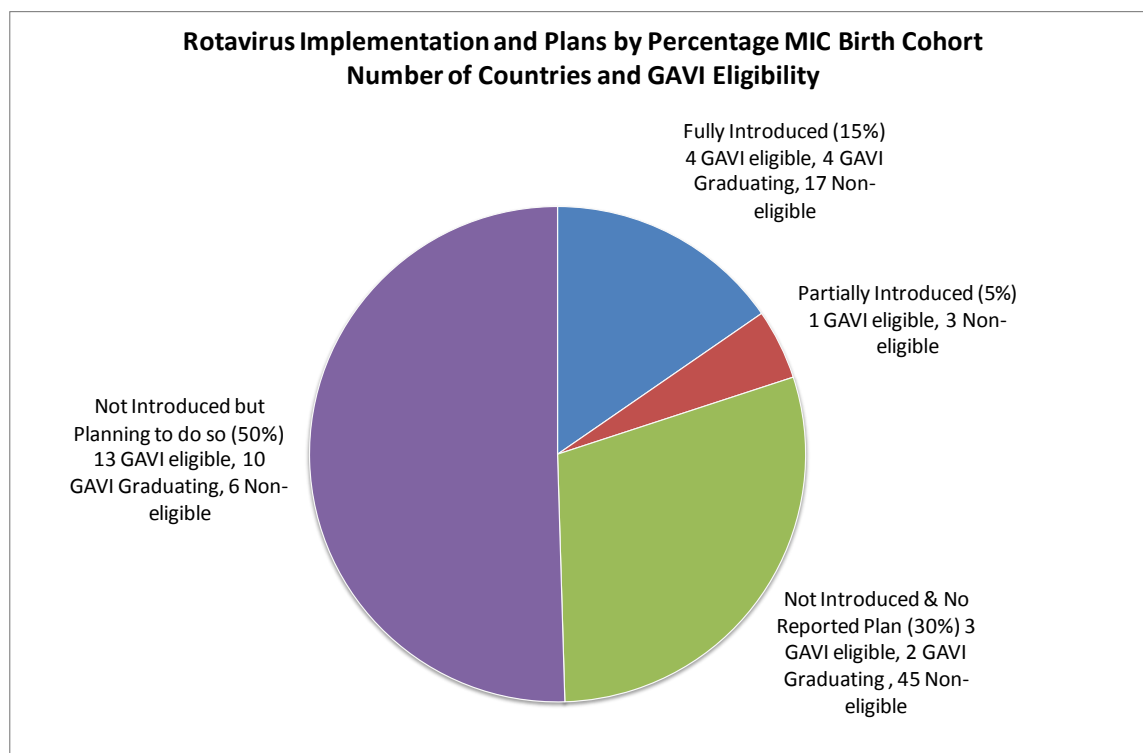
Twenty-five MICs, representing 15% of the total MIC birth cohort, have implemented RV. More than half of the countries, 14 of the 25, are from the Americas. Another 5% of the MIC birth cohort reside in four countries that have partially implemented RV; one that is GAVI eligible (Zambia), and three that are not eligible (Thailand, Philippines, and Peru).

Eighty percent of the MIC birth cohort are not currently covered by RV vaccination, however, 29 countries—making up 50% of the total MIC birth cohort—report they are planning to introduce it in the

¹⁰ Source: WHO Regional Updates until September 2012, WHO/UNICEF Joint Reporting Form 2011

future. This group is made up of 13 GAVI-eligible countries, 10 GAVI-graduating countries, and 6 non-eligible countries.

Figure 7. Rotavirus vaccine introduction¹¹ in middle-income countries, September 2012.



HPV introduction

Twelve MICs are currently conducting pilot studies for HPV. Of these, two are GAVI-graduating countries, two are not eligible, and eight are eligible.

A total of ten countries (one GAVI eligible, two graduating, and seven non-eligible) have fully introduced HPV, a further three countries (one graduating and two non-eligible) have partially implemented HPV. Two countries that implemented HPV have suspended the implementation. Nine countries have indicated plans to implement HPV in the future and a further five report being interested in implementation.

In some MICs, support for the introduction of HPV has been provided from external sources other than GAVI, such as manufacturer donations and supported program-assisted funding.

Of the 108 MICs reporting, 67 countries have not indicated any intention at this point to introduce HPV. Ten of these are GAVI eligible, eight are GAVI graduating (and are unable to apply for funding for HPV from GAVI) and 49 are not eligible for any support from GAVI.

¹¹ Source: WHO Regional Updates until September 2012, WHO/UNICEF Joint Reporting Form 2011

4. PARTNER ACTIVITIES WITH MIDDLE-INCOME COUNTRIES

To enhance the decision-making process on the sustainable implementation of new vaccines, a number of partners are extending their activities to a limited number of MICs.

Partners are conducting projects or offer services that benefit some MICs for some of the issues identified to inhibit vaccine adoption. Most of the projects and services principally target LICs, but unevenly support a subset of LICs. Some countries are benefiting from a number of programs while others do not currently have access to any. Annex 1 indicates global partner activities for each of the MICs.

Utilization of UN-pooled procurement systems by middle-income countries

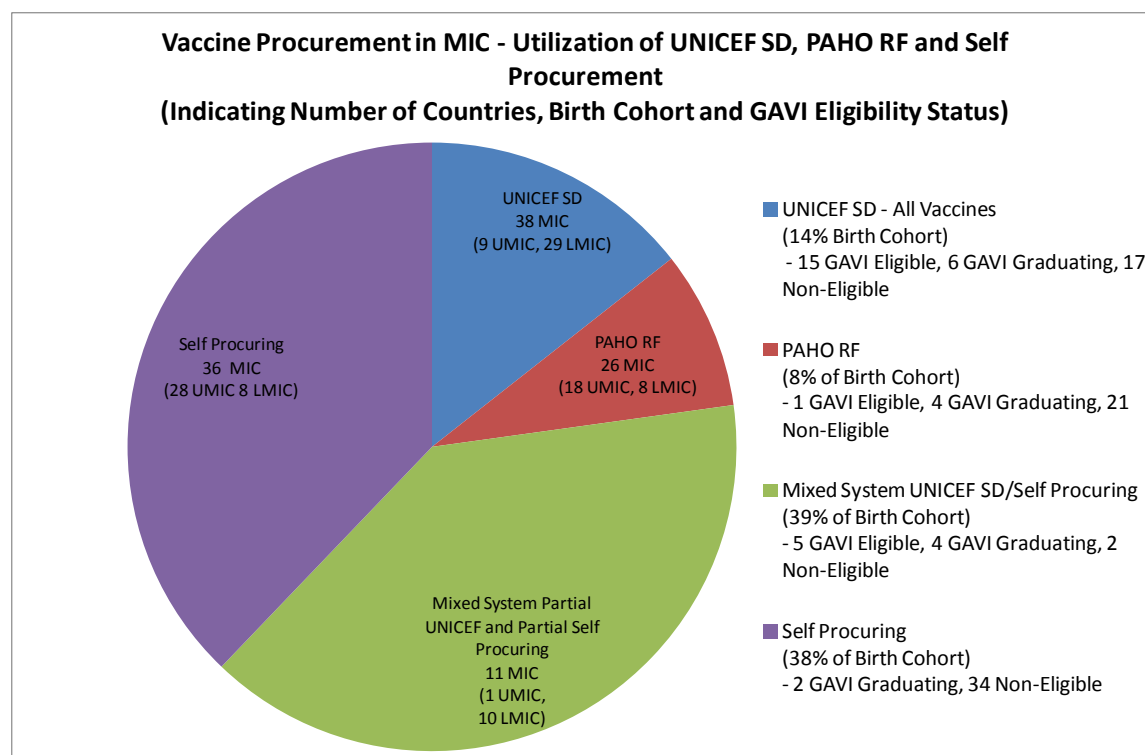
Of the 111 MICs, 75 benefit either partially or fully from the pooled procurement activities of UNICEF SD and the PAHO RF. Forty of the 75 countries involved with pooled procurement are neither GAVI eligible nor GAVI graduating. With data provided from the two procurement agencies, Figure 8 shows the utilization of the pooled procurement mechanisms by both LMICs and UMICs, indicating the MIC birth cohort covered by the procurement systems and the GAVI eligibility status.

Seventy-seven percent of the total MIC birth cohort is being provided with some or all vaccine through self-procurement; these 47 countries are procuring on the open global market. More than half of the UMICs are self-procuring vaccines while 33% of the LMICs are self-procuring for some or all vaccines. Some GAVI-eligible and GAVI-graduating countries are utilizing UNICEF SD solely for GAVI-supported vaccines and are otherwise self-procuring.

Use of UNICEF SD procurement services for the procurement of some or all vaccines is not limited to GAVI countries as indicated by the 17 non-eligible countries, nor is this service being utilized only by LMICs, as 9 UMICs are procuring some or all vaccines through UNICEF SD [15].

Figure 8. Reported procurement modalities in middle-income countries¹², July 2012.

¹² Source: UNICEF SD, PAHO RF July 2012 Self Procurement assessed by elimination



Utilization of UNICEF SD by MICs has increased, and now represents a significant share of the volume and value of UNICEF SD vaccine procurement. This in part is due to increasing GNI of previously low-income countries advancing into the MIC category. UNICEF SD does not have defined criteria for access to its services by countries and some continued utilization is based on historical use.

PAHO RF provides procurement services and technical assistance to countries and territories in the Americas region regardless of GNI. With the exception of Mexico, all other MICs in the Americas region are utilizing the PAHO RF for some or all of their vaccine procurement; these 26 MICs make up 8% of the total MIC birth cohort. The PAHO system has been a catalyst for rapid introduction of new vaccines in the region and combined with appropriate country planning and budgeting, the RF mechanism has contributed toward financial sustainability of the immunization programs.

Potential vaccine procurement interventions

Pacific Island countries pooled vaccine procurement utilizing UNICEF Vaccine Independence Initiative Mechanism. Thirteen Pacific Island countries—the majority of which are MICs—procure vaccines, autodisable syringes, and safety boxes utilizing the UNICEF Vaccine Independence Initiative mechanism through UNICEF SD. The mechanism has been and is currently utilized by other countries; however it was initiated in the Pacific Island countries in 1995 to assist with the procurement of the region’s vaccine requirements, and to facilitate logistic and supply issues given the very low populations and vast geographical dispersion. This is an innovative mechanism adapted to suit the specific needs of these small, isolated island nations [16].

UNICEF proposals. UNICEF SD, in response to the increasing awareness of the specific needs of the MICs, has begun consulting with countries, industry, and partners on possible interventions it could make within the vaccine market on behalf of the MICs. UNICEF SD is committed to the concept of tiered pricing for vaccines and offers the lowest prices it obtains to the poorest countries as determined (in most cases) by

GNI. The UNICEF options for MICs include pooling demand from MICs and conducting MIC-specific procurement processes, and negotiating price ceilings for MICs to access under certain criteria. UNICEF is also considering possible innovative financing and funding mechanisms to provide security to industry on the commitment to the forecast demand. Acknowledging that some of the current UNICEF requirements for utilization of its procurement services are difficult for some countries to utilize under government financing and public procurement rules, UNICEF is also considering options to address these concerns.

Following the outcome of a consultation process, UNICEF considers that any activities would be evolutionary, starting with a limited number of products and interested countries. [15].

WHO Vaccine Product, Price, and Procurement (V3P) Project. With funding from the Bill & Melinda Gates Foundation, WHO initiated the V3P project in 2011 to address product and price information and procurement options as obstacles to sustainable MIC introduction of new vaccines and in response to the WHA and SAGE recommendations. V3P collects, collates, and disseminates accurate and reliable data and information on vaccine pricing, procurement, and product characteristics. The focus countries are MICs and GAVI-graduating countries. The ultimate goal of the V3P project is to create a collaborative, functional, and valuable source of vaccine product, price, and procurement data and information that is available to and appropriately used by countries to aid informed decision-making.

Pooled Vaccine Procurement in the Eastern Mediterranean. In response to requests from the governments of regional MICs, the WHO Eastern Mediterranean regional office (EMRO) initiated a feasibility study on implementing a pooled procurement mechanism for these countries. The member states were concerned at the high prices being offered to them and the limited prioritization of some countries to access supply, particularly in emergency situations.

Considerable work was conducted by EMRO and partners with the countries to determine their needs and the best course of action for a phased approach to implementation. The member states endorsed the proposed process during side meetings of the WHA, Regional Committee meetings, and regional and global technical meetings, most recently during the 58th Regional Committee in October 2011 [17]. EMRO is working closely with partners on its pooled procurement considerations including UNICEF SD, as part of its MIC strategy.

Progress on specific technical activities required to move toward a sustainable pooled procurement system have been significantly slowed due to the political situation in many of the MICs of the region. The member states of the region consider, however, that this is an appropriate and needed mechanism in the region which would assist in the sustainable implementation of new vaccines, which a number of the MICs have been slow to introduce.

Technical assistance projects

During the past ten years a number of specific technical assistance tools and projects have been developed and used mainly in GAVI-eligible countries.

Comprehensive Multi-Year Planning (cMYP). One of the tools is the cMYP, developed by WHO and UNICEF, and is now a prerequisite for applications to GAVI for its new vaccine subsidy. cMYPs help to ensure comprehensive, simplified, and harmonized immunization planning, including cost estimates and financing source identification at the national level. However, only five non-GAVI-eligible MICs have implemented a cMYP (Botswana, Cape Verde, Seychelles, Swaziland, and Syrian Arab Republic). Of the 111 MICs, 41 report having a current cMYP—20 of these are currently GAVI eligible, 15 are graduating, and 1 is no longer GAVI eligible.

cMYPs have the potential to be useful to non-GAVI countries, with some adaptation, to improve decision-making, planning, and financing processes. Funding for assistance with cMYP development is currently limited, in the most part, to GAVI-eligible countries.

NRA strengthening. Since 1997 WHO has conducted a five-step capacity-building program to strengthen national regulatory systems to regulate vaccines at international standards of quality, safety, and efficacy. This program aims to help countries to develop the necessary regulatory functions for vaccines. Needs differ depending on whether the country is procuring its vaccines from UN agencies (mainly UNICEF SD and PAHO RF), using its own direct self-procuring system or producing its own vaccines. The WHO prioritizes activities in vaccine producing, self-procuring, and UN agency countries [18].

Nine MICs that produce vaccines have NRAs that have been assessed by WHO as being functional (Brazil, Bulgaria, China, Cuba, India, Indonesia, Russian Federation, Senegal, and Thailand). This allows manufacturers operating under the oversight of these NRAs to apply for WHO prequalification for individual products, so that these products would be eligible for purchase by UN agencies.

Two further MIC NRAs where vaccines are produced have been assessed as functional but no products manufactured in these countries have been awarded prequalified status. Five non-producing MIC NRAs have been assessed as functional for procurement. In total, 11 of the NRAs assessed as functional are in UMICs and 7 in LMICs.

Other MICs are actively working with WHO to develop functionality of their NRA both to meet recommended functions of a producing country (9 countries) but also to meet the recommended functions for self-procuring countries (12 countries) and UN agency procurement of vaccines (22 countries). In total, 58 MICs have or are currently working with WHO prequalification on NRA functionality (30 UMICs and 28 LMICs).

The NRA status will be particularly important for new vaccine introduction, for countries to be able to assure the quality of the vaccines they produce and procure, especially new products. There are several priority vaccines in the pipelines of some MIC vaccine producers. Specifically, at least one rotavirus vaccine and a dengue vaccine are being developed.

Additional technical support

The Gates Foundation has provided funding for technical intervention projects to improve sustainable immunization implementation. The projects have varied approaches and some of these have been extended to include some MICs, but they are not available to all MICs. Annex 1 indicates the countries in which these projects are currently being conducted. Five of the Gates Foundation-funded projects (ProVac, SIVAC, SIF, OPTIMIZE, and V3P) are indicated there as they are operating in MICs.

Four initiatives that might be more systematically applied to middle-income countries:

ProVac. PAHO's ProVac Initiative is funded by the Bill & Melinda Gates Foundation. Its goal is to strengthen the national capacity to make evidence-based transparent and objective decisions on new vaccine introduction with special emphasis on cost-effectiveness analysis. Twenty-four MICs are involved in ProVac. ProVac is specifically referenced in the GVAP as an example of strengthening countries to make informed decisions. An important development from the initial focus of ProVac on the Americas is the formation of the ProVac International Working Group, a consortium of partners (WHO, CDC, Sabin Vaccine Institute, Agence de Médecine Préventive, and PATH). ProVac received additional funding from the Gates Foundation for a two-year pilot phase (2012–2013) for the working group to use ProVac tools and methodologies in LICs and MICs in Africa, the Eastern Mediterranean, and Europe.

SIVAC. The SIVAC Initiative is a project implemented by the Agence de Médecine Préventive in partnership with the International Vaccine Institute to support the development of sustainable national immunization technical advisory groups (NITAGs) in low- and middle-income countries. NITAGs institutionalize evidence-based decision-making processes for immunization programs and policies. Eight MICs are involved in the SIVAC Initiative. The activities fall into two core areas:

1. Support for NITAG establishment, development, and strengthening. SIVAC directly operates in about 15 countries in Africa, Asia, Europe, and the Middle East, 8 of which are MICs.
2. Knowledge sharing through the NITAG Resource Center (a multilingual website that offers information, tools, and short learning modules), the development of articles and tools, and the organization of regional technical workshops.

SIF. The Sustainable Immunization Financing project managed by the Sabin Institute advocates for parliamentary prioritization of immunization and domestic financing for immunization activities. The program operates on a country-specific basis, working with parliamentarians and sub-national stakeholders to develop information and data to utilize in advocacy with decision makers. In some countries assistance is provided to draft and implement legislation to indicate government commitment to immunization. Begun with a focus on LICs, SIF has been extended to work with eight LMICs.

Project Optimize. Optimize is a collaboration between WHO and PATH to identify ways in which supply chains can be optimized to meet the demands of an increasingly large and costly portfolio of vaccines. Optimize works directly with national governments and other institutions to identify problems in the supply chain and demonstrate innovative solutions. Their goal is to help define an ideal vaccine supply chain that can be used to develop stronger, more adaptable, and more efficient logistics systems, extending the reach of lifesaving health technologies to people around the world.

As part of its efforts to guide key stakeholders at country, regional, and global levels in their work to strengthen supply and logistics systems, Optimize works to ensure that vaccine products and their packaging are designed with characteristics that best suit the needs and constraints of countries.

US Agency for International Development (USAID). In addition to these projects funded by the Gates Foundation, USAID and the US Centers for Disease Control and Prevention both conduct and fund immunization activities in a number of countries. Other bilateral donors and nongovernmental organizations provide funding and in some cases technical assistance to national immunization programs within MICs; however these have not been mapped for this paper as they vary widely and can be difficult to determine.

Despite the number of activities to provide technical assistance to MICs for the sustainable implementation of new vaccines, decisions regarding partner activities conducted in MICs are being made in relative isolation with limited coordination or prioritization. Some countries are benefiting from a

number of activities while others in need of assistance are not included in any. Addressing the specific technical assistance, data, and information needs of MICs can require individual needs assessment and tailoring.

5. DEVELOPMENT OF MIDDLE-INCOME COUNTRY GLOBAL POLICY AND COORDINATION

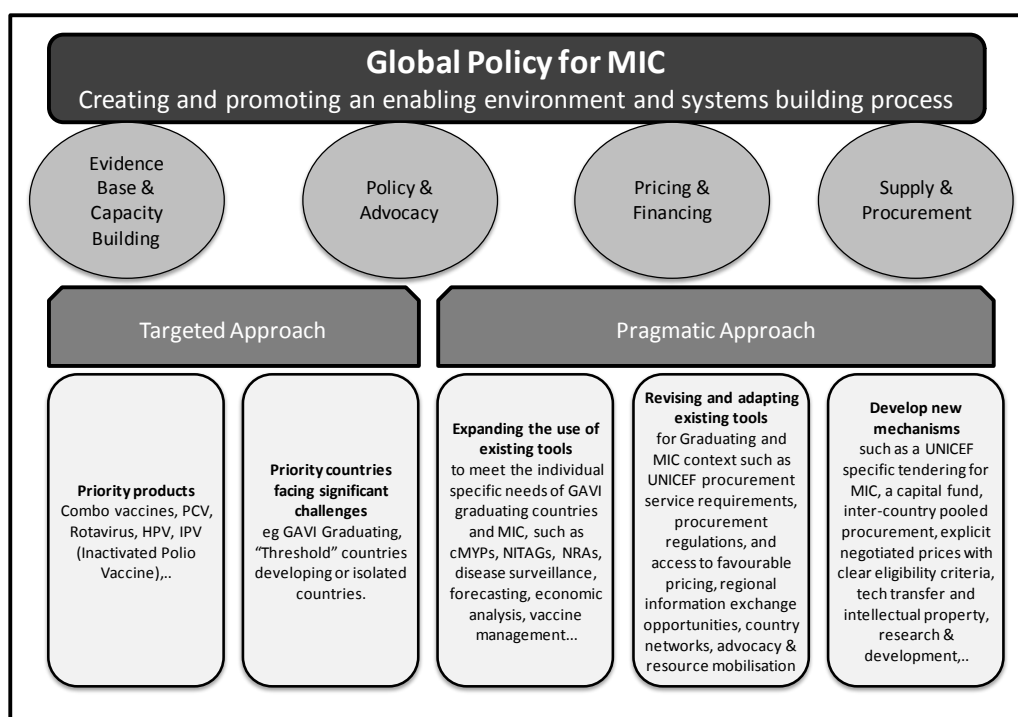
The immunization community is motivated to assist MICs to make informed decisions, but even with all the best intentions of global and regional partners a lack of coordination could result in a distortion of effort creating an inequitable focus on some areas and some countries while completely missing others. A global policy and coordination framework for appropriate targeting of activities of partners would assist in defining roles and responsibilities and maximizing efficiency of actions. The goal of any global policy for MICs should be to improve the capacity of countries to make informed decisions regarding national immunization programs to achieve the best possible outcomes in the prevention of vaccine-preventable diseases.

A global policy toward middle-income countries

The previous sections and the information gained from the study on MIC vaccine uptake decisions [7] indicate that there are three main gaps for new vaccine implementation in MICs:

1. An information gap on vaccine products, pipelines, the vaccine market, prices, innovative ideas and mechanisms, and best practices.
2. A capacity gap on applied research, institutional development, economic and epidemiologic data analysis, production and technology transfer, assurance of quality, and performance evaluation.
3. A networking gap with very few opportunities for countries to benefit from peer review, and intra- and inter-regional exchanges.

Figure 9. Possible global middle-income countries policy structure.



A global policy for MICs as shown in Figure 9 could include creating and promoting an enabling environment and a systems-building process to the benefit of all MICs. This includes sharing information on a variety of aspects of experiences with immunization and vaccines; providing technical support and mutual assistance; setting up a clear pricing strategy based on explicit agreed criteria; and promoting best standards, policies, and practices.

The study by Makinen et al. [7] referred to four pillars for support that can provide a framework for global policy:

- Evidence and capacity-building.
- Policy and advocacy.
- Costing, pricing, and financing.
- Procurement and supply chain management.

In addition to these pillars, a framework could incorporate a *targeted approach* based on criteria for selecting priority countries or products for specific action and activities and/or a *pragmatic approach* extending the use of available tools and mechanisms, adapting such tools and mechanisms for MIC particular needs, and developing MIC-specific technical assistance.

A. Targeted approach

Targeting specific countries and products: prioritization of countries for activities could include developmental indicators, burden of disease, population impact, influence on neighboring countries, and willingness and capacity to implement. Some specific priority countries could be selected based on these and other defined criteria, although it is clear that each country will need an individually tailored strategy.

To promote sustained implementation, the targeting of specific products that would have high epidemiological, market, and economic impact could also be considered.

B. Pragmatic approach

MICs are seeking an enabling environment and systems-building support, but (with a few exceptions) not direct financial assistance. Solutions exist and have already been identified [11, 12]. However, much more work is needed.

The implementation of policy should proceed pragmatically by:

1. Using existing tools. Expanding the use of existing tools to meet the individual specific needs of GAVI-graduating countries and MICs, such as cMYPs, ProVac, SIVAC, NRA strengthening, V3P, etc.
2. Revising existing mechanisms. Revising and adapting existing tools for the MICs and GAVI-graduating country context, needs and constraints, such as UNICEF procurement service requirements, procurement regulations, and access to favorable pricing for priority vaccines including access to the Advance Market Commitment price.
3. Developing new options. Design and develop innovative mechanisms and tools to better respond to MICs and GAVI-graduating country needs, such as a UNICEF specific window for MICs, a capital guarantee fund, inter-country pooled procurement, explicit negotiated prices with clear eligibility criteria, active technology transfer, intellectual property rights management, and support to research and product development efforts in MICs.
4. Ensure optimal coordination. Ensure coordination through a task team of partners who work together regularly and are supported with adequate funding to move forward with the greatest efficiency.

Conclusion

The 111 MICs are a key group of countries in the global fight against vaccine-preventable diseases. MICs are increasing in number and by proportional representation of the world's poor. The MICs have not benefited as appreciably from donor and partner activities in decreasing vaccine-preventable disease and are starting, as a group, to lag behind significantly in the sustainable implementation of new life-saving vaccines. Many reasons, beyond but including donor support and financial constraints, explain this situation.

The work conducted by R4D with support from the Bill & Melinda Gates Foundation and WHO identified the issues and concerns faced by MICs and recommended focus areas to improve national immunization programs. SAGE endorsed the R4D report on the plight of these countries acknowledging and raising awareness of the issues they face at regional and global levels.

The R4D report recommended that technical assistance and capacity-building efforts be extended to MICs. Some partners have begun to do so, but the scope of these activities is still limited to a small subset of countries and funding for activities in MICs is very limited. Other partners are looking toward developing strategies to assist MICs.

To ensure the best possible outcomes with limited resources, partners need to organize activities under a global framework to address the information, capacity, and networking gaps; utilize and expand existing tools; develop new tools and mechanisms; and utilize the comparative advantage of each of the partners in a coordinated and efficient manner.

The cost of targeted technical assistance to MICs would come at a fraction of the cost of the investment made to subsidize vaccines in the poorest GAVI-eligible countries. The potential benefits from enhanced decision-making and faster implementation of new vaccines would have a significant impact on the populations of these countries and a substantial share of the world's poor, and would contribute to the global fight against vaccine-preventable disease.

A global policy should assist partners to mobilize resources in a challenging financial environment by identifying the strategies and activities to achieving global immunization targets and reducing the vaccine-preventable disease burden in both low- and middle-income countries.

Annex 1

Middle-income countries: GNI, GAVI eligibility, total population, procurement through UNICEF SD and PAHO RF, and involvement in selected immunization projects

Country Name	World Bank Category ²	GNI 2011 ²	WHO Region	UN Population Estimate 2010 (000) ³	GAVI Eligibility	UNOHRLLS LDC, LLDC SIDs ¹⁰	Birth Cohort ⁴	Projects Reported as Operating in MIC	Vaccine Procurement Mechanism ⁶
Albania ⁹	LMIC	3,980	EUR	3,204	ex-GAVI		41,007	PROVAC, OPTIMIZE	UNICEF
Algeria	UMIC	4,470	AFR	35,468	NO		712,254	EMRO PVP, V3P	SELF
American Samoa ¹	UMIC	No Data	WPR	68	NO		No Data		SELF
Angola	UMIC	4,060	AFR	19,082	Graduating	LDC	803,274	V3P	UNICEF
Antigua and Barbuda	UMIC	12,060	AMR	89	NO	SIDS	1,597		PAHO RF
Argentina	UMIC	9,740	AMR	40,412	NO		693,484	PROVAC	PAHO RF
Armenia	LMIC	3,360	EUR	3,092	Graduating	LLDC	47,148	V3P	UNICEF
Azerbaijan	UMIC	5,290	EUR	9,188	Graduating	LLDC	183,787	PROVAC	MIXED
Belarus	UMIC	5,830	EUR	9,595	NO		106,750		SELF
Belize	LMIC	3,690	AMR	312	NO	SIDS	7,727		PAHO RF
Bhutan	LMIC	2,070	SEAR	726	Graduating	LLDC / LDC	14,832	Sabin SIF, V3P	UNICEF
Bolivia	LMIC	2,040	AMR	9,930	Graduating	LLDC	264,140	PROVAC, V3P	PAHO RF
Bosnia and Herzegovina	UMIC	4,780	EUR	3,760	ex-GAVI		31,558		SELF
Botswana	UMIC	7,480	AFR	2,007	NO	LLDC	47,208		SELF
Brazil	UMIC	10,720	AMR	194,946	NO		2,995,976	PROVAC	PAHO RF
Bulgaria	UMIC	6,550	EUR	7,494	NO		75,042		SELF
Cameroon	LMIC	1,210	AFR	19,599	Eligible		715,773	Sabin SIF	UNICEF
Cape Verde	LMIC	3,540	AFR	496	NO	SIDS	10,194		UNICEF
Chile	UMIC	12,280	AMR	17,114	NO		245,427		SELF
China	UMIC	4,930	WPR	1,341,335	ex-GAVI		16,431,611	PROVAC	SELF
Colombia	UMIC	6,110	AMR	46,295	NO		910,296	PROVAC	PAHO RF
Congo, Rep.	LMIC	2,270	AFR	4,043	Graduating	LDC	144,632	Sabin SIF, V3P	UNICEF
Cook Islands ⁹	UMIC	No Data	WPR	20	NO		430		UNICEF
Costa Rica	UMIC	7,660	AMR	4,659	NO		73,376	PROVAC	PAHO RF
Côte d'Ivoire	LMIC	1,100	AFR	19,738	Eligible		678,778	SIVAC	UNICEF
Cuba ^{1,5}	UMIC	No Data	AMR	11,258	Graduating		109,642		PAHO RF
Djibouti ¹	LMIC	No Data	EMR	889	Eligible	LDC	26,031		UNICEF
Dominica	UMIC	7,090	AMR	68	NO	SIDS	1,206		PAHO RF
Dominican Republic	UMIC	5,240	AMR	9,927	NO	SIDS	215,528	V3P	PAHO RF
Ecuador	UMIC	4,140	AMR	14,465	NO		297,868	PROVAC, V3P	PAHO RF
Egypt, Arab Rep.	LMIC	2,600	EMR	81,121	NO		1,885,631	PROVAC, EMRO PVP, V3P	SELF
El Salvador	LMIC	3,480	AMR	6,193	NO		125,686	PROVAC, V3P	PAHO RF
Fiji	LMIC	3,680	WPR	861	NO	SIDS	18,369	PIC VII	UNICEF
Gabon	UMIC	7,980	AFR	1,505	NO		41,620		UNICEF
Georgia	LMIC	2,860	EUR	4,352	Graduating		50,850	PROVAC, USAID, V3P	SELF
Ghana	LMIC	1,410	AFR	24,392	Eligible		776,010	PROVAC, USAID	UNICEF

Country Name	World Bank Category ²	GNI 2011 ²	WHO Region	UN Population Estimate 2010 (000) ³	GAVI Eligibility	UNOHRLLS LDC, LLDC SIDs ¹⁰	Birth Cohort ⁴	Projects Reported as Operating in MIC	Vaccine Procurement Mechanism ⁶
Grenada	UMIC	7,220	AMR	104	NO	SIDS	2,037		PAHO RF
Guatemala	LMIC	2,870	AMR	14,389	NO		473,216	PROVAC, OPTIMIZE	PAHO RF
Guyana ¹	LMIC	No Data	AMR	754	Graduating		13,466		PAHO RF
Honduras	LMIC	1,970	AMR	7,601	Graduating		204,512	PROVAC	PAHO RF
India	LMIC	1,410	SEAR	1,224,614	Eligible		27,098,275	USAID	MIXED
Indonesia	LMIC	2,940	SEAR	239,871	Graduating		4,331,100	SIVAC, USAID	SELF
Iran ¹	UMIC	4,520	EMR	73,974	NO		1,255,194	EMRO PVP	SELF
Iraq	LMIC	2,640	EMR	31,672	NO		1,143,989	EMRO PVP	SELF
Jamaica	UMIC	4,980	AMR	2,741	NO	SIDS	50,146	PROVAC	PAHO RF
Jordan	UMIC	4,380	EMR	6,187	NO		153,808	EMRO PVP	SELF
Kazakhstan	UMIC	8,220	EUR	16,026	NO	LLDC	344,858	SIVAC	SELF
Kiribati	LMIC	2,110	WPR	100	Graduating	LDC / SIDS	2,047	PIC VII	UNICEF
Kosovo ¹²	LMIC	3,520	EUR	1,794	NO		No Data		SELF
Lao PDR	LMIC	1,130	WPR	6,201	Eligible	LLDC / LDC	140,398		UNICEF
Latvia	UMIC	12,350	EUR	2,252	NO		24,326	V3P	SELF
Lebanon	UMIC	9,110	EMR	4,228	NO		64,673	SIVAC, EMRO PVP	UNICEF
Lesotho	LMIC	1,220	AFR	2,171	Eligible	LLDC / LDC	60,426		UNICEF
Libya ¹	UMIC	No Data	EMR	6,355	NO		143,762	EMRO PVP	SELF
Lithuania	UMIC	12,280	EUR	3,324	NO		35,239		SELF
Macedonia, FYR	UMIC	4,730	EUR	2,061	NO	LLDC	21,955		SELF
Malaysia	UMIC	8,420	WPR	28,401	NO		579,122		SELF
Maldives	UMIC	6,530	SEAR	316	NO	LDC / SIDS	5,335		UNICEF
Marshall Islands	LMIC	3,910	WPR	54	NO	SIDS	1,110		SELF
Mauritius	UMIC	8,240	AFR	1,299	NO	SIDS	16,466		SELF
Mexico	UMIC	9,240	AMR	113,423	NO		2,194,666		SELF
Micronesia, Fed. Sts.	LMIC	2,900	WPR	111	NO	SIDS	2,732		UNICEF
Moldova	LMIC	1,980	EUR	3,573	Graduating	LLDC	43,549	V3P	MIXED
Mongolia	LMIC	2,320	WPR	2,756	Graduating	LLDC	65,221	SIVAC, Sabin SIF, V3P	UNICEF
Montenegro	UMIC	7,060	EUR	631	NO		7,674		SELF
Morocco	LMIC	2,970	EMR	31,951	NO		620,253	EMRO PVP, V3P	MIXED
Namibia	UMIC	4,700	AFR	2,283	NO		60,036		SELF
Nauru ⁹	UMIC	No Data	WPR	10	NO	SIDS	209		UNICEF
Nicaragua	LMIC	1,170	AMR	5,788	Eligible		137,860	PROVAC	PAHO RF
Nigeria	LMIC	1,200	AFR	158,423	Eligible		6,457,908	Sabin SIF, USAID	UNICEF
Niue ¹⁰	LMIC	No Data	WPR	1	NO		30		UNICEF
Pakistan	LMIC	1,120	EMR	173,593	Eligible		4,763,694	USAID	MIXED
Palau	UMIC	7,250	WPR	20	NO	SIDS	417		UNICEF
Panama	UMIC	7,910	AMR	3,517	NO		69,810		PAHO RF
Papua New Guinea	LMIC	1,480	WPR	6,858	Eligible	SIDS	208,495		MIXED
Paraguay	LMIC	2,970	AMR	6,455	NO	LLDC	157,651	PROVAC	PAHO RF
Peru	UMIC	5,500	AMR	29,077	NO		590,552	PROVAC	PAHO RF
Philippines	LMIC	2,210	WPR	93,261	NO		2,357,583	PROVAC, V3P	MIXED
Romania	UMIC	7,910	EUR	21,486	NO		220,534		SELF

Country Name	World Bank Category ²	GNI 2011 ²	WHO Region	UN Population Estimate 2010 (000) ³	GAVI Eligibility	UNOHRLLS LDC, LLDC SIDS ¹⁰	Birth Cohort ⁴	Projects Reported as Operating in MIC	Vaccine Procurement Mechanism ⁶
Russian Federation	UMIC	10,400	EUR	142,958	NO		1,688,954		SELF
Samoa	LMIC	3,190	WPR	183	NO	SIDS	4,457	PIC VII	UNICEF
São Tomé and Príncipe	LMIC	1,360	AFR	165	Eligible	LDC / SIDS	5,189		UNICEF
Senegal	LMIC	1,070	AFR	12,434	Eligible	LDC	470,836	PROVAC, SIVAC, Sabin SIF, OPTIMIZE, USAID	UNICEF
Serbia	UMIC	5,680	EUR	9,856	NO		109,767		SELF
Seychelles	UMIC	11,130	AFR	87	NO	SIDS	1,094		SELF
Solomon Islands	LMIC	1,110	WPR	538	Eligible	LDC / SIDS	17,301	PIC VII	UNICEF
South Africa	UMIC	6,960	AFR	50,133	NO		1,052,420	V3P	SELF
South Sudan ^{1,11}	LMIC	No Data	EMR	8,260	YES		No Data		UNICEF
Sri Lanka	LMIC	2,580	SEAR	20,860	Graduating		373,262	Sabin SIF, V3P	MIXED
St. Lucia	UMIC	6,680	AMR	174	NO	SIDS	3,053		PAHO RF
St. Vincent & the Grenadines	UMIC	6,100	AMR	109	NO	SIDS	1,836		PAHO RF
Sudan ¹	LMIC	No Data	EMR	43,552	Eligible	LDC	1,446,755	USAID	UNICEF
Suriname ¹	UMIC	7,630	AMR	525	NO	SIDS	9,603		PAHO RF
Swaziland	LMIC	3,300	AFR	1,186	NO	LLDC	34,970		SELF
Syrian Arab Republic ¹	LMIC	No Data	EMR	20,411	NO		465,516	EMRO PVP	SELF
Thailand	UMIC	4,420	SEAR	69,122	NO		824,017	V3P	SELF
Timor-Leste ¹	LMIC	No Data	SEAR	1,124	Eligible	LDC / SIDS	44,488	USAID	UNICEF
Tonga	LMIC	3,580	WPR	104	NO	SIDS	2,777	PIC VII	UNICEF
Tunisia	UMIC	4,070	EMR	10,481	NO		179,434	PROVAC, SIVAC, OPTIMIZE, V3P	SELF
Turkey	UMIC	10,410	EUR	72,752	NO		1,288,624		SELF
Turkmenistan	UMIC	4,110	EUR	5,042	Ex-GAVI	LLDC	109,493		UNICEF
Tuvalu	UMIC	5,010	WPR	10	NO	LDC / SIDS	207	PIC VII	UNICEF
Ukraine ⁵	LMIC	3,120	EUR	45,448	Graduating		494,153	USAID	SELF
Uruguay	UMIC	11,860	AMR	3,369	NO		49,495	PROVAC	PAHO RF
Uzbekistan	LMIC	1,510	EUR	27,445	Eligible	LLDC	588,666		MIXED
Vanuatu	LMIC	2,870	WPR	240	NO	LDC	7,179	PIC VII	UNICEF
Venezuela, RB	UMIC	11,920	AMR	28,980	NO		598,472		PAHO RF
Vietnam	LMIC	1,260	WPR	87,848	Eligible		1,457,775	PROVAC, SIVAC, Sabin SIF, OPTIMIZE	MIXED
West Bank and Gaza ¹	LMIC	No Data	EMR	4,039	NO		No Data	EMRO PVP	UNICEF
Yemen, Rep.	LMIC	1,070	EMR	24,053	Eligible	LDC	939,589		UNICEF
Zambia	LMIC	1,160	AFR	13,089	Eligible	LLDC / LDC	622,268	USAID	UNICEF

¹ Estimated WB Category without GNI Listed/or Estimated GNI <http://data.worldbank.org/about/country-classifications>

² <http://data.worldbank.org/about/country-classifications>, accessed 27 July 2012, for the World Bank's explanation of its classification of countries by income.

³ <http://esa.un.org/unpd/wpp/Excel-Data/population.htm> accessed 3 August 2012 for UN Population estimations

⁴ WHO/UNICEF Joint Reporting Form Data 2011

⁵ No Longer accessing GAVI Financial Support for New vaccines

⁶ UNICEF PAHO Reported July 2012, Self Procurement estimated by Elimination

⁷ <http://www.gavialliance.org/support/apply/countries-eligible-for-support/> access June 2012

⁸ Country names provided by each project June 2012

⁹ Albania receiving GAVI support until 2013 for Pentavalent vaccine

¹⁰ Least Developed Countries, Landlocked Developing Countries, Small Island Developing States <http://www.unohrlls.org/>

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References

- [1] Glassman A, Duran D, Sumner A. 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? Center for Global Development Working Paper 270, October 2011, at <http://www.cgdev.org/content/publications/detail/1425581>, accessed 27 July, 2012
- [2] http://apps.who.int/gb/ebwha/pdf_files/WHA65/A65_22-en.pdf, accessed 27 July, 2012
- [3] Figures were obtained using the database at <http://iresearch.worldbank.org/PovcalNet/index.htm>, accessed 27 July, 2012
- [4] Moss T and Leo B. IDA at 65: Heading toward retirement or a fragile lease on life? Center for Global Development Working Paper 246, at <http://www.cgdev.org/content/publications/detail/1424903>, accessed 27 July, 2012
- [5] Sergio Tezanos Vázquez and Andy Sumner. Beyond Low Income and Middle Income Countries: What if There Were Five Clusters of Developing Countries? IDS Working Paper 404, September 2012
- [6] http://www.who.int/immunization_monitoring/data/en/, accessed 29 July, 2012
- [7] Makinen M, Kaddar M, Molldrem V, Wilson L. New vaccine adoption in lower-middle-income countries. Health Policy Plan 2012;27:ii39–49.
- [8] Black R, Cousens S, Johnson H, Lawn J, Rudan I, Bassani D, Jha P, Campbell H, Fischer Walker C, Cibulskis R, Eisele T, Liu L, Mathers C. Global, regional, and national causes of child mortality in 2008: a systematic analysis, for the Child Health Epidemiology Reference Group of WHO and UNICEF. Lancet 2010;375(9730):1969–87.
- [9] DeRoeck D, Bawazir S, Carrasco P, Kaddar M, Brooks A, Fitzsimmons J, Andrus J. Regional group purchasing of vaccines: review of the Pan American Health Organization EPI revolving fund and the Gulf Cooperation Council group purchasing program. Int J Health Plan M 2006;21(1): 23–43 .
- [10] <http://www.who.int/nuvi/en/>, accessed 27 July, 2012
- [11] <http://www.who.int/immunization/sage/en/>, accessed 27 July, 2012
- [12] <http://www.who.int/mediacentre/events/2008/wha61/en/index.html>, accessed 27 July, 2012
- [13] <http://www.resultsfordevelopment.org/focus-areas/constraints-vaccine-adoption-lower-and-middle-income-countries>, accessed 27 July, 2012
- [14] http://www.who.int/entity/wer/2011/wer8601_02.pdf, accessed 27 July, 2012
- [15] http://www.unicef.org/supply/files/VC_IC2_Key_updates_final.pdf, accessed 27 July, 2012
- [16] http://www.unicef.org/pacificislands/immunization_2881.html, accessed 29 July, 2012
- [17] EMRO 58th Regional Committee Resolution October 2011
http://www.emro.who.int/docs/RC_resolutions_2011_r5_13972.pdf
- [18] http://www.who.int/immunization_standards/national_regulatory_authorities/vaccine_indicators/en/index.html, accessed 29 July, 2012