Global cost of child survival: estimates from country-level validation
Liselore van Ekdom, Karin Stenberg, Robert W Scherpier & Louis W Niessen on behalf of the ad hoc Study Group for Child Health Cost Validation

Objective To cross-validate the global cost of scaling up child survival interventions to achieve the fourth Millennium Development Goal (MDG4) as estimated by the World Health Organization (WHO) in 2007 by using the latest country-provided data and new assumptions.

Methods After the main cost categories for each country were identified, validation questionnaires were sent to 32 countries with high child mortality. Publicly available estimates for disease incidence, intervention coverage, prices and resources for individual-level and programme-level activities were validated against local data. Nine updates to the 2007 WHO model were generated using revised assumptions. Finally, estimates were extrapolated to 75 countries and combined with cost estimates for immunization and malaria programmes and for programmes for the prevention of mother-to-child transmission of the human immunodeficiency virus (HIV).

Findings Twenty-six countries responded. Adjustments were largest for system- and programme-level data and smallest for patient data. Country-level validation caused a 53% increase in original cost estimates (i.e. 9 billion 2004 United States dollars [US$]) for 26 countries owing to revised system and programme assumptions, especially surrounding community health worker costs. The additional effect of updated population figures was small; updated epidemiologic figures increased costs by US$ 4 billion (+15%). New unit prices in the 26 countries that provided data increased estimates by US$ 4.3 billion (+16%). Extrapolation to 75 countries increased the original price estimate by US$ 33 billion (+80%) for 2010–2015.

Conclusion Country-level validation had a significant effect on the cost estimate. Price adaptations and programme-related assumptions contributed substantially. An additional 74 billion US$ 2005 (representing a 12% increase in total health expenditure) would be needed between 2010 and 2015. Given resource constraints, countries will need to prioritize health activities within their national resource envelope.

Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.
assumptions were replaced by local data or by recent updated estimates on incidence, coverage and price. Additional costs were calculated through nine model scenarios that assessed the effects of: (i) the validation and of updated epidemiologic and coverage data; (ii) population change and scale-up sensitivity ranges; and (iii) updated unit price estimates. These cross-validated results were subsequently extrapolated to 75 countries. Lastly, these final estimates were combined with published estimates of the resources needed to scale up immunization, malaria interventions and PMTCT to compute a revised total global price tag.

Cost drivers

We retained the components of the original price tag, which included interventions addressing the major causes of death among children aged less than 5 years: 10,11 newborn sepsis, pneumonia, diarrhoea, malaria, PMTCT and malnutrition. As in our original study, 11 we based cost estimates on an ingredients approach, and we focused on validating input assumptions using patient-level and programme-level costs.

Patient costs refer to the costs of an intervention at the point where services (e.g. drugs, supplies) are delivered to a client. Patient costs vary depending on disease burden, current intervention coverage, differences in case management protocols and visit prices. Programme costs are expenses incurred at the district, province or country administrative level (e.g. in-service training for health workers or information, education and communication activities). 11 Costs vary across countries depending on the choice of delivery mechanisms and level of investment in areas such as health worker training, health-care infrastructure and mechanisms for generating service demand in the community.

It was not feasible to validate every single assumption in the original model, so our questions referred to cost drivers, defined as follows. Interventions were identified as cost drivers when the relative proportion of an intervention contributed to 10% or more of overall patient costs in the specific country. A programme cost category was identified as a cost driver if it fulfilled the following two criteria: (i) the cost category contributed to 10% or more of the overall programme cost estimated for the specific country, and (ii) the particular component accounted for at least 70% of the costs of that category. More details are provided in Appendix C, available at: http://www.who.int/choice/publications/p_2011_cost_validation_webannexes.pdf

Survey instrument and analysis

A self-administered questionnaire was developed and sent to WHO experts based in 32 countries with high child mortality in all 6 WHO regions (Appendix A). These experts, responsible for child health in each WHO country office and usually having a medical background, were the first point of contact. The respondents liaised with ministry of health officials responsible for child health to jointly review the costing assumptions and input data used by WHO to derive cost estimates. Involvement of child health staff at the ministries was intended to ensure that the replies obtained were nationally representative and in line with national policies. The data collection verification process lasted from 2 to 4 months in each country.

The survey contained two types of questions: generic questions applicable to all countries and country-specific questions covering each country’s cost drivers (Appendix C and Box 1). The survey showed the country-specific values used for the original calculations and prompted respondents to review each one and to explicitly indicate if they agreed or disagreed with these estimates. Respondents who disagreed with the original assumption were asked to provide alternative data and their sources (Appendix A).

For data quality control, we asked respondents to: (i) clearly state their reference source and (ii) indicate if health ministry officials agreed with the new data. Country responses were classified into four categories and acted upon as follows:

1. valid agreement: the original assumption was considered valid by the respondent and remained unchanged;
2. invalid disagreement: the newly validated information was considered to be inadequately supported and was used in place of the original assumption;
3. invalid disagreement: the newly validated information was considered to be inadequately supported and the original assumption was maintained;
4. information not provided: the original estimate remained unchanged.

Price adjustments

Cost data were provided by countries in their local currencies and were converted to 2004 United States dollars (US$). When an input price was reported in US$ for a tradable good (such as medicines), we used the US$ deflation rate. When respondents provided input prices in local currency units, we applied average annual inflation rates obtained from the International Monetary Fund. When input prices for non-tradable goods such as staff salaries were provided in US$, they were converted into local currency units for the equivalent year, deflated to the 2004 level using the country-specific local currency deflation rate, and then converted to 2004 US$ equivalents.

Stepwise validation and estimate updates

Table 1 lists nine successive model estimates grouped into three categories: (i) validation (V), (ii) sensitivity analyses (S), and (iii) information updates (U). In each successive model estimate new information was added in a stepwise fashion to a preceding estimate. When country-validated data had been provided, they
<table>
<thead>
<tr>
<th>Model† and description</th>
<th>Reference year for price data</th>
<th>Country-validated assumptions</th>
<th>Reference year for population, incidence and intervention coverage data</th>
<th>Inputs updated</th>
<th>Expected effect on overall costs, all else being the same</th>
<th>Finding</th>
</tr>
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<tbody>
<tr>
<td>Original 2007 WHO</td>
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<tr>
<td>Original price tag</td>
<td>2004</td>
<td>No</td>
<td>Population, 2002; incidence and coverage, 2004</td>
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<tr>
<td>Validation (V) and update (U) analysis (n=26)</td>
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<tr>
<td>Model V: original price tag estimates updated with country inputs</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2002; incidence and coverage, 2004</td>
<td>Country inputs</td>
<td>Unknown (depending on higher/ lower country validation of ingredients)</td>
<td>Costs increased by 53% from original</td>
</tr>
<tr>
<td>Model U1: as per model V, with population updates</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2008</td>
<td>Population, update from 2002 to 2008 projections (medium variant)</td>
<td>Expect higher costs, as population estimates have increased on average since the 2002 projections for the 75 countries</td>
<td>Costs for V2 decreased by 3% (vs V)</td>
</tr>
<tr>
<td>Model U2: as per model V, with incidence updates</td>
<td>2004</td>
<td>Yes</td>
<td>Incidence of severe malnutrition</td>
<td>Incidence, new formulas available for estimating incidence from prevalence</td>
<td>Expect higher costs, as incidence estimates will increase</td>
<td>Costs increased 15% (vs V)</td>
</tr>
<tr>
<td>Model U3: As per model V, with coverage updates</td>
<td>2004</td>
<td>Yes</td>
<td>Coverage, Countdown 2008b</td>
<td>Intervention coverage</td>
<td>Expect lower additional costs (than original) because current coverage has most likely increased</td>
<td>Coverage resulted in 5% higher costs (vs V) but effect not significant when combined with demographic data (U4)</td>
</tr>
<tr>
<td>Model U4: V and U1–U3 combined (population, incidence and coverage updates)</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2008; incidence and coverage, Countdown 2008b</td>
<td>Examine combined effect of updating population, incidence and coverage</td>
<td>Unknown</td>
<td>Unknown</td>
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<td>Sensitivity (S) analysis (n=26)</td>
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<td>Model S1: Model U4 rerun with alternative scale-up strategy (linear)</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2008; incidence and coverage, Countdown 2008b</td>
<td>Linear scale-up</td>
<td>Unknown</td>
<td>Costs decreased slightly due to cost drivers in the sample, e.g. China, Egypt and India, now with a slower scale-up trajectory than in the original analysis</td>
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<td>Model S2: Model U4 rerun with alternative population projection, high variant</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2008; incidence and coverage, Countdown 2008b</td>
<td>Population, based on UN 2008 projections, high variant</td>
<td>Expect higher additional costs</td>
<td>Overall costs increased by 2% (vs U4); patient costs increased by 4%</td>
</tr>
<tr>
<td>Model S3: Model U4 rerun with alternative population projection, low variant</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2008; incidence and coverage, Countdown 2008b</td>
<td>Population, based on UN 2008 projections, low variant</td>
<td>Expect lower additional costs</td>
<td>Overall costs decreased by 3% (vs U4); patient costs decreased by 6%</td>
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were maintained and not replaced in subsequent models. The stepwise presentation shows the net effect of each step (Table 1 and Appendix D, available at: http://www.who.int/choice/publications/p_2011_cost_validation_webannexes.pdf).

Model V estimates show the effect of adding new and validated country data to the original 2007 estimates. The U1–U4 model estimates show the effect of successively updating the data on population, disease incidence15,16 and intervention coverage,2 while Models S1–S3 show the effect of changes in demographic figures and in the assumed progress of the scale-up process. Model U5 estimates present the effect of recent unit price updates by WHO-CHOICE, which were performed by using new input values for the independent variables in the CHOICE regression analysis.2

### Extrapolation to 75 countries

WHO’s Commission on Macroeconomics and Health (CMH) has developed the only index available to date for classifying countries’ health systems into four different levels of strength based on constraints other than lack of funds (e.g., constraints related to demand and care-seeking, health sector policy and broader economic and political factors).17 We estimated the average percentage increase in the projected cost of child survival interventions and related activities, by CMH category, for the 26 countries included in Model U5. The original costs for the remaining 49 countries were then increased in accordance with this adjustment factor. In this manner we extrapolated the results to all 75 countries that together accounted for 94% of all child deaths in the world (the 32 countries included in the validation accounting for 78% of such deaths). Finally, we incorporated recently updated price tags for immunization and malaria programmes and for PMTCT.

### Results

#### Validating and adapting global cost assumptions

More than 80% (26/32) of the countries with high child mortality rates responded. This included countries from all regions, the majority (12) of them in the African Region, as outlined in Appendix A. The level of agreement with the generic assumptions used for the original global cost estimates varied substantially among country respondents, as shown in Fig. 1. It ranged from 80% agreement to 100% disagreement, although for specific areas little information was available.
Country-level information on the incidence of common childhood illnesses, especially pneumonia and diarrhoea, was particularly scarce. When available, the data provided by the countries did not conform to our quality criteria. Of the 26 respondent countries, 17 (65%) provided updated information on the coverage of pneumonia and diarrhoea management interventions. Demographic and Health Surveys were the source of information for all countries (Appendix A). About 65% of the respondent countries provided no data on the coverage of breast feeding counselling.

Not surprisingly, agreement on drug prescription quantities was strong; 77% of the respondents agreed with the global default estimates for drugs used to treat pneumonia and diarrhoea, based on standardized WHO treatment guidelines. Most disagreement had to do with the country’s choice of first-line treatments (e.g. co-trimoxazole versus amoxicillin for pneumonia).

A total of 11 countries reported updated prices for oral rehydration salt sachets. Nine countries reported a price that was, on average, 50% higher than the original global median price. Less information was provided about the average cost of outpatient visits and hospital admissions, a reflection of the scarcity of cost studies at the country level and/or the limited use of their results for national planning.

Upon request, 13 countries provided updated per diem costs for Integrated Management of Childhood Illness in-service training participants. On average, the new per diem amounts were more than double the original estimates. Similarly, the original figures for community health worker (CHW) pay were reported as inaccurate by 16 of the 26 respondent countries. Nine countries presented higher figures, four reported a lower amount and three reported that CHWs received no remuneration.

Consensus was limited on the CHW density needed to support family care practices and community-based care. Of 10 countries that provided data, 5 reported a density higher than the model assumption of 1 CHW per 1000 rural residents and 1 CHW per 1500 urban residents, whereas 5 reported a lower density. The updated numbers of existing CHWs that were provided by respondent countries also differed from the estimates available in the WHO database, most likely owing to differences in definition. For the 16 countries that reported using CHWs, the new data resulted in a median increase of 53% in CHW remuneration levels, which emerged as a major cost component.

Validating outcomes for 26 countries

Table 2 shows the new cost estimates based on validated country inputs. New country-level data (Model V) resulted in a 53% increase in total costs for the 26 countries surveyed. When new population data were provided (U1), costs fell by 4%. With updated incidence calculations for severe malnutrition (U2), costs increased further, to 77% more than the original estimate. Updating intervention coverage lowered total costs somewhat, to 61% of the original estimate (U3). Combining these updates (U4) yielded a total increase of 63%.

The validation survey (V) showed relatively robust patient cost estimates (an increase of 20%). Programme cost estimates, however, more than doubled (+140%) in Model V. CHW expenditures contributed the most to this increase. Such expenditures increased by 280% (range: 0–1146%), on average, for the 19 countries that provided feedback, mainly because of higher updated figures for CHW remuneration (rather than number of CHWs). The second most influential adjustment was an average doubling of infrastructure costs (+103%), mostly comprised of the equipment needed to upgrade existing hospitals. As a result of the validation process, the cost of training and of information, education and communication activities decreased to 91% and 78% of the original cost estimates, respectively (Appendix D).

The sensitivity analysis (S2, S3) showed that population size was not a major cost driver; low and high popula-
tion estimates caused a change of only 2% to 3% in total costs. Changing the model to a linear scale-up (S1) lowered total costs by 11%. Model U5 results in a 16% increase in overall costs when updated WHO-CHOICE prices for the year 2005 were used.3

Overall our analysis showed that country feedback affected costs the most. Additional substantial effects resulted from updated WHO-CHOICE prices (U5) and from improved estimates of the incidence of severe malnutrition management, pneumonia management, diarrhoea management, antibiotic treatment for dysentery, measles complications, community-based case management, neonatal infections, vitamin A supplementation and regular deworming. In addition, it includes the following programme cost components: community health workers, supervision, training, monitoring and evaluation; information, education and communication; advocacy; laws, policy and regulation; infrastructure; technical assistance; general management.

As shown in Fig. 2, the original price tag substantially underestimated total costs. After the validation, the median per capita investment needed in 2015 increased by 24% for the 26 countries surveyed (range: −31% to +498%) (Appendix E, available at: http://www.who.int/choice/publications/p_2011_cost_validation_webannexes.pdf).

We extrapolated the new findings to estimate the costs (in 2005 US$ for consistency with recent publications from the High Level Taskforce on International Innovative Financing for Health Systems and others) for the 75 countries having high child mortality rates, based on the percentage change, per CMH category, observed among the countries in our survey. Our analysis, based on re-
Table 3. Additional cost of scaling up entire child survival package in 75 countries with high child mortality, 2010–2015

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<tr>
<td>Cost (billions of 2005 US$)</td>
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<tr>
<td>CAH package</td>
<td>7.68</td>
<td>8.15</td>
<td>9.04</td>
<td>9.72</td>
<td>10.18</td>
<td>10.84</td>
<td>55.60</td>
<td>29.79</td>
<td>-87</td>
</tr>
<tr>
<td>Immunization</td>
<td>2.27</td>
<td>2.78</td>
<td>3.09</td>
<td>2.96</td>
<td>2.68</td>
<td>2.65</td>
<td>16.42</td>
<td>9.22</td>
<td>-78</td>
</tr>
<tr>
<td>Malaria</td>
<td>0.15</td>
<td>0.18</td>
<td>0.47</td>
<td>0.24</td>
<td>0.25</td>
<td>0.54</td>
<td>1.83</td>
<td>1.72</td>
<td>+7</td>
</tr>
<tr>
<td>PMTCT of HIV</td>
<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.15</td>
<td>0.34</td>
<td>-55</td>
</tr>
<tr>
<td>Total additional cost</td>
<td>10.11</td>
<td>11.12</td>
<td>12.62</td>
<td>12.95</td>
<td>13.14</td>
<td>14.07</td>
<td>74.00</td>
<td>41.06</td>
<td>+80</td>
</tr>
<tr>
<td>Total additional cost per capita (US$)</td>
<td>2.0</td>
<td>2.2</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
<td>2.6</td>
<td>14.1</td>
<td>7.9</td>
<td>+79</td>
</tr>
</tbody>
</table>

CAH, Department of Child and Adolescent Health and Development (World Health Organization); PMTCT, prevention of mother-to-child transmission.

Discussion

Our revised estimate of the global price tag for selected child survival packages for the period 2010–2015 is 74 billion in 2005 US$. Incorporating the country information received resulted in an 80% increase in our 2007 global estimates.
Patient cost estimates were relatively robust. Country respondents reported agreement with the treatment protocols recommended by WHO, although some countries reported prices higher than the original estimates. The wide variation in drug prices among countries has important policy implications for child health programme financing.\textsuperscript{21,22} Epidemiologic cost drivers are also important: a change in the estimated incidence of severe malnutrition alone increased original costs by 15%. The original price tag, relying on generic model defaults, resulted in considerable underestimation. Programme cost estimates increased substantially (+140%). A significant share of the total costs corresponded to health systems resources related to service delivery.

While our empirical validation reduced some measurement uncertainties, others pertaining to the scale-up process and specific implementation strategies remain.\textsuperscript{23–25} The debate surrounding facility-based versus community-based care, for example, is likely to continue. While facility-based care may prevent the more severely ill children from dying,\textsuperscript{26} access to those facilities is limited. Timely community-based care can prevent deaths by increasing access and preventing children from becoming severely ill.\textsuperscript{27} With improved standardized care delivery options, systematic costing research can indicate the resource implications for each option, thus informing government programme strategies about the most cost-efficient alternatives.

Our study has also shown that essential country-level epidemiological data (e.g., incidence rates or cause-specific mortality figures) are rarely available.\textsuperscript{28} Data on the provision of essential child survival services are rare; 65% of the survey respondents could not provide data on breastfeeding counselling. Countries depend extensively on data that are synthesized and disseminated internationally. Exist ing information, particularly regarding current epidemiological trends, needs to be more widely disseminated. Needs-based planning requires more routine data collection at the local level and more economic research. Internationally comparable data on community healthy workers are lacking. This points to the need to develop comparable human resource estimates, an area in which human resources for health observatories can play an important role.\textsuperscript{29}

Recent analyses have highlighted the resource needs associated with different scale-up strategies.\textsuperscript{30} National-level costing is needed for national planning involving local stakeholders and to determine the actual resources required to scale up strategies in a manner that accounts for local economies of scale. Child health planning should be conducted in conjunction with broader health sector planning. Given resource constraints, countries will need to prioritize health activities within their national resource envelopes.

The relative lack of information on country-level spending on child health complicates priority setting.\textsuperscript{31} Better instruments and processes, such as sub-accounts for child health,\textsuperscript{32} and the monitoring of current (under-)spending, strengthen the case for investing in child survival and help direct resources towards effective uses. Both external and in-country financing can play a key role, especially in countries with weak health systems. The recent launch of a Global Plan for Maternal, Newborn and Child Health may increase partnerships around country plans to fund activities in this area.\textsuperscript{33} While donors are pledging increased resources for maternal and child health,\textsuperscript{34} developing country governments need to raise even more funds. Our empirical reveal revealed an 80% increase in the global price tag for scaling up child survival interventions, which means that countries must reassess their budget allocation towards child health if they are to reach MDG4. When possible, options should be explored to increase national health expenditures: the estimated resource needs are equivalent to a gradual increase of 12% over 2007 levels.

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Coût global de la survie de l’enfant: estimations à partir de la validation au niveau du pays

Objectif Effectuer une validation croisée du coût global du renforcement des interventions chirurgicales pédiatriques afin d’atteindre le quatrième objectif du Millénaire pour le développement (OMD4) sur la survie de l’enfant.

Méthodes Après l’identification des principales catégories de coût et l’estimation du coût global de l’intervention à partir des données officielles, un questionnaire de validation a été soumis à chaque pays, au niveau du système et au niveau de chaque programme.

Résultats Six pays ont répondu. Les ajustements étaient les plus importants pour les données relatives aux systèmes et aux programmes, et les moins importants pour les données des patients. La validation du niveau du pays s’est traduite par une augmentation de 43% des estimations de coût d’origine. Les chiffres démographiques actualisés n’avaient que peu d’impact, et les chiffres socio-économiques et sanitaires avaient un impact plus important. Le coût total des programmes de vaccination et de lutte contre le paludisme a augmenté de 14%. Les résultats de cette étude soulignent l’importance de la validation à l’échelle du pays et de la qualité des données utilisées pour l’estimation des coûts globaux de la santé.

Conclusion Les résultats de cette étude indiquent que la validation du coût global de la survie de l’enfant est cruciale pour une planification efficace et une allocation optimale des ressources. Les ajustements importants pour les données relatives aux systèmes et aux programmes soulignent l’importance de l’utilisation de données de haute qualité pour une estimation précise des coûts des interventions de santé publique.
La comprobación a nivel nacional produjo un aumento del 53% de datos del sistema y de los programas que en los datos de los pacientes. Respondieron 26 países. Los ajustes fueron mayores en los resultados maternofetales del virus de la inmunodeficiencia humana. La malaria, así como de los programas de prevención de la transmisión únicamente, las estimaciones se extrapolaron a 75 países y se combinaron elaboraron nueve actualizaciones del modelo de la OMS de 2007. Por nivel individual y dentro del programa. Con los supuestos revisados, se la intervención, los precios y los recursos de las actividades realizadas a disposición pública de la incidencia de enfermedades, la cobertura de la intervención, los precios y los recursos de las actividades realizadas a nivel individual y dentro del programa. Con los supuestos revisados, se elaboraron nueve actualizaciones del modelo de la OMS de 2007. Por último, las estimaciones se extrapolaron a 75 países y se combinaron con las estimaciones del costo de los programas de vacunación y contra la malaria, así como de los programas de prevención de la transmisión maternofetal del virus de la inmunodeficiencia humana. Resultados Respondieron 26 países. Los ajustes fueron mayores en los datos del sistema y de los programas que en los datos de los pacientes. La comprobación a nivel nacional produjo un aumento del 53% de la intervención, los precios y los recursos de las actividades realizadas a nivel individual y dentro del programa. Con los supuestos revisados, se elaboraron nueve actualizaciones del modelo de la OMS de 2007. Por último, las estimaciones se extrapolaron a 75 países y se combinaron con las estimaciones del costo de los programas de vacunación y contra la malaria, así como de los programas de prevención de la transmisión maternofetal del virus de la inmunodeficiencia humana. Resultados Respondieron 26 países. Los ajustes fueron mayores en los datos del sistema y de los programas que en los datos de los pacientes. La comprobación a nivel nacional produjo un aumento del 53% de los cálculos originales del gasto (es decir, 9 000 millones de dólares estadounidenses en 2004 [US$] en 26 países, debido a la revisión del sistema y de los supuestos del programa, especialmente en lo referente a los costes del personal sanitario comunitario). El efecto adicional de las cifras actualizadas de la población fue pequeño; las cifras epidemiológicas actualizadas hicieron que el coste aumentara en US$ 4 000 millones (+15%). Los nuevos precios unitarios de los 26 países que aportaron sus datos aumentaron las estimaciones en US$ 4 300 millones (+16%). La extrapolación a los 75 países provocó un aumento de la estimación original del precio de US$ 33 000 millones (+80%) para el periodo comprendido entre 2010 y 2015. Conclusión La validación a nivel nacional tuvo un efecto considerable en las estimaciones del gasto mundial. Las adaptaciones de los precios y los supuestos relacionados con los programas contribuyeron de forma significativa a dicho aumento. Entre 2010 y 2015 harán falta US$ 74 000 millones más (de 2005), lo que significa un aumento del 12% del gasto sanitario total. En vista de las limitaciones de los recursos, los países deberán dar prioridad a las actividades sanitarias en sus dotaciones presupuestarias nacionales.
References


