Global cost of child survival: estimates from country-level validation
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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 中文, Français, Русский and Español at the end of each article.

Introduction
In keeping with the fourth Millennium Development Goal (MDG4), nations have pledged to reduce child mortality by two-thirds between 1990 and 2015. This calls for a scale-up of child survival interventions, whose global cost the World Health Organization (WHO) recently estimated for 75 countries that have a high burden of mortality among children aged less than five years. In an effort to support the countries in greatest need, WHO’s Department of Child and Adolescent Health and Development (CAH) has identified 33 countries (Appendix A, available at: http://www.who.int/choice/publications/p_2011_cost_valida
tion_webannexes.pdf) that together contribute 78% of all deaths among children under 5 years of age.

Updated and improved global data on child health have recently become available. Also available now are updated estimates on the prevalence of malnutrition; new intervention coverage estimates made available by Countdown-to-2015; updated price estimates from the WHO-CHOICE project and updated estimates of the resources needed to scale up immunization, malaria and prevention of mother-to-child transmission (PMTCT) of human immunodeficiency virus (HIV) programmes. Although global price estimates for the scale-up of packages of selected child health interventions are regularly published, to our knowledge none has been empirically validated against existing country data. Empirical validation differs from the type of conceptual validation by experts that we first conducted. This paper reports on the results of this country-level empirical validation process, for which we use country feedback data in conjunction with new, published global data on epidemiology and prices. It presents a validated and revised global price tag for the scale-up of child survival interventions required to attain MDG4 and serves as an investment guide for governments and their development partners.

Methods
We used the original cost projection developed by WHO to derive the 2007 global price tag for child survival. The validation comprised only the key interventions included in the CAH model, including the management of pneumonia, diarrhoea and severe malnutrition, as well as nutrition counselling (complete list available in Appendix B, available at: http://www.who.int/choice/publications/p_2011_cost_validation_webannexes.pdf).

We identified major cost drivers by country and then sent a validation questionnaire covering these cost drivers to 32 countries with high child mortality. Each data input category for the costing model (disease incidence, intervention coverage and prices and input volumes for individual-level and programme-level activities) was validated against local data. Original as-

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The components of childhood mortality (Box 1) were used to validate the generic cost estimates. 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.

**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 1. Stepwise validation models and data updates applied in the revision of 2007 World Health Organization (WHO) global estimates for child survival interventions, 2010–2015

<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>
</thead>
<tbody>
<tr>
<td>Original 2007 WHO</td>
<td></td>
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</tr>
<tr>
<td>Original price tag</td>
<td>2004</td>
<td>No</td>
<td>Population, 2002; incidence and coverage, 2004</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validation (V) and update (U) analysis (n=26)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<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 2006 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>Incidence15 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; incidence15 and coverage, Countdown 2008b</td>
<td>Examine combined effect of updating population, incidence and coverage</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Sensitivity (S) analysis (n=26)</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Model S1: Model U4 rerun with alternative scale-up strategy (linear)</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2008; incidence15 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 (U4)</td>
</tr>
<tr>
<td>Model S2: Model U4 rerun with alternative population projection, high variant</td>
<td>2004</td>
<td>Yes</td>
<td>Population, 2008; incidence15 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; incidence15 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>
</tr>
</tbody>
</table>

Updating (U) analysis of the global price tag
Table 1:

<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>Extrapolation to 75 countries</th>
<th>Combination: estimates combined with costs for immunization, malaria and PMTCT of HIV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model V</td>
<td>2005</td>
<td>Yes</td>
<td>Population, 2008; incidence, 2008</td>
<td>Extrapolation to 75 countries</td>
<td>Costs taken from recent publications on HIV/AIDS, malaria and immunization</td>
</tr>
<tr>
<td>Model U5: estimates combined with costs for immunization, malaria and PMTCT of HIV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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). 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-

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### Table 2. Estimated cost,\(^a\) by model, of child survival interventions\(^b\) in 26 respondent countries, 2010–2015

<table>
<thead>
<tr>
<th>Model(^c)</th>
<th>Total cost 2010–2015 (%)</th>
<th>Change from original (%)</th>
<th>Change from V (%)</th>
<th>Change from U4 (%)</th>
<th>Patient costs 2010–2015 (%)</th>
<th>Change from original (%)</th>
<th>Change from V (%)</th>
<th>Change from U4 (%)</th>
<th>Programme costs 2010–2015 (%)</th>
<th>Change from original (%)</th>
<th>Change from V (%)</th>
<th>Change from U4 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original 2007</td>
<td>16.86</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>12.19</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4.67</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>V</td>
<td>25.88</td>
<td>53</td>
<td>–</td>
<td>–</td>
<td>14.66</td>
<td>20</td>
<td>–</td>
<td>–</td>
<td>11.21</td>
<td>140</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>U1</td>
<td>25.14</td>
<td>49</td>
<td>–2.8</td>
<td>–</td>
<td>12.64</td>
<td>4</td>
<td>–14</td>
<td>–</td>
<td>12.50</td>
<td>167</td>
<td>11</td>
<td>–</td>
</tr>
<tr>
<td>U2</td>
<td>29.83</td>
<td>77</td>
<td>15</td>
<td>–</td>
<td>17.33</td>
<td>42</td>
<td>18</td>
<td>–</td>
<td>12.50</td>
<td>167</td>
<td>11</td>
<td>–</td>
</tr>
<tr>
<td>U3</td>
<td>27.16</td>
<td>61</td>
<td>5.0</td>
<td>–</td>
<td>14.66</td>
<td>20</td>
<td>0</td>
<td>–</td>
<td>12.50</td>
<td>167</td>
<td>11</td>
<td>–</td>
</tr>
<tr>
<td>U4</td>
<td>27.48</td>
<td>63</td>
<td>6.2</td>
<td>–</td>
<td>14.98</td>
<td>23</td>
<td>2</td>
<td>–</td>
<td>12.50</td>
<td>167</td>
<td>11</td>
<td>–</td>
</tr>
<tr>
<td>S1</td>
<td>24.37</td>
<td>44</td>
<td>–5.8</td>
<td>–11.3</td>
<td>12.52</td>
<td>3</td>
<td>–15</td>
<td>–16.4</td>
<td>11.84</td>
<td>153</td>
<td>6</td>
<td>–5.3</td>
</tr>
<tr>
<td>S2</td>
<td>28.12</td>
<td>67</td>
<td>8.7</td>
<td>2.3</td>
<td>15.62</td>
<td>28</td>
<td>7</td>
<td>4.3</td>
<td>12.50</td>
<td>167</td>
<td>11</td>
<td>0.0</td>
</tr>
<tr>
<td>S3</td>
<td>26.67</td>
<td>58</td>
<td>3.1</td>
<td>–2.9</td>
<td>14.17</td>
<td>16</td>
<td>–3</td>
<td>–5.4</td>
<td>12.50</td>
<td>167</td>
<td>11</td>
<td>0.0</td>
</tr>
<tr>
<td>U5</td>
<td>31.83</td>
<td>89</td>
<td>23.0</td>
<td>15.8</td>
<td>18.55</td>
<td>52</td>
<td>27</td>
<td>23.9</td>
<td>13.28</td>
<td>184</td>
<td>18</td>
<td>6.2</td>
</tr>
</tbody>
</table>

\(^a\) Sensitivity analyses; \(^b\) Information updates; \(^c\) Validation.

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### Fig. 2. Scale-up curves comparing original costs to revised cost estimates for intervention package\(^d\), for 26 respondent countries

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S, sensitivity analyses; U, information updates; V, validation.

\(^d\) Of the World Health Organization’s Department of Child and Adolescent Health and Development (CAH).
Revised estimates and on new published cost estimates for PMTCT,\textsuperscript{9} immunization\textsuperscript{18} and malaria programmes,\textsuperscript{19} has shown the need to invest an additional US$ 74 billion from 2010 to 2015, starting with US$ 10 billion in 2010 and reaching US$ 14 billion by 2015 (Table 3). This represents an increase of US$ 33 billion (+80%) over previous estimates for the span of 6 years. The planned introduction of new vaccines resulted in increased immunization costs. On the other hand, the incremental resources needed for PMTCT decreased due to recent progress in scaling up and to new, lower estimates of the incidence of HIV infection.

The newly derived costs correspond to a per capita increase of US$ 2.6 in total health expenditure in 2015 relative to 2007. As shown in Fig. 3, countries with weak health systems (CMH1) need to make the greatest investment; in such countries, the additional resources needed per capita are two to three times greater than in countries belonging to CMH categories 3 and 4. Countries with high child mortality rates in the Eastern Mediterranean Region were found to require the greatest investment (Appendix F, available at http://www.who.int/choice/publications/p_2011_cost Validation_webannexes.pdf, presents the additional funds needed per capita by WHO region).

In response to the United Nations Millennium Declaration, governments have committed themselves to scaling up health services to reach the MDGs.\textsuperscript{20} Fig. 4 shows that for all 26 survey countries combined, the additional investment needed would represent a median increase of approximately 12% (range: 1–55%) over the total health expenditure for 2007. Countries in CMH categories 1 and 2 would require a median increase of 18% above 2007 levels, compared with 6% for countries in CMH categories 3 and 4.

### 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.

### Table 3. Additional cost of scaling up entire child survival package in 75 countries with high child mortality, 2010–2015

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Cost (billions of 2005 US$)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAH package</td>
<td>7.68</td>
<td>8.15</td>
<td>9.04</td>
<td>9.72</td>
<td>10.18</td>
<td>10.84</td>
<td>55.60</td>
<td>29.79</td>
<td>+87</td>
</tr>
<tr>
<td>Immunization</td>
<td>2.27</td>
<td>2.78</td>
<td>3.09</td>
<td>2.96</td>
<td>2.68</td>
<td>2.65</td>
<td>16.42</td>
<td>9.22</td>
<td>+78</td>
</tr>
<tr>
<td>Malaria</td>
<td>0.15</td>
<td>0.18</td>
<td>0.47</td>
<td>0.24</td>
<td>0.25</td>
<td>0.54</td>
<td>1.83</td>
<td>1.72</td>
<td>+7</td>
</tr>
<tr>
<td>PMTCT of HIV</td>
<td>0.01</td>
<td>0.02</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.15</td>
<td>0.34</td>
<td>−55</td>
</tr>
<tr>
<td>Total additional cost</td>
<td>10.11</td>
<td>11.12</td>
<td>12.62</td>
<td>12.95</td>
<td>13.14</td>
<td>14.07</td>
<td>74.00</td>
<td>41.06</td>
<td>+80</td>
</tr>
<tr>
<td>Total additional cost per capita (US$)</td>
<td>2.0</td>
<td>2.2</td>
<td>2.4</td>
<td>2.4</td>
<td>2.6</td>
<td>14.11</td>
<td>14.1</td>
<td>7.94</td>
<td>+79</td>
</tr>
</tbody>
</table>

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

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

### Fig. 3. Additional investment needed per capita in 2015 to scale up entire child survival package, by Commission on Macroeconomics and Health (CMH) category, for 75 countries

![Fig. 3: Additional investment needed per capita in 2015 to scale up entire child survival package, by Commission on Macroeconomics and Health (CMH) category, for 75 countries](image-url)
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{3} access to those facilities is limited. Timely community-based care can prevent deaths by increasing access and preventing children from becoming severely ill.\textsuperscript{2} With improved standardization of 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{26} 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. Existing information, particularly regarding current epidemiologic 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 revision 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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**Competing interests:** None declared.
Global cost of scaling up child survival interventions

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 (OMD)4, selon les estimations de l’Organisation mondiale de la Santé (OMS) en 2007, en utilisant les dernières données fournies par les pays ainsi que de nouvelles hypothèses.

Méthodes
Après l’identification des principales catégories de coût pour chaque pays, des questionnaires de validation ont été transmis à 32 pays présentant une forte mortalité infantile. Les estimations publiquement disponibles pour l’incidence des maladies, la couverture des interventions, les tarifs et les ressources relatives aux activités au niveau individuel et au niveau des programmes ont été validées par comparaison avec les données locales. Neuf mises à jour du modèle OMS 2007 ont été réalisées grâce aux hypothèses révisées. Enfin, les estimations ont été extrapolées à 75 pays et intégrées aux estimations de coût des programmes de vaccination et de lutte contre le paludisme et des programmes de prévention de la transmission mère-enfant du virus de l’immunodéficience humaine.

Résultats
Vingt-six pays ont répondu. Les réajustements étaient les plus importants pour les données relatives aux systèmes et aux programmes, et les moins importants pour les données des patients. La validation au niveau des pays s’est traduite par une augmentation de 53% des estimations de coût d’origine (c.-à-d. 9 milliards de dollars américains de 2004 [USD]) pour 26 pays, du fait de la révision des hypothèses liées aux systèmes et aux programmes, plus particulièrement celles concernant les coûts afférents au personnel de santé communautaire. Les chiffres démographiques actualisés n’avaient que peu d’effet ajouté et les chiffres épidémiologiques actualisés augmentaient les coûts de 4 milliards de dollars américains (+15%). Les tarifs des nouvelles unités des 26 pays qui avaient fourni les données augmentaient les estimations de 4,3 milliards de dollars américains (+16%). L’extrapolation à 75 pays

Malzak

التكاليف العالمية للحفاظ على بقاء الأطفال على قيد الحياة: تقديرات التحقق من المصداقية على الصعيد القطري

يجري التحقق على الصعيد القطري له تأثير ملموس على التقديرات...

факторы

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Résumé

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

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Summary

Global cost of scaling up child survival interventions

Objectives
To perform a cross-validation of the cost of scaling up child survival interventions in developing countries in order to reach the fourth Millennium Development Goal (MDG)4, using the latest data available from countries, and including new assumptions.

Methods
After identifying the main categories of cost for each country, questionnaires of validation were sent to 32 countries presenting high infant mortality. Publicly available estimates for the incidence of diseases, coverage of interventions, prices, and resources related to activities at the individual level and at the program level were validated by comparison with local data. Nine updates of the model OMS 2007 were carried out. Finally, estimates were extrapolated to 75 countries and integrated to the estimates of costs of vaccination programs and of malaria control and other child survival interventions. A total of 26 countries participated.

Results
The validation increased estimates by 53% (2004 $9 billion) compared to routine estimates. Among the most important factors were the health care workers costs (16%). The extrapolation to 75 countries increased the estimates by 330 billion dollars (16% of the original estimates).

Conclusion
Validation of costs had a considerable impact. Adjustments to data and assumptions are very important. By 2015, an additional 4.3 billion dollars per year should be allocated to child survival programs in developing countries.
Глобальные затраты на обеспечение выживания детей: валидация оценок на страновом уровне

Цель Провести перекрестную валидацию выполненной Всемирной организацией здравоохранения (ВОЗ) в 2007 году оценки глобальных затрат по расширению масштаба интервенций в области обеспечения выживания детей для достижения Цели № 4 ООН в области развития, сформулированной в Декларации тысячелетия (ЦРДТ 4), с использованием новейших данных, представленных странами, и новых допущений.

Методы После определения основных категорий затрат для каждой страны валидационные анкеты были разосланы в 32 страны с высокой детской смертностью. Была проведена валидация опубликованных оценок встречаемости заболеваний, сферы действия интервенций, а также цен и ресурсов для мероприятий на индивидуальном и программном уровнях по сравнению с местными данными.

На основе использования измененных допущений были получены девять уточнений модели ВОЗ 2007 года. В заключение оценки были экстраполированы на 75 стран и объединены с оценками стоимости иммунизационной и противомалярийной программ, а также программ профилактики передачи вируса иммунодефицита человека от матери ребенку.

Результаты Ответы получены от 26 стран. Корректировки были наибольшими для данных на системном и программном уровнях и наименьшими – для данных о пациентах. Валидация на страновом уровне привела к 53%-ному повышению первоначальных оценок затрат (в сумме 9 млрд долларов США [долл. США]) для 26 стран из-за изменения системных и программных допущений, особенно в связи с затратами на медицинских работников на уровне общин). Дополнительное воздействие уточненных данных о численности населения было незначительным; уточнение эпидемиологических показателей привело к повышению стоимости на 4.3 млрд долл. США (+15%). Новые удельные цены в 26 странах, предоставивших данные, привели к повышению оценок на 4 млрд долл. США (+80%) на период 2010–2015 годов.

Вывод Валидация на страновом уровне оказалась существенное воздействие на оценки затрат. Этому значительно способствовали адаптация цен и допущения, связанные с программами. В период с 2010 по 2015 год потребуются дополнительные ассигнования в сумме 74 млрд долл. США 2005 года (что отражает 12%-ный прирост глобальных расходов на здравоохранение). Учитывая ограниченность ресурсов, странам понадобится повысить приоритет финансирования мероприятий в области здравоохранения.

Resumen

Coste mundial de la supervivencia infantil: cálculos procedentes de las validaciones nacionales

Objetivo Realizar una validación cruzada del gasto mundial correspondiente al aumento de las intervenciones para la supervivencia infantil, calculado en 2007 por la Organización Mundial de la Salud (OMS), con los últimos datos proporcionados por los países y los nuevos supuestos, para alcanzar el Objetivo del Milenio 4 de la OMS.

Métodos Tras identificar las principales categorías del gasto de cada país, se enviaron los cuestionarios de validación a 32 países con una mortalidad infantil elevada. Se cotejaron los datos locales con las estimaciones 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 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


