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 عربي, 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.[1] 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_validation_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[2]; updated price estimates from the WHO-CHOICE project[3] and updated estimates of the resources needed to scale up immunization,[4] malaria[5] and prevention of mother-to-child transmission (PMTCT) of human immunodeficiency virus (HIV) programmes.[6]

Although global price estimates for the scale-up of packages of selected child health interventions are regularly published,[7,8] to our knowledge none has been empirically validated against existing country data.[9] Empirical validation differs from the type of conceptual validation by experts that we first conducted.[1] 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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sumptions 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.

Box 1. **Information solicited in questionnaire sent to 32 countries with high child mortality**

Questions on pneumonia, diarrhoea and malnutrition were part of the generic questions section, as these conditions are among the leading causes of child mortality in the countries in our study.[14] Generic questions on community health workers were also included for all countries.

In relation to the calculation of patient costs, the questionnaire solicited information on: (i) the epidemiology/incidence of major conditions (pneumonia and diarrhoea) and the coverage of interventions addressing these problems (breastfeeding counselling, antibiotics for pneumonia, oral rehydration salts for diarrhoea); (ii) differences in local standard case management protocols compared with generic World Health Organization standards (quantities of medicines and supplies); (iii) prices and quantities of medicines and supplies; (iv) costs of outpatient visits and inpatient management (Appendix C).

In relation to programme costs, generic questions were included about the number of community health workers needed and their remuneration. In addition, the survey included country-specific questions on information, education and communication activities, as well as on the organization of health worker training, infrastructure and equipment.

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,[12] 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).[13] 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:

i) valid agreement: the original assumption was considered valid by the respondent and remained unchanged;
ii) valid disagreement: the newly validated information was considered to be adequately supported and was used in place of the original assumption;
iii) invalid disagreement: the newly validated information was considered to be inadequately supported and the original assumption was maintained;
iv) 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 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**

Model[a] and description	Reference year for price data	Country-validated assumptions	Reference year for population, incidence and intervention coverage data	Inputs updated	Expected effect on overall costs, all else being the same	Finding
Original 2007 WHO						
Original price tag	2004	No	Population, 2002; incidence and coverage, 2004	–	–	–
Validation (V) and update (U) analysis ($n=26$)						
Model V: original price tag estimates updated with country inputs	2004	Yes	Population, 2002; incidence and coverage, 2004	Country inputs	Unknown (depending on higher/lower country validation of ingredients)	Costs increased by 53% from original
Model U1: as per model V, with population updates	2004	Yes	Population, 2008	Population, update from 2002 to 2008 projections (medium variant)	Expect higher costs, as population estimates have increased on average since the 2002 projections for the 75 countries	Costs for V2 decreased by 3% (vs V)
Model U2: as per model V, with incidence updates	2004	Yes	Incidence[15] of severe malnutrition	Incidence, new formulas available for estimating incidence from prevalence	Expect higher costs, as incidence estimates will increase	Costs increased 15% (vs V)
Model U3: As per model V, with coverage updates	2004	Yes	Coverage, Countdown 2008[b]	Intervention coverage	Expect lower additional costs (than original) because current coverage has most likely increased	Coverage resulted in 5% higher costs (vs V) but effect not significant when combined with demographic data (U4)
Model U4: V and U1–U3 combined (population, incidence and coverage updates)	2004	Yes	Population, 2008; incidence[15] and coverage, Countdown 2008[b]	Examine combined effect of updating population, incidence and coverage	Unknown	–
Sensitivity (S) analysis ($n=26$)						
Model S1: Model U4 rerun with alternative scale-up strategy (linear)	2004	Yes	Population, 2008; incidence[15] and coverage, Countdown 2008[b]	Linear scale-up	Unknown	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
Model S2: Model U4 rerun with alternative population projection, high variant	2004	Yes	Population, 2008; incidence[15] and coverage, Countdown 2008[b]	Population, based on UN 2008 projections, high variant	Expect higher additional costs	Overall costs increased by 2% (vs U4); patient costs increased by 4%
Model S3: Model U4 rerun with alternative population projection, low variant	2004	Yes	Population, 2008; incidence[15] and coverage, Countdown 2008[b]	Population, based on UN 2008 projections, low variant	Expect lower additional costs	Overall costs decreased by 3% (vs U4); patient costs decreased by 6%
Updating (U) analysis of the global price tag						

Model[a] and description	Reference year for price data	Country-validated assumptions	Reference year for population, incidence and intervention coverage data	Inputs updated	Expected effect on overall costs, all else being the same	Finding
Model U5 (n = 26): Model U4 rerun with updated 2005 WHO-CHOICE prices	2005	Yes	Population, 2008; incidence[15] and coverage, Countdown 2008[b]	WHO-CHOICE prices	Expect higher costs since WHO-CHOICE price update gives higher price estimates (due to changes in technology mix over time)	Overall costs increased by 16% (vs U4)
Extrapolation						
To 75 countries: results from Model U5 extrapolated	2005	Yes	Population, 2008; incidence[15] and coverage, Countdown 2008[b]	No additional changes in assumptions: extrapolation from 26 to 75 countries	–	–
Combination						
Combination[c]: estimates combined with costs for immunization, malaria and PMTCT of HIV	2005	NA	NA	Costs taken from recent publications on HIV/AIDS, malaria and immunization	–	–

AIDS, acquired immunodeficiency syndrome; CAH, Department of Child and Adolescent Health and Development (WHO); HIV, human immunodeficiency virus; NA, not applicable; PMTCT, prevention of mother-to-child transmission; UN, United Nations.

[a] The CAH model includes patient-level intervention cost components: breastfeeding counselling, improvement of complementary feeding, 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-level cost components: community health workers, supervision, training, monitoring and evaluation; information, education and communication; advocacy; laws, policy and regulation; infrastructure; technical assistance; general management.

[b] Countdown coverage data were only available for three interventions (management of diarrhoea, management of pneumonia and vitamin A supplementation) and for 23 of the 26 selected countries.

[c] Refers to a combination with other models that include immunization costs; general management and infrastructure for immunization; PMTCT of HIV programmes; general management of PMTCT programmes; costs of malaria interventions in children under five and general management of such malaria programmes.

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 incidence[15,16] 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.[3]

Extrapolation to 75 countries

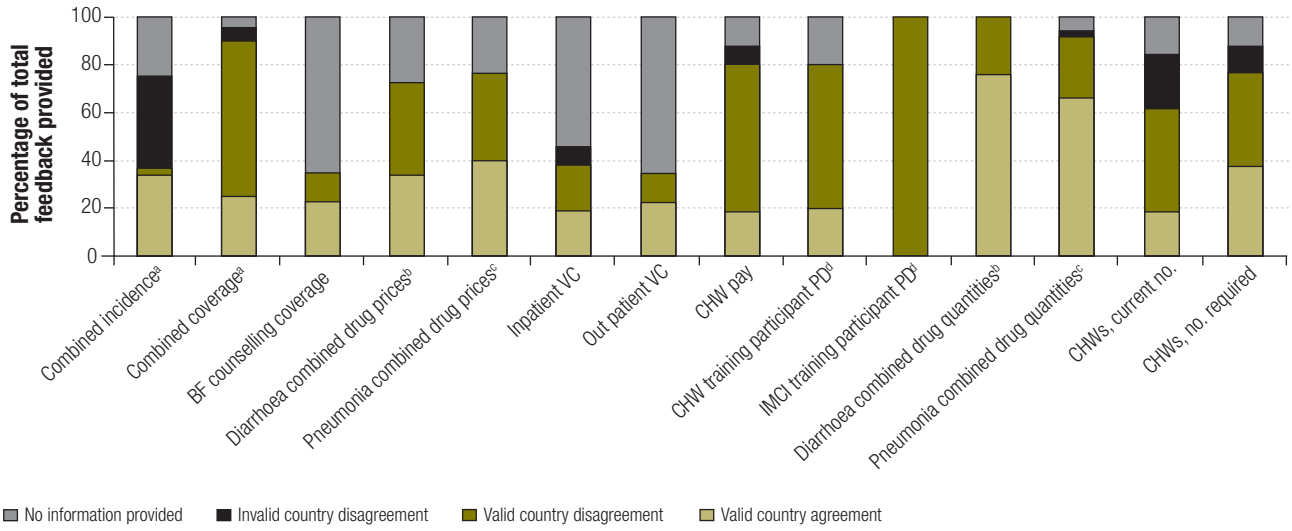
WHO's Commission on Macroeconomics and Health (CMH) has developed the only index available to date for classifying countries' health systems into four different levels of strength based on constraints other than lack of funds (e.g. constraints related to demand and care-seeking, health sector policy 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.

Fig. 1. **Classification of country responses as a percentage of total feedback provided, by input category, for 26 respondent countries**



BF, breastfeeding; CHW, community health worker; IMCI, Integrated Management of Childhood Illness; ORS, oral rehydration salts; PD, per diem; VC, visit costs.
[a] Combined coverage and combined incidence refer to aggregate results for pneumonia and diarrhoea.
[b] Combined diarrhoea prices and quantities refers to ORS and zinc;
[c] Combined pneumonia prices and quantities refers to paracetamol, salbutamol (oral), amoxicillin (oral), ampicillin (injectable), gentamycin (oral).
[d] Number of responses: CHW, 10; IMCI training, 1.

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,[14] 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-

Table 2. **Estimated cost,[a] by model, of child survival interventions[b] in 26 respondent countries, 2010–2015**

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

S, sensitivity analyses; U, information updates; V, validation.
[a] In billions of 2004 United States dollars.
[b] Of the World Health Organization's Department of Child and Adolescent Health and Development (CAH).
[c] The CAH model includes patient-related (intervention) costs for the following areas: breastfeeding counselling, improvement of complementary feeding, 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.

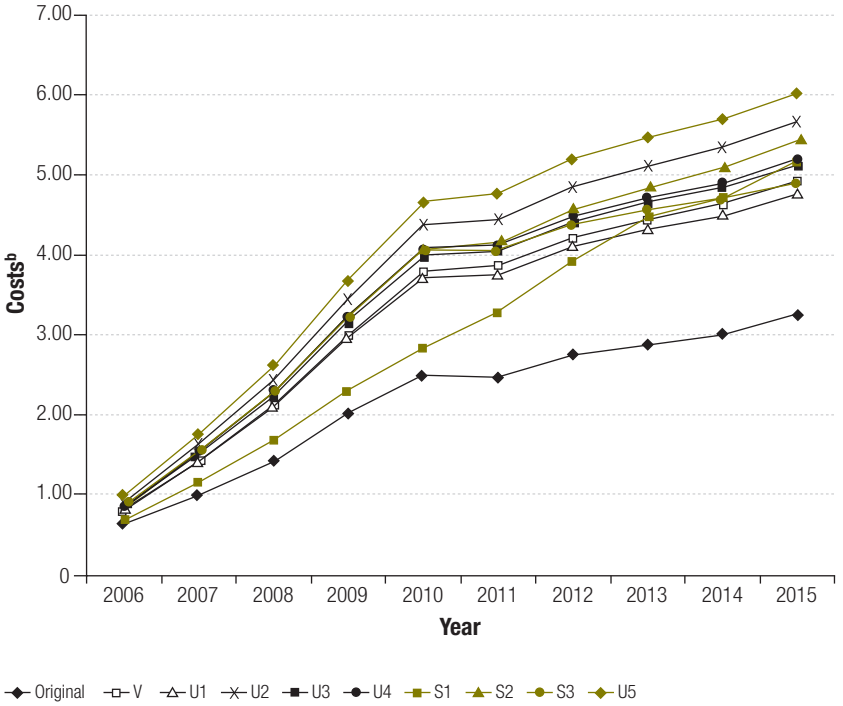
tion estimates caused a change of only 2% to 3% in total costs. Changing the model to a linear scale-up (S1) lowered total costs by 11%. Model U5 results in a 16% increase in overall costs when updated WHO-CHOICE prices for the year 2005 were used.[3]

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 (U2). The design of the scale-up curve (S1) had an important effect (−11%), along with updated programme coverage figures (+5%). Population projections (U1) had a small effect; the shift from 2002 to 2008 United Nations projections caused a 3% cost decrease and the use of low versus high projections had a moderate effect (range: +2 to −3%). We are referring to gross changes; the importance of these factors may vary across countries.

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-

Fig. 2. **Scale-up curves comparing original costs to revised cost estimates for intervention package,[a] for 26 respondent countries**



S, sensitivity analyses; U, information updates; V, validation.
[a] Of the World Health Organization's Department of Child and Adolescent Health and Development.
[b] In billions of 2004 United States dollars.

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

Component	2010	2011	2012	2013	2014	2015	New total, 2010–2015	Original estimate, 2010–2015	Change (%)
Cost (billions of 2005 US$)									
CAH package	7.68	8.15	9.04	9.72	10.18	10.84	55.60	29.79	+87
Immunization	2.27	2.78	3.09	2.96	2.68	2.65	16.42	9.22	+78
Malaria	0.15	0.18	0.47	0.24	0.25	0.54	1.83	1.72	+7
PMTCT of HIV	0.01	0.02	0.02	0.03	0.03	0.04	0.15	0.34	–55
Total additional cost	10.11	11.12	12.62	12.95	13.14	14.07	74.00	41.06	+80
Total additional cost per capita (US$)	2.0	2.2	2.4	2.4	2.4	2.6	14.1	7.9	+79

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

vised estimates and on new published cost estimates for PMTCT,[9] immunization[18] and malaria programmes,[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.

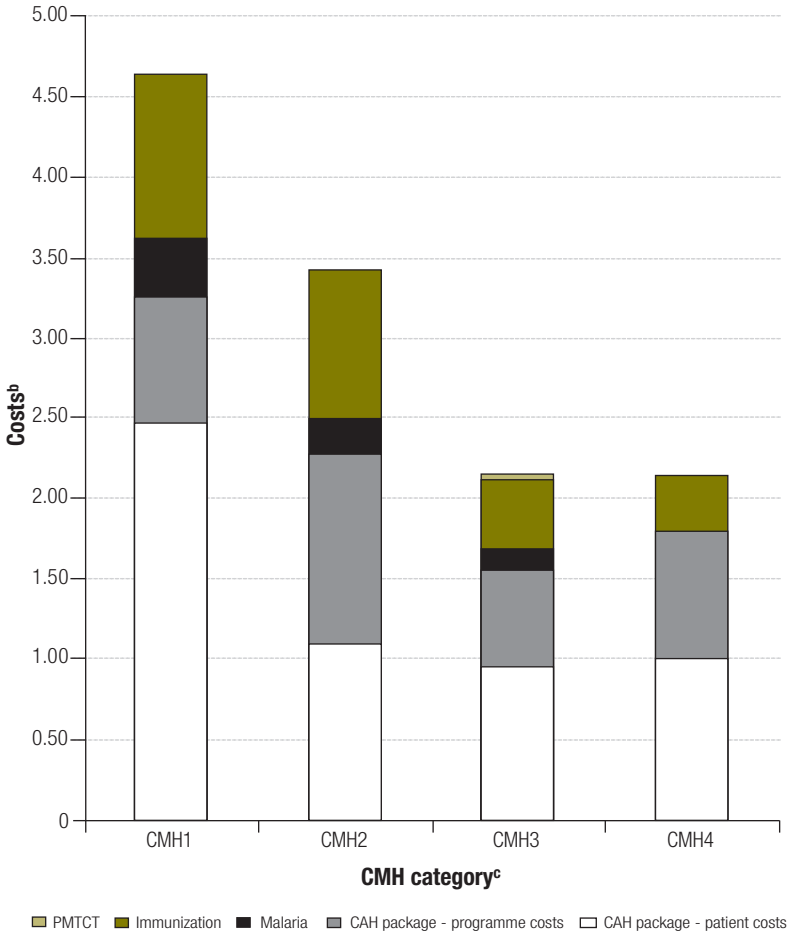
The newly derived costs correspond to a per capita increase of US$ 2.6 in total health expenditure in 2015 relative to 2007. As shown in Fig. 3, countries with weak health systems (CMH1) need to make the greatest investment; in such countries, the additional resources needed per capita are two to three 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.[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.

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



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

[a] Of the World Health Organization's Department of Child and Adolescent Health and Development.

[b] In 2005 United States dollars.

[c] Country typology by constraint quartiles: 1, most constrained; 4, least constrained.[17] Countries included: CMH1, 7; CMH2, 8; CMH3, 6; CMH4, 5.

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.[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.

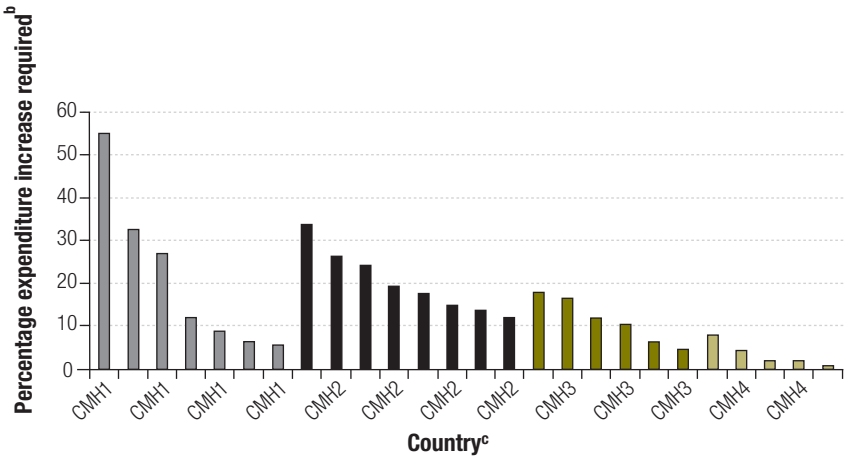
While our empirical validation reduced some measurement uncertainties, others pertaining to the scale-up process and specific implementation strategies remain.[23–25] The debate surrounding facility-based versus community-based care, for example, is likely to continue. While facility-based care may prevent the more severely ill children from dying,[26] access to those facilities is limited. Timely community-based care can prevent deaths by increasing access and preventing children from becoming severely ill.[27] 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.[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. Existing 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.[29]

Recent analyses have highlighted the resource needs associated with different scale-up strategies.[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.[31] Better instruments and processes, such as sub-accounts for child health[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.[33] While donors are pledging increased resources for maternal and child health,[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. ■

Fig. 4. **Increase over the total health expenditure (THE) for 2007 required to scale up entire child survival package,[a] by Commission on Macroeconomics and Health (CMH) category, for 26 respondent countries, 2010–2015**



[a] Of the World Health Organization's Department of Child and Adolescent Health and Development.
[b] Cost in 2015 compared with 2006 expenditure.
[c] Country typology by constraint quartiles: 1, most constrained; 4, least constrained.[17] Countries included: CMH1, 7; CMH2, 8; CMH3, 6; CMH4, 5.

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ملخص

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

الغرض مقارنة التحقق من مصداقية التكاليف العالمية للارتقاء بتدخلات تحقيق المرمى الرابع من المرامي الإنمائية للألفية، كما قدّرته منظمة الصحة العالمية في عام 2007، باستخدام آخر المعطيات المقدمة من البلدان والافتراضات الجديدة.

الطريقة بعد تحديد فئات التكاليف الرئيسية لكل بلد، أُرسِل استبيانٌ للتحقق من المصداقية لـ 32 بلداً تعاني من معدل وفيات أطفال مرتفع. وجرى التحقق من التقديرات العمومية المتاحة لانتشار المرض، والتغطية بالتدخل، والأسعار، والموارد على صعيد الأنشطة الفردية وعلى صعيد الأنشطة البرامجية مقارنة بالمعطيات المحلية. وأجري تسعة تحديثات لنموذج منظمة الصحة العالمية لعام 2007 باستخدام الافتراضات المنقّحة. وأخيراً، أجرى استقراء خارجي لـ 75 بلداً وأُدمج مع التكاليف التقديرية لبرامج التحصين ومكافحة الملاريا وبرامج توقّي انتقال العدوى بفيروس العوز المناعي البشري من الأم للطفل.

النتائج شارك 26 بلداً في الاستجابة. وكانت التصحيحات كبيرة بين المعطيات على صعيد النظام وصعيد البرنامج بينما كانت الاختلافات ضئيلة بالنسبة لمعطيات المريض. وأدى التحقق من المصداقية على الصعيد القطري إلى زيادة قدرها 53% في التكاليف الأصلية التقديرية (أي بحوالي 9 بلايين دولار أمريكي) لـ 26 بلداً بسبب تنقيح افتراضات النظام والبرنامج، ولاسيما تكاليف العاملين الصحيين المجتمعيين المحليين. وكان التأثير الإضافي لتحديث أرقام السكان ضئيلاً؛ وأدى تحديث الأرقام الوبائية إلى زيادة التكاليف بمقدار 4 بلايين دولار أمريكي (+15%). وأدت الأسعار الجديدة للوحدة في 26 بلداً قدمت معطياتها إلى زيادة التقديرات بمقدار 4.3 بلايين دولار أمريكي (+16%). وأدى الاستقراء الخارجي لـ 75 بلداً إلى زيادة السعر الأصلي التقديري بمقدار 33 بلايين دولار (+80%) للأعوام 2010-2015.

الاستنتاج إن التحقق على الصعيد القطري له تأثير ملموس على التقديرات العالمية. وهناك حاجة إضافية إلى 74 بليون دولار أمريكي (وهذا يمثّل زيادة قدرها 12% في إجمالي الإنفاق على الصحة) خلال الأعوام من 2010 حتى 2015. ونظراً لمحدودية الموارد، على البلدان أن تحدّد أولويات أنشطتها الصحية ضمن حزمة مواردها الوطنية.

摘要

来自国家级验证的儿童生存全球成本估计

目的 旨在通过最新国家提供的数据和新的假设，交叉验证2007年世界卫生组织（WHO）估计的达到第四个千年发展目标（MDG4）的扩大儿童生存干预的全球成本。

方法 确定每个国家主要成本种类之后，验证问卷被送到儿童死亡率高的32个国家。对个人层面和项目层面活动的发病率、干预覆盖率、价格以及资源的公开现有估计均基于本地数据进行验证。运用修正的假设，对2007年世界卫生组织模型进行了9项更新。最后，估计结果外推到75个国家，并结合免疫和疟疾项目的成本估计和人类免疫缺陷病毒（HIV）的母婴传播干预项目的成本估计。

结果 26个国家响应了此项调查。系统和项目层面的调整最大，病人数据层面的调整最小。因为系统修订和项目假设的原因，国家级验证造成了26个国家原始成本估算（即2004年90亿美金）增加53%，特别是周边社区卫生工作者费用。更新的人口数字引起的额外效应很小；而更新的流行病学数字则增加了40亿美元成本（+15%）。在提供数据的26国家中，新的单价增加了43亿美元成本估算（+16%）。2010到2015年间，外推到75个国家则增加了330亿美元的原始成本估计（+80%）。

结论 国家级验证对成本估计有比较大的影响。价格调整和与项目有关的假设起了很大作用。2005年需要额外的740亿美元（即增加总卫生费用12%）才能满足2010到2015年间需求。加之资源条件的限制，各国需要在国家资源层面优先考虑与健康有关的活动。

Résumé

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), 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

augmentait l'estimation des tarifs d'origine de 33 milliards de dollars américains (+80%) sur la période 2010–2015.
Conclusion La validation au niveau des pays a eu un impact significatif sur les estimations de coût. Les hypothèses d'ajustement des tarifs et les hypothèses liées aux programmes y ont largement contribué. Ce sont 74 milliards de dollars américains de 2005 (représentant une augmentation de 12% dans les dépenses de santé totales) qui seraient nécessaires entre 2010 et 2015. Au vu des contraintes de ressources, les pays devront établir les priorités des activités sanitaires dans leur enveloppe de ressources nationale.

Резюме

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 млрд долл. США (+15%). Новые удельные цены в 26 странах, предоставивших данные, привели к повышению оценок на 4.3 млрд долл. США (+16%). Экстраполирование оценок на 75 стран привело к повышению первоначальной оценки цены на 33 млрд долл. (+80%) на период 2010–2015 годов.
Вывод Валидация на страновом уровне оказала 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 coste 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.

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