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Disease Control Priorities in Developing Countries, 3rd Edition
Working Paper # 20

Title: Costing Universal Health Coverage: The *DCP3* Model

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1. Introduction

A central question for countries moving towards universal health coverage (UHC) is which health interventions should be publicly financed.(1) Highly resource-constrained low-income (LI) and lower middle-income (LMI) countries in particular currently have low coverage levels of health services and thus will probably require large incremental investments in order to achieve UHC. *Disease Control Priorities, Third Edition* (DCP3) has proposed a concrete notion of UHC that is based on a focused set of health interventions that provide very good value for money, address a significant disease burden, and are feasible to implement in LI and LMI countries.

Volume 9, Chapter 3, of DCP3 (forthcoming), entitled "Universal Health Coverage and Essential Packages of Care," draws on the content of 21 packages of essential health interventions contained in DCP3 and synthesizes them into a model health benefits package,(2) termed "essential UHC" (EUHC). A subset of these interventions have been distilled into a "highest-priority UHC package" (HPP) that is designed to address the

specific health needs of – and be feasible to implement in – LI countries by the end of the Sustainable Development Goal (SDG) period in 2030.(3)

The objective of this working paper is to present the approach, data sources, and assumptions used to generate estimates of the cost of EUHC and HPP presented in DCP3 Volume 9 Chapter 3.

2. Methods

As described in Volume 9 Chapter 3 of DCP3, the EUHC package is based on the content of 21 essential packages of care that cover, with some degree of overlap, the health concerns that different professional communities tend to address (e.g., reproductive health, cancer, or tuberculosis). EUHC reflects a harmonized, de-duplicated list of 218 unique health interventions that reflect the recommendations of these 21 groups of authors and editors. The HPP reflects a subset of EUHC interventions that were identified – using explicit criteria – by the authors of Volume 9 Chapter 3 of DCP3 as most feasible and high-impact in very low resource settings during the SDG period.

2.1 Analytic Framework

A variety of approaches have been used to estimate the cost of packages of health services.[4-8] Cost estimates for the same set of conditions can vary greatly according to time horizon, perspective, and what sorts of costs are included (e.g., financial vs. economic, marginal vs. average costs, total vs. incremental costs, etc.). An even more fundamental question is the objective of the costing exercise: is it primarily for an economic evaluation, or a national or subnational budget impact analysis, or perhaps for

advocacy and fundraising – as some global "price tag" (sometimes called "investment case") studies have recently done?[5, 6, 9]

DCP3 draws heavily on cost estimates conducted for (micro) economic evaluations and has summarized this literature in systematic reviews undertaken for several of its volumes. The recommendations of DCP3 have also been informed by previous global reports; for instance, the composition of its reproductive, maternal/neonatal, and child health packages closely mirrors the packages assessed by previous investment cases.(1, 6) However to explore the potential costs of implementing a UHC scheme at a national level, the present costing exercise sought to estimate the budget impact of UHC and the HPP in "typical" LI and LMI settings.

Our costing approach was informed by the "comparative statics" approach that is commonly used in economic analysis.[10] Such an approach would treat population coverage of a specified set of interventions as an exogenous parameter and hold constant all other variables – such population size and structure and prices and quantities of goods and services – constant. The resulting cost estimate would be interpreted as a counterfactual estimate of the change in cost due to an instantaneous shift in the exogenous parameter (in this case, coverage).

While this approach is indeed a simplification of the potential stream of costs and their evolution over time in a given country, there are simply too many nuances, including both local contextual (health system) factors and knock-on epidemiological and demographic effects over time to provide a more precise, "normative" estimate of costs in one or more countries. In addition, the scope of DCP3's work is meant to be illustrative

rather than prescriptive. Hence we revert to estimating a cross-sectional, counterfactual set of costs without making reference to costs in specific countries or regions, which will deviate significantly from the estimates we present.

Within a comparative statics framework, the incremental cost C_1 of EUHC or an HPP containing n interventions can be expressed as

$$C_1 = \sum_{i=1}^{n} pop_i \times \Delta cov_i \times cost_i$$

where pop_i is a number of individuals in need of intervention i, Δcov_i is the difference in the proportion of individuals covered ex post minus ex ante (e.g., Δcov_i = 0.7 if current coverage is 10% and target coverage is 80%), and $cost_i$ is the yearly per-patient cost of the intervention (ideally incorporating both recurrent costs and annualized capital costs). This approach would incorporate unit cost estimates that reflect long-run average costs

rather than marginal costs. Again, equilibrium is assumed ex ante and ex post, and Δcov_i is the exogenous parameter.

By inference, the total cost C_2 of the package would be

$$C_2 = T \sum_{i=1}^{n} pop_i \times cost_i$$

The scalar T is applied to the total cost based on the target coverage. For this analysis, we chose a target coverage of 80%, consistent with prior targets set by WHO for a variety of conditions.[11]

2.2 Data Sources

The following sections detail data sources for costing most of DCP3's essential packages. Methods for a few unique packages (surgery, rehabilitation, palliative care, and pandemics) are presented at the end of this section.

2.2.1 Unit Cost of Interventions

We took as a starting point the cost and cost-effectiveness analyses contained in systematic reviews undertaken for DCP3. These reviews contain most of the highest-quality economic studies that have been conducted in low- and middle-income countries in their respective fields. We supplemented this database of economic evaluations with other studies cited in specific chapters of DCP3 or with our own literature search for intervention costs when we could not identify costs anywhere in DCP3. In a few cases where there were absolutely no previous published cost estimates, we undertook our own

"bottom-up" costing using assumptions about personnel, equipment, and drugs and consumables.

In all cases, we extracted costs in 2012 US dollars (i.e., as reported in the DCP3 systematic reviews) or converted and inflated costs when needed to 2012 US dollars (i.e., when we used other literature sources or undertook our own costing).

For many interventions, there was more than one published cost estimate. Due to differences in costing methods and quality, we did not attempt meta-analysis of these data points but rather selected the costing study that we deemed to be the highest quality (based on recognized standards for costing studies[12]) and most useful for our purposes – i.e., detailed costs that reflected long-run average costs.

We gave preference to studies from LI and LMI countries, but we used upper middle-income country data when necessary. It could be argued that cost structures for interventions across these country settings would vary substantially. We sought to identify estimates of long-run average costs, which would theoretically mitigate this concern partially – in the case of long-run average costs, all cost components would be variable costs, and the only significant source of variation in cost structure across country settings would be due to regional practice patterns that result in different quantities of resources consumed.

We did modify our unit cost data to account for price differences between country income groups. To accomplish this, we used an internal WHO database of healthcare worker salaries for different skill levels for all countries (J. Serjie, 2015 – personal

communication). The final estimate of $cost_{i,y}$ (the unit cost of the *i*th intervention in country income group *y*) would be expressed as

$$cost_{i,y} = \left[a \times \left(cost_{i,x}\right) \times \frac{\bar{s}_y}{\bar{s}_x}\right] + \left[(1-a) \times \left(cost_{i,x}\right)\right]$$

Where a is the proportion of healthcare costs that are nontraded, $cost_{i,x}$ is the "raw" unit cost estimate for intervention *i* in country *x*, $\bar{s}_y$ is the weighted average skilled healthcare worker salary in country income group *y*, and $\bar{s}_x$ is the average skilled healthcare worker salary in country *x*. We assigned a a value of 0.70, which is an average value based on analyses of WHO System of Health Accounts data (S. Horton).

2.2.2 Population in Need of Specific Interventions

We next identified the population in need of an intervention. For most interventions, this was equivalent to the annual number of incident or prevalent cases of disease/injury for acute or longitudinal interventions, respectively. For some routine services, such as screening interventions, vaccinations, or family planning services, we used demographic estimates (e.g., 2015 birth cohort, women of reproductive age, adults 30-69 years, etc.). Often the epidemiological or demographic estimates were scaled down based on assumptions about the proportion of eligible individuals who would actually receive the service. For instance, screening for diabetes is recommended in adults over 40, but only every three years, so the number of individuals over 40 in the population would be

divided by three to estimate the number of individuals in a given year who would receive screening.

Most incidence and prevalence data were taken as country-level data and aggregated into LI and LMI groups from the Global Burden of Disease 2015 study unless similar data were available from the World Health Organization.[13] For a variety of epidemiological estimates related to reproductive and maternal health, we used data from a report from the Guttmacher Institute on the cost of these services, which provided aggregate estimates by country income group.[14]

Our population estimates for LI and LMI countries were based on our aggregation of country-level GBD demographic estimates by income groups based on World Bank classification in 2014. These estimates were very similar to UN Population division estimates. The final estimates of aggregate population were 0.90 billion for LI countries and 2.7 billion for LMI countries. We conducted a similar aggregation of gross national income (GNI) for countries for which GNI estimates were available (84% of LI and 96% of LMI countries, respectively). These values when applied to the total population of those two income groups were US$ 830 and US$ 2100, respectively. Since GNI data were missing for some LI countries, particularly countries that were fragile or in conflict (and likely poorer than average) our GNI figures could be overestimates.

2.2.3 Baseline and Target Levels of Coverage

Estimates of baseline coverage of specific interventions in LI and LMI countries are usually sparse. The WHO Global Health Observatory provides the most comprehensive list of coverage indicators, aggregated in many cases by country income group.[15] Where

relevant and available, we used coverage indicators from WHO. For interventions that were closely related to a service for which we had coverage estimates, we assumed the available coverage estimate would be a reasonable proxy. (For instance, we have coverage rates for antiretroviral drug therapy but not for community-based HIV testing and counseling, so we assumed that coverage of testing and counseling would be similar to coverage of antiretrovirals.)

In a number of cases, particularly for noncommunicable diseases (NCDs), we had no data on coverage rates. Discussions with DCP3 authors and experts in LI and LMI countries supported the assumption that baseline coverage of these interventions would be very low. For interventions without good proxy indicators for coverage, we made the following assumptions: for Group I causes (communicable, maternal, perinatal, and nutritional disorders) we assumed baseline coverage of 40% and 50% in LI and LMI countries, respectively, which is similar to ANC4. For Group II and III causes (noncommunicable diseases and injuries), we assumed baseline coverage of 10% and 20%, which is roughly the average coverage across cardiovascular diseases, cancers, and mental disorders. For cross-cutting packages (e.g., palliative care, rehabilitation), we assumed baseline coverage of 5% and 10% based on expert opinion,

As mentioned previously, we chose 80% as the target coverage for all interventions. This suggests differential coverage gaps, ranging only a few percent for immunizations to nearly 75% for interventions for some neglected NCDs. These gaps influence the estimates of incremental but not total costs. Implicit in this costing framework is that it is equally feasible by 2030 to address a 75% coverage gap for one intervention and a 5% coverage gap for another. In reality, there will be more momentum to close coverage gaps

for major infectious diseases and maternal/child health interventions than for NCDs and injuries. Still, since we endorse the progressive universalist approach to UHC as the most ethically defensible and efficient one, we present costs of reaching full coverage for all interventions. We argue that if budget constraints are tight then a smaller set of interventions should be implemented at full coverage rather than a larger set at partial coverage.

2.2.4 Exceptions to general costing approach

Surgery

An analysis by Levin and colleagues (forthcoming) details the methods, data sources, and assumptions used to estimate the cost of essential surgical procedures. We used the final cost estimates from their analysis for this study.

In brief, Levin and colleagues started by estimating the cost of first-level hospital services. They used a top-down approach based on detailed facility survey data in Ghana, Zambia, Uganda and Kenya that were collected for the Access, Bottlenecks, Costs, and Equity (ABCE) study (http://www.healthdata.org/dcpn/abce). They allocated hospital expenditures proportionally to surgical services, then they used data on facility size and catchment area to extrapolate costs in LI and LMI countries.

Next, they estimated the cost of the outpatient and specialty surgical procedures contained in the essential surgery package. They assumed the outpatient procedures would comprise ten percent of the total cost of surgery at first-level hospitals. They used

rates of specialty procedures from previous publications and multiplied by the average cost per surgery (US$ 400).

The DCP3 essential surgery package also contains a few interventions that require a general surgeon instead of a general physician or midlevel practitioner with surgical training (the latter of which is the norm in most LI and LMI first-level hospital settings). Hence we added the annual salary of a specialist physician (taken from the Guttmacher report) to the cost of the first-level hospital services, assuming one surgeon per hospital (or about one surgeon per 100,000 population).

Palliative care and pain control

Costs for the palliative care essential package were estimated in Volume 9 Chapter 12 of DCP3 and also reported in the *Global Alliance for Palliative Care and Pain Control* report in the *Lancet*. The authors of that chapter conducted a bottom-up costing of palliative care services using detailed data from three countries. They concluded that the package would cost about US$ 2.15 and US$ 0.71 per capita in a LI or LMI country, respectively (X. Jiang, 2017 – personal communication).

Rehabilitation and disability

The package of rehabilitation services presented in Volume 9 Chapter 16 of DCP3 is oriented around human resources rather than equipment, drugs, and consumables. Further, other costs beside human resources are likely to vary widely according to epidemiological context. For instance, older populations suffering from causes like stroke or visual/hearing impairment will require more assistive devices, whereas younger populations suffering from causes like injury will require more rehabilitative exercise

equipment. WHO has recommended a target of 750 rehabilitation specialists per million population, so we estimated the cost of the rehabilitation package as the cost of these human resources. We took WHO salary data for skilled workers (level 3) in LI and LMI countries.

Pandemic preparedness

The pandemic preparedness package largely followed the recommendations of the Commission on a Global Health Risk Framework for the Future, which drew on costs estimated by a 2012 World Bank report for scaling up preparedness in a large number of low- and middle-income countries.[16] This report estimated that the annual incremental cost of bringing all low- and middle-income countries up to international preparedness standards would be between US$ 1.9 billion and US$ 3.4 billion depending on epidemiological assumptions. Applying the higher figure to the total population in these countries implies an incremental per-capita cost of US$ 0.94. We assumed that in LI and LMI countries the incremental and total costs would be equivalent.

2.2.5 Other Cost Components

Ancillary services

In nearly all cases, we applied a markup for facility-level ancillary services, sometimes called indirect costs. These costs include items such as non-medical personnel, utility costs, and rents. These costs are not easily allocable to specific health services but are required in order to deliver the services. They are also not usually included in microcosting studies such as the ones used for this costing exercise. We thus applied a standard markup of 50% to our estimated total and incremental costs.[6, 17] The

exception to this was the essential pathology package, which we subtracted from the 50% markup. (Volume 9 Chapter 11 of DCP3 estimated that essential pathology services generally comprise about six percent of total facility expenditures.)

Other system costs

Whereas ancillary services can be conceived as "indirect" or "overhead" costs that are allocable to delivery of specific health services, there are a variety of other costs that are not allocable to specific interventions but are nonetheless important investments that ensure the health system is able to effectively deliver all the components of UHC at scale. The most widely cited report on these costs is the 2009 WHO High Level Taskforce (HLTF) on innovative international financing for health systems.(8) That report identified four unique system cost categories that were not accounted for service delivery costs or facility-level indirect costs: supply chain/logistics, health information systems, governance, and health financing. Across four scenarios, the average fraction of total costs attributed to each of these four components was 7%, 2%, 4%, and 2%, respectively. These figures implied a markup of 17% in total on the sum of service delivery and ancillary costs.

2.2.6 Sensitivity Analyses

We recognize that there are important sources of uncertainty in our cost model assumptions and the underlying primary data inputs. To get a sense of the overall level of uncertainty in our EUHC and HPP costs, we constructed a worst case and a best case scenario. Compared to baseline values, key model parameters were assigned alternate worst and best case values, and total and incremental costs were recalculated using those

values. We varied unit costs by plus (worst case) and minus (best case) 20%, population in need by plus and minus 20%, the nontraded share of costs by 50% to 90%, the baseline coverage by minus and plus 10%, the markup on ancillary/indirect costs plus and minus 20%, and the markup on other health system costs from 27% to 9%.

One additional potential driver of costs, total fertility rates, was identified but was not included in this analysis. We acknowledge that changing uptake of family planning services may lead to higher-than- or lower-than-projected fertility rates in 2030, so the incidence of pregnancy and the size of the 0-9 population may be different than assumed here, impacting the cost of the maternal and child health packages.

We also note the concern that our costs may not accurately reflect dollar amounts faced by LI and LMI countries in 2030. In absolute terms this is certainly true; prices of nontradeable goods are expected to rise with income, so dollar costs will rise. However as a fraction of income, we expect costs to be fairly similar in 2030 as in 2015, the year from which we take demographic and epidemiological data. So we expect the cost of EUHC and HPP as a share of income will be very similar during the SDG period. At the same time, in the longer term, demographic and epidemiological shifts will occur both naturally and as a result of certain interventions – particularly those that affect child and young adult survival. We stress that our approach to costing (comparative statics) is meant to be illustrative and does not claim to capture all potential long-term shifts in demography and epidemiology. Methods for projecting disease burden and costs will,

hopefully, become more advanced over the next decade and will allow for more precise and realistic long-run economic models.

3. Findings

Table 1 presents cost estimates by package, including current spending, incremental costs, total costs (the sum of the prior two figures), and the proportion of total health service allocable costs that can be attributed to each package. The largest shares are from the cardiovascular and related disorders package (26% in LI and 34% in LMI countries) and the sum of the HIV and STIs and malaria and adult febrile illness packages (24% in LI and 19% in LMI countries). Ancillary/indirect and other health system costs together comprised 40% of total EUHC costs (60% of costs were direct service delivery costs).

The overall cost of the HPP and EUHC are presented in Table 2. Unlike the costs in Table 1, these costs do not include duplicate interventions that appear in multiple packages. At full coverage, the HPP would cost $42 per person per year, or about 5.1% of current income, in LI countries and $58 per person, or 2.8% of current income, in LMI countries. The incremental annual cost required to reach full coverage would be $26 and $31 in LI and LMI countries, respectively. At full coverage, EUHC would cost $76 per capita, or 9.1% of current income, in LI countries and $110 per capita, or 5.2% of current income, in LMI countries. The incremental cost required to reach full coverage would be $53 and $61, respectively. Uncertainty in these cost estimates (best vs. worst case scenarios) was about a factor of four or five in most cases. Table 2 also presents

aggregate costs (in billions of dollars) of these packages in LI and LMI countries, drawing on our population data.

Table 3 presents estimates of incremental costs by platform (panel A) and intervention urgency (panel B). The majority of incremental investments in both the HPP and EUHC in both country groups would be in health centers, followed by first-level hospitals and community platforms. Similarly, about half of incremental investments in both the HPP and EUHC would be in chronic (longitudinal, ongoing) care – generally for a small number of highly prevalent and expensive chronic diseases like HIV/AIDS, tuberculosis, cardiovascular and metabolic diseases, and respiratory diseases. Urgent interventions would comprise about a quarter to a third of incremental costs.

4. Interpretation

DCP3 has presented a concrete notion of UHC that is grounded in economic realism and draws on a wide body of economic evidence that can inform efficient pathways to reaching UHC in highly resource-constrained settings. The findings of this costing exercise confirm that DCP3's notion of UHC, which economically efficient, is indeed expensive and will require a large amount of additional resources to implement.

As a share of current income, publicly financed EUHC is probably unaffordable and unsustainable in most LI countries. The total annual cost of this package, US$ 76 per capita, is three times the combined investment by governments and donors of US$ 25 per capita, and reaching EUHC would require significant investments in health system capacity as well as expansion of the scope of existing services. Financing even the HPP, which has a more narrow scope, would still require a significant increase in resources –

about US$26 per capita (or 3.1% of income) annually in the short run and US$ 42 in total annual costs to sustain at 80% coverage. Conceivably, much of this could come from external support, particularly for costly, high-priority issues such as HIV/AIDS and maternal/child health. Yet recent trends suggest that developmental assistance for health is flattening out, and it is unlikely that donors in such an austere environment will expand their priorities to issues such as noncommunicable diseases and injuries.(18)

By contrast, at 2.8% of current income, a publicly financed HPP would probably be sustainable in LMI countries and would require an additional 1.5% of current income. To meet the SDG 3 targets for UHC, many LMI countries could start by ensuring full implementation of the HPP, and then as resources permit, they could begin to phase in EUHC. At 5.2% of current income, the EUHC package would be a significant investment but similar to the share currently devoted in more well-resourced countries. The incremental cost of EUHC would require about 2.9% of current income. Countries that could not afford the entire EUHC package could consider a package that builds on the HPP and adds in the EUHC interventions that provide the best value for money and have the greatest overall impact on health, subject to the budget constraint. Such decisions would ideally be based on local analyses that take into account the existing health system, local epidemiology, and the needs and preferences of the population.

One implication of comparing the costs of EUHC and the HPP in LI and LMI countries is that the latter are probably more on track to implement significant UHC reforms during the SDG period. At the same time, LI countries would not be able to implement such reforms, raising the unsettling prospect of widening inequalities between LI countries and the rest of the world. An urgent priority for LI countries and

international agencies over the coming years will be to identify fiscal space for UHC so that these countries can make progress towards SDG 3. A recent review of fiscal space analyses undertaken by WHO suggested that improved efficiency of spending is probably the most feasible approach to increasing fiscal space in many countries.(19) In keeping with this general principle – and the prospect of limited additional domestic resources for health – our HPP may provide a framework for disinvestment in more costly, less effective services, and this could complement other measures to increase efficiency.

Our estimates are comparable to previous costing exercises, though somewhat higher. The WHO *Commission on Macroeconomics and Health* estimated that a basic package of services would cost the equivalent of US$ 71 per capita in current dollars.(4) A more recent updated assessment from the WHO High-Level Task Force suggested a figure of US$ 86 per capita.(8) McIntyre and colleagues proposed a minimum target for UHC spending of five percent of GDP per capita, which would imply a minimum spend of US$ 90 in LMI countries.(20) Our scenario analyses fall within the range of these costs but also raise the possibility that the minimum cost of EUHC could be much higher, ranging US$ 79 (HPP) to US$ 140 (EUHC) in LI countries and US$ 100 (HPP) to US$ 190 (EUHC) in LMI countries. Our scenario analyses underscore the need for better data, not just on the direct cost of health services, but also on the other health system costs required to implement EUHC.

While the data sources and methods are different, our analysis is also comparable to the recent WHO investment case for SDG 3.(21) Table 4 compares the WHO study with this analysis. Generally speaking, our point estimates of cost were lower than those in the WHO study, though our uncertainty ranges largely overlapped with the range of country-

specific costs presented in that study. Their costing framework included labor and major capital in “health system costs,” which they state comprised 75% of total costs. By contrast, most labor and capital in our framework was included in facility-level costs (service delivery and ancillary/indirect costs), so only 40% of our total costs were health system costs (reflecting that a subset of labor and capital costs were used for direct service delivery).

Another reason that the WHO cost estimates were higher than in this study is that their objective in large part was to estimate the cost of reaching key health system targets – e.g., around density of healthcare workers, number of health facilities, emergency preparedness competencies, etc. By contrast, this study was only concerned with costing a package of specific services; whether or not health system targets would be met by the investments in the HPP and EUHC was outside the scope of this analysis.

5. Conclusions

While financing EUHC will be challenging for many LMI countries, it could be a reasonable aspiration during the SDG period for most of these countries. EUHC would probably not be affordable or sustainable for LI countries, but the HPP would be a reasonable starting point. At the same time, even implementing the HPP would require significant external aid and domestic resource mobilization in LI countries. Our UHC cost estimates are consistent with the work of other groups but have the added value of providing detailed costs by package and by intervention and are thus complementary to

other groups, which have often focused on minimum health system capacity and investments more than on the cost of priority health services themselves.

Our costing framework may be useful as a starting point for ministries of health that do not currently have the capacity to conduct budget analyses but who wish to advocate for additional resources to plan the transition to UHC. A critical research priority for the global community will be to develop detailed, transparent, user-friendly, open-access costing models. Such models would ideally also be able to forecast the future burden of disease, identify potential economies of scope and scale across interventions, and determine the optimal allocation of current resources.

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8. Tables and Figures

Table 1. Cost of essential UHC in low- and lower-middle-income countries, by package.

Panel A. Low-income countries

	Current spending, per capita	Current spending, population (US$ billions)	Incremental cost, per capita	Incremental cost, population (US$ billions)	Total cost, per capita	Total cost, population (US$ billions)	Package share of total costs
Age-related							
1. Maternal and newborn health (2)	$1.2	$1.1	$1.7	$1.6	$3.0	$2.7	6.1%
2. Child health (2)	$2.2	$2.0	$1.1	$1.0	$3.4	$3.0	6.9%
3. School-age health and development (8)	$0.094	$0.085	$0.20	$0.18	$0.30	$0.27	0.61%
4. Adolescent health and development (8)	$0.31	$0.28	$0.44	$0.40	$0.75	$0.68	1.5%
5. Reproductive health and contraception (1,2,8)	$0.78	$0.71	$0.37	$0.33	$1.1	$1.0	2.3%
Infectious diseases							
6. HIV and STIs (6)	$3.4	$3.0	$3.7	$3.3	$7.0	$6.3	14%
7. Tuberculosis (6)	$0.30	$0.27	$0.13	$0.12	$0.43	$0.39	0.89%
8. Malaria and adult febrile illness (2,6,8)	$2.2	$2.0	$2.5	$2.3	$4.7	$4.3	9.6%
9. Neglected tropical diseases (6)	$0.32	$0.29	$0.30	$0.27	$0.61	$0.54	1.2%
10. Pandemic and emergency preparedness (9)	$0.016	$0.014	$0.71	$0.63	$0.75	$0.68	1.5%
Noncommunicable disease and injury							
11. Cardiovascular, respiratory and related disorders (5)	$0.63	$0.56	$12	$11	$13	$11	26%
12. Cancer (3)	$0.20	$0.18	$2.4	$2.2	$2.6	$2.4	5.4%
13. Mental, neurological, and substance use disorders (4)	$0.48	$0.44	$1.8	$1.6	$2.3	$2.1	4.7%
14. Musculoskeletal disorders (9)	$0.74	$0.67	$1.2	$1.1	$1.5	$1.3	3.0%

15. Congenital and genetic disorders (9)	$0.55	$0.50	$1.1	$1.0	$1.7	$1.5	3.4%
16. Injury prevention (7)	$0.0044	$0.0039	$0.039	$0.035	$0.044	$0.039	0.089%
17. Environmental improvement (7)	$0.047	$0.042	$0.044	$0.040	$0.09	$0.082	0.19%
Health services							
18. Surgery (1)	$1.6	$1.5	$1.3	$1.1	$2.9	$2.6	5.9%
19. Rehabilitation (9)	$0.10	$0.089	$1.5	$1.3	$1.6	$1.4	3.2%
20. Palliative care and pain control (9)	$0.11	$0.10	$1.6	$1.5	$1.7	$1.6	3.5%
21. Pathology (9)	$0.69	$0.62	$0.9	$0.8	$1.6	$1.4	3.2%
Totals							
Total service delivery costs	$15	$14	$34	$31	$49	$44	
De-duplicated service delivery costs	$11	$10	$15	$14	$27	$24	72%
Total health system costs	$4.4	$4.0	$6	$5	$10	$9	28%
Total cost (sum of service delivery and health systems)	$16	$14	$21	$19	$37	$33	100%

Panel B. Lower-middle-income countries

	Current spending, per capita	Current spending, population (US$ billions)	Incremental cost, per capita	Incremental cost, population (US$ billions)	Total cost, per capita	Total cost, population (US$ billions)	Package share of total costs
Age-related							
1. Maternal and newborn health (2)	$1.7	$4.5	$2.1	$5.7	$3.8	$10.1	5.5%
2. Child health (2)	$3.2	$8.4	$1.01	$2.7	$4.2	$11	6.0%
3. School-age health and development (8)	$0.083	$0.22	$0.21	$0.57	$0.29	$0.79	0.42%
4. Adolescent health and development (8)	$0.37	$0.99	$0.53	$1.4	$0.90	$2.4	1.3%
5. Reproductive health and contraception (1,2,8)	$1.7	$4.4	$0.45	$1.2	$2.1	$5.6	3.0%
Infectious diseases							
6. HIV and STIs (6)	$2.6	$7.0	$4.0	$11	$6.6	$18	9.6%

7. Tuberculosis (6)	$0.32	$0.85	$0.18	$0.47	$0.50	$1.3	0.71%
8. Malaria and adult febrile illness (2,6,8)	$4.1	$11	$2.3	$6.2	$6.5	$17	9.3%
9. Neglected tropical diseases (6)	$0.36	$1.0	$0.39	$1.0	$0.73	$1.9	1.0%
10. Pandemic and emergency preparedness (9)	$0.094	$0.25	$0.66	$1.8	$0.75	$2.0	1.1%
Noncommunicable disease and injury							
11. Cardiovascular, respiratory and related disorders (5)	$9.2	$25	$15	$39	$24	$63	34%
12. Cancer (3)	$0.64	$1.7	$1.8	$4.7	$2.4	$6.4	3.5%
13. Mental, neurological, and substance use disorders (4)	$1.8	$4.8	$3.7	$9.8	$5.47	$15	7.9%
14. Musculoskeletal disorders (9)	$1.1	$3.0	$2.1	$5.6	$2.8	$7.5	4.0%
15. Congenital and genetic disorders (9)	$0.72	$1.9	$1.2	$3.3	$2.0	$5.2	2.8%
16. Injury prevention (7)	$0.021	$0.055	$0.11	$0.30	$0.13	$0.36	0.19%
17. Environmental improvement (7)	$0.11	$0.30	$0.10	$0.26	$0.16	$0.42	0.23%
Health services							
18. Surgery (1)	$1.6	$4.2	$0.97	$2.6	$2.6	$6.8	3.7%
19. Rehabilitation (9)	$0.41	$1.1	$2.9	$7.6	$3.3	$8.7	4.7%
20. Palliative care and pain control (9)	$0.071	$0.19	$0.50	$1.3	$0.57	$1.5	0.82%
21. Pathology (9)	$1.0	$2.7	$1.0	$2.8	$2.3	$6.2	3.3%
Totals							
Total service delivery costs	$30	$81	$40	$106	$69	$185	
De-duplicated service delivery costs	$17	$44	$17	$46	$39	$103	72%
Total health system costs	$6	$17	$7	$18	$15	$40	28%
Total cost (sum of service delivery and health systems)	$23	$62	$24	$64	$53	$143	100%

Table 2. Potentials cost of Essential UHC and the HPP in low- and lower-middle-income countries, including uncertainty ranges from scenario analyses.

	Low-income countries		Lower-middle-income countries	
	HPP	**EUHC**	**HPP**	**EUHC**
Incremental annual cost (in billions of 2012 US dollars)	US$ 23 (9.2 to 51)	US$ 48 (20 to 100)	US$ 82 (32 to 180)	US$ 160 (66 to 350)
Incremental annual cost per person	US$ 26 (10 to 57)	US$ 53 (22 to 110)	US$ 31 (12 to 67)	US$ 61 (25 to 130)
Total annual cost (in billions of 2012 US dollars)	US$ 38 (19 to 71)	US$ 68 (34 to 130)	US$ 160 (81 to 280)	US$ 280 (150 to 500)
Total annual cost per person	US$ 42 (21 to 79)	US$ 76 (37 to 140)	US$ 58 (30 to 100)	US$ 110 (54 to 190)
Incremental annual cost as a share of current GNI per person	3.1% (1.2 to 6.9)	6.4% (2.6 to 13)	1.5% (0.57 to 3.2)	2.9% (1.2 to 6.2)
Total annual cost as a share of current GNI per person	5.1% (2.5 to 9.5)	9.1% (4.5 to 17)	2.8% (1.4 to 4.8)	5.2% (2.6 to 9.1)

Table 3. Share of incremental costs of the HPP and EUHC by platform and by intervention urgency.

Panel A: Incremental costs by platform				
	Low-income countries		**Lower-middle-income countries**	
	HPP	**EUHC**	**HPP**	**EUHC**
Population-based	0.6%	2.3%	0.6%	2.0%
Community	18%	16%	12%	14%
Health center	50%	52%	57%	52%
First-level hospital	25%	25%	22%	25%
Referral and specialty hospitals	6.4%	5.2%	9.1%	6.1%
	100%	**100%**	**100%**	**100%**

Panel B: Incremental costs by urgency				
	Low-income countries		**Lower-middle-income countries**	
	HPP	**EUHC**	**HPP**	**EUHC**
Urgent	35%	28%	27%	24%
Chronic	41%	48%	50%	52%
Time-bound (non-urgent)	24%	24%	23%	24%
	100%	**100%**	**100%**	**100%**

Table 4. Comparison of methods, data, and findings of the DCP3 UHC costing exercise and the WHO SDG3 investment case (Stenberg and colleagues, 2017).

Parameter	WHO	DCP3
Countries included	27 low-income, 22 lower-middle-income, and 18 upper-middle-income countries (World Bank 2016 classification); 67 countries in total	34 low-income and 49 lower-middle-income countries (World Bank 2014 classification); 83 countries in total
Types of costs presented	Incremental yearly costs through 2030; total cost in 2030 extrapolated based on current expenditure	Total and incremental (counterfactual) costs in 2015 assuming instantaneous shift in coverage to 80%
Selection of interventions	187 interventions recommended by WHO disease-specific clusters	218 interventions recommended by technical experts (*DCP3* authors and editors)
Scenarios assessed	1. Progress = target coverage limited by absorptive capacity of system (target coverage levels vary by country and intervention type) 2. Ambitious = most countries achieve high levels of target coverage (and hence SDG3 coverage and mortality targets)	1. Essential UHC (EUHC) = sum of all recommended health sector interventions in *DCP3* 2. Highest-priority package (HPP) = narrower scope (~ 100 services) compared to EUHC (prioritized on the basis of explicit criteria); same target coverage level (80%)
Inclusion of costs of non-health sector interventions	Included, but only with health sector component of costs ("above the line")	Not included
Analytic tool(s) and cost data	OneHealth Tool, with some modeling in Excel. All unit costs were calculated using a bottom-up approach based on OneHealth Tool assumptions and price databases	Excel-based. Unit costs using a bottom-up approach were taken from the literature and adjusted to "average" LI and LMI country prices.
Main findings (annual cost per capita; WHO estimates deflated to 2012 US dollars)	1. Progress scenario: LI countries: US$ 85 total and US$ 61 incremental LMI countries: US$ 120 total and US$ 40 incremental 2. Ambitious scenario: LI countries: US$ 100 total and US$ 70 incremental LMI countries: US$ 130 total and US$ 52 incremental	1. HPP: LI countries: US$ 42 total and US$ 26 incremental LMI countries: US$ 58 total and US$ 31 incremental 2. EUHC: LI countries: US$ 76 total and US$ 53 incremental LMI countries: US$ 110 total and US$ 61 incremental