

Public Health Priorities: Funding for Disease Control (part 2) [excerpt]

Disease management is suddenly a household topic due to COVID-19. But what are the normal priorities of the World Health Organization (WHO) and other disease control organizations?

Part 1 of this series talked about what public health is. This article discusses public health priorities from a policy perspective. How are funds for disease prevention and control spent? Should we reprioritize funding due to COVID-19?

The article focuses on disease control and prevention organizations around the world: the WHO, the US Centers for Disease Prevention and Control (US CDC), the European CDC (ECDC), the Indian National CDC (NCDC) and the Africa Centres for Disease Control and Prevention (Africa CDC) (see **sidebar** for details).

The **World Health Organization** (WHO) works to promote health, improve the health of vulnerable populations, promote universal health coverage and protect a billion people from health emergencies. Founded 7 April 1948 (now World Health Day).

The **European Center for Disease Prevention and Control** (ECDC) focuses on infectious diseases with surveillance, epidemic response, and public health preparedness. Established 2005 by EU.

The **U.S. Centers for Disease Control and Prevention** (US CDC) works to protect Americans from health, safety and security threats, including chronic, acute, and preventable diseases as well as health threats from human error, deliberate attack and global disease threats. It also promotes public health. Founded 1946 to fight malaria.

Africa Centres for Disease Control and Prevention (Africa CDC) strengthens the capacity and capability of Africa's public health institutions as well as partnerships to detect and respond quickly and effectively to disease threats and outbreaks, based on data-driven interventions and programs. Founded 2016 after Ebola outbreak.

National Centre for Disease Control (NCDC) was established as the Central Malaria Bureau in India in 1909. It is now a national center of excellence for control of communicable diseases.

Pan American Health Organization (PAHO) works with countries in North, Central, and South America to fight communicable and non-communicable diseases, improve health systems, and respond during emergencies and disasters.

Public Health priorities

The focus of public health organizations can be categorized into five themes:

- **Chronic and non-communicable diseases (NCD)**, such as diabetes, obesity, and asthma, as well as mental health and substance abuse issues; cancer also falls into this category.
- **“Common” infectious diseases**, such as tuberculosis (TB), the flu, sexually transmitted diseases (STDs) and polio
- **Emerging infectious diseases**, including HIV in the 1980s and 1990s and SARS, H1N1, Ebola, and now COVID-19. Included in this category are **One Health** efforts, which bring together animal and human disease specialists who track zoonotic diseases, such as rabies and brucellosis, that can jump between

animals and humans.

- **Environmentally-caused diseases**, such as dysentery, cholera and other waterborne diseases; respiratory diseases caused by air pollution; and even poverty-related diseases such as asthma caused by rodents and cockroaches prevalent in some low-income housing
- **Other topics**, such as maternal health, birth defects, child mortality, developmental disabilities, and injuries

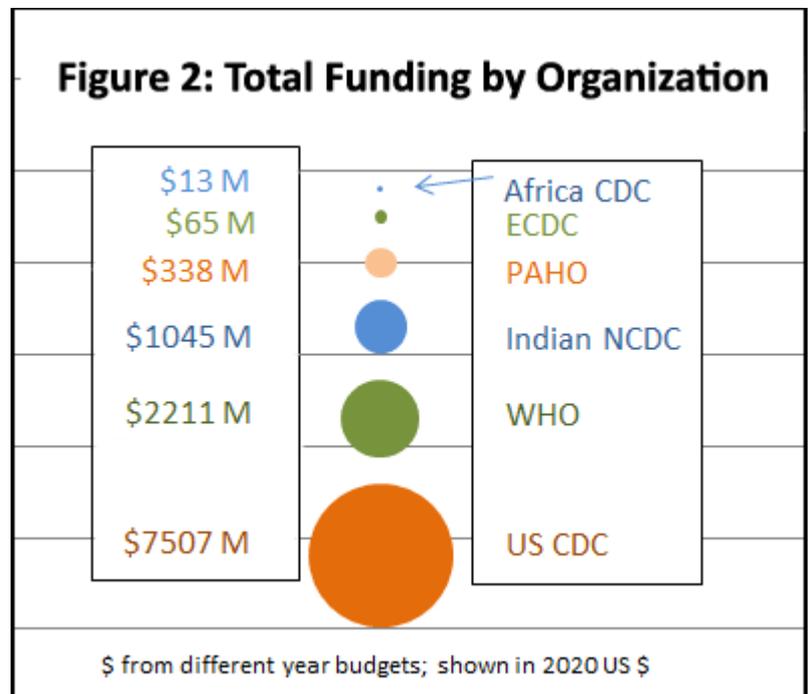
A Look at Budgets

Budgets show the priorities of an organization as well as its funders, such as government agencies.

The US CDC is the largest disease control organization in the world, with an annual budget of US \$7.5 B.¹ **Figure 2** shows how the US CDC's budget dwarfs the other organizations.

The WHO comes next in size, with an annual budget of \$2.2 (based on a 2-year budget of \$4.4 B). The WHO's budget in 2018-2019 was only 29% of US CDC's budget.

The Indian National CDC has a budget of over \$1 M, followed by PAHO with \$676 M. The European CDC has a budget one-tenth the size (\$65 M), while the Africa CDC started with a budget of \$7 M and 20 staff, though its 2020 budget is \$13 M, or one-fifth of the ECDC's.



Return on Investment (ROI)

Health care organizations calculate a Return on Investment (ROI) for preventive measures, to determine their efficacy and worthiness for funding. The WHO estimates an ROI of US \$1.40 for every dollar spent on universal health coverage, \$8.30 for every dollar spent on protection from health emergencies and \$1.50-\$121 for every dollar spent on making populations healthier.²

Sample ROI

Let's imagine a program where community health workers (CHWs) visit people at home to help them manage chronic diseases such as diabetes and heart disease. The program costs³ (see **Figure 3**) include the CHW salaries, time for both travel to client homes and the visit itself, plus any supplies they hand out. There are also administrative costs, including the CHWs' supervisor and building and facility costs. In this sample program, let's say the total program costs are \$315,000 (\$315 K).

Now let's assume these home visits mean people are eating a more appropriate, low-salt or low-fat diet and exercising more. Some people will no longer need to be on medication for heart disease or diabetes.

¹ Unless otherwise specified, all budget figures are in 2020 US dollars, adjusted using the U.S. Bureau of Labor Statistics Inflation Calculator, comparing January values for years in question

² WHO. Proposed programme budget 2020–2021. (2019)

³ In this example, numbers are fictitious; through the rest of the article, numbers are real

Others will need to visit their doctors less often and a few will not need to go to the hospital due to a heart attack or other disease-related emergency. Let’s say these prevented costs add up to \$630K.

If you divide the savings (\$630 K) by the program costs (\$315 K), then the return on investment is \$2 for every \$1 spent on the program. From an ROI perspective, this program is worthwhile to run.

Policy questions about ROIs

Financial returns on investments can be far trickier to calculate than my simple example shows. The factors and assumptions used to calculate an ROI can be debated.



Figure 3

| CHW program costs | Health care savings |
|--|--|
| <ul style="list-style-type: none"> ▪ CHW salary \$200K ▪ Manager salary \$70K ▪ Supplies \$5K ▪ Admin/overhead \$40K | <ul style="list-style-type: none"> ▪ Reduced medication \$20K ▪ Fewer doctor visits \$40K ▪ Less ER usage \$100K ▪ Less inpatient stays \$470K |
| Total: \$315K | Total: \$630K |
| ROI: \$630 / \$315 = \$2 ROI for every \$1 spent on program | |

However, the concept of using ROIs to select health care programs elicits policy issues: Should there be a minimum ROI threshold to justify health care programs? Can individual cases or conditions be exempted from an ROI requirement, such as conditions affecting children, programs for vulnerable groups who may have not had equitable access to health care services or treatment for specific diseases? What about programs that improve quality of life but do not save money?

ROI must be >\$1 to have a positive financial return

Three real-world examples illustrate the challenges of identifying what diseases or health conditions to prioritize: measles, polio and COVID-19.

Example #1: Measles

Measles is a highly contagious but usually non-fatal disease, with outbreaks both in developed and low-and-middle-income (LMIC) countries.

Measles is easily preventable through vaccination of children at 12-14 months and then again at 4-6 years. The cost of measles vaccines range from US \$0.38 per dose (or <\$1 for both doses) for a program in Afghanistan run by GAVI, the Vaccine Alliance and UNICEF⁴ to US \$2.17 (or \$4 for both doses) for public health agencies purchasing doses through the US CDC or \$7.87 (or \$16 for both doses) for a private physician in America purchasing directly from the pharmaceutical company⁵. Prevention is thus not only feasible but cheap. The measles, mumps and rubella (MMR) vaccine is part of the of immunization schedule for infants in most developed countries.

By comparison, the total cost of measles is not as cheap. Costs can be broken down into three categories:

- **Cost of health care:** For measles cases without complications, home care and over the counter (non-prescription) medication is sufficient. However, costs are not always so low:⁶

⁴ GAVI. <https://www.gavi.org/news/media-room/measles-vaccine-campaign-launched-afghanistan>

⁵ US CDC. CDC Vaccine Price List. Updated 1 June 2020. <https://www.cdc.gov/vaccines/programs/vfc/awardees/vaccine-management/price-list/index.html>

⁶ US CDC. https://www.cdc.gov/measles/symptoms/complications.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fmeasles%2Fabout%2Fcomplications.html

- 1 in 10 children with measles get ear infections, which may necessitate at a minimum a visit to the doctor
 - 1 in 10 people have diarrhea, which can lead to dehydration and thus hospitalization
 - 1 out of 20 children get pneumonia, the most common cause of death from measles in young children
- **Household economic burden (non-healthcare):** If a parent needs to take unpaid sick days to care for the child, the household suffers economically. Other family members are also likely to get the measles, adding to the household's burden. In addition, 1 - 3 out of 1.000 people with measles die even with medical care and 1 out of every 1.000 people with measles have brain swelling, which could lead to brain damage. Any deaths or disabilities caused by measles place a further economic burden on the household (in addition to the emotional cost).
 - **Controlling an outbreak:** The majority of costs associated with measles come from contact tracing by public health officials to determine from whom the patient caught the measles and who else both people came into contact with. During the 2019 measles outbreak in the state of Washington on the Pacific coast, 64 cases were expected to cost a total of \$1 M in additional department of health staff costs, or almost \$15.600 per case. The 2018 MMR vaccination rate in Washington State was 90.8%, according to the US CDC, too low for herd immunity to be effective (see **sidebar**).^{7,8}

Measles ROI

In the Netherlands, a measles outbreak in 2013-2014 had 2.700 cases, with an average cost of US \$1.739 per case. 380 patients (14%) had complications, including hospitalizations. One child died and one patient with encephalitis spent 8 months in a rehabilitation clinic. The total cost for direct health care was US \$1.3 M, or a mean of \$465/case, while an additional \$136/case was estimated for productivity losses. See **Figure 4**, detailing the direct health care costs. The study concluded that outbreak management represented 54% of total costs, medical costs were 27% of total costs, while vaccinations were 11% and productivity loss was 8% of total costs.⁹

Figure 4: Estimated direct health care costs during measles outbreak, the Netherlands, 2013–2014

| Type of cost | Total # patients | Unit cost (US \$) | Avg health care utilization | Total cost (US \$) |
|---|------------------|-------------------|-----------------------------|--------------------|
| Physician consultation | | | | |
| Uncomplicated measles, # visits | 2.320 | \$ 37,35 | 0.2 | \$ 17.330 |
| Uncomplicated measles, # phone calls | 2.320 | \$ 18,07 | 0.1 | \$ 4.192 |
| Hospitalizations | 181 | \$ 37,35 | 1.0 | \$ 6.760 |
| Other complicated measles | 199 | \$ 37,35 | 2.0 | \$ 14.865 |
| Treatment for pneumonia in general practice | 75 | \$ 16,02 | 1.0 | \$ 1.202 |
| Length of hospitalization | | | | |
| General ward | 174 | \$ 600 | 4.6 | \$ 480.240 |
| Intensive care unit | 7 | \$ 2.866 | 13.1 | \$ 262.812 |
| Rehabilitation | 1 | \$ 447 | 245 | \$ 109.515 |
| Serologic test results | 993 | \$ 21,37 | 1.0 | \$ 21.220 |

⁷ US CDC. Seither et al. "Vaccination Coverage with Selected Vaccines and Exemption Rates Among Children in Kindergarten — United States, 2018–19 School Year." (2019). https://www.cdc.gov/mmwr/volumes/68/wr/mm6841e1.htm?s_cid=mm6841e1_w

⁸ U.S. National Institutes of Health (NIH). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6906342/>

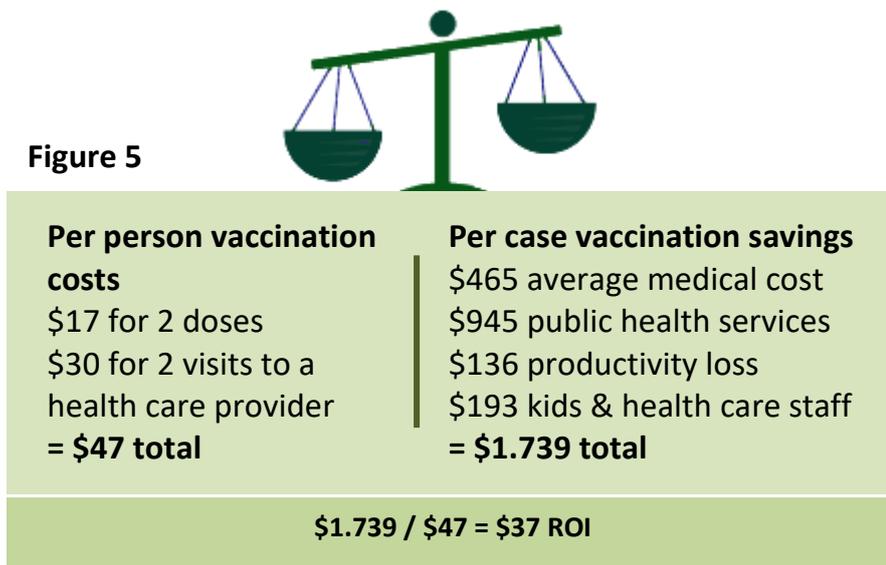
⁹ Suijkerbuijk, A. et al. *Emerging Infectious Diseases*. "Economic Costs of Measles Outbreak in the Netherlands, 2013–2014." (2015)

Figure 4: Estimated direct health care costs during measles outbreak, the Netherlands, 2013–2014

| Type of cost | Total # patients | Unit cost (US \$) | Avg health care utilization | Total cost (US \$) |
|-----------------------|------------------|-------------------|-----------------------------|---------------------|
| DNA/RNA amplification | 1342 | \$ 251,55 | 1.0 | \$337.580 |
| Total | | | | \$ 1.255.718 |
| Cost per case | 2.700 | | | \$ 465 |

Source: Suijkerbuijk, A. et al. *Emerging Infectious Diseases*. "Economic Costs of Measles Outbreak in the Netherlands, 2013–2014." (2015)

When weighing the costs against the benefits (see **Figure 5**), the ROI is \$37 for every \$1 spent on vaccination.



A study in *Health Affairs* about the ROI for vaccinations in 94 low and middle income countries (LMIC) showed a return of \$16 in costs for averted illnesses for every dollar invested in vaccinations and a \$44 return when quality of life and lifespan were included (see **Figure 6**). Measles had the highest ROI, 58 times the cost of investment.¹⁰

[...]

Funding for epidemics

How much funding is available for the identification and containment of zoonotic and other emerging infectious diseases? I calculated the rough amount of funding available at each organization for identifying and managing epidemics. I tried to take a liberal view, including all funding in categories that might be relevant during an infectious disease epidemic, even if only part of those funds are typically used for disease monitoring and response. See **Figure 11** for a list of budget categories included as pandemic funding for this article.

¹⁰ Ozawa, S. et al. *Health Affairs*. "Return On Investment From Childhood Immunization In Low- And Middle-Income Countries, 2011–20". (2016) <https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2015.1086>

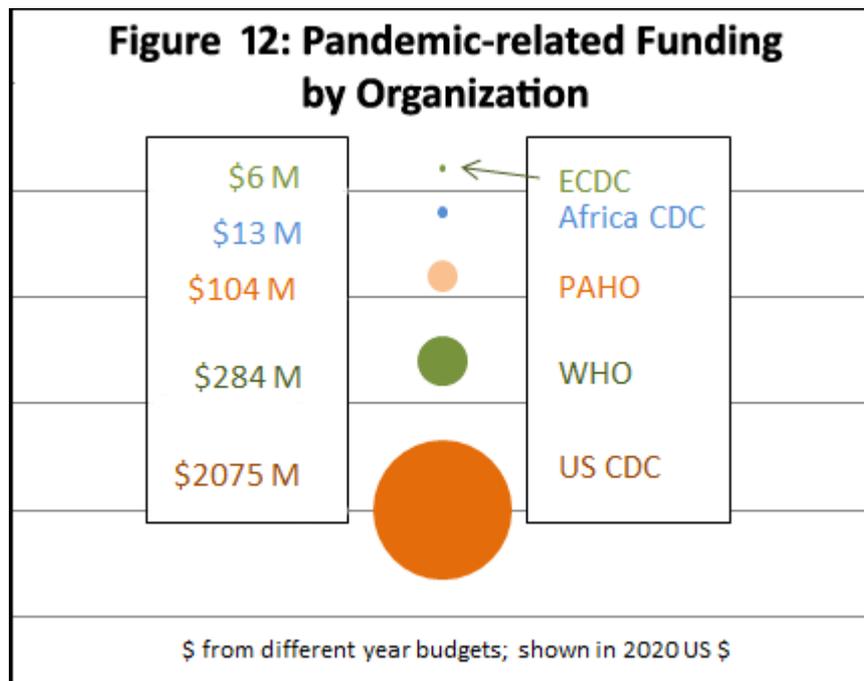
According to my calculations, the WHO spends approximately 13% of its budget on pandemic funding while the US CDC spends 27% and PAHO spends 31% of their respective budgets on pandemic surveillance and response. The ECDC, whose mission is to combat infectious diseases, spends only 10% of its budget on pandemic-related activities. Because the Africa CDC was founded in response to Ebola with the mission of identifying emerging infectious diseases, I have included its entire budget as epidemic-related.

I was only able to identify 0.2% of the NCDC’s funding as being specifically targeted for epidemics, but the main, non-detailed line items in the budget likely also include services to identify and combat emerging infectious diseases; I was therefore not able to calculate the actual percentage of funding the NCDC spends on emerging infectious diseases.

However, less important than the percentage of funds is the actual dollar value – even if the ECDC spent its entire budget preparing for and preventing pandemics, it would still only be contributing \$65 M to the effort.

Figure 11: Funding categories included as “pandemic funds”
US CDC: Emerging and Zoonotic Infectious Diseases; portions of Global Health, Public Health Preparedness and Response, and other
WHO: WHO Health Emergencies Programme; does not include additional fundraising for specific emergencies
ECDC: Surveillance and epidemic intelligence; Preparedness and response
PAHO: Risk factors for communicable diseases; Elimination of communicable diseases; Data, information, knowledge, and evidence; Health emergencies preparedness and risk reduction; Epidemic and pandemic prevention and control; Health Emergencies Detection and Response; Outbreak and crisis response
Africa CDC: Entire budget included due to CDC’s founding to combat emerging infectious diseases
NCDC: Not included; one category, Coordination of Prevention and control of Zoonotic Diseases, is relevant but reflects only a tiny portion of the budget; additional funding is likely included in the general line items.

Figure 12 shows the relative amounts of pandemic-related budget activities for each of the target organizations: The ECDC spends only approximately \$6 M—less than the Africa CDC. PAHO spends over \$200 M, the WHO spends \$568 M, while the US CDC spends \$2.000 M – almost as much as the entire budget for the WHO for one year. The Indian NCDC likely contributes another large sum, given its \$1 B budget.



[...]

Example 3: COVID-19 ROI

What is the ROI for spending on COVID-19? It's obviously much too early to know total costs, including the enormous economic toll in addition to the health care costs. However, some estimates can be done using current caseload data.

COVID-19 currently has a mortality rate of around 7% among infected people. That means without quarantine measures to reduce the spread, the death toll could theoretically be 540 M out of our 7.8 B world population—or almost ten times the annual worldwide death rate of 60 M. With countermeasures, the actual death toll will obviously be much lower. Currently it is 472.000 out of 9.1 M cases of COVID-19 (5,2%), or .006% of the 7.8 B people on the planet.¹¹

Mortality rates are usually given as a percentage of 100.000 people, making COVID-19's mortality rate 6,1%, i.e., 6 out of 100.000 people in the world. By comparison:

- Unsafe water, sanitation and hygiene infrastructure (WASH) annually kills:
 - 46 out of every 100.000 people in Africa;
 - 15 out of 100.000 in southeast Asia; and
 - 11 out of 100.000 in the eastern Mediterranean.¹²

- The mortality rate for non-communicable diseases is:¹³
 - over 900 in Sierra Leone and the Ivory Coast
 - around 800 or more in Guinea, Togo, Egypt and Yemen
 - around 700 in Uzbekistan and the Ukraine

 - over 500 in Zambia, Zimbabwe, Timor-Leste
 - around 400 for the US, Ecuador and Germany
 - 300 - 350 for Switzerland, France and Greece

Funding for Disease Control and Prevention

We are now experiencing a scary, bewildering crisis, the likes of which we have not faced since the Spanish flu epidemic a century ago. Funds must certainly be diverted to reduce how many people die and prevent economies from collapsing. But what makes the most sense?

If we don't focus on funding for a vaccine for COVID-19, we could have a worldwide economic meltdown and more deaths in the next couple of years. But if we ignore other health issues (for now), we will have more short-term deaths that could have been prevented (such as from cholera and malaria) as well as longer-term illness, disability and deaths due to chronic, long-term diseases whose impact could have been reduced through health outreach and treatment measures.

How do we weigh future health costs against current urgent needs? There are no easy answers. **Part 3** of this series will provide a more in-depth view of the US CDC's policy decisions and funding history, as a way of showing trends in policy decision making.

¹¹ COVID-19 figures as of 23.6.2020

¹² WHO. Mortality rate attributed to exposure to unsafe WASH services.

[https://www.who.int/data/gho/data/indicators/indicator-details/GHO/mortality-rate-attributed-to-exposure-to-unsafe-wash-services-\(per-100-000-population\)-\(sdg-3-9-2\)](https://www.who.int/data/gho/data/indicators/indicator-details/GHO/mortality-rate-attributed-to-exposure-to-unsafe-wash-services-(per-100-000-population)-(sdg-3-9-2))

¹³ WHO. Total NCD Mortality. <https://www.who.int/data/gho/data/themes/topics/indicator-groups/indicator-group-details/GHO/total-ncd-mortality>