IMPACT OF NATIONAL ECONOMIC TRENDS ON PUBLICLY FUNDED NEGLECTED DISEASE R&D

What were we hoping to discover?

The aim of this study was to determine whether there were any systematic and statistically significant relationships between nations' public sector funding for neglected disease (ND) R&D and three broader measures of their overall economic situation: their gross domestic product (GDP), their overall level of government spending, and their funding for official development assistance (ODA).

Our hypothesis was that increases in government spending and periods of growth in GDP would, on average, tend to correlate with increases in neglected disease R&D funding. The existence of this kind of relationship could potentially help stakeholders forecast changes in national neglected disease funding, particularly as a result of any future COVID-induced global economic slowdown.

How we collected and analysed the data

In order to find out if there was a relationship between nations' public funding for neglected disease R&D and the selected measures of their economic activity, we filtered the public neglected disease R&D funding data reported as part of the G-FINDER survey between 2007 and 2019 to identify a consistent group of nations, funding entities and neglected diseases, which together provide a consistent measure of national public neglected disease R&D funding over time.

To maximise the range of annual national funding totals included in our data set, we independently selected the survey years included for each nation, taking into account differences in national participation in the G-FINDER survey. This left us with a total of 237 individual annual funding totals for neglected disease R&D, from 24 different countries and 45 national funding agencies. The number of years of data included for each nation varies, with, for example, eight nations (including the US, the UK and South Africa) having funding estimates for each of the 13 years covered by the G-FINDER survey, and two nations (South Korea and Malaysia) having only two years of comparable data.

We then obtained annual GDP and total government expenditure data published by the International Monetary Fund (IMF), as well as data on gross national ODA from the Organisation for Economic Cooperation and Development (OECD). We used linear regression to test these data sets for statistical relationships with our measure of ND R&D funding.

Rather than analysing these as 24 different national-level time-series, each with somewhere between two and 13 observations, we opted to pool the data into a single cross-national data set, comprising 230 distinct ND/GDP pairs.[1] This larger data set enabled us to perform a more statistically robust analysis, but required us to simultaneously estimate the relationships between ND R&D funding and the wider economy both over time and between different nations. We provide more detail below about what the structure of our analysis means for interpreting our results.

Results

There is a strong relationship between funding for neglected disease R&D and overall government spending

We found a clear relationship between different levels of government expenditure and public funding for neglected disease R&D.

Figure 1 shows a logarithmic scatter plot of nations' neglected disease R&D funding against their total government spending in that year,[2] with funding from high-income countries (HICs) shown in blue and funding from low- and middle-income countries (LMICs) shown in orange.

It shows a strong positive relationship between government spending in a given year (on the horizontal axis) and the amount of neglected disease R&D funding provided by that nation (on the vertical axis), with the overall relationship estimated by the upward trend line and a clear positive trend for both HICs (in blue) and LMICs (in orange).

FIGURE 1. Neglected disease R&D funding vs overall government spending – by nation and year (log scale)
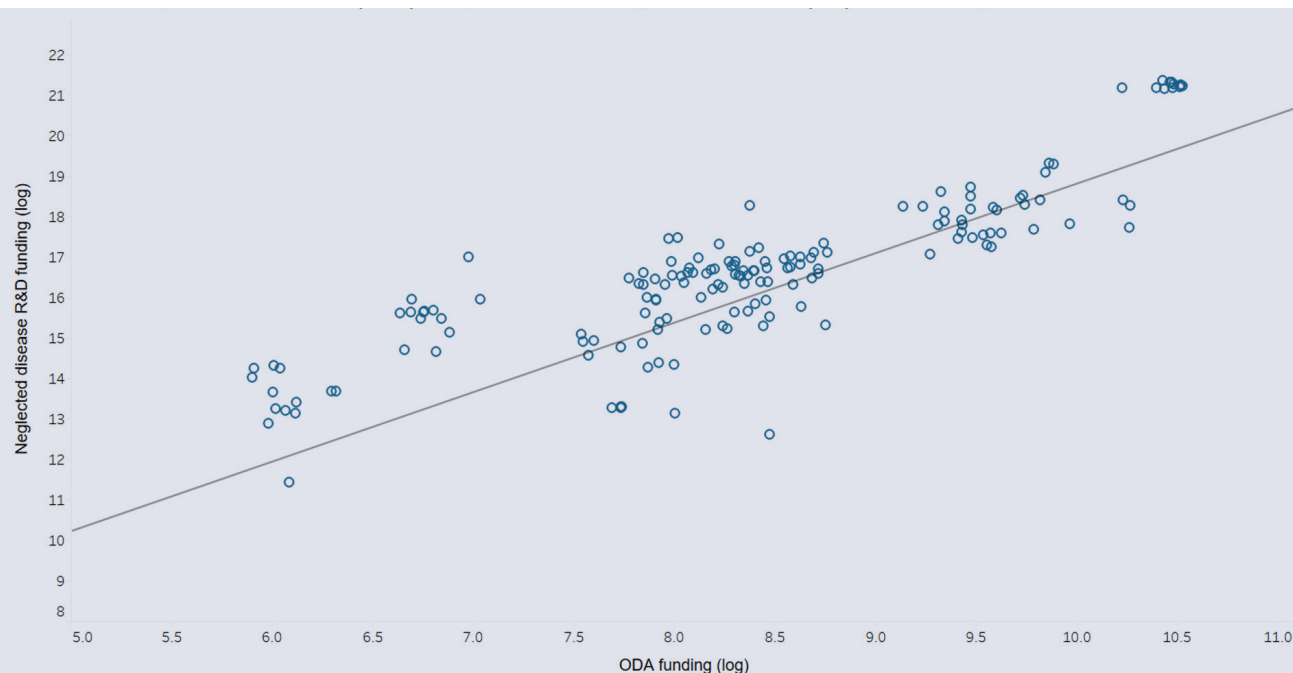

---

1   There were gaps in the IMF data series for Cuban GDP and spending, and LMICs reported no ODA funding over the period covered, meaning the exact number of observations included varies slightly between analyses.

2   Throughout this section, we use the natural logarithm of the variables we were considering, rather than the raw numbers themselves. This transformation makes it easier to graphically capture the huge range of spending totals in our data – ranging from an annual $350k for Cuba to $1.7 billion per year for the US – and lets us interpret the relationship between them in terms of relative percentage changes. Except where we indicate otherwise, the linear (untransformed) relationships between the same variables showed the same direction and were also statistically significant, so the transformation doesn't have a material impact on our headline results.

We found an even stronger relationship between nations' ODA funding over time and their neglected disease R&D funding, as shown in Figure 2, below:[3]

FIGURE 2. Neglected disease R&D funding vs ODA funding – by nation and year (log scale)

When we confirmed these correlations using regression analysis, we found a statistically significant relationship ($p<0.001$), with differences in total government spending explaining about two thirds ($R^2 = 0.67$) of the overall variation in neglected disease R&D funding. Overall, the data suggest that when total government spending rises by 1%, neglected disease R&D funding will rise by an average of 1.39%.

There was also a significant ($p<0.001$) and even stronger link between ODA and public ND R&D funding. Differences in ODA explain nearly three-quarters ($R^2 = 0.73$) of variation in ND R&D funding, with a 1% increase in ODA associated with a 1.46% increase in ND R&D funding in the same year.

Both higher government spending and higher ODA predict higher neglected disease R&D funding, but the link is strongest between ODA and ND funding

By looking at the relationships between government spending, ODA and ND R&D funding all together, we were also able to determine whether the apparent link between ODA and ND R&D funding is mediated through higher spending overall. In other words, whether governments that spend more simply end up spending more on both ODA and neglected disease R&D.

We found that these relationships exist independently of each other. Higher spending on ODA predicts increased funding for neglected disease R&D, even when overall government spending is held constant, and vice versa: a 1% increase in ODA funding, holding overall government spending constant, predicts a 1.05% increase in neglected disease R&D funding, while a 1% increase in government funding, holding ODA constant, predicts a 0.42% increase for neglected disease R&D funding.

---

3   None of the LMICs included in our dataset provided any ODA, meaning that this graph includes only (blue) HIC data.
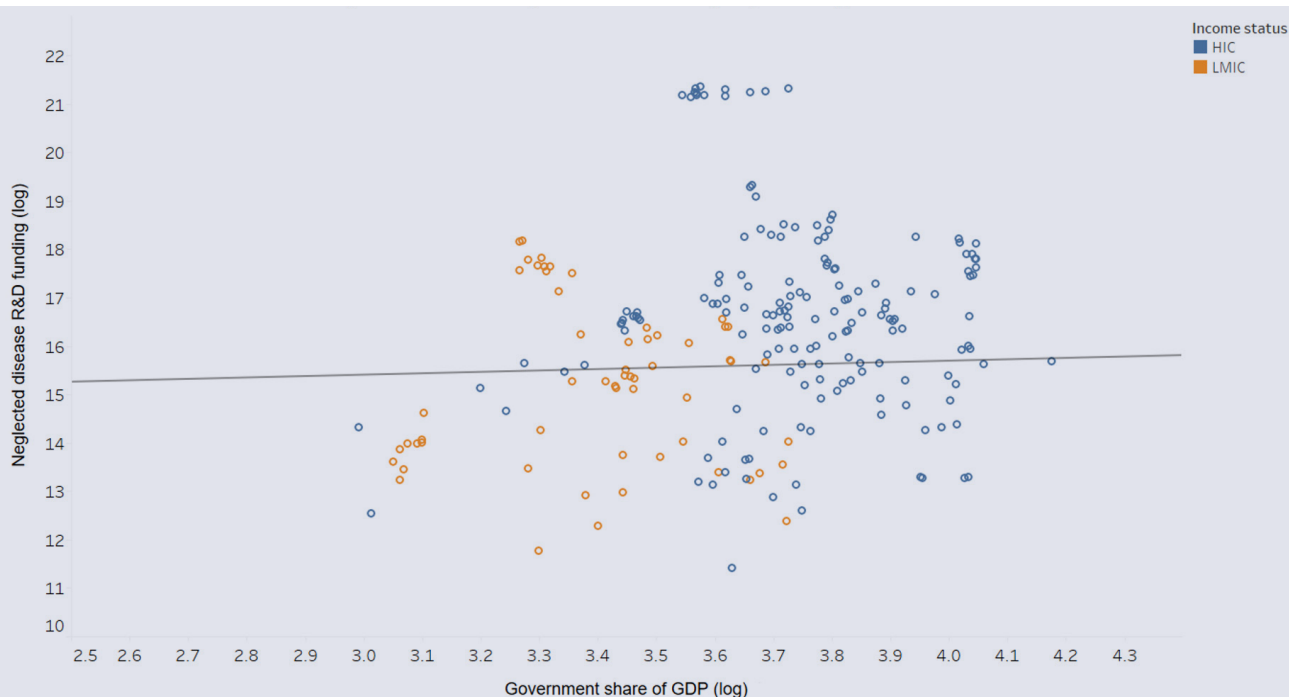
The relationship between government spending and neglected disease R&D funding persists, but gets weaker, once we adjust for differences in country size

The above analysis provides a potentially useful insight into how different nations allocate their overall government spending to ODA and ND R&D – nations that provide more ODA tend to spend more on neglected disease R&D – but doesn't tell us much about whether individual nations increase their neglected disease R&D funding in line with their overall expenditure and ODA budgets *over time*.

The links we've described so far mostly reflect the fact that bigger countries provide more of all kinds of funding, necessitating an adjustment for the different size of nations' governments. So, we adopted a series of approaches to try to correct for the effects of nation size on the relationship between ND R&D funding and government spending in our data:

First, instead of looking at overall government spending, we tried looking at government spending as a share of each nation's economy. This analysis, shown as a scatter plot in Figure 3, allows us to place the US and Cuba on a relatively more even footing, and to look more closely at the effect of changes in the size of government over time.

FIGURE 3. **Neglected disease R&D funding vs government share of GDP – by nation and year (log scale)**

By adjusting for the strong relationship we found between the overall *amount* of a government's spending and the amount it provides for neglected disease R&D, this analysis captures a much weaker – but still statistically significant – relationship between the *share* of government spending and its total ND R&D funding, as estimated by the slight upward slope of the trend line in Figure 3. Differences in the government's share of the economy account for just 3% ($R^2 = 0.029$) of variation in neglected disease R&D funding, with a 1% increase in the share of government spending predicting, albeit with a high degree of uncertainty, a 1.39% increase in neglected disease R&D funding.[4]

---

4   The reason that the size of the effect of government share of the economy on ND funding is the same as that for overall government spending, but the former explains much less of the overall variation in ND funding – as demonstrated by the much lower R2 – is that there is much less variation in governments' share of the economy across our sample. A 1% increase in government spending is commonplace, but a 1% increase in government's share of the economy is far less likely.

Changes in government spending also predict changes in neglected disease R&D funding

Our next attempt at correcting for differences in nations' size was to compare year-on-year *changes* in neglected disease R&D funding to changes in total government spending, instead of their total values, as shown in Figure 4. This allowed us to look directly at how changes over time influence overall funding.[5]

FIGURE 4. Change in neglected disease R&D funding vs change in government spending – by nation and year

This analysis showed a statistically significant relationship between changes in total spending and changes in neglected disease R&D funding, explaining about 17% of the variation in neglected disease R&D funding across our sample. Based on these results, we estimate that a $10m increase in overall government spending predicts a $1,582 increase in neglected disease R&D funding.

Do the relationships hold at the individual country level?

Finally, we looked at the time-series data for individual nations, to see if they matched the overall trends we found across nations and over time. Since each of these checks involved only a few data points, the relationships did not always meet the threshold for statistical significance, but they did allow us to sanity check our overall conclusions.

We found positive relationships between neglected disease R&D funding and total ODA in 11 out of the 15 nations which provide ODA (73%); a positive relationship between change in ND R&D funding and change in government spending over time in 14 out of 21 nations (67%)[6] and a positive relationship between government spending and neglected disease R&D funding for 13 out of 23 nations (56%). The relationship between government spending and funding for ND R&D was much stronger for HICs, with 69% of HICs showing a positive relationship, compared to only 29% of LMICs.

---

5   Since it is impossible to take logarithms where a change is negative, we did not use the log transform for this part of the analysis, and relationships are reported in dollar terms rather than as percentages.

6   Excluding two nations with only two consecutive years of funding data and therefore only one data point for change in funding.

These results suggest that the relationships we found when looking simultaneously across nations and over time do, on average, hold within individual nations, but that the links are relatively weak, and may often be overwhelmed by the specific national context.

The clearest link between government spending and neglected disease funding was for the United States. We found two statistically significant relationships: between US government spending and US ND R&D funding, and between *changes* in US government spending and ND funding, (p<0.04), with, for example, big increases in both categories of spending in 2009 followed by cuts to both in 2010.

We found no clear links between economic growth and neglected disease R&D funding

We found no significant relationship between either absolute or percentage change in neglected disease R&D funding and economic growth (measured via percentage change in GDP) in either the current or previous year.

This might be because we don't yet have enough data, or perhaps because of the ambiguous effect growth has on government spending: periods of high growth will increase governments' capacity for spending, but periods of slow growth also tend to encourage increased spending in the form of fiscal stimulus.

What do these results tell us?

It is unsurprising, but still informative, to find clear evidence that nations with high levels of total government spending tend to provide more funding for neglected disease R&D, and that ND R&D funding rises more rapidly than government spending overall.

The strong links between ODA and neglected disease R&D funding, which persist even after holding overall government spending constant, suggest that there is a common set of social and political factors which have a similar influence on both categories of spending, and that what is good for ODA is, at least on average, good for neglected disease R&D funding as well.

Our other analyses, which try to adjust for differences in nations' size, further suggest that ND R&D funding benefits from growth in government spending more than it suffers from reduced spending, in the immediate term at least.

In our accompanying executive summary, we present modelling for the impact of several real world scenarios on neglected disease R&D funding based on the statistical relationships we have derived, including changes in global and UK ODA targets, and a global recession mirroring the one that followed the Global Financial Crisis.

As we begin to consider the prospect of sharp cuts in government expenditure as the bills for pandemic-driven stimulus start to fall due, supporters of neglected disease research should be aware of the likely impact of reduced overall spending on neglected disease R&D budgets and work together to ensure funding levels are assessed based on value and impact, rather than mechanical formulas for 'sharing the pain' of overall reductions in funding.

You can find a short overview of our findings in the accompanying executive summary

www.policycuresresearch.org   g-finder@policycuresresearch.org   https://gfinderdata.policycuresresearch.org/