



# Global Fund contributions to health security in ten countries, 2014–20: mapping synergies between vertical disease programmes and capacities for preventing, detecting, and responding to public health emergencies

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## Summary

**Background** The Global Fund to Fight AIDS, Tuberculosis and Malaria is a robust vertical global health programme. The extent to which vertical programmes financially support health security has not been investigated. We, therefore, endeavoured to quantify the extent to which the budgets of this vertical programme support health security. We believe this is a crucial area of work as the global community works to combine resources for COVID-19 response and future pandemic preparedness.

**Methods** We examined budgets for work in Kenya, Uganda, Vietnam, Democratic Republic of the Congo, Guatemala, Guinea, India, Indonesia, Nigeria, and Sierra Leone from January, 2014 to December, 2020. These ten countries were selected because of the robustness of investments and the availability of data. Using the International Health Regulations Joint External Evaluation (JEE) tool as a framework, we mapped budget line items to health security capacities. Two researchers independently reviewed each budget and mapped items to the JEE. Budgets were then jointly reviewed until a consensus was reached regarding if an item supported health security directly, indirectly, or not at all. The budgets for the study countries were inputted into a single Microsoft Excel spreadsheet and line items that mapped to JEE indicators were scaled up to their respective JEE capacity. Descriptive analyses were then done to determine the total amount of money budgeted for activities that support health security, how much was budgeted for each JEE capacity, and how much of the support was direct or indirect.

**Findings** The research team reviewed 37 budgets. Budgets totalled US\$6 927 284 966, and \$2 562 063 054 (37·0%) of this mapped to JEE capacities. \$1 330 942 712 (19·2%) mapped directly to JEE capacities and \$1 231 120 342 (17·8%) mapped indirectly to JEE capacities. Laboratory systems, antimicrobial resistance, and the deployment of medical countermeasures and personnel received the most overall budgetary support; laboratory systems, antimicrobial resistance, and workforce development received the greatest amount of direct budgetary support.

**Interpretation** Over one-third of the Global Fund's work also supports health security and the organisation has budgeted more than \$2 500 000 000 for activities that support health security in ten countries since 2014. Although these funds were not budgeted specifically for health security purposes, recognising how vertical programmes can synergistically support other global health efforts has important implications for policy related to health systems strengthening.

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## Introduction

Health security focuses on protecting against the international spread of infectious diseases and other public health emergencies by promoting the prevention, detection, and response to such events. Many countries, however, have struggled to adequately invest in building and maintaining the capacities necessary for achieving this goal, and we see this now in the global response to the COVID-19 pandemic.<sup>1–3</sup> The International Health Regulations (IHR) are a legally binding framework that represent the existing guiding framework for health security efforts.<sup>4</sup> The IHR require that member states

develop and maintain core public health capacities in ways that avoid unnecessary obstructions to international traffic and trade. Accordingly, health security relies on strong, comprehensive health systems and efforts to develop or strengthen these capacities generally endorse a horizontal approach focused on strengthening the overall structure and function of health systems.

WHO supports a Monitoring and Evaluation framework for the IHR, which includes assessments of countries' IHR core capacities. Before 2016, these assessments relied on State Parties self-reporting by annually completing questionnaires. However, the implementation of this

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### Research in context

#### Evidence before this study

Health security strives to prevent public health emergencies and the international spread of infectious disease, and relies on strong, comprehensive health systems. Millions of dollars are invested annually under the umbrella of health systems strengthening and hundreds of global health programmes have been created to leverage and mobilise funding from governments, civil society organisations, and other actors (ie, private sector organisations and external funders). Much research has sought to explain the emergence of health systems strengthening as a global health priority and a lively discussion surrounds approaches for using funding most efficiently. These discussions generally categorise programmes as either vertical (ie, endorsing a disease-specific approach) or horizontal (ie, using an approach that seeks to treat underlying conditions and issues). Previous work has discussed how global health programmes and initiatives need not be exclusive and how there is potential for synergies to exist. Other work has discussed how vertical programmes contributed to the response to public health emergencies, with much of this work focusing on how polio initiatives in west Africa supported the response to the 2014 Ebola epidemic. However, there is a notable absence of research regarding the extent to which disease-specific global health initiatives also support health security efforts and might be leveraged for responding to current and future pandemics. We searched PubMed and Web of Science for articles related to vertical programmes, disease specific, capacity building, systems strengthening, and health security between Jan 1, 2000, and Dec 31, 2019. No language restrictions were applied. We used the search terms “vertical

program” or “stand-alone program” or “stand alone program” or “stand-alone programme” or “stand alone programme” or “disease specific”; “health security” or “public health emergency” or “health emergency” or “pandemic” or “international health regulations” or “public health emergency of international concern”; capacity or capacities or system or systems; and build\* or strength\* or enhanc\* or increas\*.

#### Added value of this study

To our knowledge, this Article is the first to examine financial contributions from vertical disease programmes to health security. Our results show that slightly over one-third of the disease-specific work budgeted for by The Global Fund to Fight AIDS, Tuberculosis and Malaria—a vertical programme—synergistically supports health security efforts. Furthermore, since 2014, The Global Fund has budgeted more than \$2 500 000 000 for activities that support health security in the Democratic Republic of the Congo, Guatemala, Guinea, India, Indonesia, Kenya, Nigeria, Sierra Leone, Uganda, and Vietnam.

#### Implications of all the available evidence

These results lend support to the stance that the dichotomy between vertical approaches and other global health initiatives focused on broader health systems strengthening is false or, at least, not definitive. This assertion creates a compelling new narrative for discussions surrounding health systems strengthening. Other vertical programmes and governments might wish to review their budgets and agendas as a means of identifying synergies between their work and that of other health initiatives.

strategy was erratic,<sup>5</sup> and there were concerns regarding the validity of the information reported.<sup>6</sup> In 2014, the Global Health Security Agenda was launched to accelerate progress towards developing these capacities and the WHO strategy was revised in response to the concerns raised and new approaches developed by this initiative. WHO now recommends an approach that combines mandatory self-assessments with voluntary external evaluations, simulation exercises, and after-action reports.<sup>7</sup> The voluntary external evaluations rely on a Joint External Evaluation (JEE) tool that was first developed in 2015 and includes 48 indicators that correspond to 19 core capacities (appendix p 1).<sup>8</sup> These capacities are further categorised as relating to preventing, detecting, or responding to emergencies, and other considerations and hazards. The COVID-19 pandemic is showing that the JEE indicators are not perfect for predicting national response success, but they remain the best and most widely adopted indicators for health security.

Established in 2002, the Global Fund to Fight AIDS, Tuberculosis and Malaria has worked to accelerate the end of HIV/AIDS, tuberculosis, and malaria as epidemics. The Global Fund is a partnership—between governments,

private-sector organisations, civil society, and affected populations—that supports programmes in over 100 countries run by experts in health systems at both, the local and national level. Because of the prioritisation of HIV/AIDS, tuberculosis, and malaria, the scope of the Global Fund’s work inherently endorses a vertical approach that targets specific diseases and conditions, although the organisation’s strategy has been criticised for not allocating sufficient funds to strengthen health systems more broadly.<sup>9,10</sup> Still, building resilient and sustainable health systems is a strategic pillar of the Global Fund and is essential for ending HIV/AIDS, tuberculosis, and malaria epidemics. In a recent funding cycle from 2015 to 2017, 27·3% of the Global Fund’s investments focused on health system strengthening.<sup>11</sup> This funding was for disease-specific interventions that contribute to strengthening systems (eg, laboratory capacity, community case management, etc) as well as those intended to directly strengthen cross-cutting system functions (eg, supply chain, service delivery integration, etc).<sup>11</sup> These actions are well aligned with calls for development assistance for health to support a diagonal managerial approach—one that uses explicit intervention priorities to promote the overall

See Online for appendix

strengthening of health systems—rather than a purely vertical or purely horizontal managerial approach.<sup>12</sup> This emphasis is unique, as the institutional mandates of vertical programmes can occasionally impede horizontal or diagonal approaches by restricting the reallocation of funding for broader health priorities.

Previous work has explored the emergence of health system strengthening as a global health priority,<sup>13</sup> how synergies can exist between global health security and other health initiatives such as universal health coverage<sup>14</sup> and reducing non-communicable disease burdens,<sup>15</sup> and the roles disease-specific programmes have had in contributing to public health emergencies.<sup>16,17</sup> However, at the time of publishing, no work has investigated the extent to which the disease-specific investments of vertical programmes have financially supported health security efforts. To address this knowledge gap, we assessed the extent to which the activities of the Global Fund also supported health security efforts by mapping activities in the budgets of ten Global Fund supported countries to the indicators of health security described in the JEE tool. This research was completed in early December, 2019, before the COVID-19 pandemic, but the findings are relevant for the current response as well as future health emergencies.

## Methods

### Mapping Global Fund budgets to JEE

We initially examined the Global Fund budgets from January, 2014, to December, 2020, for the Kenya, Uganda, and Vietnam country portfolios as a pilot study. Budgets were obtained from the Global Fund Secretariat and assumed to list line items (ie, individual entries appearing on a separate line in a budget) in current US\$. These countries were selected because of the robustness of investments and the availability of budgetary data. 2014 was selected as the starting point because it was the year that the Global Health Security Agenda was launched. The Global Funds' funding cycle runs in 3-year periods that correspond to their replenishment periods. Our analysis included budgets from the 2014–16 and 2017–19 funding cycles. The analysis did not include budgets from the 2020–22 funding cycle. Some line items included in the reviewed budgets listed implementation periods beginning in 2020, which accounts for this time discrepancy.

We blinded two researchers and had them independently review each budget, mapping budget line items to one of the 48 JEE indicators when appropriate. We created an additional capacity (S.1.1 General Health Security Support) to include activities or items that did not clearly map to a JEE capacity but had clear links to health security capacity (eg, computers for the ministry of health). During the mapping process, we indicated if line items directly or indirectly supported health security. For this study, we defined direct support as an investment or activity that is explicitly related to a

capacity listed in the JEE; whereas indirect support was defined as an investment or activity that had a disease-specific focus beyond the realm of health security but was tangentially related to JEE capacities (eg, cold chain capacities for HIV treatments) or other materials that could be used or altered in the event of a public health emergency (eg, vehicles for the ministry of health). All line items mapped to S.1.1 General Health Security Support were mapped as indirect support for health security.

The two researchers were then unblinded and met to review any discrepancies in mapping to reach an agreement. If a consensus was not reached, we flagged the line item for further discussion with Global Fund country officers. Based on the information received in subsequent discussions, an agreement was reached regarding if these items mapped to the JEE. During these meetings, we also queried if there were any contextual factors that made budgets difficult to implement and if the Global Fund country officers thought the work outlined in the budgets supported the response to any public health emergencies. Once we had reviewed all the budgets, a single researcher (MRB) reviewed all of the data to ensure consistency in mapping methodology between budgets.

Upon completion of the pilot project, we mapped the budgets for seven additional countries from 2014 to 2020—Democratic Republic of the Congo, Guatemala, Guinea, India, Indonesia, Nigeria, and Sierra Leone—using the same methodology. These countries were also selected based on the robustness of their budgetary data, but also purposively selected to expand the geographical scope of the study in a way that better reflects the Global Fund's overall body of work (appendix p 2).

### Data analysis

We consolidated the budgets for all of the study countries into a single Microsoft Excel spreadsheet and line items that mapped to JEE indicators were scaled up to their respective JEE capacity (eg, D.1.1, D.1.2, D.1.3, and D.1.4 were recoded as D.1 Laboratory systems). We then did descriptive analyses to determine the total amount of money budgeted for activities that support health security, how much was budgeted for each JEE capacity, and how much of the support was direct or indirect.

### Role of the funding source

The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data and had final responsibility to submit for publication.

## Results

The research team reviewed 37 budgets containing 110 629 total line items from the years 2014–20. The Global Fund budgets supported health interventions linked to HIV/AIDS, tuberculosis, malaria, resilient and

	HIV and AIDS, US\$	HIV and tuberculosis, US\$	HSS, US\$	Malaria, US\$	Tuberculosis, US\$	Total, US\$
Democratic Republic of the Congo	213 932 821	149 742 294	..	781 743 467	71 475 894	1 216 894 477
Guatemala	19 670 563	..	..	6 298 652	12 372 154	38 341 369
Guinea	95 420 296	14 606 301	..	120 756 989	3 882 781	234 666 367
India	422 050 253	18 283 889	..	181 441 803	549 425 209	1 171 201 155
Indonesia	173 807 070	..	7 962 130	105 254 463	206 573 486	493 597 149
Kenya	552 053 184	..	..	174 003 213	132 515 942	858 602 339
Nigeria	554 860 359	5 089 851	42 996 203	733 677 775	221 742 729	1 558 366 918
Sierra Leone	64 867 420	..	131 315 622	10 376 495	..	206 559 536
Uganda	463 470 620	28 995 077	..	384 785 918	40 148 267	917 399 882
Vietnam	126 367 858	..	..	15 249 221	90 038 695	231 655 774
Total	2 686 500 444	216 717 412	182 273 955	2 513 587 996	1 328 175 157	6 927 284 966

HSS=health systems strengthening.

**Table 1: Financial description of Global Fund budgets analysed for HIV and AIDS, tuberculosis, malaria, HSS, and HIV and tuberculosis, 2014–20**

	Direct support, US\$ (%)	Indirect support, US\$ (%)	Total, US\$ (%)
Democratic Republic of the Congo	165 309 425 (13.6%)	298 701 046 (24.6%)	464 010 471 (38.1%)
Guatemala	10 402 667 (27.1%)	6 266 341 (16.3%)	16 669 008 (43.5%)
Guinea	38 675 727 (16.5%)	35 536 731 (15.1%)	74 212 458 (31.6%)
India	385 040 662 (32.9%)	249 988 003 (21.3%)	635 028 665 (54.2%)
Indonesia	169 090 478 (34.3%)	75 392 401 (15.3%)	244 482 879 (49.5%)
Kenya	117 716 877 (13.7%)	107 698 255 (12.5%)	225 415 132 (26.3%)
Nigeria	160 208 115 (10.3%)	309 826 850 (19.9%)	470 034 965 (30.2%)
Sierra Leone	51 295 835 (24.8%)	58 576 697 (28.4%)	109 872 532 (53.2%)
Uganda	139 692 102 (15.2%)	58 224 970 (6.4%)	197 917 072 (21.6%)
Vietnam	93 510 824 (40.4%)	30 909 048 (13.3%)	124 419 872 (53.7%)

Direct support is defined as an investment or activity that is explicitly related to a capacity listed in the Joint External Evaluation. Indirect support is defined as an investment or activity that had a disease-specific focus beyond the realm of health security but was tangentially related to Joint External Evaluation capacities, or other materials that could be used or altered in the event of a public health emergency.

**Table 2: Summary of direct and indirect budgetary support provided by the Global Fund that supported health security capacities from 2014 to 2020, by country**

sustainable systems for health, and HIV and tuberculosis. A total of 43 351 (39.2%) line items mapped to a JEE capacity, with 22 355 (20.2%) of these items mapping directly to JEE capacities and 20 996 (19.0%) line items mapping indirectly to JEE capacities. From a financial perspective, the Global Fund budgets for the ten countries during this 7-year period accounted for a total of US\$6 927 284 966 (table 1). Of this, \$2 562 063 054 (37.0%) mapped to JEE capacities; \$1 330 942 712 (19.2%) mapped directly to JEE capacities and \$1 231 120 342 (17.8%) mapped indirectly to JEE capacities.

The Global Fund activities contained in the budgets mapped to 13 of 19 JEE capacities. The JEE capacities that did not receive any budgetary support from the Global Fund were zoonotic disease (P.4), food safety (P.5), immunisation (P.7), reporting (D.3), chemical events (CE.1), and radiological events (RE.1).

The budgets from India contributed the most support to health security and budgeted a total of \$635 028 665 for activities that also supported JEE capacities (table 2). Proportionally, all the budgets contributed to 21.6–54.2% of the funds towards activities that mapped to JEE capacities, with India (54.2%), Vietnam (53.7%), and Sierra Leone (53.2%) providing the greatest percentage of budgetary support (table 2). With the exceptions of Democratic Republic of the Congo, Nigeria, and Sierra Leone, all countries' budgets contributed more direct support than indirect support to health security.

Overall, the Global Fund budgets contained the most budgetary support for capacities focused on detecting public health emergencies. The health security capacities receiving the greatest amounts of overall support were laboratory systems (\$677 253 433), antimicrobial resistance (AMR; \$508 390 424), and the deployment of medical countermeasures and personnel (\$678 554 731). The budgets contained the greatest direct budgetary support for laboratory systems (\$496 809 988), AMR (\$424 279 885), and workforce capacities (\$290 166 708).

The remaining \$4 365 221 912 (63.0%) contained in the Global Fund budgets that did not support health security generally supported disease-specific activities or programme-related costs (eg, procurement of condoms and lubricants, quality control activities for HIV antiretroviral therapy, etc), administration costs (eg, grant audits, bank fees for grant sub-recipients, etc), or other line items with insufficient detail (eg, non-specific laboratory materials, monthly meetings, etc).

From 2014 to 2020, the Global Fund budgeted a total of \$539 283 506 for activities that supported health security efforts for preventing public health emergencies, with \$433 009 986 (80.3%) coming as direct support, and \$106 273 520 (19.7%) coming as indirect support (table 3). Of the JEE capacities focused on preventing public health emergencies, the AMR capacity received the greatest amounts of direct, indirect, and total support.

Selected Global Fund activities included in the budgets that supported capacities focused on preventing public health emergencies included the drafting of national plans for the detection of priority diseases and drug resistance; reviewing and revising national programmes, policies, and laws; hosting workshops focusing on the financing or development of essential public health capacities; validating national programmes or guidelines; hiring external consultants to aid in the drafting of relevant legislation; supporting interagency and ministerial coordination meetings; supporting multiagency review meetings; completing drug resistance surveys; developing and supporting laboratory systems required for detecting drug resistance; supporting the development and implementation of health-care associated infection prevention and control programmes; promoting good antibiotic stewardship practices through the procurement and responsible use of first-line and second-line drugs; and procuring personal protective equipment.

The greatest amount of support for health security from the Global Fund came as support for capacities focused on detecting public health emergencies. A total of \$1152909372 was budgeted from 2014 to 2020 for activities that also supported health security efforts for detecting public health emergencies, with \$824785501 (71.5%) directly contributing to health security and \$328123871 (28.5%) indirectly contributing (table 4). Of all the JEE capacities, laboratory systems were the health security capacity most financially supported by the Global Fund, with nearly \$496809988 (73.4%) directly supporting health security laboratory capacities, and over \$180443445 (26.6%) indirectly supporting health security laboratory capacities.

Selected Global Fund activities that supported capacities focused on detecting public health emergencies included laboratory materials required for the diagnosis of HIV, tuberculosis, and malaria; procurement and distribution costs for laboratory materials; costs related to the transportation of biological specimens from sampling sites to reference laboratories; developing and distributing tools for collecting surveillance data; integrating data from multiple surveillance systems and promoting linkages across systems; training for public health and medical worker cadres; health-focused training for community health-care workers, community health volunteers, law enforcement officers, and other professionals referenced in the JEE; and salary support of health-care professionals.

A majority of the Global Fund's support for responding to public health emergencies came as indirect support. A total of \$732250706 was budgeted for activities that also supported health security efforts for responding to public health emergencies, with \$69466345 (9.5%) contributing directly and \$662784361 (90.5%) contributing indirectly (table 5). Of the JEE capacities related to responding to public health emergencies, the capacity focused on medical countermeasure and personnel deployment received the greatest amount of direct, indirect, and total support.

	Direct support, * US\$	Indirect support, US\$	Total, US\$
P.1 Legislation	5 509 687 (36.5%)	9 587 703 (63.5%)	15 097 390
P.2 Coordination	1 749 910 (90.1%)	192 572 (9.9%)	1 942 482
P.3 Antimicrobial resistance	424 279 885 (83.5%)	84 110 539 (16.5%)	508 390 424
P.4 Zoonotic	0	0	0
P.5 Food safety	0	0	0
P.6 Biosafety and biosecurity	1 470 504 (10.6%)	12 382 706 (89.4%)	13 853 210
P.7 Immunisation	0	0	0
Total	433 009 986 (80.3%)	106 273 520 (19.7%)	539 283 506

All percentages are a proportion of the capacity total. Direct support is defined as an investment or activity that is explicitly related to a capacity listed in the Joint External Evaluation. Indirect support is defined as an investment or activity that had a disease-specific focus beyond the realm of health security but was tangentially related to Joint External Evaluation capacities, or other materials that could be used or altered in the event of a public health emergency.

**Table 3: Summary of direct and indirect budgetary support provided by the Global Fund for Joint External Evaluation capacities for preventing public health emergencies in ten countries from 2014 to 2020**

	Direct support, US\$	Indirect support, US\$	Total, US\$
D.1 Laboratory systems	496 809 988 (73.4%)	180 443 445 (26.6%)	677 253 433
D.2 Surveillance systems	37 808 805 (83.7%)	7 346 357 (16.3%)	45 155 162
D.3 Reporting	0	0	0
D.4 Workforce	290 166 708 (67.4%)	140 334 069 (32.6%)	430 500 777
Total	824 785 501 (71.5%)	328 123 871 (28.5%)	1 152 909 372

All percentages are a proportion of the capacity total. Direct support is defined as an investment or activity that is explicitly related to a capacity listed in the Joint External Evaluation. Indirect support is defined as an investment or activity that had a disease-specific focus beyond the realm of health security but was tangentially related to Joint External Evaluation capacities, or other materials that could be used or altered in the event of a public health emergency.

**Table 4: Summary of direct and indirect budgetary support provided by the Global Fund for Joint External Evaluation capacities for detecting public health emergencies in ten countries from 2014 to 2020**

	Direct support, US\$	Indirect support, US\$	Total, US\$
R.1 Preparedness	2 632 738 (36.2%)	4 632 943 (63.8%)	7 265 681
R.2 Emergency response operations	2 577 770 (57.7%)	1 893 483 (42.3%)	4 471 253
R.3 Linking health and security	101 610 (72.7%)	38 127 (27.3%)	139 737
R.4 MCM and personnel deployment	54 008 813 (8.0%)	624 545 918 (92.0%)	678 554 731
R.5 Risk communication	10 145 414 (24.3%)	31 673 890 (75.7%)	41 819 304
Total	69 466 345 (9.5%)	662 784 361 (90.5%)	732 250 706

All percentages are a proportion of the capacity total. Direct support is defined as an investment or activity that is explicitly related to a capacity listed in the Joint External Evaluation. Indirect support is defined as an investment or activity that had a disease-specific focus beyond the realm of health security but was tangentially related to Joint External Evaluation capacities, or other materials that could be used or altered in the event of a public health emergency. MCM=medical countermeasure

**Table 5: Summary of direct and indirect budgetary support provided by the Global Fund for Joint External Evaluation capacities for responding to public health emergencies in ten countries from 2014 to 2020**

Selected activities supported by the Global Fund that supported capacities focused on responding to public health emergencies included mapping health facilities, treatment centres, pharmacies, and other health-related facilities; producing medical commodity stock reports; supporting the investigation of infectious disease outbreaks; developing, reviewing, and distributing standard operating procedures, job aids, and treatment

guidelines for drug-resistant tuberculosis; sensitising law enforcement and military personnel; costs related to the distribution and storage of health products and commodities; procurement and supply chain management information system costs; validating risk communication systems and strategies; sponsoring regular television and radio campaigns; and purchasing or renting billboards.

The Global Fund also budgeted a total of \$3680880 for activities that supported other public health hazards and considerations related to health security. All of this support came as direct support for capacities and activities at points of entry, and included a range of activities including maintaining warehouse and distribution centres at points of entry, implementing epidemiological surveillance posts in border areas, supporting the digital tracking of populations at borders, and implementing civil–military screening algorithms in border regions with poor access to health.

Global Fund budgets included \$133938590 for activities that supported general health security. This indirect support included activities such as operational costs for ministries of health, information and communications technology costs, fuel and generators to provide power to government offices or health facilities, and vehicles (inclusive of insurance, maintenance, and fuel) for the implementation of activities.

## Discussion

To our knowledge, this is the first study to examine financial contributions from vertical disease programmes to health security. The results show that slightly over one-third of the disease-specific work budgeted for by the Global Fund synergistically supports health security efforts; and that since 2014, the Global Fund has budgeted more than \$2500000000 for activities that directly or indirectly support health security in the Democratic Republic of the Congo, Guatemala, Guinea, India, Indonesia, Kenya, Nigeria, Sierra Leone, Uganda, and Vietnam.

It is not surprising that the Global Fund did not support JEE capacities focused on zoonotic disease, food safety, reporting, chemical events, or radiological events, as none of the Global Fund's priority diseases are currently considered to be zoonotic diseases, or related to food safety, chemical emergencies, or radiological emergencies. The absence of Global Fund support for health security reporting capacities can be explained by the scope of the JEE capacity, which focuses on establishing reporting networks and protocols for reporting public health emergencies to relevant international authorities (eg, WHO).<sup>8</sup> Given that outbreaks of the Global Fund's priority diseases are unlikely to warrant reporting to international authorities, this result is also unsurprising.

The Global Fund might wish to consider nuanced shifts in strategy to continue to support their work and

simultaneously enhance health security. For example, although an effective vaccine does not currently exist for HIV, the BCG vaccine has been in use for nearly a century to protect against tuberculosis.<sup>18</sup> This vaccine provides protection against disseminated tuberculosis in infants when administered intradermally at birth.<sup>19</sup> BCG vaccine has shown variable efficacy against disease in adolescents and adults, but recent research has suggested that efficacy could be improved by changing its route of administration.<sup>20</sup> Still, the Global Fund budgets for these ten countries did not contain any financial support for BCG vaccination campaigns. Alternatively, although there is currently no licensed malaria vaccine, recent decades have seen substantial progress towards the development of these vaccines. In 2019, the governments of Ghana, Kenya, and Malawi launched the world's first pilot programmes for malaria vaccine.<sup>21</sup> These developments provide the Global Fund with new opportunities to reduce the burdens of tuberculosis and malaria and support health security immunisation focused efforts by providing assistance for the drafting, review, and revision of immunisation plans or for bolstering cold chain systems that are a key consideration of the immunisation capacity in the JEE and necessary for vaccine delivery throughout a country. Should the Global Fund support this work, or similar work in the future, it could improve the ability of countries to deliver vaccines during outbreaks of novel pathogens once a vaccine is developed. We expect the Global Fund will be active participants in any international effort to leverage all assets to deliver medical countermeasures to COVID-19.

Furthermore, as outlined in the JEE, AMR is a high health security priority. Although the Global Fund currently makes substantial contributions to combat AMR, these are almost exclusively through their tuberculosis activities. Given that AMR is recognised as a crucial threat for the treatment of all three of the Global Fund's priority diseases,<sup>22–25</sup> the organisation might wish to consider extending AMR initiatives to their HIV and malaria project portfolios, especially in countries that have shown a high prevalence of HIV or malaria drug resistance. Such work could also contribute to broader regional and national AMR strategies and the sustainability of the Global Fund's efforts to combat these diseases.

This research answers the call for a perpendicular framing of global health that advocates for considering vertical programmes in terms of how they support and operationalise horizontal systems and policies.<sup>26</sup> It also lends support to the stance that the dichotomy between vertical, disease-specific approaches and other health initiatives focused on broader health systems strengthening is false or, at a minimum, not always distinct.<sup>26,27</sup> This contention is important because it has been previously cautioned that concentrating funds into disease-based initiatives can compromise the integrity and equity of health systems.<sup>28</sup>

The results of this study could inform other organisations providing external funding for health. Scholars have called for health-focused development partners to strengthen coordination among themselves and with recipient countries in efforts to improve financial efficiency and equity.<sup>29</sup> Such work is especially pertinent in a time when scepticism regarding the use of international aid is rising and aid budgets are under pressure to provide tangible results.

Recognising where the Global Fund is already making contributions towards health security efforts, other development partners could focus their efforts on contributing to areas that are neglected by the Global Fund's scope of work. Similarly, the results of this study can inform the efforts of the governments of the included countries to pool external funding for health in an efficient manner. All the countries included in this study are receiving international aid,<sup>30</sup> and knowing which aspects of health security are being supported by the Global Fund could inform strategies for pooling other funding to make the largest overall impact on health systems.

This study has several limitations, most notable that we only mapped budget line items to one JEE capacity, which might have introduced a form of observer bias. For example, all health-care worker trainings were mapped as support for the workforce capacity in the JEE because these line items did not always provide sufficient detail to determine the focus of the training. Still, it is likely that some of these trainings might have focused on biosafety and biosecurity, risk communication, or other health security aspects, and could have also been mapped to those respective capacities.

Additionally, although the JEE represents one framework for conceptualising health security, other frameworks exist that might include or omit additional aspects and capacities. For example, from 2014 to 2020, the Global Fund spent over \$1000000000 on activities focused on vector control in the ten countries considered in this study. Vector control is beyond the scope of the JEE, and although the Global Fund's motivations for this work were focused on controlling the spread of malaria, the procurement and distribution of bed nets, training in epidemiological methods for vector-borne diseases, and messaging in behavioural change communication campaigns (eg, environmental modification to reduce the amount of standing water) also support the control and prevention of other vector-borne diseases, such as yellow fever, Zika virus, or any other emerging or re-emerging vector-borne disease, that are health security priorities.

This work underscores how valuable investments from vertical programmes can be for broader health system strengthening efforts. Future research might wish to use other frameworks to conceptualise the contributions of vertical programmes to health security and should explore the extent to which other vertically oriented programmes contribute to these efforts. Doing so would

allow for development partners to create synergies between their work and other initiatives and help them articulate more complete narratives of how their investments are contributing to both vertical and horizontal health system strengthening efforts. This reconceptualisation would allow for their work to simultaneously and synergistically benefit health systems as a whole—a situation in which everyone wins. There has never been a more crucial time for these efforts to come together to support global health.

#### Contributors

All authors contributed to the study conceptualisation and design.

AA-J, MRB, JL, RK, and SM made substantial contributions towards data analysis and interpretation. MRB and RK drafted the manuscript that was subsequently reviewed and revised by all authors. MRB created the figures shown in the appendix. All authors have read and approved of the final version of the manuscript.

#### Declaration of interests

We declare no competing interests.

#### Data sharing

Data analysed in the study are property of the Global Fund to Fight AIDS, Tuberculosis and Malaria and will not be made available by the authors. Interested parties may inquire with the Global Fund regarding data availability.

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