**COVID-19 and HIV pandemic response:
measuring testing, tracing, and treatment outcomes for both pandemics**

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Abstract

Background

As of June 21st, 2020, the COVID-19 pandemic has caused 8,944,463 confirmed illnesses and claimed over 467,280 deaths worldwide. The experience of well-resourced countries including China, United States, Italy and France, illustrates that COVID-19 threatens to overwhelm even the best-resourced health systems. Interventions have focused on social distancing including isolation and quarantine with some countries effectively using testing and contact tracing.

Methods

Data analyses used UNAIDS testing and treatment data on HIV among the 56 countries, 31 with the highest HIV burden (85% of global HIV burden) and 26 high-income countries (2018 GDP per capita of more than USD 20,000 and more than 3,000 people living with HIV). Additional HIV data was sourced directly from official websites or PEPFAR Country Plans. Economic status was determined using World Bank data. COVID-19 data are from the Worldmeters site.

Results

Higher HIV viral suppression in the 26 high-income countries was, on average, associated with lower COVID testing and higher COVID-19 death rates. Comparing their HIV treatment coverage and COVID testing capacity showed no relation in the rankings. This is likely due to many factors including the phase of the national COVID-19 epidemic, ability to provide tests, and health care system access and quality. Among these countries, there is a weak and negative correlation between COVID tests per case detected and deaths per 1,000 COVID cases. Among the 31 high HIV burden countries, COVID pandemic is in early stages in most.

Conclusion

While the HIV has many differences, people engaged in the HIV and COVID-19 responses would do well to share lessons learned about how to address the major challenge of testing and treating millions of people to address these ongoing major pandemics.

Introduction

As of June 21st, 2020, the COVID-19 pandemic has caused 8,944,463 confirmed illnesses and claimed over 467,280 deaths worldwide (1)(2). The experience of well-resourced countries including China, United States, Italy and France, illustrates that COVID-19 threatens to overwhelm even the best-resourced health systems (3-5)(6). COVID-19 is a novel zoonotic virus and there are no proven treatments or vaccine. Interventions have focused on social distancing including isolation and quarantine with some countries effectively using testing and contract tracing. The economic impact is significant as social distancing often includes “shelter in place” and the cessation of non-essential activities (7). Although governments have responded with a variety of stimulus and social support packages, it is increasingly clear that sustained social distancing measures will have significant short and long-term effects on individual and national economic well-being (8). Social and physical distancing, when adhered to, does appear to have a major impact on transmission (9)(10). Estimating that they have moved through the worst of the epidemic, some countries are relaxing and/or considering relaxing restrictions (11)(12). While expanding access to testing is essential, it is likely that to prevent the resurgence of infection, long-term or intermittent social distancing will be required (13).

The tension between the first priority of safeguarding individual and public health and restarting the economy is complicated by lack of data and understanding regarding how to evaluate the risks and benefits of relaxing restrictions. Based on the experience of countries including Singapore and Hong Kong that used testing to contain COVID-19 (14), case management and contract tracing, scaling antibody and PCR-based testing with triage and contact tracing is seen as essential for containment and as a means to make decisions regarding lifting social distancing measures. Despite lack of data regarding immunity, it is likely that countries will use testing, tracing, and treatment (clinical support) to ensure containment, while allowing some people to return to work and/or remain in physical quarantine.

COVID-19 and HIV testing

Scaling COVID-19 testing to reach millions of people represents a significant political, technical and supply chain challenge. Expanding access to sophisticated testing and disease control management has been a major element of the global response to the HIV pandemic and there are significant lessons to be learned. The early decades of the HIV response used antibody testing primarily as a diagnostic tool in clinical settings (15). With the advent of HIV treatment and increased community acceptance and demand, antibody and PCR-based testing was expanded into the community at a large scale (16)(17)(18). While contact tracing for HIV has been limited, active case management that includes finding potentially exposed partners is now seen as part of

the solution in many settings (16)(19)(20). HIV-self testing, available for the past 10 years, is still not available for the millions of people who need it in high HIV burden settings (21)(22)(23)(24).

HIV is 100% fatal without treatment, however, treatment prevents illness, death, and transmission (25). A key element in the HIV response was the establishment of the UN 90-90-90 target by UNAIDS in 2014—they call for 90% of people living with HIV to be diagnosed, of those diagnosed 90% on treatment and of those on treatment 90% virally suppressed (18). The 90-90-90 target along with the overwhelming scientific evidence helped change the strategy from “test and wait” (26)(27) to “test and treat” to ensure that people remain healthy and do not transmit the virus (25)(28)(29)(30). Billions of dollars of investment coupled with the move to “test and treat” has markedly decreased illness, deaths and transmission even the most challenging settings (31)(32, 33). However, the delay in shifting to “test and treat” has contributed to delays in access to earlier diagnosis and treatment (27). In 2018, an estimated 38 million people were living with HIV, 1.7 million were newly infected, 770,000 died, and around 13 million (34%) still do not have access to treatment (34). Although effective treatment is not yet available, as the response to the COVID pandemic evolves, it is highly likely that it will confront similar controversies and challenges slowing efforts to expand access to testing, tracing and treatment.

Examining efforts to scale testing and successful treatment for HIV among the 31 countries with the highest HIV burden (85% of global HIV burden) provides insights regarding successes and ongoing challenges (Table 1). While data collection and analysis have some variation between countries (see sources for details), the data illustrate that some well-resourced countries continue to struggle to deliver basic HIV testing and treatment. The ranking (based on viral suppression among all people living with HIV) also demonstrate that with a sound strategy, political will, and resources it is feasible to offer testing and lifelong HIV treatment to millions of people—even in the face of considerable stigma, economic and health infrastructure challenges (Table 1).

COVID-19 with its estimated 6 day doubling time, airborne transmission and lack of an effective treatment is not HIV. However, as with any pandemic, setting targets and planning to scale testing is part of the solution. As with the HIV 90-90-90 target, COVID-19 testing and death among positive cases are not always associated with economic status (Table 1 and 2). Higher HIV viral suppression in the 26 countries with 2018 GDP per capita of more than USD 20,000 and more than 3,000 people living with HIV was, on average, associated with lower COVID testing and higher COVID-19 death rates (figures not shown). Comparing the high-income countries HIV treatment coverage and COVID testing capacity showed no relation in the rankings (Figure 1). This is likely due to many factors including the phase of the national COVID-19 epidemic, ability to provide tests, and health care system access and quality. Among the high-income countries, there is a weak and negative correlation between COVID tests per case detected and deaths per

1,000 COVID cases (Figure 2). Although confounding is likely, this suggests that increased testing in the community may reduce COVID-19 death rates. The data should be interpreted with caution as testing and reporting protocols have varied significantly between and within countries. Specifically, some countries used scarce testing resources on hospitalized patients with concomitant under-reporting of cases and deaths in the community. Additionally, the data has not been adjusted for a number of factors including age, sex, and/or the timing of the national COVID-19 epidemic.

Testing, tracing, and treatment may be a common pathway for HIV and COVID-19

As with HIV, an easy-to-use point of care COVID-19 serology test that does not rely on an overburdened central laboratory will likely be necessary to successfully contain the pandemic while allowing for a resumption of economic activity. Antigen testing, CRISPR technology-based testing, and antibody tests are all coming online soon and should provide valuable tools to help address challenges around determining sensitivity, specificity, positive and negative predictive values (35)(36). Combining COVID-19 testing, triage, and case management has already proven effective in some settings (37). When available, layering on earlier treatment and vaccine could further reduce the threat of COVID-19. However, caution is warranted as after nearly 40 years the HIV pandemic remains an ongoing significant public health problem with over 35 million deaths and over 75 million people infected with this 100% fatal virus. In 2018, HIV testing and early diagnosis remains a significant challenge in many settings and an estimated 13 million are not on treatment (34). HIV impacts countries regardless of income status and the United States reports around 38,000 new HIV infections a year (38). It is increasingly clear that *business as usual* is not enough and that lessons learned in countries with successful HIV response are needed to ensure that most people living with HIV achieve viral suppression as part of the effort to reach 90-90-90 and 95-95-95 targets (18). Testing, tracing and treatment are already part of many successful countries efforts to reach people with HIV earlier to prevent illness, death and transmission.

While the HIV pandemic has many differences, people engaged in the HIV and COVID-19 responses would do well to share lessons learned about how to address the major challenge of testing and treating millions of people to address these ongoing major pandemics.

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Table 1: Progress towards 90-90-90 and COVID-19 performance of top 31 high HIV burden countries

Rank	Country	Year	Estimated PLHIV	PLHIV who know their status (1st 90)	PLHIV who know their status receiving ART (2nd 90)	ART coverage	PLHIV receiving ART with suppressed viral load (3rd 90)	PLHIV with suppressed viral load	Total COVID Cases	Total COVID Deaths	Total COVID Tests	Tests/ 1M pop
1	Namibia	2018	200,000	92%	100%	92%	95%	87%	40	NA	6,514	2,565
2	Eswatini	2018	210,000	92%	93%	86%	94%	81%	586	4	6,551	5,649
3	Botswana	2018	370,000	91%	91%	83%	98%	81%	79	1	33,176	14,119
4	Rwanda	2018	220,000	94%	93%	87%	85%	74%	646	2	101,856	7,872
5	Thailand	2018	480,000	94%	80%	75%	97%	73%	3,146	58	468,175	6,708
6	Kenya	2018	1,600,000	80%	95%	76%	95%	72%	4,257	117	130,498	2,429
7	Malawi	2018	1,000,000	90%	87%	78%	88%	69%	592	8	8,904	466
8	Myanmar	2018	240,000	NA	NA	70%	93%	65%	286	6	56,726	1,043
9	Uganda	2018	1,400,000	84%	86%	72%	89%	64%	741	NA	155,882	3,413
10	Mexico	2018	230,000	76%	92%	70%	90%	63%	165,455	19,747	453,481	3,518
11	United States	2017	1,000,000	86%	NA	NA	NA	63%	2,263,756	120,688	26,724,848	80,755
12	Tanzania	2018	1,600,000	78%	91%	71%	87%	62%	509	21	NA	NA
13	Brazil	2018	900,000	85%	78%	66%	94%	62%	983,359	47,869	2,344,437	11,032
14	Ethiopia	2018	690,000	79%	82%	65%	92%	60%	3,954	65	202,214	1,761
15	Zambia	2018	1,200,000	87%	90%	78%	76%	59%	1,416	11	46,549	2,535
16	Lesotho	2018	340,000	86%	71%	61%	93%	57%	4	NA	1,515	707
17	South Africa	2018	7,700,000	90%	69%	62%	87%	54%	83,890	1,737	1,228,098	20,716
18	China	2018	1,250,000	69%	84%	58%	93%	54%	83,325	4,634	NA	NA
19	Ukraine	2017	240,000	71%	73%	52%	92%	48%	34,984	985	542,247	12,397
20	Cameroon	2018	540,000	74%	70%	52%	87%	45%	10,638	282	NA	NA
21	Nigeria	2018	1,900,000	67%	79%	53%	79%	42%	18,480	475	106,006	515
22	Cote d'Ivoire	2018	460,000	63%	87%	55%	75%	41%	6,444	49	41,443	1,573
23	DR Congo	2018	450,000	62%	92%	57%	68%	39%	5,283	117	NA	NA
24	Mozambique	2018	2,200,000	72%	78%	56%	68%	38%	662	4	20,263	649
25	Russia	2017	1,000,000	81%	44%	36%	75%	27%	569,063	7,841	16,321,964	111,846
26	Ghana	2018	330,000	57%	60%	34%	62%	21%	12,929	66	261,319	8,417
27	Angola	2018	330,000	42%	64%	27%	70%	19%	166	8	10,000	305
28	Zimbabwe	2018	1,300,000	90%	98%	88%	NA	NA	463	4	52,905	3,561
29	Viet Nam	2018	230,000	NA	NA	65%	NA	NA	342	NA	275,000	2,826
30	India	2017	2,140,000	79%	70%	55%	NA	NA	381,539	12,606	6,426,627	4,659
31	Indonesia	2018	640,000	51%	33%	17%	NA	NA	43,803	2,373	601,239	2,199

Note: These 31 countries have highest people living with HIV and account for 85% of global HIV burden.

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8. COVID-19 data are from <https://www.worldometers.info/coronavirus/>. Accessed on: June 19, 2020, 09:28 GMT
9. NA: Not available, PLHIV: People living with HIV; ART: Antiretroviral therapy

Table 2: Progress towards 90-90-90 and COVID-19 performance for high-income countries

No.	Country	Year	Estimated PLHIV	PLHIV who know their status (1st 90)	PLHIV who know their status receiving ART (2nd 90)	ART coverage	PLHIV receiving ART with suppressed viral load (3rd 90)	PLHIV with suppressed viral load	Total COVID Cases	Total COVID Deaths	Deaths per 1000 cases	Total COVID Tests	Tests/ 1M pop	Test per confirmed case
1	United Kingdom	2018	103,800	93%	97%	90%	98%	88%	300,469	42,288	141	7,259,555	106,956	24
2	Denmark	2016	6,000	92%	96%	88%	98%	87%	12,344	600	49	859,514	148,408	70
3	Switzerland	2017	16,600	90%	96%	86%	97%	84%	31,200	1,956	63	485,948	56,163	16
4	Sweden	2015	8,320	90%	97%	87%	95%	83%	56,043	5,053	90	385,659	38,195	7
5	Netherlands	2018	23,300	92%	93%	87%	96%	82%	49,319	6,078	123	505,370	29,496	10
6	Australia	2017	27,000	92%	87%	80%	95%	76%	7,409	102	14	1,964,271	77,063	265
7	Germany	2016	86,100	87%	92%	80%	95%	76%	190,126	8,946	47	5,029,696	60,038	26
8	France	2014	156,600	85%	91%	77%	97%	75%	158,641	29,603	187	1,384,633	21,214	9
9	Austria	2016	7,079	92%	94%	86%	85%	74%	17,271	688	40	552,130	61,316	32
10	Portugal	2016	38,959	92%	87%	80%	90%	72%	38,089	1,524	40	1,032,268	101,227	27
11	Spain	2016	146,000	82%	97%	80%	88%	70%	292,348	27,136	93	4,826,516	103,232	17
12	Belgium	2015	18,758	85%	87%	74%	93%	69%	60,476	9,695	160	1,087,369	93,836	18
13	Ireland	2017	7,205	87%	83%	72%	95%	69%	25,355	1,714	68	393,421	79,707	16
14	Italy	2016	130,000	88%	87%	77%	87%	67%	238,159	34,514	145	4,831,562	79,908	20
15	Finland	2018	4,000	91%	84%	76%	88%	67%	7,119	326	46	224,400	40,502	32
16	Singapore	2017	7,800	77%	87%	67%	95%	64%	41,615	26	1	576,189	98,514	14
17	Canada	2016	63,000	86%	81%	70%	91%	63%	100,220	8,300	83	2,295,440	60,837	23
18	United States	2017	1,000,000	86%	NA	NA	NA	63%	2,263,756	120,688	53	26,724,848	80,755	12
19	Estonia	2018	7,400	83%	71%	59%	90%	53%	1,979	69	35	101,748	76,704	51
20	Czech	2016	3,230	78%	71%	55%	92%	51%	10,283	334	32	513,979	47,998	50
21	Norway	2018	5,800	95%	86%	82%	NA	NA	8,708	244	28	298,420	55,061	34
22	Japan	2018	30,000	NA	NA	80%	NA	NA	17,668	935	53	396,433	3,134	22
23	Israel	2013	8,039	93%	68%	63%	NA	NA	20,243	304	15	804,743	87,495	40
24	Greece	2016	16,665	83%	69%	57%	NA	NA	3,227	188	58	270,338	25,933	84
25	Bahamas	2018	6,000	NA	NA	52%	NA	NA	104	11	106	2,326	5,917	22
26	South Korea	2015	NA	NA	NA	88%	NA	NA	12,306	280	23	1,158,063	22,588	94

Note: These 26 countries have GDP per capita of more than USD 20,000 (2018 World Bank data) and more than 3,000 people living with HIV.

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8. NA: Not available, PLHIV: People living with HIV; ART: Antiretroviral therapy

Figure 1: Comparison of HIV and COVID-19 rankings for high-income countries based on ART coverage and COVID tests per million population, respectively

Note: The numbers in brackets on left show the ART coverage (2018) while those on the right show the number of COVID-tests per million population (June 2020). Black arrows (6) show that rankings of countries are not very different. While red arrows (9) connect countries that rank higher on HIV compared to COVID-19, green arrows (11) connect the countries that rank higher on COVID-19 vis-à-vis HIV.

Figure 2: Correlation between COVID testing and deaths among high-income countries

Note: There is a negative and weak correlation between COVID tests per confirmed case and deaths per one thousand cases. Countries testing between 5 to 30 people for every COVID case are seeing large variations in death rates: from 1 to 187 per thousand cases.