WHO Global Clinical Platform
for COVID-19

Data for public health response

Clinical features and prognostic factors of COVID-19 in people living with HIV hospitalized with suspected or confirmed SARS-CoV-2 infection

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Abbreviations

aHR	adjusted hazard ratio
aOR	adjusted odds ratio
ART	antiretroviral therapy
BMI	body mass index
CI	confidence interval
HIV	human immunodeficiency virus
SAP	statistical analysis plan
WHO	World Health Organization
PLHIV	people living with HIV

Background

Available published evidence on the impact of HIV infection on severity and mortality associated with COVID-19 is limited and conflicting, and analyses have been based primarily on small cohorts of individuals in specific settings (1-7).

A retrospective cohort study in the United Kingdom found that people living with HIV (PLHIV) appear to be at increased risk for mortality (8). A retrospective cohort study in the United States of America found that while PLHIV do not appear to be at increased risk of infection, they are at increased risk for poor outcomes (mainly owing to higher rates of severe disease requiring hospitalization). In this sample of patients, the risk of hospitalization increased with the progression of HIV disease (9). Data from South Africa showed HIV to be an independent risk factor for in-hospital mortality (10).

Data from meta-analyses are also inconsistent. One meta-analysis found that HIV infection was not associated with poor composite outcomes (11). However, two meta-analyses found that PLHIV had a moderately increased risk of mortality than compared with people without HIV (12, 13).

Additional evidence from larger datasets with a broader geographical representation is required to expand the understanding of the interplay between HIV and SARS-CoV2 co-infection and guide global discussion on optimal clinical care for PLHIV who are infected with SARS-CoV-2.

To expand the understanding of clinical characteristics and prognostic factors among patients hospitalized with suspected or confirmed COVID-19, and to inform optimal clinical management and interventions, the World Health Organization (WHO) has established the Global Clinical Platform, which is a secure web-based database including individual-level, anonymized clinical data of hospitalized patients with suspected or confirmed COVID-19 from health facilities across the globe. The WHO Global Clinical Platform is intended to provide Member States with a standardized clinical data collection system to characterize the natural history of COVID-19; identify risk factors for severe disease and poor outcomes; and describe treatment interventions and outcomes among adults, children, and subpopulations, including pregnant women and PLHIV.

Objectives of the analysis

This report describes the demographics, clinical presentation, clinical outcomes, and risk factors among PLHIV who have been hospitalized for suspected or confirmed COVID-19.

The specific objectives of the analysis were to:

- describe the clinical characteristics and outcomes of PLHIV hospitalized for COVID-19
- assess whether PLHIV hospitalized with COVID-19 were at increased risk of presenting with severe or critical illness at admission and were at increased risk of in-hospital death compared to individuals not infected with HIV
- assess risk factors associated with severe or critical illness at hospital admission and of in-hospital death among PLHIV hospitalized for COVID-19.

Methods

We conducted a preliminary analysis of anonymized patient-level clinical data submitted to the WHO Global Clinical Platform for COVID-19 between 1 January 2020 and 29 April 2021 by a mix of national registries and sentinel health facilities from 37 countries.

Data Collection Tools

Two options exist to contribute data to the WHO Clinical Platform: i) use of the WHO Case Report Form (CRF), which exists in both paper-based or electronic formats, and ii) data entered into a local system or database. For locally entered data, relevant variables were mapped and aligned to the WHO CRF data dictionary and transferred to the WHO Clinical Platform hosted on OpenClinica.

The WHO CRF contains a standardized set of variables, including demographics, severity, medications, comorbidities, and clinical outcomes (discharged alive to home, in-hospital mortality, transfer to another facility for further care, remaining in the hospital at the time of data entry and discharged to palliative care or hospice). The CRF is divided into three modules. Module1 is completed on the first day of inpatient admission to the healthcare facility, module 2 is completed daily during hospital stay for as many days as resources allow and module 3 is completed at the time of discharge or death. The CRF has been translated into Arabic, Chinese, English, French, Russian, Spanish and Portuguese.

Inclusion Criteria

All patients, regardless of age, with known HIV status and admitted to a hospital or health facility with laboratory-confirmed or suspected COVID-19 were included in the analysis.

Statistical Analysis

Descriptive and regression analyses were conducted to summarize demographic and clinical characteristics and to evaluate their association with HIV status, disease severity at hospital admission and in-hospital mortality. Records with missing data were excluded when determining distributions across outcome levels, and chi-square tests and student t-tests were used to assess the relationship between clinical characteristics and outcomes.

The two clinical outcomes of interest were **in-hospital mortality** (yes vs no) and **clinical severity**, defined as follows. Cases were defined as **severe or critical** if they met one or more of the following conditions at hospital admission: 1) SpO2: <90%; 2) respiratory rate: >30 breaths/minute in adults and children over 5 years old; 3) received extracorporeal membrane oxygenation (ECMO); 4) admitted to an Intensive Care Unit (ICU); 5) received an inotrope or vasopressor; and 6) received oxygen therapy or ventilation. Cases not meeting all the conditions described above, and those meeting the conditions below were described as **mild or moderate**: 1) SpO2: ≥90% without supplemental oxygen; 2) respiratory rate: ≤30 breaths/minute in adults and children over 5 years old, and 3) did not receive oxygen therapy or ventilation.

A logistic regression model using generalized estimating equations (GEE) was fitted to evaluate whether HIV infection was a risk for severe or critical illness at admission, and a proportional hazards model (that adjusted in variance estimation for clustering at the country level) was fitted to evaluate whether HIV infection was a risk factor for mortality. Age (≤65 years, >65 years), sex (male, female) with the binary indicator for HIV positive status (yes/no) were included in the model a priori.

Covariates were considered for inclusion in the model when >80% reported data was not highly correlated with other variables using a correlation matrix threshold of >0.8, and they were associated with both the outcome (severity or mortality) and exposure (HIV status) at $p<0.10$ level. After covariate selection, they were then retained in the final model if further found to be significant at $p<0.05$ level.

Based on the above criteria, the following underlying conditions were considered in the analysis: chronic cardiac disease, diabetes, hypertension, chronic pulmonary disease, tuberculosis, asthma and malignant neoplasms. A second model included categories of the number of underlying conditions or "comorbidity burden" (none, 1-2 underlying conditions, and ≥3 underlying conditions) to determine if the number of conditions, rather than the individual conditions themselves, had an impact on severe or critical illness and mortality.

A subgroup analysis stratifying mortality risk by WHO geographical region to determine the impact of WHO Region of origin on mortality was also conducted. Regression analysis was repeated in the restricted sample of PLHIV to evaluate risk factors for disease severity at admission (logistic model) and risk factors for mortality (proportional hazards model).

In a sensitivity analysis, the regression models were repeated, excluding individuals from South Africa, which represented the main data contributor and accounted for 94.6% of the data.

All analyses were conducted in SAS version 9.4 (Copyright (c) 2016 by SAS Institute Inc., Cary, North Carolina, United States of America) or R version 3.6.3 (R: A Language and Environment for Statistical Computing, R Core Team, R Foundation for Statistical Computing, Vienna, Austria 2020, https://www.R-project.org) and maps were drawn using ARCGIS Pro Release 2.5.0 (Environmental Systems Research Institute (ESRI), 2020. Redlands, California, United States of America).

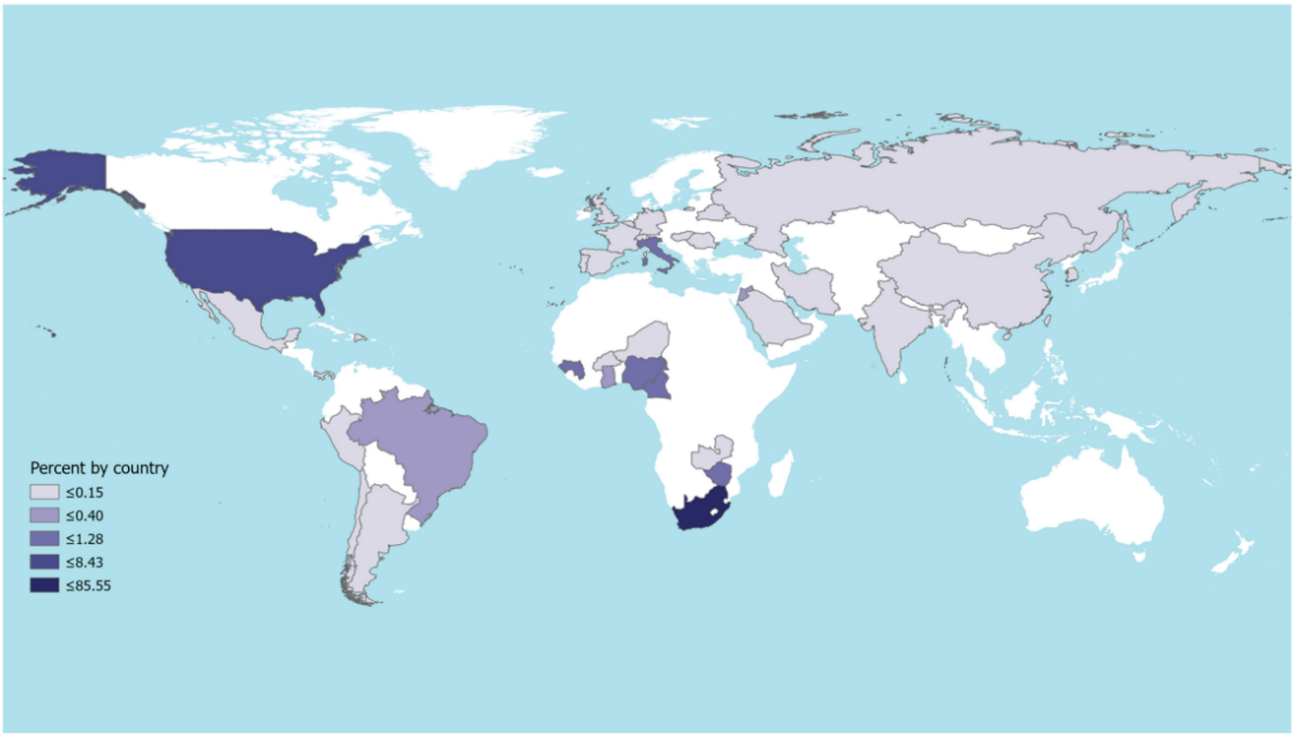
Results

As of 29 April 2021, 37 countries had contributed data to the WHO Global COVID-19 Clinical Data Platform with clinical information on 268 412 patients hospitalized with suspected or confirmed COVID-19 (**Fig. 1a**). 24 countries contributed clinical data on PLHIV (**Fig. 1b**).[1]

In this global sample, 9.2% (15 522/168 649) of cases hospitalized with suspected or confirmed COVID-19 were HIV positive; and 96.1% (14 914/15 522) of the PLHIV included in the analysis were from the WHO African Region, with 94.6% (14 682/15 522) of cases reported from South Africa alone.

Among PLHIV, 37.1% (5737/15 442) were male, the mean age was 45.5 years, 91.8% (8842/9631) were on ART, and 36.2% (5613/15 522) had severe or critical illness on hospital admission. Among the severe cases, 89.8% (5039/5611) were ≤65 years of age and 39.1% (2187/5596) were male. Overall, the mean duration from hospital admission to death or discharge was 9.5 days (SD 13.4, n= 14,776).

Fig. 1a. Countries contributing clinical data to the WHO Global Clinical Platform for COVID-19 as of 29 April 2021



The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of WHO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: Global COVID-19 Clinical Data Platform
Map Production: SRH/RLC

World Health Organization

[1] Argentina, Belarus, Brazil, Cameroon, Chile, China, Democratic Republic of the Congo, Dominican Republic, France, Germany, Guinea, India, Italy, Jordan, Nigeria, Panama, Romania, Russian Federation, South Africa, Spain, United Kingdom, United States of America, Zambia, Zimbabwe.

Fig. 1b. Countries[1] contributing clinical data on people living with HIV to the WHO Global Clinical Platform for COVID-19 as of 29 April 2021

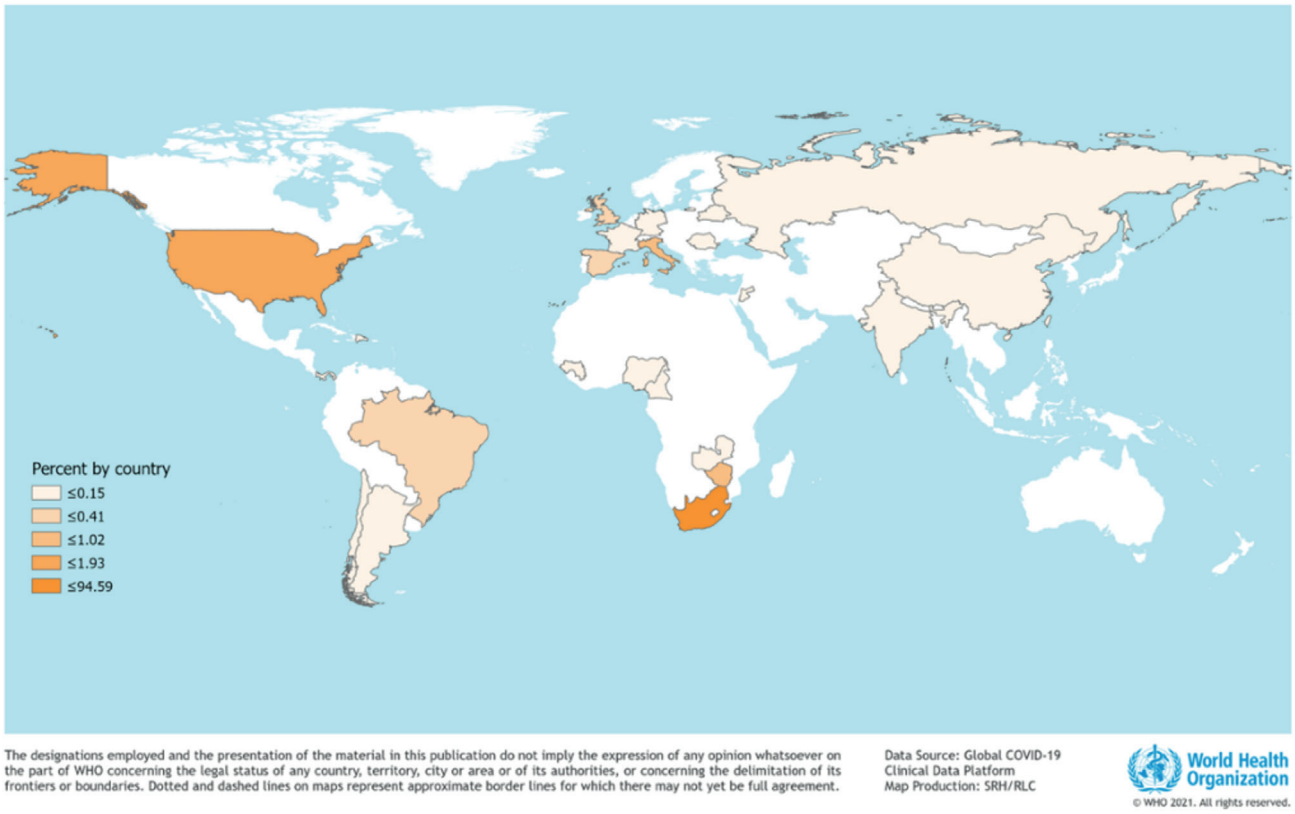
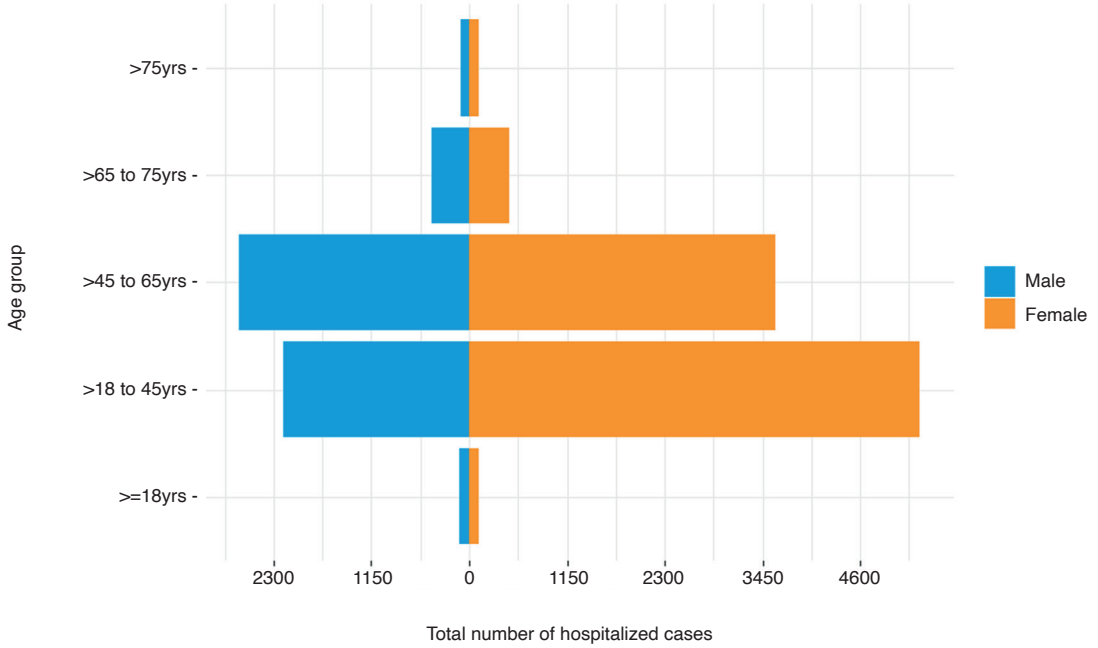


Table 1. Demographic characteristics of people living with HIV hospitalized with suspected or confirmed COVID-19

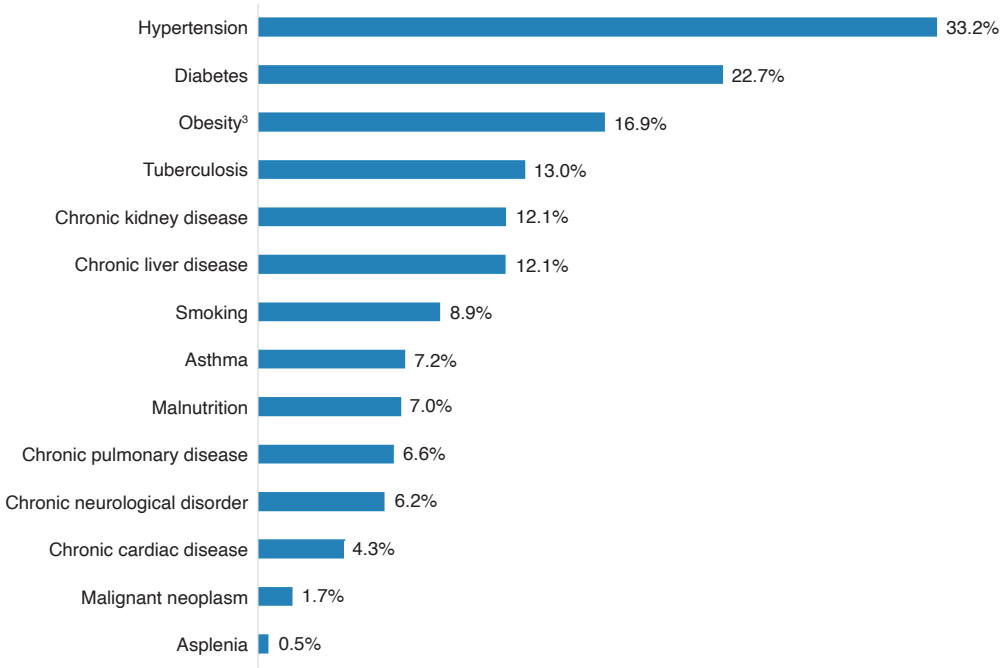
Characteristics		People living with HIV (n=15 522)	
		n	%
Age	≤65 years	14 101	92.6
	>65 years	1 132	7.4
Age group	≤18 years	229	1.5
	18-45 years	7513	49.3
	46-65 years	6359	41.7
	66-75 years	920	6.0
	>75 years	212	1.4
Sex	Male	5737	37.2
	Female	9705	62.9
Pregnant	Yes	729	7.5
Health care worker	Yes	328	2.2
	No	14 636	97.8

Fig. 2. Distribution of people living with HIV hospitalized with COVID-19 by age and sex



Reported underlying conditions[2] in PLHIV are shown in **Fig. 3**. The most common underlying conditions were hypertension (33.2%), diabetes (22.7%) and obesity (16.9%). The presence of one or more underlying conditions was reported at the time of admission in 55.5% (7752/13 975) of PLHIV. Among those, 61% reported having one underlying condition, and 28.7% reported two underlying conditions. 10% had three or more underlying conditions. 13% (1548/11 873) were reported to be co-infected currently or previously with tuberculosis.

Fig. 3. Frequency of underlying conditions among PLHIV hospitalized with COVID-19

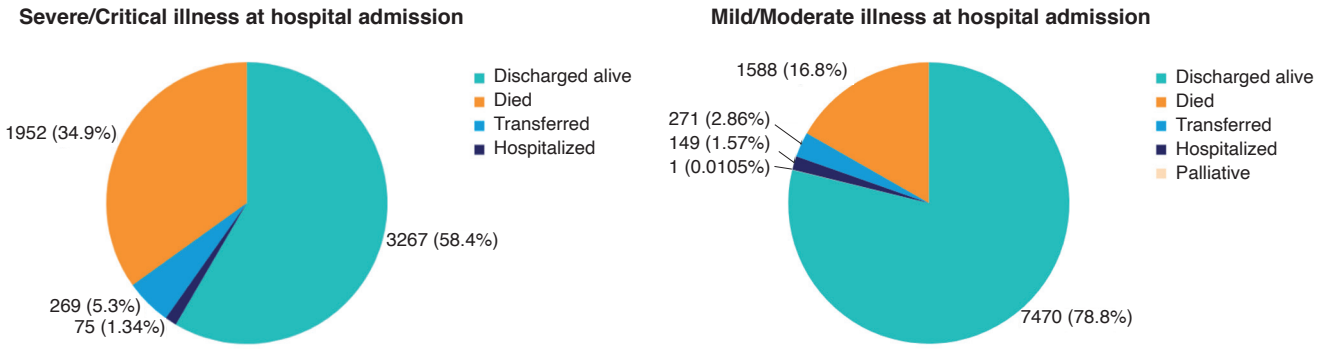


[2] Asplenia, asthma, chronic cardiac disease, chronic kidney disease, chronic liver disease, chronic neurological disorder, chronic pulmonary disease, current smoker, diabetes, hypertension, malignant neoplasms, tuberculosis.

[3] Obesity is defined as Body Mass Index >30

23.1% (3578/15 463) of PLHIV with a known outcome died during the hospital stay. Mortality and other clinical outcomes in PLHIV presenting with severe/critical illness or mild/moderate illness are shown in **Fig. 4**.

Fig. 4. Clinical outcomes among PLHIV hospitalized with COVID-19, stratified by severity of illness at hospital admission



Clinical outcomes included: 1) discharged to home, 2) died in hospital, 3) transferred (to another facility for further care), 4) remaining hospitalized at the time of data entry, and 5) discharged to palliative care or hospice

HIV infection and risk of severe or critical illness at hospital admission

We assessed whether HIV infection was independently associated with a higher risk for severe or critical presentation of COVID-19 at hospital admission.

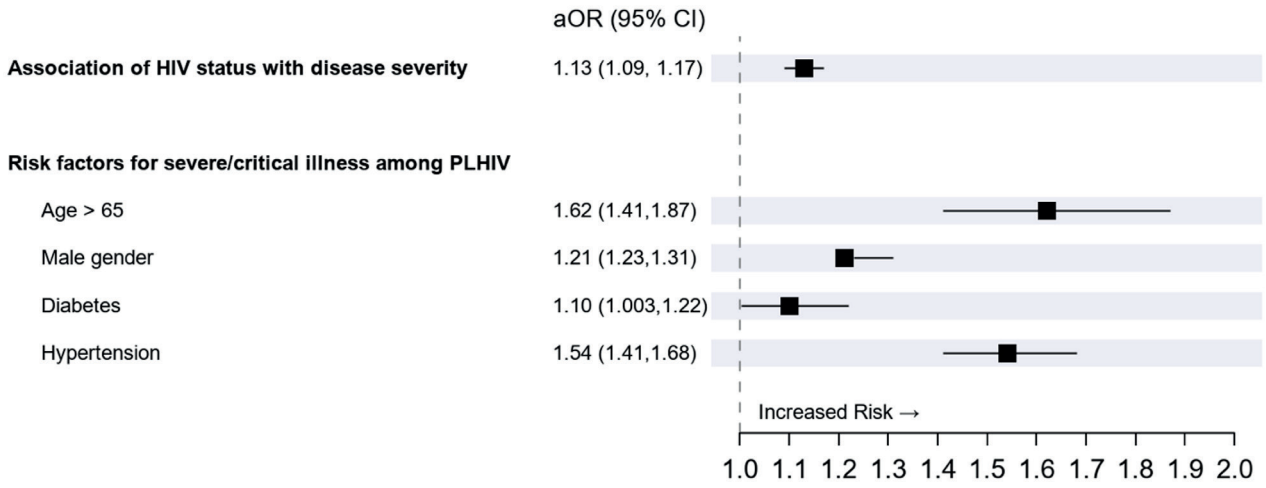
In this hospitalized population, PLHIV were at increased risk of severe or critical disease at hospital admission (aOR 1.06, 95% CI 1.02–1.11) compared to HIV-negative individuals, after adjusting for age, sex and the presence of underlying conditions (diabetes, tuberculosis, malignant neoplasms and chronic cardiac and pulmonary diseases). By including in the model the number of underlying conditions (comorbidity burden) rather than individual conditions, we found a similar risk of severe or critical disease (aOR 1.13, 95% CI 1.09–1.17) (**Fig. 5.**)

A sensitivity analysis was repeated to assess the impact of the country of origin on the severity outcome. After excluding data from South Africa, a total of 38 774 cases were available. Of those, 840 were people living with HIV, and 425 had information on severity status. In this analysis, HIV positive status remained an independent risk factor for severe/critical illness at hospital admission (aOR 2.27, 95% CI 1.73–2.97) after adjusting for age, sex and the presence of underlying conditions (diabetes, neoplasms and chronic cardiac disease).

Risk factors associated with severe/critical illness among people living with HIV admitted to hospital with COVID-19.

We assessed the associations between potential risk factors and severe/critical illness at hospital admission in this sample of PLHIV. After adjusting for age, sex, and underlying conditions (diabetes and hypertension), we found that PLHIV who were >65 years of age (aOR 1.62, 95% CI 1.41-18.7), male (aOR 1.21, 95% CI 1.23–1.31), with diabetes (aOR 1.10, 95% CI 1.03-1.22) or hypertension (aOR 1.54, 95%CI 1.41-1.68) had an increased risk of severe or critical illness at hospital admission after controlling for the other risk factors. All estimates were significant at $p<0.0001$ level (see **Fig. 5**., below).

Fig. 5. HIV infection and risk of severe or critical illness of COVID-19 at hospital admission



The upper part of the figure shows HIV infection as a significant independent risk factor for severe or critical presentation of COVID-19, after adjusting for age, sex, burden of underlying conditions (adjusted odds ratio (aOR). The lower part of the figure shows the adjusted odds ratio for each risk factor for severe or critical presentation of COVID-19 among PLHIV, after controlling for the other risk factors.

HIV infection and risk of in-hospital mortality

HIV infection was independently associated with a higher risk of death (aHR 1.29, 95% CI 1.23–1.35) compared to the HIV-negative population, after adjusting for age, sex, disease severity and underlying conditions (diabetes, chronic pulmonary disease and malignant neoplasms).

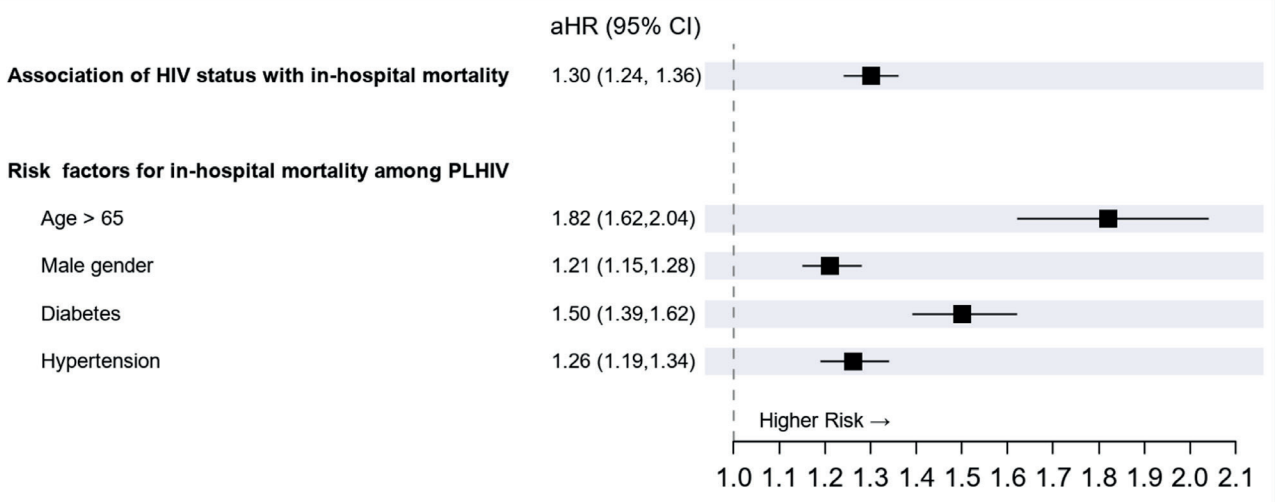
A similar risk (aHR 1.30, 95% CI 1.24–1.36) was found after adjusting for age, sex, disease severity at admission and the number of underlying conditions (comorbidity burden). (**Fig. 6**).

The presence of one or two underlying conditions (aHR 1.40, 95% CI 1.37–1.43) and the presence of three or more underlying conditions (aHR 1.50, 95% CI 1.44–1.56) were associated with increased risk of death. All estimates were significant at $p<0.0001$ level.

We performed a subgroup analysis, stratifying mortality risk by WHO geographic region. After adjusting for age, sex, underlying conditions and clinical presentation at hospital admission (mild/moderate versus severe/critical illness), HIV infection was independently associated with an increased risk for in-hospital mortality in the WHO African Region (aHR 1.29, 95% CI 1.23-1.34) but not in the WHO European Region (aHR 0.59, 95% CI 0.29-1.2) or the WHO Region of the Americas (aHR 0.92, 95% CI 0.37-2.31). For other Regions, modelling for mortality outcomes was not possible due to the limited sample size.

A sensitivity analysis was repeated to assess the impact of the country of origin on the mortality. When excluding data received from South Africa (resulting in a total of 311 HIV positive cases compared with 7474 HIV negative cases with a known outcome), the risk of death in people living with HIV hospitalized with COVID-19 remained elevated, but was no longer statistically significant (aHR 1.16, 95% CI 0.90–1.51). Adjustment for covariates other than sex and age was not possible due to the limited sample size.

Fig. 6. HIV infection and risk of in-hospital mortality for COVID-19



The upper part of the figure shows HIV infection as a significant independent risk factor for in-hospital mortality of COVID-19, after adjusting for age, sex, disease severity and burden of underlying conditions (adjusted hazard ratios (aHR)). The lower part of the figure shows the adjusted hazard ratio for each risk factor for in-hospital mortality among PLHIV, after controlling for the other risk factors.

Risk factors associated with in-hospital mortality among people living with HIV admitted to hospital with suspected or confirmed COVID-19.

We also assessed the relationship between potential risk factors predicting in-hospital mortality in this sample of PLHIV. Among PLHIV, being >65 years of age (aHR 1.82, 95% CI 1.62–2.04), male (aHR 1.21, 95% CI 1.15–1.28), having diabetes (aHR 1.50, 95% CI 1.39–1.62) and hypertension (aHR 1.26, 95% CI 1.19-1.34) increased the risk of in-hospital death after controlling for the other risk factors. All estimates were statistically significant with $p<0.0001$. (**Fig. 6**., lower section).

Limitations

The WHO Global Clinical Platform for COVID-19 is an evolving project, and measures to improve the harmonization of data collection are in place. Not all facilities that submitted data to the WHO platform used the WHO case report form, which may have contributed to some heterogeneity and incompleteness of data. A major limitation of the data submitted to the WHO Platform was missing information on anti-retroviral therapy (ART) that was only available in 40% of the cases, which precluded meaningful analysis of clinical outcomes (disease severity on admission and in-hospital mortality) stratified by ART status.

Some countries contributed data derived from national registries of hospitalized patients, while other countries contributed data from a convenience sample of clinics or sentinel clinics. Thus, lack of representativeness and potential selection bias may limit the generalizability of these findings.

In this analysis, the data are predominantly from South Africa. Although this may limit the generalizability of the results, it is worth noting that this country is the epicenter of the HIV pandemic and has the largest AIDS epidemic globally, accounting for 20% of all people living with HIV worldwide and 20% of new HIV infections.

Not all potentially relevant risk factors, such as body mass index (BMI), were considered in the regression model due to insufficient data reported; and this may have influenced our findings. In addition, findings only refer to in-hospital mortality and do not capture information on post-discharge outcomes, thus potentially underestimating the impact of HIV infection on overall mortality due to COVID-19.

Conclusions

HIV appears to be a significant independent risk factor for severe or critical illness at hospital admission and in-hospital mortality.

To improve our understanding of the clinical characterization and management impact of patients hospitalized with COVID-19, WHO will continue to expand the collection and analysis of clinical data of hospitalized patients with and without HIV through the WHO Global Clinical Platform for COVID-19 and encourage countries and stakeholders to contribute anonymized data.

As the data contribution continues to expand, the generalizability of findings will increase and inform optimal clinical management in this co-infected vulnerable population. These analyses will be updated regularly to improve our understanding of the clinical characterization and management of people living with HIV that are hospitalized with COVID-19.

References

1. Mirzaei H, McFarland W, Karamouzian M, Sharifi H. COVID-19 Among People Living with HIV: A Systematic Review. 2021;25:85-92. doi: 10.1007/s10461-020-02983-2.
2. Cooper TJ, Woodward BL, Alom S, Harky A. Coronavirus disease 2019 (COVID-19) outcomes in HIV/AIDS patients: a systematic review. 2020;21:567-77. doi: 10.1111/hiv.12911.
3. Costenaro P, Minotti C. SARS-CoV-2 infection in people living with HIV: a systematic review. 2021;31:1-12. doi: 10.1002/rmv.2155.
4. Zheng Z, Peng F, Xu B, Zhao J, Liu H, Peng J et al. Risk factors of critical & mortal COVID-19 cases: A systematic literature review and meta-analysis. J Infect. 2020;81:e16-e25. doi: 10.1016/j.jinf.2020.04.021.
5. Boulle A, Davies MA, Hussey H, Ismail M, Morden E, Vundle Z et al. Risk factors for COVID-19 death in a population cohort study from the Western Cape Province, South Africa. Clin Infect Dis. 2020. doi: 10.1093/cid/ciaa1198.
6. Hadi YB, Naqvi SFZ, Kupec JT, Sarwari AR. Characteristics and outcomes of COVID-19 in patients with HIV: a multicentre research network study. AIDS. 2020;34:F3-f8. doi: 10.1097/qad.0000000000002666.
7. Geretti AM, Stockdale AJ, Kelly SH, Cevik M, Collins S, Waters L et al. Outcomes of COVID-19 related hospitalization among people with HIV in the ISARIC WHO Clinical Characterization Protocol (UK): a prospective observational study. Clin Infect Dis. 2020. doi: 10.1093/cid/ciaa1605.
8. Bhaskaran K, Rentsch CT, MacKenna B, Schultze A, Mehrkar A, Bates CJ et al. HIV infection and COVID-19 death: a population-based cohort analysis of UK primary care data and linked national death registrations within the OpenSAFELY platform. Lancet HIV. 2021;8:e24-e32. doi: 10.1016/s2352-3018(20)30305-2.
9. Tesoriero JM, Swain CE, Pierce JL, Zamboni L, Wu M, Holtgrave DR et al. COVID-19 Outcomes Among Persons Living With or Without Diagnosed HIV Infection in New York State. JAMA Netw Open. 2021;4:e2037069. doi: 10.1001/jamanetworkopen.2020.37069.
10. Jassat W, Cohen C, Masha M, Goldstein S, Kufa T, Savulescu D et al. COVID-19 in-hospital mortality in South Africa: the intersection of communicable and non-communicable chronic diseases in a high HIV prevalence setting. medRxiv. 2020:2020.12.21.20248409. doi: 10.1101/2020.12.21.20248409.
11. Hariyanto TI, Putri C, Frinka P, Louisa J, Lugito NPH, Kurniawan A. Human Immunodeficiency Virus (HIV) and outcomes from coronavirus disease 2019 (COVID-19) pneumonia: A Meta-Analysis and Meta-Regression. AIDS Res Hum Retroviruses. 2021. doi: 10.1089/aid.2020.0307.
12. Mellor MM, Bast AC, Jones NR, Roberts NW, Ordóñez-Mena JM, Reith AJM et al. Risk of adverse coronavirus disease 2019 outcomes for people living with HIV. AIDS. 2021;35:F1-f10. doi: 10.1097/qad.0000000000002836.
13. Hariyanto TI, Rosalind J. Human immunodeficiency virus and mortality from coronavirus disease 2019: A systematic review and meta-analysis. 2021;22:1220. doi: 10.4102/sajhivmed.v22i1.1220.

Annex 1. Contributors to the WHO Global COVID-19 Clinical Platform

As of the 29th of April 2021, the following health care facilities/collaborators have contributed anonymized clinical data to the WHO Global Clinical Platform.

Global

WHO Collaborating Centre for TB and Lung Diseases, Maugeri Care and Research Institute, Italy
Alma Mater Studiorum University of Bologna, Bologna, Italy
Aristotle University of Thessaloniki, Thessaloniki, Greece
ASST Spedali Civili, Brescia, Italy
Catholic University Ruzomberok, Slovakia
Centre Hospitalier Universitaire, Nantes, France
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Lausanne University, Lausanne, Switzerland
Lausanne University Hospital CHUV, Lausanne, Switzerland
Lithuanian University of Health Sciences, Kaunas, Lithuania
Luigi Sacco Hospital, Milan, Italy
National Institute for Infectious Diseases 'L. Spallanzani', Rome, Italy
McMaster University, Hamilton, Canada
Ministerio de Salud, Chile
Ministerio de Saluda, Panama City, Panama
Ministerio de Salud Pública y Bienestar Social, Asunción, Paraguay
Ministerio de Salud y Protección Social, Colombia
Ministry of Health, Lima, Peru
Moscow Research and Clinical Center for Tuberculosis Control, Moscow, Russian Federation
National Centre for Infectious Diseases, Singapore
National Institute of TB and Respiratory Diseases, New Delhi, India
National University of Singapore, Singapore
National University Health System, Singapore
Nestor Goulart Reis Hospital, São Paulo, Brazil
Niguarda Hospital, Milan, Italy
Northern State Medical University, Arkhangelsk, Russian Federation
Parramatta Chest Clinic, Parramatta, Australia
P.D. Hinduja Hospital and Medical Research Centre, Mumbai, India
Public Health Consulting Group, Lugano, Switzerland
Public Health Institute of Serbia "Dr Milan Jovanovic Batut", Belgrade, Serbia
Republican Klaipėda Hospital, Klaipėda, Lithuania
Republican Research and Practical Center for Pulmonology and Tuberculosis, Minsk, Belarus
Republic Scientific and Practical Center of Pulmonology and Tuberculosis, Minsk, Belarus
Riga East University Hospital, Riga, Latvia
Royal London Hospital, London, United Kingdom
Secretaria de Salud Departamental, Cuaca, Colombia
Secreteria de Salud de Honduras, Tegucigalpa, Honduras
Servicio de Salud Antofagasta, Chile

Servicio de Salud Arica, Chile
Servicio de Salud Concepción, Chile
Servicio de Salud Iquique, Chile
Servicio de Salud Magallanes, Chile
Servicio de Salud Metropolitano Central, Chile
Servicio de Salud Metropolitano Occidente, Chile
Servicio de Salud Metropolitano Oriente, Chile
Servicio de Salud Metropolitano Sur, Chile
Servicio de Salud Suroriente, Chile
Servicio de Salud Talcahuano, Chile
Servicio de Salud Vaplaraíso San Antonio, Valparaíso, Chile
Sondalo Hospital, Sondrio, Italy
Tuberculosis Research Programme SEPAR, Barcelona, Spain
Unitat Clínica de Tractament Directament Observat de La Tuberculosi, Barcelona, Spain
Université de Picardie Jules Verne, Amiens, France
Universidad del Cauca, Popayán, Colombia
Universidade Federal de Goiás, Goiânia, Brazil
Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
University Hospital of Monterrey, Monterrey, Mexico
University of Cape Town, Cape Town, South Africa
University of Groningen, Groningen, Netherlands
University of Insubria, Varese-Como, Italy
University of Milan, Milan, Italy
University of Sassari, Sassari, Italy
University of Sydney, Sydney, Australia
University of Torino, Italy
University of Virginia, Charlottesville, Virginia, United States of America
Université Paris Est Créteil, Créteil, France
Vall d'Hebron University Hospital, Barcelona, Spain
"Victor Babes" Clinical Hospital of Infectious Diseases and Pneumophtisiology, Cariova, Romania
Vilnius University Hospital Santaros Klinikos, Vilinius, Lithuania
Virginia Department of Health, Richmond, Virginia, United States of America
VMMC and Safdarjung Hospital, New Delhi, India
Volgograd State Medical University, Volgograd, Russian Federation
Westmead Hospital, Westmead, Australia

African Region

Burkina Faso

ALIMA (Alliance for International Medical Action), Burkina Faso
CHU-T and CHU-B, Ouagadougou, Burkina Faso
Clinique les Genets, Ouagadougou, Burkina Faso

Cameroon

Biyem-Assi District Hospital, Yaounde, Cameroon
Djoungolo District Hospital, Yaounde, Cameroon
Efoulan District Hospital, Yaounde, Cameroon
Nkolbisson District Hospital, Yaounde, Cameroon
Nkolndongo District Hospital, Yaounde, Cameroon
Soa District Hospital, Yaounde, Cameroon

Democratic Republic of the Congo

ALIMA, Democratic Republic of the Congo
Cliniques Universitaires de Kinshasa (CUK), Kinshasa, Democratic Republic of the Congo

Ghana

Komfo Anokye Teaching Hospital, Kumasi, Ghana
Global Health and Infectious Diseases Research Group, Ghana
Kumasi Centre for Collaborative Research in Tropical Medicine, Kumasi, Ghana
Kwame Nkrumah University of Science and Technology, Kumasi Ghana

Guinea

ALIMA, Guinea
CHU Donka, Conakry, Guinea

Nigeria

Abubakar Tafawa Balewa University Teaching Hospital, Bauchi, Nigeria
Bingham University Teaching Hospital, Jos, Nigeria
Federal Medical Centre, Asaba, Nigeria
Federal Medical Centre, Yola, Nigeria
General Hospital Abakaliki, Abakaliki, Nigeria
General Hospital Riyom, Riyom, Nigeria
Infectious Disease Centre, Specialist Hospital, Yola, Nigeria
Infectious Disease Hospital, Akure, Nigeria
Infectious Disease Hospital Amanawa, Amanawa, Nigeria
Infectious Disease Hospital, Olodo, Nigeria
Isolation Centre Amachara, Umuahia, Nigeria
Jos University Teaching Hospital, Jos, Nigeria
Kapital Klub Isolation and Treatment Centre, Abuja, Nigeria
Lagos University Teaching Hospital, Lagos, Nigeria
National Hospital of Abuja, Abuja, Nigeria
Niger State Ministry of Health, Minna, Nigeria
Obafemi Awolowo University Teaching Hospital, Ile-Ife, Nigeria
Ogunstate Ministry of Health, Abeokuta, Nigeria
Plateau State Specialist Hospital, Jos, Nigeria
State Specialist Hospital, Damaturu, Nigeria
State Specialist Hospital, Osogbo, Nigeria
Taraba State Specialist Hospital, Jalingo, Nigeria
This Day Dome Isolation and Treatment Centre, Abuja, Nigeria
UN Sari Clinic, Abuja, Nigeria
University of Abuja Teaching Hospital, Abuja, Nigeria

South Africa

Steve Biko Academic Hospital, Gauteng Provincial Department of Health, Pretoria, South Africa
National Institute of Communicable Diseases, Johannesburg, South Africa

Zambia

Levy Mwanawasa University Teaching Hospital, Lusaka, Zambia

Zimbabwe

Arundel Hospital, Harare, Zimbabwe
Bindura Farm Health Centre, Bindura, Zimbabwe
Gweru Infectious Diseases Hospital, Gweru City, Zimbabwe
Hauna Hospital, Hauna, Zimbabwe
HealthPoint, Harare, Zimbabwe
Marondera Provincial Hospital, Marondera, Zimbabwe
Mater Dei Hospital, Bulawayo, Zimbabwe
Mutare Infectious Diseases Hospital, Mutare, Zimbabwe
Parirenyatwa General Hospital, Harare, Zimbabwe
St Annes Hospital, Harare, Zimbabwe
Thorngrove Hospital, Bulawayo, Zimbabwe
United Bulawayo Hospital, Bulawayo, Zimbabwe
Victoria Chitepo Provincial Hospital, Mutare, Zimbabwe

Region of the Americas

Brazil

Instituto de Infectologia Emilio Ribas, São Paulo, Brazil
Grupo Hospitalar Conceição, Porto Alegre, Brazil

Colombia

Clínica Colsanitas, Bogota, Colombia
Dominican Republic
Hospital Regional Universitario Jose Maria Cabral y Baez, Santiago, Dominican Republic
Hospital Regional Dr. Arturo Grullon, Santiago,

Dominican Republic

Hospital Metropolitano de Santiago (HOMS), Santiago, Dominican Republic

Mexico

Hospital Pediátrico de Sinaloa, Culiacán, Mexico

United States of America

Bronxcare Health System, New York City, USA
Henry Ford Hospital, Detroit, USA
New York City Health + Hospitals, New York City, USA

South-East Asia Region

India

Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India

European Region

Belgium

Infectious Diseases Clinic Brugmann Hospital, Brussels, Belgium

Germany

University Hospital Frankfurt, Frankfurt, Germany

Hungary

UD Kenezy Gyula University Hospital, Debrecen, Hungary

Italy

AOU Ospedali Riuniti, Ancona, Italy
Infectious Diseases Unit, Bergamo, Italy
San Giuliano Hospital – ASL Napoli 2 Nord, Naples, Italy
Clinica Malattie Infettive, Università Politecnica delle Marche, Ancona, Italy
SIMIT (Italian Society of Infectious Diseases and Tropical Medicine), Italy
AOU Mater Domini, Catanzaro, Italy
AOU Policlinico Giaccone, Palermo, Italy
AOU Policlinico S. Orsola-Malpighi, Bologna, Italy
ASUR Marche Area Vasta 4, Fermo, Italy
AULS Toscana Centro, Pistoia, Italy
Instituto Giannina Gaslini, Genova, Italy
O.C. 'Dell'Angelo', Mestre-Venezia, Italy
Ospedali Galliera, Genova, Italy
Ospedale Policlinico Consorziale, Italy
Ospedale San Bortolo, Vicenza, Italy
Santa Maria della Misericordia, Italy
Università Vanvitelli, Italy

Spain

Hospital Universitario Ramón y Cajal, Madrid, Spain

Eastern Mediterranean Region

Iran (Islamic Republic of)

Shiraz University of Medical Sciences, Shiraz, Iran

Jordan

King Abdulla University Hospital, Ar-Ramtha, Jordan
Prince Hamza Hospital, Amman, Jordan

Pakistan

Indus Hospital Research Center, Karachi, Pakistan

Saudi Arabia

King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

Western Pacific Region

China

Prince of Wales Hospital, Hong Kong Special Administrative Region, China
School of Public Health, Capital Medical University, Beijing, China

Republic of Korea

National Medical Centre, Seoul, Republic of Korea

Singapore

National Centre for Infectious Diseases, Singapore
National Institute of Communicable Diseases, Singapore


World Health
Organization