



## Impact of the COVID-19 pandemic on HIV care in Guatemala

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### ARTICLE INFO

#### Article history:

Received 18 April 2021

Received in revised form 3 June 2021

Accepted 5 June 2021

#### Keywords:

COVID-19

HIV testing

Opportunistic infections

Healthcare attention

### ABSTRACT

**Objectives:** To describe the impact of the coronavirus disease 2019 (COVID-19) pandemic on the diagnosis of human immunodeficiency virus (HIV) and deaths from opportunistic infections in Guatemala.

**Methods:** A retrospective study was conducted to investigate the impact of the COVID-19 pandemic on people with HIV at a referral clinic (Clinica Familiar Luis Angel García, CFLAG), as well as the disruption of services at a diagnostic laboratory hub (DLH) which provides diagnosis for opportunistic infections to a network of 13 HIV healthcare facilities. Comparative analysis was undertaken using the months March–August from two different time periods: (i) pre-COVID-19 (2017–2019); and (ii) during the COVID-19 period (2020).

**Results:** During the COVID-19 period, 7360 HIV tests were performed at Clinica Familiar Luis Angel García, compared with an average of 16,218 tests in the pre-COVID-19 period; a reduction of 54.7% [95% confidence interval (CI) 53.8–55.4%]. Deaths from opportunistic infections at 90 days were 10.7% higher in 2020 compared with 2019 (27.3% vs 16.6%;  $P = 0.05$ ). Clinical samples sent to the DLH for diagnosis of opportunistic infections decreased by 43.7% in 2020 (95% CI 41.0–46.2%).

**Conclusion:** The COVID-19 pandemic is having a substantial impact on HIV care in Guatemala. Diagnostic services for HIV have been severely affected and deaths from opportunistic infections have increased. The lessons learnt must guide the introduction of strategies to reduce the impact of the pandemic.

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### Introduction

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) emerged in China in late 2019 (Li et al., 2020; Schlottau et al., 2020). Following the first reported case of coronavirus disease 2019 (COVID-19), it spread rapidly and the World Health Organization (WHO) declared a pandemic in March 2020 (World Health Organization, 2020a). At the time of writing, there have been a total of 134,957,021 confirmed cases worldwide (World Health Organization, n.d.). In Guatemala, the first case was reported on 13 March 2020, and by the end of November 2020, 74,989 cases and 3094 deaths had been reported (Gobierno de Guatemala, n.d.).

Beyond the direct impact of the COVID-19 pandemic, all sectors of the healthcare system have been affected. In this context, access to routine services has been reduced due to reassignment of clinical staff to activities related to COVID-19, disruption of medical supplies, and restrictions in transportation and personal mobility. According to a WHO survey in 155 countries, 53% of healthcare services have been partially or completely disrupted during the COVID-19 pandemic (World Health Organization, 2020b). Among people living with human immunodeficiency virus (HIV), interruptions in both healthcare attention and treatment could result in an increased mortality rate and further spread of HIV in the community. This increase in mortality would most likely be attributed to delays in the diagnosis of opportunistic infections secondary to a lack of adequate access to care. Therefore, this study evaluated the impact of the COVID-19 pandemic on the diagnosis of HIV and deaths from opportunistic infections in Guatemala.

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**Methods**

*Study design and data sources*

To understand the COVID-19 situation in Guatemala, data on the total number of monthly COVID-19 cases reported by the Ministry of Health (MOH) from March to August 2020 were collected. The MOH and the Pan American Health Organization publish an online open-access dashboard with essential information on the COVID-19 epidemic in Guatemala ([Gobierno de Guatemala, n.d.](https://gob.gub.gt)). According to the MOH, a positive result on a polymerase chain reaction assay or an antigen test was considered as a laboratory-confirmed case of COVID-19. Data were organized by date. Government policies implemented to contain the COVID-19 pandemic were also collected from the Central America Diary (<https://legal.dca.gob.gt>).

A programme to improve the diagnosis of the most common opportunistic infections in Guatemala was implemented in 2017. Diagnostic services are provided to a healthcare facility network, composed of 13 HIV facilities located across the country, by a diagnostic laboratory hub (DLH) in Guatemala City that receives clinical samples daily via a courier service. The Clinica Familiar Luis Angel García (CFLAG) is the largest healthcare facility of the network, located within the Hospital General San Juan de Dios in Guatemala City, which is one of two national reference hospitals. Since 1987, CFLAG has provided inpatient and outpatient services as well as HIV testing and counselling programmes. This study included all outpatients and inpatients diagnosed with HIV, and cases of opportunistic infection detected at CFLAG. Two periods were defined for comparison. Each period encompassed 8 months: the pre-COVID-19 period from March to August of 2017–2019, and the COVID-19 period from March to August 2020. The same months were chosen for comparative purposes, and to see the impact of the COVID-19 pandemic in the first 8 months after its introduction in Guatemala. Deaths from opportunistic infections at 90 days were analysed for patients diagnosed in 2017, 2018 and 2019 compared with those diagnosed in 2020. Deaths that occurred within 90 days of patient screening were attributed to the opportunistic infection diagnosed at the DLH.

Opportunistic infection screening was performed for patients newly diagnosed with HIV, out-of-care who return, and patients on antiretroviral therapy (ART) with symptoms compatible with an

opportunistic infection. Opportunistic infection screening included testing for histoplasmosis, cryptococcosis, tuberculosis and non-tuberculous mycobacteria infections, as described by [Medina et al. \(2020, 2021\)](#). In addition, screening for *Pneumocystis jirovecii* pneumonia has been implemented since 2018. To analyse disruption of the opportunistic infection diagnosis programme caused by the COVID-19 pandemic, the number of samples received at the DLH during the first 8 months of the COVID-19 period were compared with the pre-COVID-19 period. DLH services functioned in accordance with government guidelines throughout the COVID-19 pandemic.

*Ethics statement*

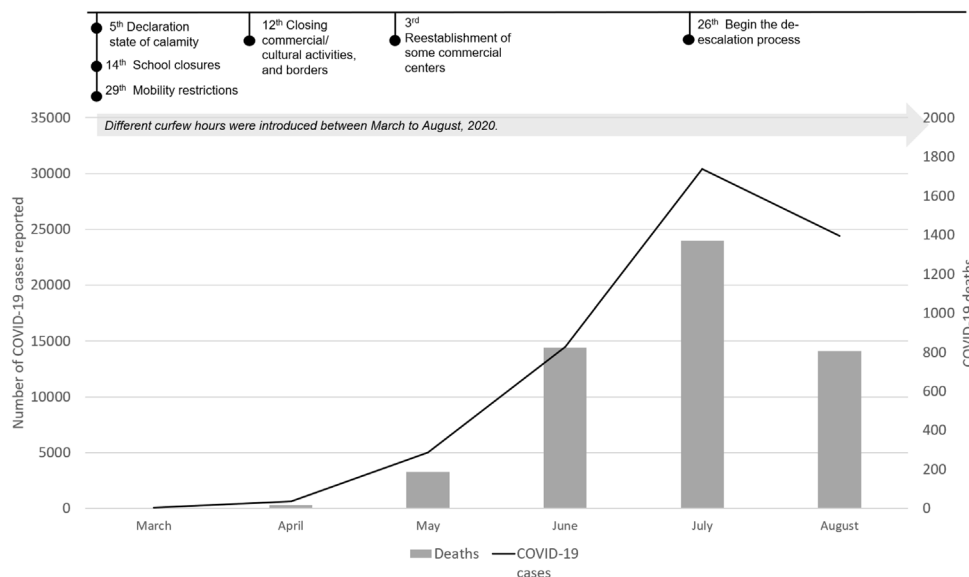
This study was based on data from the national COVID-19 dashboard and the opportunistic infection system from the network. Patient informed consent was not required as overall data were collected and analysed (rather than individual data).

*Statistical analysis*

Statistical analysis was performed using SPSS Version 25.0 (IBM Corp., Armonk, NY, USA). Proportions, medians and a trend  $\chi^2$  test were used for descriptive analysis. Continuous variables were compared using the Mann-Whitney *U*-test. *P* < 0.05 was considered to indicate significance.

**Results**

Between March and August 2020, 75,004 new cases of COVID-19 were registered in Guatemala, along with 3207 deaths. In total, 244,720 COVID-19 tests were performed during this period, with a positivity rate of 31%. [Figure 1](#) shows the number of COVID-19 cases per month and the main measures implemented by the Government of Guatemala. On 29th March 2020, several restrictions were implemented, including the closure of public transport, establishment of curfew hours, and limitations on mobility between regions. These measures remained in place until July 2020 and were then modified progressively. This led to limitations of the healthcare attention given to people with HIV during this period.



**Figure 1.** Number of cases of coronavirus disease 2019 (COVID-19) and timeline of the principal governmental measures in Guatemala. Total number of cases was based on the date of the result test according to the Ministry of Health.

Regarding HIV testing during the COVID-19 period, CFLAG experienced a decrease of 54.7% [95% confidence interval (CI) 53.8–55.4%;  $P < 0.0001$ ]: 7360 HIV tests were performed in the COVID-19 period compared with 16,218 tests performed, on average, during the pre-COVID-19 period. Figure 2 shows the number of HIV tests performed and the number of new HIV cases diagnosed at CFLAG. As expected, the rate of HIV testing decreased progressively, with the lowest number of HIV tests performed in April 2020. Despite this trend, the number of patients newly diagnosed with HIV during the COVID-19 period only decreased by 10.7% (216 cases in the COVID-19 period vs 242 cases in the pre-COVID-19 period); a higher proportion of men who have sex with men (MSM) were referred to CFLAG in the COVID-19 period compared with previous years. The proportion of MSM in 2020 was 56.2% ( $n = 221$ ), compared with 40% ( $n = 203$ ) in 2019 and 39.6% ( $n = 180$ ) in 2018 ( $P < 0.0001$ ).

Concerning the HIV programme for pregnant women, which includes labour and delivery services as well as the outpatient obstetric clinic, the results were as follows. In the COVID-19 period, HIV testing decreased by 32.5% (95% CI 31.5–33.6%) with 5805 HIV tests in the COVID-19 period vs 8609 tests performed, on average, in the pre-COVID-19 period. Among pregnant women, four cases were newly diagnosed with HIV in the COVID-19 period vs eight cases in the pre-COVID-19 period, a 50% decrease.

At CFLAG, screening for opportunistic infections decreased by 31.2% (95% CI 28.7–33.9%): 836 samples were tested in the COVID-19 period vs 1216 in the pre-COVID-19 period. The number of opportunistic infections diagnosed decreased by 67.9% (95% CI 57.1–77.1%): 26 cases in the COVID-19 period vs 81 cases in the pre-COVID-19 period. Overall deaths from opportunistic infections at 90 days was 27.3% in 2020 (18/66 cases), which was 10.7% higher than the overall mortality observed in 2019 (16.6%;  $P = 0.053$ ), 7.9% higher than in 2018 (19.4%;  $P = 0.191$ ) and 2.3% higher than in 2017 (25%;  $P = 0.650$ ). Figure 3 shows the number of people living with HIV screened for opportunistic infections, the total number of cases detected, and deaths from opportunistic infections identified at CFLAG by year.

By January 2020, a total of 3677 people living with HIV comprised the cohort of patients from CFLAG; by August 2020, 44 (1.2%) cases of COVID-19 had been diagnosed, 36 (81.8%) of whom were on ART. The mean age of those diagnosed with COVID-19 was 44 years, and four patients had co-infections (three cryptococcal disease and one tuberculosis). Twenty-six of these patients had a CD4 cell count available, and the median cell count was 301 cells/

mm<sup>3</sup> (interquartile range 61–475). Mortality at 90 days for patients with COVID-19 was 27.2% (12/44 cases).

This study also determined the impact of the COVID-19 pandemic on the opportunistic infection screening programme performed at the DLH for the whole network of 13 HIV units. Table 1 shows the number of samples received by the DLH every month. In the COVID-19 period, the number of samples received by the DLH decreased to 38% (95% CI 36.1–39.8%), and this increased to 43.7% (95% CI, 41.0–46.2%) when the 12 healthcare facilities located outside of Guatemala City were analysed. Compared with the pre-COVID-19 period, the decreases observed in April and June 2020 were remarkable: 46% and 75%, respectively.

### Discussion

The COVID-19 pandemic has affected healthcare services for people living with HIV. At CFLAG, a referral healthcare facility in Guatemala City, HIV testing decreased by 54.7% (95% CI 53.8–55.4%) during the COVID-19 period. HIV testing represents an entry point to identify and bring HIV-infected patients into care. In March 2020, when the first case of COVID-19 was reported in Guatemala, the number of HIV tests decreased, and this trend was maintained during the following months (Table 1). This finding is in accordance with the results from other studies (Bechini et al., 2020; Lagat et al., 2020; Mhango et al., 2020). Lagat et al. (2020) reported a 50% decline in female index enrolment in an assisted partner notification programme for HIV in Kenya. As expected, the number of HIV tests performed in pregnant women at CFLAG also decreased. As essential services were maintained in the labour and delivery ward, the difference was lower compared with the overall decrease in HIV testing (32.5% vs 54.7%).

A 10.7% decrease in the number of newly diagnosed HIV patients was noted in the COVID-19 period; this value was lower than expected considering that there was a 54.7% decrease in HIV testing. The results showed that the proportion of MSM patients who were brought into care at CFLAG was 16.2% higher in 2020 compared with 2019 and 2018 ( $P < 0.0001$ ). This could be attributed to higher HIV awareness in this group, along with an increased number of programmes dedicated to testing this specific population. Nevertheless, an overall decrease in the number of newly diagnosed HIV patients was seen; this is of concern as many recently acquired cases of HIV are not diagnosed, especially within the heterosexual population who are more likely to progress to advanced HIV disease (Meléndez et al., 2019; Medina et al., 2021).

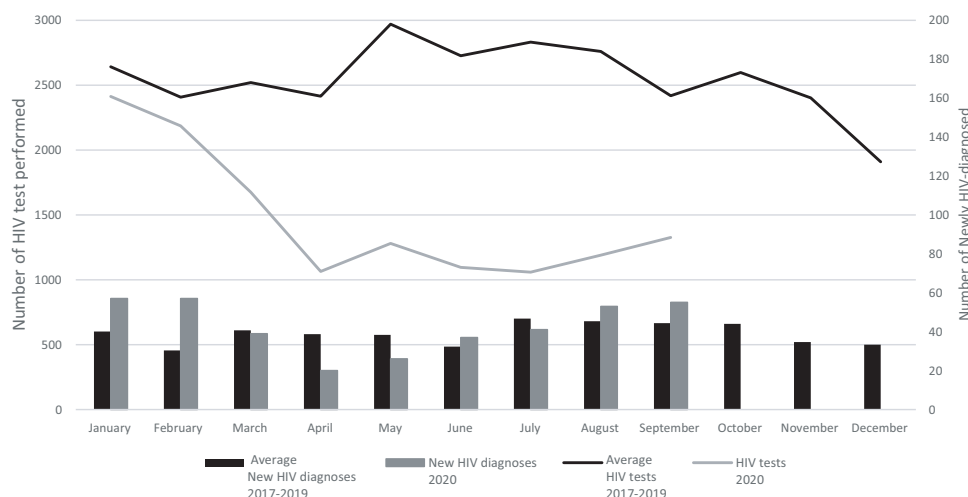
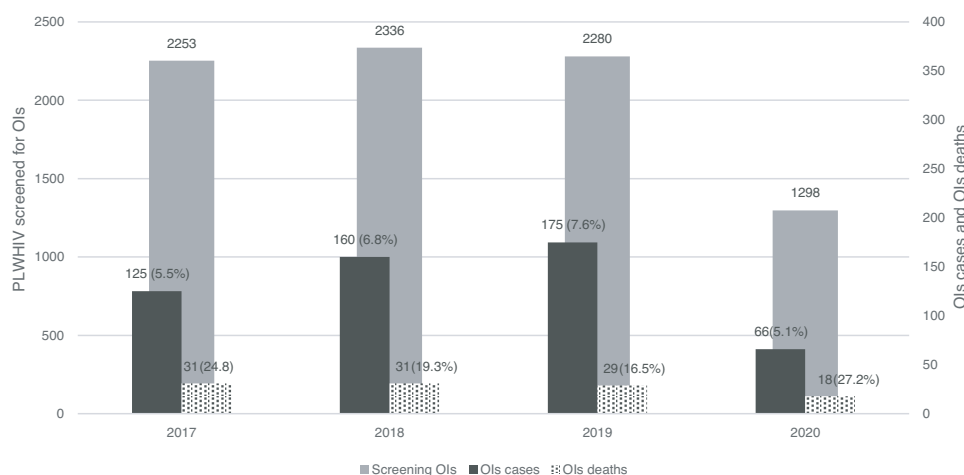


Figure 2. Number of human immunodeficiency virus (HIV) tests performed at Clinica Familiar Luis Angel García each month in 2017–2019 compared with 2020, and new HIV diagnoses.



**Figure 3.** Number of people living with human immunodeficiency virus (PLWHIV) screened for opportunistic infections (OIs), cases of OI detected and deaths due to OIs at Clinica Familiar Luis Angel García.

**Table 1**  
Number of samples received for the diagnosis of opportunistic infections at the diagnostic laboratory hub and overall difference in 2020.

Month	Number of samples received for OI diagnosis		Overall difference (95% CI)
	Average 2017–2019	2020	
January	376	550	+46.3% (41.3–51.3)
February	408	524	+28.5% (24.3–32.9)
March	391	327	-16.4% (13.3–20.4)
April	366	90	-75.4% (70.7–79.5)
May	481	260	-46.0% (41.5–50.4)
June	417	221	-47.0% (42.3–51.8)
July	509	383	-24.8% (21.2–28.7)
August	480	360	-25.1% (21.3–29.1)
September	448	409	-8.8% (6.4–11.7)
October	451	-	-
November	387	-	-
December	278	-	-

CI, confidence interval.

On the other hand, patients are normally able to select their preferred clinic, but in the context of the COVID-19 pandemic where HIV services have been disrupted in many places, more MSM patients may have been referred to CFLAG.

Regarding the reduced detection of newly diagnosed HIV patients during the COVID-19 period, in 2018, the national report of the HIV care continuum showed that only 63% of people living with HIV were aware of their diagnosis (Programa Nacional de Prevención y Control de ITS VIH y SIDA, 2019), which is much lower than the UNAIDS goal of 90%. As such, it is critical that the national HIV programme develops strategies to identify patients with HIV even in the context of the COVID-19 pandemic. An example of a possible alternative is HIV self-testing, which is now recommended by WHO as an additional method to increase HIV testing rates (World Health Organization, 2019).

The impact of the COVID-19 pandemic on patients with opportunistic infections was striking. The diagnostic programme for opportunistic infections at CFLAG showed a steady decrease in deaths from opportunistic infections, from 25% in 2017 to 16.6% in 2019. This represented an overall decrease of 8.4% since the programme’s implementation in 2017. However, as soon as the COVID-19 pandemic hit in Guatemala, deaths from opportunistic infections increased by 10% compared with 2019, slightly surpassing the rate in 2017 (25%). A modelling study by Hogan et al. (2020) estimated that the potential impact of the COVID-19 pandemic on people living with HIV in low-to-middle-income countries will be reflected as an increase in deaths due to HIV of up

to 10% in the next 5 years. The contributing factors for the increased deaths include, but are not limited to: a delay in HIV diagnosis until presenting with advanced disease; inadequate diagnosis of life-threatening opportunistic infections (evidenced here by a 38% decrease in referred samples for opportunistic infection screening at the DLH); an indirect impact of COVID-19 on patients with HIV affected by opportunistic infections (27.2% mortality); and the organizational arrangements that divert healthcare workers away from caring for people living with HIV.

As expected, the number of opportunistic infection screening samples received at the DLH from the healthcare facilities located outside of Guatemala City decreased more than the samples obtained from CFLAG, which is located in Guatemala City (43.7% vs 31.2%). During the COVID-19 period, the overall delivery of clinical samples to the DLH decreased by 38% (95% CI 36.1–39.8%). Therefore, limitations to the number of opportunistic infection samples sent for diagnosis may result in underestimation of cases and deaths.

Other immediate effects of COVID-19 on survival that were not analysed include the consequences of ART interruptions and loss of virological suppression associated with increased ART resistance. In South Africa, a social media survey for people living with HIV found that 13% of the people surveyed did not have access to their ART during lockdowns (HSRC Study on COVID-19, n.d.). Moreover, a mathematical model estimated that these potential effects could lead to 1.63 times more deaths considering the effects of a 6-month interruption of ART supply (Jewell et al., 2020). Although the

Government of Guatemala started to de-escalate restrictions on mobility by the end of July 2020, public transportation remained limited and more costly, making it difficult for many patients to travel to their respective healthcare facilities to receive their appropriate medications, including ART. Due to this situation, alternatives to minimize the impact of the COVID-19 pandemic have been developed. Several studies have proposed the implementation of telemedicine platforms (Mgbako et al., 2020), while UNAIDS and WHO have called on governments to provide multi-month dispensing of ART for people living with HIV who are currently stable (UNAIDS, n.d., World Health Organization, 2020); this concept has already been implemented at CFLAG where ART is dispensed for 3-month periods. In South Africa, one project packaged and delivered medications to community-based locations (Mendelsohn and Ritchwood, 2020). In Guatemala, a similar strategy was implemented to deliver ART directly to the patients. This programme has been functioning for the network since June 2020.

Concerning the direct impact of COVID-19 on people living with HIV, a lower risk of infection was initially hypothesized due to the possible suppression of coronavirus replication by ART; however, a randomized clinical trial with patients who had severe COVID-19 showed no benefit from the ritonavir-boosted lopinavir over standard care (Cao et al., 2020). Other analysis also showed no differences in previous use of nucleoside reverse transcriptase inhibitors or non-nucleoside reverse transcriptase inhibitors (Vizcarra et al., 2020). Despite these findings, there is no additional evidence to support a higher risk of COVID-19 infection among people living with HIV (Vizcarra et al., 2020; World Health Organization, 2020d). The present study found 44 cases of COVID-19 in one clinic in Guatemala City. Considering the entire cohort of people living with HIV in this facility, the frequency of COVID-19 infection was 1.2% (95% CI 0.9–1.6%). This rate was slightly lower compared with that reported by Vizcarra et al. (2020) in Spain (1.8%, 95% CI 1.3–2.3%). The number of deaths in the present study was much higher compared with deaths reported in the Spanish cohort (4%). Other missed diagnoses, such as opportunistic infections, could contribute to this result. Overall deaths due to COVID-19 were similar to overall deaths from opportunistic infections (27.2% vs 27.3%). Considering the decrease in deaths due to opportunistic infections achieved by the programme in 2019 (16.6%), the indirect impact of the COVID-19 pandemic on the care of people living with HIV and management of opportunistic infections is remarkable.

This study has several limitations. Available data represent the situation from one clinic in Guatemala City, while effects on other HIV clinics in more remote parts of the country could be more profound. Unfortunately, it was not possible to track the effects on these clinics. Furthermore, other aspects that might increase the magnitude of the effect of the COVID-19 pandemic, such as the interruption of ART, were not determined. Although all patients diagnosed with COVID-19 at CFLAG were included in this study, it is possible that this was underestimated because of the low availability of HIV testing in patients with COVID-19 in other hospital units. The presence of comorbidities and outcomes were also not estimated. Despite its limitations, this is the first study to describe the impact of the COVID-19 pandemic on people living with HIV in the region. This study found that the COVID-19 pandemic is having a substantial impact on HIV care in Guatemala, HIV testing programmes were severely affected, and deaths due to opportunistic infections have increased. Maintaining the most essential healthcare services and implementing new strategies could substantially reduce the overall impact of the pandemic.

#### Author contributions

Conceptualization: JLRT, AAI, NM.  
Formal analysis: NM and JLRT.

Resources: OB, BO, OG and DM.

Writing – original draft: NM.

Writing – review and editing: JLRT, AAI, OB, BO, DM, JCPS, LRS, EA, and DWD.

#### Conflict of interest statement

Over the last 3 years, Dra Ana Alastruey Izquierdo has received honoraria as a speaker from Astellas, Gilead Sciences, MSD and Pfizer outside the submitted work. Dr Eduardo Arathoon has received honoraria from GILEAD for educational conferences and participation in advisory board meetings. Dr. David W. Denning and family hold founder shares in F2G Ltd., a University of Manchester spin-out antifungal discovery company. Current grant support includes the National Institute for Health Research Biomedical Research Centre in Manchester, the Medical Research Council, Carigest Foundation and the Fungal Infection Trust. Dr Denning also acts or has recently acted as a consultant to Pulmatrix, Pulmocide, Zambon, iCo Therapeutics, Mayne Pharma, Biosergen, Bright Angel Therapeutics and Metis. Over the last 3 years, Dr Denning has been paid for talks on behalf of Dynamiker, Hikma, Gilead, Merck, Mylan and Pfizer. Dr Denning is a long-standing member of the Infectious Disease Society of America Aspergillosis Guidelines group, the European Society for Clinical Microbiology and Infectious Diseases Aspergillosis Guidelines group. All other authors declare no conflicts of interest.

#### Funding sources

None.

#### Acknowledgements

Fungired members: Oscar Eduardo López Pérez, Hospital La Amistad Japón-Guatemala, Izabal; Brenan Ortiz Barrientos, Hospital General San Juan de Dios, Guatemala City; Vilma Alejandrina Reyes Muñoz, Hospital Nacional 'Dr Jorge Vides Molina', Huehuetenango; Gladys Sajché Aguilar, Hospital Nacional 'Juan José Ortega' Coatepeque, Quetzaltenango; Aura Marina Méndez Andrade, Hospital Nacional de Escuintla, Escuintla; Luis Roberto Santa Marina de León, Hospital Nacional de Malacatán, San Marcos; Ana Lucía Gómez Alcázar, Hospital Nacional de Occidente, Quetzaltenango; Eduardo Celada González, Hospital Nacional de Retalhuleu, Retalhuleu; (ix) Gustavo A Quiñónez M, Hospital Nacional Infantil 'Elisa Martínez', Izabal; Germán Orlando Cuyuch Sontay, Hospital Regional 'Hellen Lossi de Laugerud', Alta Verapaz; Alba Virtud Contreras Marín, Hospital Regional de Cuilapa, Santa Rosa; María de Lourdes Fong Araujo, Hospital Regional de San Benito, Petén, Claudia Mazariegos, Hospital Regional de Zacapa, Zacapa; and Brenda Guzmán, Diagnostic Laboratory Hub, Asociación de Salud Integral, Guatemala City.

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