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Impact of COVID-19 pandemic in community-based testing and diagnosis of HIV, HCV, HBV and other STI in Portugal

Mafalda de Almeida Duarte Bessa de Melo

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Medicina
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Dedicatória

Para a Mafalda do futuro.

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Resumo

Introdução: Em março de 2020, Portugal registou os primeiros casos de COVID-19. Desde então temos assistido a mudanças nas nossas comunidades, economia e acesso aos cuidados de saúde, incluindo na prevenção de doenças sexualmente transmissíveis e testagem.

De forma a compreendermos melhor o impacto da pandemia de COVID-19 na prestação testes de VIH, VHC, VHB e sífilis em centros base comunitária em Portugal, fizemos uma análise comparativa do número de sessões de teste, testes feitos para cada uma das infeções e proporção de testes com resultados reativos, entre janeiro de 2016 e dezembro de 2020.

Métodos: Analisamos dados relativos a 26 centros de base comunitária. Para avaliar o número de sessões de teste realizadas, assim como o número de testes e a percentagem de resultados reativos ao longo do tempo, utilizamos o modelo aditivo de decomposição sazonal. Implementamos uma decomposição simples da série temporal, utilizando uma média móvel a 30 dias, para isolarmos a tendência do número de testes. Adicionalmente, calculamos a componente sazonal, determinando uma média do valor para cada mês analisado (2016-2020). A componente aleatória foi estabelecida removendo a componente sazonal e a tendência da série temporal. Fizemos também análise de *breakpoints*.

Resultados: A tendência do número de testes aumentou, desde o início do período analisado, com um pico em 2019, seguido de um declínio acentuado no início de 2020. A componente sazonal mostrou, anualmente, um aumento no número de testes realizados em novembro e uma diminuição em abril. Foi possível identificar um *breakpoint* entre março e junho de 2020 no número de sessões de teste. Apesar disto, a percentagem de testes com resultados reativos para o VIH e VHC aumentou durante este período. De salientar ainda que apesar das medidas restritivas de mitigação da COVID-19, os centros de base comunitária parecem ter conseguido, em parte, recuperar no segundo semestre.

Conclusões: A pandemia de COVID-19 impactou os serviços de saúde de base comunitária, nomeadamente no número de sessões de teste, testes realizados e diagnósticos de doenças sexualmente transmissíveis. No entanto, algumas características populacionais combinadas com os esforços dos centros de base comunitária permitiram que, durante o segundo semestre, a sua atividade fosse retomada.

Palavras Chave

VIH/SIDA, SARS-CoV-2, Hepatite B, Hepatite C, Infeções sexualmente transmissíveis.

Abstract

Background: In March 2020, Portugal registered its first cases of COVID-19. Since then, we have seen unprecedented changes in our communities, economically, and in access to health care including access to sexually transmitted infections prevention, testing and linkage to care.

To better understand the impact of the COVID-19 pandemic in testing provision at community-based testing centres in Portugal, we analyzed the numbers of testing sessions, tests performed for each infection, and proportion of reactive results from January 2016 to December 2020.

Methods: We used data from 26 community-based testing centres' number of testing sessions, HIV, HBV, HCV and Syphilis tests performed and its results.

To assess the trend of the number of testing sessions, number of tests performed and the percentage of reactive tests over time an additive seasonal decomposition was used. We implemented a simple decomposition using the 30-day moving average to isolate the trend of the number of tests, and we calculated the seasonal component by computing an average value of the relative number of tests for each month across the entire span of the data (2016–2020). The decomposition error was then computed by removing the trend and seasonal components from the original time series data. We also searched for breakpoints throughout the time period analysed.

Results: The trend for the number of tests increased, with a peak in middle 2019 followed by a stark drop-off leading into 2020. The seasonal components showed an annual spike in the number of tests during November and a decrease in April. We also pinpointed a breakpoint between March and June 2020 regarding the number of sessions. However, the percentages of reactive HIV and HCV tests increased during this period. Nevertheless, even under strict measures to mitigate the SARS-CoV-2 transmission, activity seems to have returned almost to normal in the second semester.

Conclusions: The COVID-19 pandemic impacted the community-based provision of care, the number of testing sessions and, consequently, HIV, HBV, HCV and Syphilis diagnosis. However, population characteristics, as well as efforts made by community-based healthcare services, might have helped these centres to resume their activity in the second semester.

Keywords

HIV/AIDS, SARS-CoV-2, Hepatitis B, Hepatitis C, Sexually transmitted infections.

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Lista de Acrónimos

AIDS	Acquired Immunodeficiency Syndrome
ART	Antiretroviral Therapy
CHW	Community Healthcare Worker
ECDC	European Centre for Disease Prevention and Control
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunodeficiency Virus
MSM	Men who have sex with men
PWUD	People who use drugs
RCC	Portuguese Community Screening Network (Rede de Rastreio Comunitária)
STI	Sexually transmitted infection
SW	Sex worker

Chapter 1

Introduction

In December 2019, Wuhan (China) reported treating several pneumonia cases from an unknown cause. Days after, they identified the SARS-CoV-2 virus as responsible for this disease, which rapidly spread across the world and was declared a public health emergency and, then, a pandemic. On March 2nd 2020, Portugal registered its first cases of COVID-19. With a rapid increase in the number of infected people, not only in Portugal but throughout all the European region, the Portuguese Government announced a national lockdown on March 18th 2020. These lockdown measures were held until May 4th 2020 (1).

Consequently, we have seen unprecedented changes in our communities, social engagement, economics, and healthcare access. Non-essential workers and students of all ages left their workplaces and schools and started to work from home. Venues and restaurants closed. Primary healthcare centres and hospitals postponed surgeries, screenings, and non-essential care. Human and financial resources were reallocated to respond to the new disease. These measures were essential to mitigate the SARS-CoV-2 infection spread, and the health workforce tried to adapt to this new threat by implementing teleconsultations and limiting the number of patients' visits (2–4).

Millions of people are affected by HIV worldwide. The early diagnosis is crucial to initiate treatment, increase life expectancy and prevent further complications due to the disease (5,6). Early testing plays a major role in linkage to care and access to preventive care. Similarly, early testing for hepatitis provides access to early treatment, which translates into reducing viral load and a possible cure. However, if left untreated, hepatitis can progress to severe liver disease and hepatocellular carcinoma (7,8). Additionally, Syphilis is a sexually transmitted infection (STI) that evolves throughout time into different stages with different severity levels. Early diagnosis is vital to prevent its dissemination between sexual partners as well as sequelae of the disease (9).

In other countries, it has been described the effect of the COVID-19 pandemic in access to STI prevention, testing and linkage to care. Studies reported a decrease in access to HIV testing and treatment, as well as increasing difficulties in engaging new people into care (10–12). Similarly, hepatitis preventive care and treatment were also negatively affected, leading to a decline in treatment volumes and HCV and HBV screening (12–14). Sexual health services have been reported abated as well as STI testing availability (12,15,16).

The fear of infection from the new coronavirus combined with the lockdown measures that governments implemented might have decreased the number of risk behaviours, such as sexual encounters with multiple partners. However, we can also acknowledge that this same reason made many patients postpone their care, similar to what happened with other health conditions (2,15,17,18).

Community-based centres provide healthcare to everyone who needs it, free of charge, including voluntary counselling and STI/HIV testing. They are an essential link to care in our National Health System for many key populations (e.g. migrants, MSM, sex workers) that would otherwise be harder to reach. Community-based strategies have been expanding, providing communities with rapid testing and rapid results in a way that is tailored to their needs, always assuring the best technical quality of service (19). During the lockdown in Portugal, these centres were, in the majority of cases, forced to limit their activities, including preventive care and testing.

Therefore, we aimed to understand the impact of the COVID-19 pandemic in HIV, HBV, HCV and syphilis testing provision at community-based centres in Portugal by analysing the numbers of testing sessions, tests performed for each infection, and proportion of reactive results from January 2016 to December 2020.

Chapter 2

Methods

Data Collection

The Portuguese Community Screening Network (RRC) is a group of community-based organisations that offer a point of care rapid testing for HIV, HBV, HCV and Syphilis, counselling and preventive care. They are an important link to healthcare and the National Health Service.

Users of these community-based organisations are invited to answer a standardised online questionnaire when they attend a consultation and are tested. Those who accept provide information on a face-to-face interview with the trained community healthcare worker (CHW) who performs the test. This questionnaire includes: social and demographic indicators, testing history, reason(s) for testing, risk factors, drug use and sharing drug paraphernalia, knowledge and use of pre and post-exposure prophylaxis, and reported experience of violence. Tests and their results are also recorded in this questionnaire. All patients with reactive tests are offered the appropriate referral to the National Health Service.

The ethics committee of the Institute of Public Health of the University of Porto (ISPUP) approved the study (CE 15045), and individuals are included upon informed oral consent.

Inclusion and exclusion criteria

We included data from 98 884 testing sessions from the community-based centres from January 2016 to December 2020. We included only visits where people were tested for at least one of the following infections: HIV, HBV, HCV or Syphilis. Only the community-based centres that contributed to the National Network throughout the total four analysed years were included (n=26). We excluded all visits where users had less than 15 years old (n=98).

Therefore, 98 786 testing sessions from the 26 community-based centres and 14 organisations, part of a national network - RRC - were included in this analysis.

Study instruments and variables

There are three types of questionnaires: one for first-time users (baseline), another for follow-up consultations and a shorter version for those who refuse to answer the full questionnaire

(refusal questionnaire). The variables used for this study are collected in every questionnaire. However, they might be obtained in different ways.

For this analysis, we used information on each visit about the participants' age, which we stratified into age groups (15 - 24 years old, 25 - 49 years old and ≥ 50 years old), gender (male, female, trans women and trans man).

We also analysed information regarding the participants' key population, which were categorised as following if a baseline or a follow-up questionnaire was answered:

- Men who have sex with men (MSM): reported male sex at birth and gender and at least one male sexual partner in the last 12 months;
- Sex workers (SW): reported ever having had sex in exchange for money, goods, or services;
- People who use drugs (PWUD): reported lifetime injectable/smokable/inhalable drug use;
- Migrants: reported country of birth other than Portugal.

If a refusal questionnaire was answered, information on key populations, if MSM, SW or PWUD, was provided by the community healthcare worker, based on a triage guide.

Note that people can identify themselves as part of more than one key population group when answering the questionnaire. To simplify the analysis, we used the variables separately.

Regarding testing, the tests performed by the community-based centres are HIV-1 and HIV-2 antibodies test, hepatitis B surface antigen test, hepatitis C antibodies test and syphilis antibodies test. Tests are offered according to tests characteristics and an individual risk assessment.

Statistical analysis

To assess the trend of the number of testing sessions, the number of HIV, HBV, HCV and syphilis tests performed, and the percentage of reactive tests over time, an additive seasonal decomposition was used.

The decomposition model reduces a time series into three components: trend, seasonal effects, and random errors. We implemented a simple decomposition using the 30-day moving average to isolate the trend of the number of tests, and we calculated the seasonal component by computing an average value of the relative number of tests for each month across the entire

span of the data (2016–2020). The decomposition error was then computed by removing the trend and seasonal components from the original time series data.

These are presented monthly to facilitate comparisons between the different STI tests and results. We also searched for breakpoints throughout the time period analysed.

We analysed the overall effect of COVID-19 on testing and diagnosis, and we stratified testing sessions by gender, age group and key population.

Statistical analysis was done using RStudio® (Version 1.4.1106): Integrated Development for R.

Chapter 3

Results

We analysed a total of 98 786 testing sessions from January 2016 to December 2020. From those of whom we had information on gender (n=97 207), 59.0% were male, 40.5% were female, 0.4% were trans women, and 0.1% were trans men. The majority were part of the 25-49 years old age group.

Regarding their key population group, 43 472 (53,8%) sessions were among people identified as migrants, 25 373 (30,6%) as men who have sex with men, 8 010 (9,7%) as people who use drugs and 5 947 (7,2%) as sex workers.

In 2020, there were 20 870 testing sessions, 5 216 less than in 2019. We decomposed the time series and analysed the seasonal components, which showed an annual spike in the number of tests during November and a decrease in April (Fig. 1). We also pinpointed a breakpoint between March and June 2020 regarding the number of sessions.

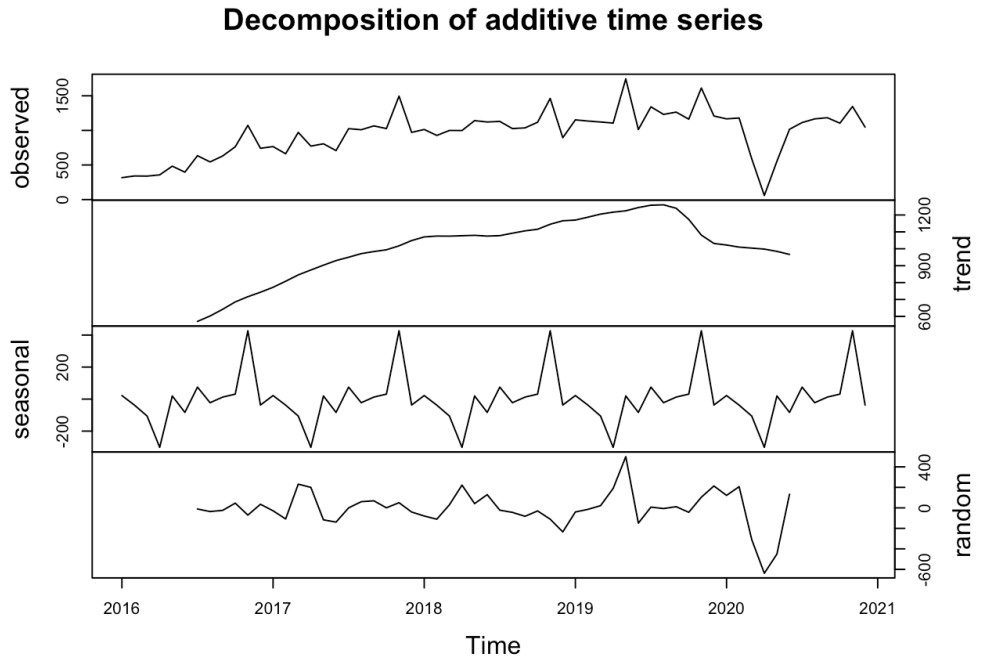

Figure 1: Decomposition of Testing Sessions' Time Series (observed) into 3 components: trend, seasonal effects, and random errors. Observing the trend component, we can see that the trend of testing sessions was steadily increasing until 2019, with a significant decrease in early 2020. The seasonal component shows an annual increase in the number of testing sessions in November and a decrease in April. The error component (random), also shows an important decrease in the number of testing sessions in early 2020.

Populational Characteristics

Gender

We can also see in Figure 2 that after the breakpoint, the female population attending screening sessions seemed to return to an increasing trend, contrary to the male population, whose screening sessions were still decreasing up to the end of 2020.

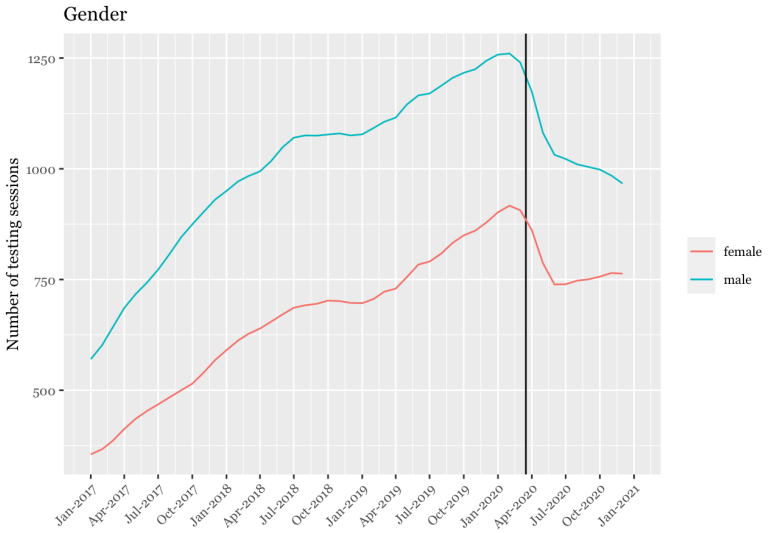

Figure 2: Number of testing sessions per gender group per month.

Age Groups

Analysing Figure 3, we can see that the only age group whose testing session seemed to return to its usual trend was the ≥ 50 years old age group after the breakpoint.

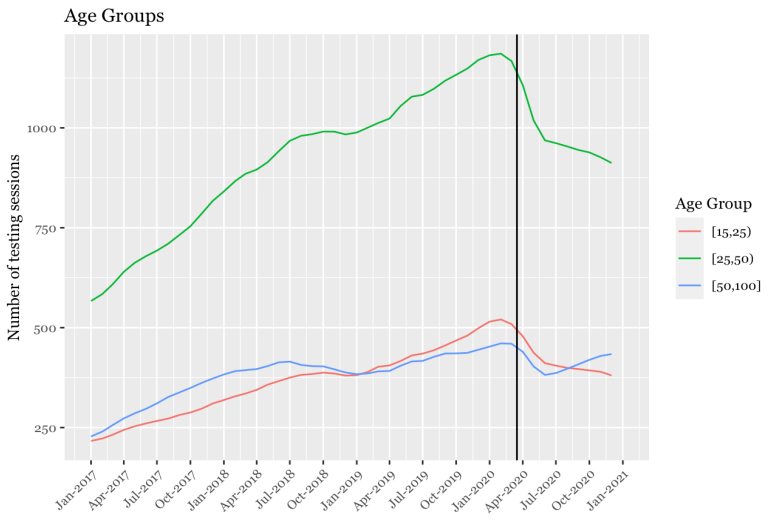

Figure 3: Number of testing sessions per age group per month.

Key Population Groups

Migrants seem to be the only population group that has increased its number of sessions after the breakpoint (Fig. 4). Both sex workers and people who use drugs have seen a steep decrease in screening sessions throughout 2020. After the breakpoint, men who have sex with men continued to decrease the number of screening sessions, however, with a less steep trend than in early 2020.

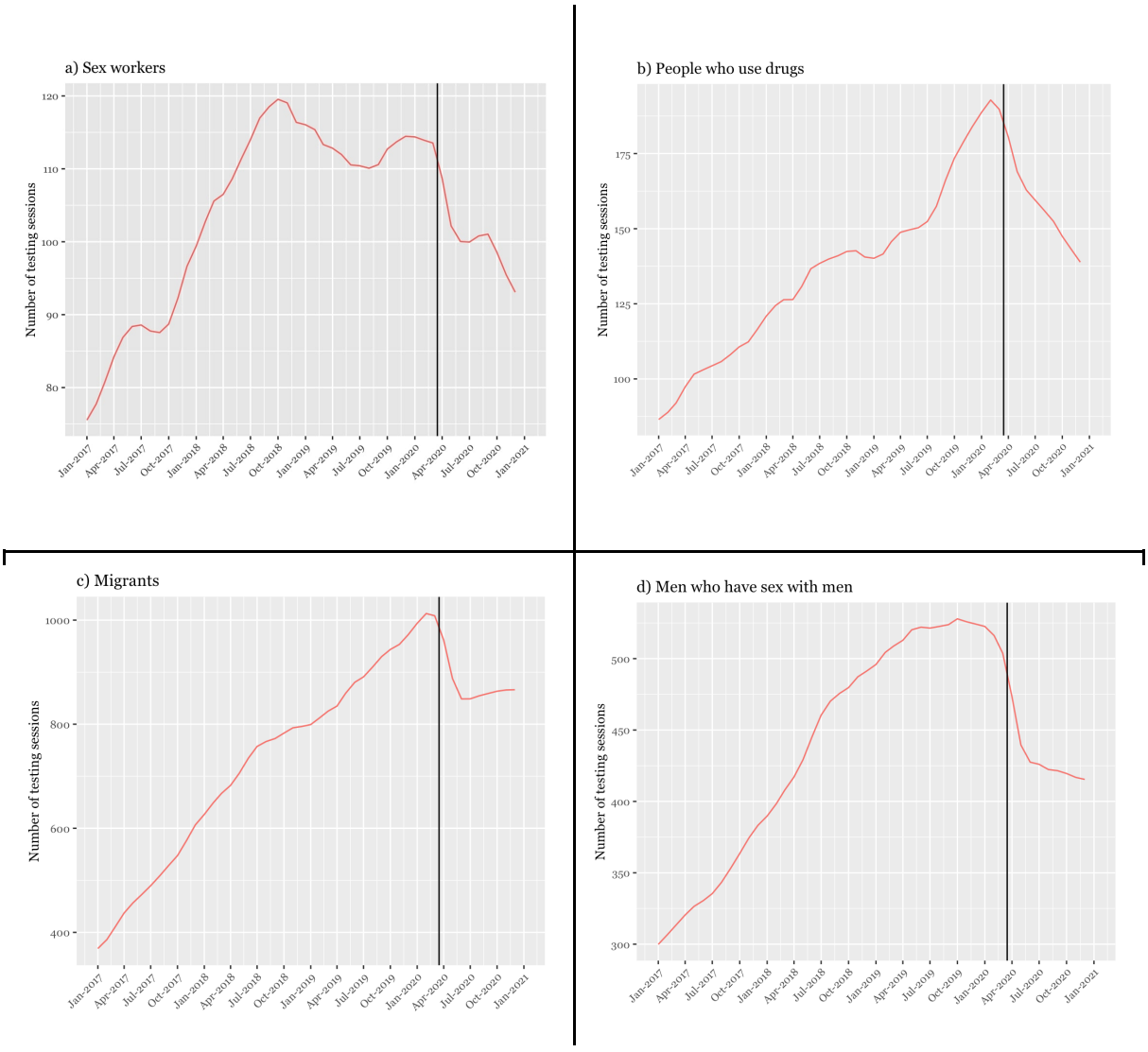

Figure 4: Number of testing sessions per key population group per month.

STI testing

HIV

Between 2016 and 2019, the number of HIV tests performed increased, peaking in middle 2019 and a stark drop-off leading into 2020. The error component showed a decrease of 525, 1160, and 948 tests on March, April and May of 2020 compared to the same component in previous years.

The percentage of positive HIV tests decreased from 2016 to 2019. However, we observed a peak in 2020, between March and April.

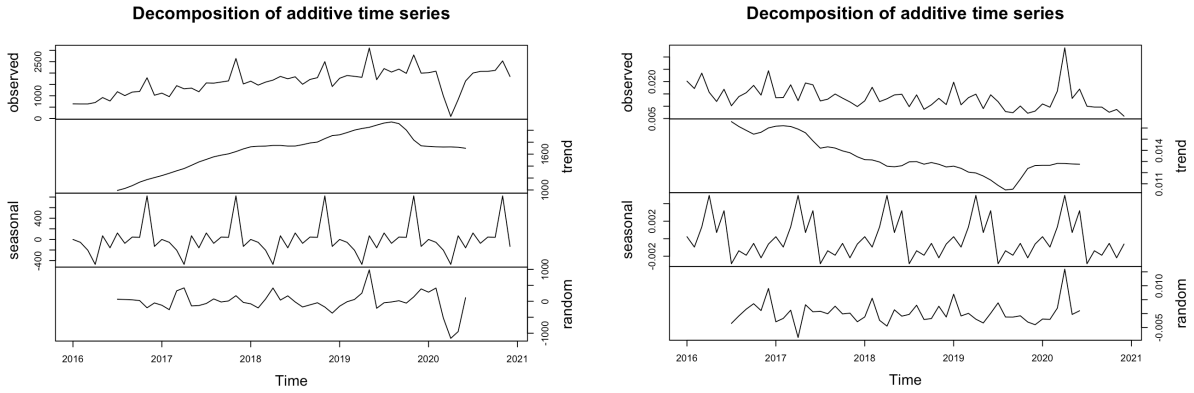

Figure 5: Decomposition of the number of HIV tests' time series (left); Decomposition of the proportion of HIV reactive tests' time series (right).

Viral hepatitis (HCV and HBV)

From 2016 to 2019, we observed an increase in the number of HCV and HBV tests performed. However, it dropped abruptly in 2020. The error component showed a decrease of 347, 677 and 589 of HCV tests in March, April and May 2020 compared to the usual value of this component. For the HBV testing, the error component showed a decrease of 273, 576 and 589 tests in March, April and May 2020 compared to the usual value of this component.

Similarly to what happened to the percentage of positive HIV tests, the percentage of HCV tests also spiked in 2020, particularly in April. The percentage of reactive HBV tests decreased in March and spiked in April and May 2020.

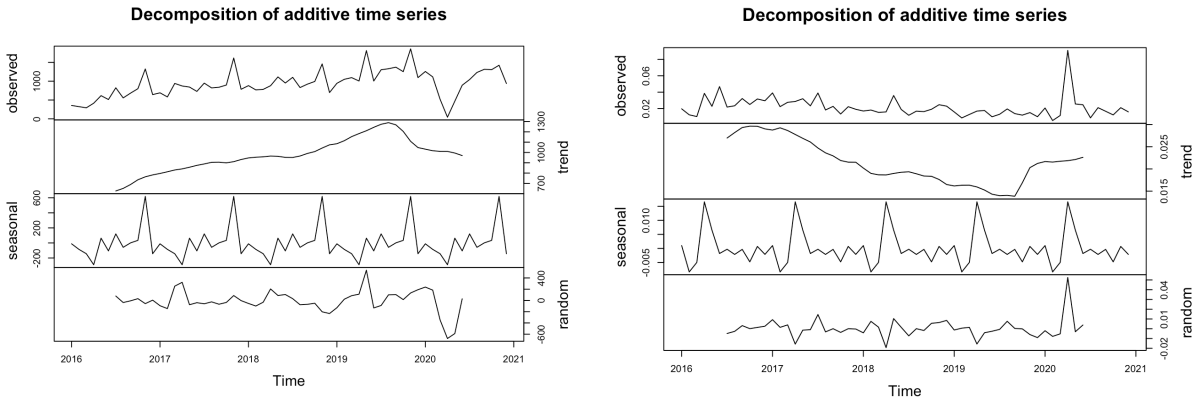

Figure 6: Decomposition of the number of HCV tests' time series (left); Decomposition of the proportion of HCV positive tests' time series (right).

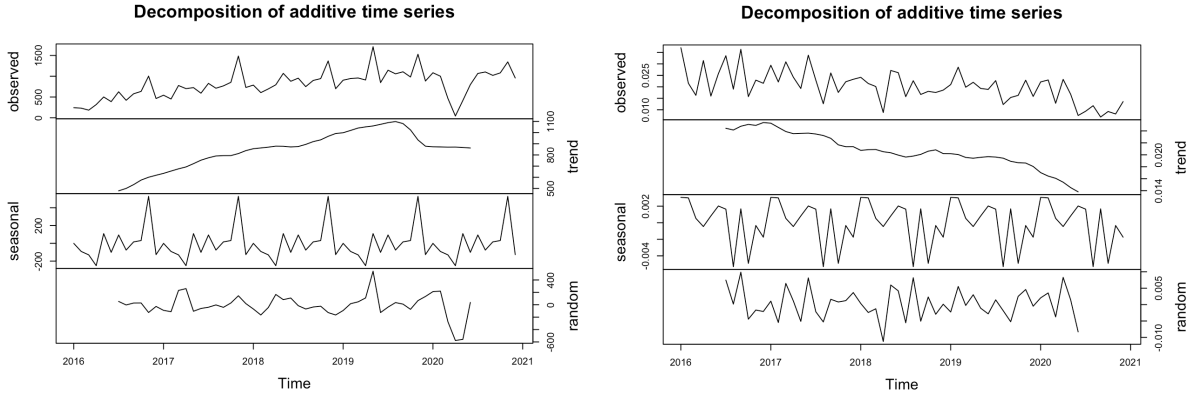

Figure 7: Decomposition of the number of HBV tests' time series (left); Decomposition of the proportion of HBV positive tests' time series (right).

Syphilis

From 2016 to 2019, the number of syphilis tests performed increased, dropping in 2020. The error component showed a decrease of 521, 1063 and 866 tests in March, April and May 2020 compared to the usual value of this component. The percentage of syphilis reactive tests continued to decrease throughout 2020, with a slight increase in March.

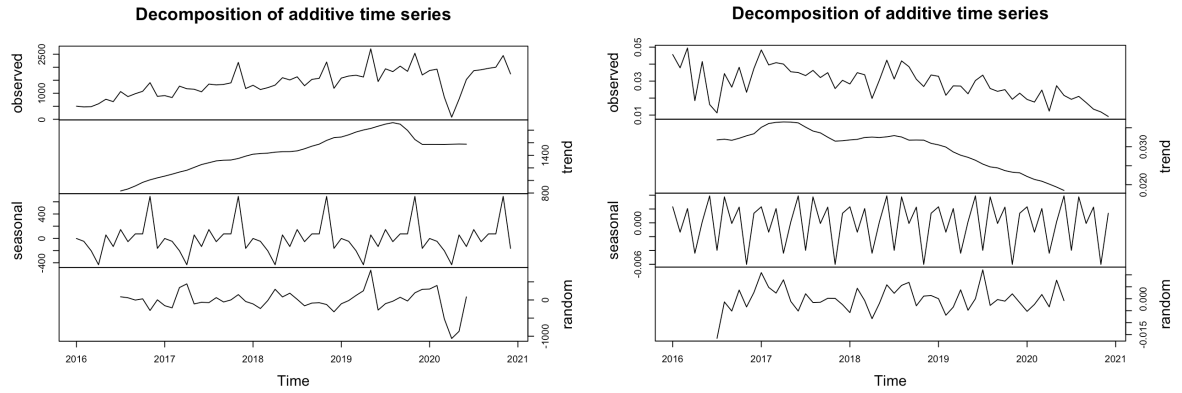

Figure 8: Decomposition of the number of syphilis tests' time series (left); Decomposition of the proportion of syphilis positive tests' time series (right).

Chapter 4

Discussion

The beginning of the COVID-19 pandemic in Portugal and the consequent lockdown measures implemented by the government coincided with a significant decrease (breakpoint) in the number of testing sessions done in community-based centres. During this lockdown, even though the number of STI tests decreased, the percentage of positive tests increased for both HIV and HCV. After the lockdown period, the community centres reopened their services. We observed that while some population groups such as PWUD and SW decreased their number of testing sessions through late 2020, others like the female population, migrants and users ≥50 yo were the first to return to community-based testing, reverting the decreasing trend seen in early 2020.

Our time series' seasonal component showed an increase in the number of testing sessions in November and a decrease in April, annually. In fact, the European Testing Week has happened in November, in the last few years, which could explain these numbers (20). We were not able to determine the factor that contributed to the decrease of testing sessions in April.

The stay-at-home measures not only closed a lot of community-based centres, limiting the number of testing sessions but also, health care, in general, had to implement new triaging processes for patients (12). Non-urgent care, surgeries, routine monitoring, screening and preventive care were postponed and somewhat neglected (2,21). Regarding STI screening and care, users with STI symptoms, reporting STI contact, and at risk for complications were prioritised (22), which might explain the increase in the percentage of positive HIV and HCV tests observed after the breakpoint. Thus, all of these factors culminated in a steep decrease in the number of testing sessions during the lockdown period.

A decrease in the number of tests of this magnitude means that there was a large piece of the population that otherwise would be tested and was not - in our case, in 2020, there were 5 216 fewer testing sessions than in 2019, approximately a 25% decrease. Before the beginning of the COVID-19 pandemic, other studies estimate that, globally, one in seven people living with HIV are not aware of their status (23) and that less than 50% of people living with viral hepatitis are diagnosed and aware of their condition (24,25). In Portugal, estimates show that in 2018 over 90% of people living with HIV were diagnosed (26), and to the best of our knowledge, there were no such estimates for viral hepatitis and syphilis. These numbers show that under normal circumstances, people are still not being tested to the fullest. Crisis, such as the current pandemic, increase barriers and disparities in access to healthcare (27,28), which

might only worsen the number of people oblivious of their health condition and infection status.

Even though the lockdown measures were lifted in May 2020, the trend of testing sessions did not return to what it was in the previous year, still decreasing through late 2020, even if with a less steep slope. In fact, it has been reported a change in patients' perception of healthcare facilities, from a safe place to a place of fear and where people get infected. Hospitals have seen a decrease in the number of patients attending the emergency department due to fear of infection (18). This might also be true for community-based centres and might partly explain why the number of testing sessions still has not returned to "normal".

Additionally, studies have shown that the COVID-19 pandemic has negatively affected mental health in the general population. Users of the community-based centres are usually from vulnerable population groups and are at risk for a greater impact from the lockdown measures (10,29). In fact, emotional distress has been shown to be ubiquitous in communities that undergo crisis. The stay-at-home measures have had several outcomes in the population, such as stress or depression (30). These factors may affect the retention of users in care and explain why the testing sessions numbers have yet to normalise (31).

Several factors might influence the return of specific population groups to care. On the one hand, we have the population characteristics and inherent health needs. On the other hand, changes in services provided and difficulties faced to reopen these services may also influence those who access them.

As mentioned above, women seem to have returned to the testing sessions quicker than men. In fact, the OECD and European Union 2018 report showed that women were more likely to report health problems and chronic illnesses that affected their day-to-day activities (32). Thus, it would be expected that women would have an increased need to access healthcare services, reporting more health conditions. Moreover, another population group whose testing sessions increased after the observed breakpoint was the one with users ≥ 50 years old. The world population has been through a demographic transition, with an increase in elderly individuals. Multimorbidity increases with ageing, increasing the need for healthcare services (33). Thus, the prevalence of several comorbidities in older people might explain this population group resume in their testing sessions. Migrants were also one of the population groups that reversed the negative trend of testing from early 2020. This community is generally out of reach and suffers from severe inequalities in healthcare access. However, in this case, community-based centres might be the only known and trusted link to care, especially if these migrants are undocumented.

Some centres also reported changes in the services provided. After the lockdown period, new outreach mobile units for migrants were implemented, with an increase in the number of CHW available to provide preventive care and testing. These units provide care in areas such as neighbourhoods with a strong migrant community, which also might explain the increase in the number of tests performed in migrants after the lockdown measures were raised. Before the pandemic, some centres had outreach health programmes for SW and PWUD. However, these programmes were put on hold with the pandemic and may explain the continuous decrease in the number of testing sessions in these key population groups. Additionally, changes in the availability of personal protective equipment as well as stock in general (e.g. tests, gloves, and others) might also have influenced the reopening timeline in different centres.

This study has some limitations. Firstly, the RRC does not cover the total amount of the Portuguese community based-centres, which can influence the results since other centres might have experienced different difficulties or lack thereof during the lockdown period. However, our sample covers a large group of centres with geographical representation (mainly major urban centres). Secondly, our analysis focuses on large population groups, which might cover barriers in healthcare access in specific minority groups.

Decreasing the tests performed might increase the number of STI positive individuals who are not aware of their situation and might unknowingly transmit the disease, for example, through their sexual partners. Additionally, delays in starting the correct treatment can decrease the chance of cure (for infections where this is possible) and increase the chance of preventable comorbidities. In fact, in the EU/EEA, most AIDS diagnoses result from late HIV diagnosis (23) and, HBV and HCV are major factors for liver disease, such as cirrhosis, and hepatocarcinoma, if left untreated (24). Furthermore, modelling studies have shown that one of the biggest consequences for HIV patients is the disruption in ART (34,35).

Even though the community-based centres analysed showed resiliency and were able to timely reopen after the lockdown period, there is still a lot that can be learned. We are only now starting to understand the impact of the COVID-19 pandemic globally and nationally, and further studies about this topic are needed. However, while learning from this experience, it is important to understand that the mitigation measures, even though essentials, might have, in the short term, unmeasurable consequences. Systems should have contingency plans that do not neglect or risk the well-being and follow-up of healthcare services' users.

Chapter 5

References

1. Cronologia de uma pandemia em português. Os três meses que mudaram o país [Internet]. [cited 2021 Apr 25]. Available from: https://www.dn.pt/vida-e-futuro/cronologia-de-uma-pandemia-em-portugues-os-tres-meses-que-mudaram-o-pais-12259916.html

2. Melo RB de, Tavares NT, Duarte R. COVID-19 and the Invisible Damage. Acta Médica Port. 2020 May 4;33(5):293–4.

3. Barua S. Understanding Coronanomics: The Economic Implications of the Coronavirus (COVID-19) Pandemic [Internet]. Rochester, NY: Social Science Research Network; 2020 Apr [cited 2021 Apr 27]. Report No.: ID 3566477. Available from: https://papers.ssrn.com/abstract=3566477

4. Nogueira PJ, Nobre M de A, Nicola PJ, Furtado C, Carneiro AV. Excess Mortality Estimation During the COVID-19 Pandemic: Preliminary Data from Portugal. Acta Médica Port. 2020 Jun 1;33(6):376–83.

5. May MT. Better to know: the importance of early HIV diagnosis. Lancet Public Health. 2017 Jan 1;2(1):e6–7.

6. HIV Testing | HIV/AIDS | CDC [Internet]. 2020 [cited 2021 Apr 4]. Available from: https://www.cdc.gov/hiv/testing/index.html

7. Miller MH, Dillon JF. Early diagnosis improves outcomes in hepatitis C. The Practitioner. 2015 Nov;259(1787):25–7, 3.

8. Easterbrook PJ, Roberts T, Sands A, Peeling R. Diagnosis of viral hepatitis. Curr Opin HIV AIDS. 2017 May;12(3):302–14.

9. STD Facts - Syphilis (Detailed) [Internet]. 2019 [cited 2021 Apr 5]. Available from: https://www.cdc.gov/std/syphilis/stdfact-syphilis-detailed.htm

10. Santos G-M, Ackerman B, Rao A, Wallach S, Ayala G, Lamontage E, et al. Economic, Mental Health, HIV Prevention and HIV Treatment Impacts of COVID-19 and the COVID-19 Response on a Global Sample of Cisgender Gay Men and Other Men Who Have Sex with Men. AIDS Behav. 2021 Feb;25(2):311–21.

11. Dorward J, Khubone T, Gate K, Ngobese H, Sookrajh Y, Mkhize S, et al. The impact of the

COVID-19 lockdown on HIV care in 65 South African primary care clinics: an interrupted time series analysis. Lancet HIV. 2021 Mar;8(3):e158–65.

12. Simões D, Stengaard AR, Combs L, Raben D, The EuroTEST COVID-19 impact assessment consortium of partners. Impact of the COVID-19 pandemic on testing services for HIV, viral hepatitis and sexually transmitted infections in the WHO European Region, March to August 2020. Eurosurveillance [Internet]. 2020 Nov 26 [cited 2021 Mar 31];25(47). Available from: https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2020.25.47.2001943

13. Laury J, Hiebert L, Ward JW. Impact of COVID-19 Response on Hepatitis Prevention Care and Treatment: Results From Global Survey of Providers and Program Managers. Clin Liver Dis. 2021 Feb 1;17(1):41–6.

14. Sperring H, Ruiz-Mercado G, Schechter-Perkins EM. Impact of the 2020 COVID-19 Pandemic on Ambulatory Hepatitis C Testing. J Prim Care Community Health. 2020 Jan 1;11:2150132720969554.

15. Latini A, Magri F, Donà MG, Giuliani M, Cristaudo A, Zaccarelli M. Is COVID-19 affecting the epidemiology of STIs? The experience of syphilis in Rome. Sex Transm Infect. 2021 Feb 1;97(1):78–78.

16. Nagendra G, Carnevale C, Neu N, Cohall A, Zucker J. The Potential Impact and Availability of Sexual Health Services During the COVID-19 Pandemic. Sex Transm Dis. 2020 Jul;47(7):434–6.

17. Wingrove C, Ferrier L, James C, Wang S. The impact of COVID-19 on hepatitis elimination. Lancet Gastroenterol Hepatol. 2020 Sep 1;5(9):792–4.

18. Wong LE, Hawkins JE, Langness S, Murrell KL, Iris P, Sammann A. Where Are All the Patients? Addressing Covid-19 Fear to Encourage Sick Patients to Seek Emergency Care. Nejm Catal Innov Care Deliv [Internet]. 2020 May 14 [cited 2021 Apr 27]; Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7371298/

19. Service delivery approaches to HIV testing and counselling (HTC): A strategic HTC Programme Framework [Internet]. [cited 2021 Apr 27]. Available from: http://apps.who.int/iris/bitstream/handle/10665/75206/9789241593877_eng.pdf%3Bjsessionid=5C6B210DA230045003EA4F3A22EE8653?sequence=1

20. Eventos [Internet]. GAT Portugal. [cited 2021 Apr 25]. Available from: https://www.gatportugal.org/eventos/semana-europeia-do-

teste?fbrefresh=89127348912

21. Wright A, Salazar A, Mirica M, Volk LA, Schiff GD. The Invisible Epidemic: Neglected Chronic Disease Management During COVID-19. J Gen Intern Med. 2020 Sep;35(9):2816–7.

22. STD Treatment options - COVID19 [Internet]. [cited 2021 May 3]. Available from: https://www.cdc.gov/std/dstdp/DCL-STDTreatment-COVID19-04062020.pdf?deliveryName=USCDCNPIN_252-DM25769

23. HIV/AIDS surveillance in Europe 2020 (2019 data) [Internet]. [cited 2021 May 3]. Available from: https://www.ecdc.europa.eu/en/publications-data/hivaids-surveillance-europe-2020-2019-data

24. Hepatitis B and C testing in the EU/EEA: progress in reaching the elimination targets. :11.

25. Stasi C, Silvestri C, Voller F. Update on Hepatitis C Epidemiology: Unaware and Untreated Infected Population Could Be the Key to Elimination. SN Compr Clin Med. 2020 Dec 1;2(12):2808–15.

26. Relatório Infeção VIH e SIDA em Portugal – 2020 - INSA [Internet]. [cited 2021 May 4]. Available from: http://www.insa.min-saude.pt/relatorio-infecao-vih-e-sida-em-portugal-2020/

27. Sirotich E, Hausmann JS. Removing barriers and disparities in health: lessons from the COVID-19 pandemic. Nat Rev Rheumatol. 2021 Mar;17(3):125–6.

28. Nshimyiryo A, Barnhart DA, Cubaka VK, Dusengimana JMV, Dusabeyezu S, Ndagijimana D, et al. Barriers and coping mechanisms to accessing healthcare during the COVID-19 lockdown: a cross-sectional survey among patients with chronic diseases in rural Rwanda. BMC Public Health. 2021 Apr 10;21(1):704.

29. Vulnerable Populations: Who Are They? [Internet]. AJMC. [cited 2021 May 3]. Available from: https://www.ajmc.com/view/nov06-2390ps348-s352

30. Pfefferbaum B, North CS. Mental Health and the Covid-19 Pandemic. N Engl J Med [Internet]. 2020 Apr 13 [cited 2021 May 3]; Available from: https://www.nejm.org/doi/10.1056/NEJMp2008017

31. Kowalska JD, Skrzat-Klapaczyńska A, Bursa D, Balayan T, Begovac J, Chkhartishvili N, et al. HIV care in times of the COVID-19 crisis — Where are we now in Central and Eastern Europe? Int J Infect Dis. 2020 Jul;96:311–4.

32. OECD, European Union. Health at a Glance: Europe 2018: State of Health in the EU Cycle [Internet]. OECD; 2018 [cited 2021 May 3]. (Health at a Glance: Europe). Available from: https://www.oecd-ilibrary.org/social-issues-migration-health/health-at-a-glance-europe-2018_health_glance_eur-2018-en

33. Divo MJ, Martinez CH, Mannino DM. Ageing and the epidemiology of multimorbidity. Eur Respir J. 2014 Oct;44(4):1055–68.

34. Mitchell KM, Dimitrov D, Silhol R, Geidelberg L, Moore M, Liu A, et al. The potential effect of COVID-19-related disruptions on HIV incidence and HIV-related mortality among men who have sex with men in the USA: a modelling study. Lancet HIV. 2021 Apr;8(4):e206–15.

35. Stover J, Chagoma N, Taramusi I, Teng Y, Glaubius R, Mahiane G. Estimation of the Potential Impact of COVID-19 Responses on the HIV Epidemic: Analysis using the Goals Model [Internet]. HIV/AIDS; 2020 May [cited 2021 May 3]. Available from: http://medrxiv.org/lookup/doi/10.1101/2020.05.04.20090399