

Original Article

Cite this article: Ruffieux Y *et al* (2021). The treatment gap for mental disorders in adults enrolled in HIV treatment programmes in South Africa: a cohort study using linked electronic health records. *Epidemiology and Psychiatric Sciences* **30**, e37, 1–11. <https://doi.org/10.1017/S2045796021000196>

Received: 22 October 2020

Revised: 4 March 2021

Accepted: 8 March 2021

Key words:




Mental health care; people living with HIV; South Africa; treatment gap

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The treatment gap for mental disorders in adults enrolled in HIV treatment programmes in South Africa: a cohort study using linked electronic health records

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Abstract

Aims. Mental disorders are common in people living with HIV (PLWH) but often remain untreated. This study aimed to explore the treatment gap for mental disorders in adults followed-up in antiretroviral therapy (ART) programmes in South Africa and disparities between ART programmes regarding the provision of mental health services.

Methods. We conducted a cohort study using ART programme data and linked pharmacy and hospitalisation data to examine the 12-month prevalence of treatment for mental disorders and factors associated with the rate of treatment for mental disorders among adults, aged 15–49 years, followed-up from 1 January 2012 to 31 December 2017 at one private care, one public tertiary care and two public primary care ART programmes in South Africa. We calculated the treatment gap for mental disorders as the discrepancy between the 12-month prevalence of mental disorders in PLWH (aged 15–49 years) in South Africa (estimated based on data from the Global Burden of Disease study) and the 12-month prevalence of treatment for mental disorders in ART programmes. We calculated adjusted rate ratios (aRRs) for factors associated with the treatment rate of mental disorders using Poisson regression.

Results. In total, 182 285 ART patients were followed-up over 405 153 person-years. In 2017, the estimated treatment gap for mental disorders was 40.5% (95% confidence interval [CI] 19.5–52.9) for patients followed-up in private care, 96.5% (95% CI 95.0–97.5) for patients followed-up in public primary care and 65.0% (95% CI 36.5–85.1) for patients followed-up in public tertiary care ART programmes. Rates of treatment with antidepressants, anxiolytics and antipsychotics were 17 (aRR 0.06, 95% CI 0.06–0.07), 50 (aRR 0.02, 95% CI 0.01–0.03) and 2.6 (aRR 0.39, 95% CI 0.35–0.43) times lower in public primary care programmes than in the private sector programmes.

Conclusions. There is a large treatment gap for mental disorders in PLWH in South Africa and substantial disparities in access to mental health services between patients receiving ART in the public vs the private sector. In the public sector and especially in public primary care, PLWH with common mental disorders remain mostly untreated.

Introduction

Mental illness is a leading cause of disease burden in Africa (Global Burden of Disease Study. GDB Compare, 2015; Vos *et al.*, 2015). In South Africa, mental disorders affect one in three adults during their lifetime (Herman *et al.*, 2009). The Global Burden of Disease (GBD) study estimates a 12-month prevalence of mental disorders of 15% among adults of 15–49 years old (Global Burden of Disease Collaborative Network, 2018).

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South Africa has the largest number of people living with HIV (PLWH) globally. In 2019, there were 7.7 million PLWH in South Africa, over 5 million of whom were receiving antiretroviral therapy (ART) (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2020). Mental disorders are highly prevalent among PLWH (Olley *et al.*, 2003; Freeman *et al.*, 2006; Myer *et al.*, 2008) and associated with suboptimal HIV treatment outcomes, and increased mortality (Uthman *et al.*, 2015; Haas *et al.*, 2020a, 2020b).

Early diagnosis and management of mental disorders not only improves the quality of people with lived experience of mental illness, but may also prevent HIV disease progression, development of drug resistance and HIV transmission (Safren *et al.*, 2016). Despite the impact of mental health at all levels of the HIV treatment cascade, there is a large ‘treatment gap’ for mental disorders in South Africa (Docrat *et al.*, 2019). The treatment gap refers to the difference between the prevalence of a disorder and the proportion of people who receive treatment for that disorder (Kohn *et al.*, 2004).

Globally, estimates of the treatment gap for mental disorders in the general population range from 50 to over 90% (Abas and Broadhead, 1997; Demyttenaere *et al.*, 2004; Kohn *et al.*, 2004; Mogga *et al.*, 2006; Seedat *et al.*, 2008; Docrat *et al.*, 2019). Previous study on the treatment gap in mental health care has focused on the general population. To the best of our knowledge, there are no data on the treatment gap for mental disorders in PLWH in low- and middle-income countries.

This study aims to quantify the treatment gap for mental disorders among PLWH who enrolled in HIV care at public and private sector ART programmes in South Africa and to examine demographic and socioeconomic disparities in access to mental health care.

Methods

Overview

We conducted a cohort study using routine HIV programme data covering the period from 1 January 2004 to 31 December 2017, linked pharmacy and hospitalisation data covering the period from 1 January 2012 to 31 December 2017 and disease prevalence estimates from the GBD 2017 study (Institute for Health Metrics and Evaluation (IHME), 2018) to examine mental health service utilisation among PLWH followed under ART at four South African HIV treatment programmes. The primary exposure of interest was the type of health care offered at HIV treatment programmes defined as public primary care, public tertiary care or private care. We followed patients from baseline (the date of ART initiation or 1 January 2012, whichever occurred later) to their last clinical visit or their 50th birthday, whichever occurred first. Table 1 provides an overview of outcome measures, data source and analytical procedures.

Setting

We examined the utilisation of mental health services at three public and one private sector HIV treatment programmes in South Africa. The Gugulethu Community Health Centre (CHC), the Khayelitsha ART programme and the Tygerberg Academic Hospital are public sector HIV treatment programmes providing ART according to national treatment guidelines (Meintjes *et al.*, 2017). The three programmes are situated in

Cape Town in South Africa. Gugulethu and Khayelitsha are public primary care programmes located in townships and Tygerberg is a public tertiary care facility which manages patients with more severe illness. In Cape Town’s public sector health care system, primary care facilities are the first point of care for individuals with common and stable, serious mental disorders. Individuals with serious mental disorders requiring either admission or more specialised services are referred to and managed at secondary and tertiary care facilities (Western Cape Government, 2019). The Aid for AIDS (AfA) programme is a private sector HIV programme for insured and employed people in South Africa. HIV treatment is provided by private medical practitioners and specialists following national treatment guidelines (Meintjes *et al.*, 2017). In the private sector, mental health care is provided by independent general practitioners, psychiatrists and psychologists and private inpatient mental health facilities. Involuntary admissions are handled by state services.

Estimation of the prevalence of mental disorders in PLWH

We calculated the 12-month prevalence of mental disorders in PLWH in South Africa in each year by combining, through a set of equations (Appendix A), estimates for the prevalence of HIV and mental disorders in adults (aged 15–49 years) in the general South African population from the GBD 2017 study (Institute for Health Metrics and Evaluation (IHME), 2018) and, a literature estimate for excess mental disorders in HIV-positive compared with HIV-negative populations (Adewuya *et al.*, 2007).

Mental health service utilisation among PLWH receiving ART

Measures

We estimated three measures of mental health service utilisation among PLWH: (1) rates of treatment for mental disorders, (2) adjusted rate ratios (aRRs) for treatment of mental disorders and (3) the 12-month prevalence of treatment for mental disorders (Table 1). We calculated these measures for three types of treatment: (1) pharmacological treatment of mental disorders, (2) inpatient treatment of mental disorders and (3) any treatment of mental disorders (either pharmacological or inpatient). We had no data on non-pharmacological outpatient treatments such as psychotherapy and did not consider these therapies in our analysis.

We defined pharmacological mental health treatment as treatment with antipsychotics (anatomical therapeutic chemical [ATC]: code N05A), anxiolytics (N05B), antidepressants (N06A), psychostimulants (N06B) or a combination of psychiatric drugs (N06C). We defined inpatient treatment of a mental disorder as hospitalisation at a psychiatric health facility for any reason, or as hospitalisation at any health facility for the treatment of an organic mental disorder (International Statistical Classification of Diseases and Related Health Problems, 10th revision [ICD-10] codes F04–F06.1, F06.3–F07.0, F09), a psychotic disorder (F20–F29), a mood disorder (F30–F39), an anxiety disorder (F40–F48) or any other mental disorder (F50–F99, G47–G47.29, G47.4–G47.9, R40–R40.4, R45–R49, Z03.2, Z04.6–Z04.72, Z13.4, Z64, Z81, Z81.8, Z86.5 or Z86.59). ICD-10 code descriptions are provided in online Supplementary Table S1. We estimated aRRs for specific categories of inpatient treatments (psychotic, mood or anxiety disorder) and pharmacological treatments (antipsychotics, anxiolytics or antidepressants).

Table 1. Overview of outcome measures, data source and analytical procedures

Outcome measure	Stratification	Estimation	Data sources
Prevalence of mental disorders in PLWH			
12-month prevalence of mental disorders in PLWH	By year	Notation: $\alpha(y)$ defined as the 12-month prevalence of mental disorders in PLWH in year y Equations for estimation are provided in Appendix A	<ul style="list-style-type: none"> Estimates for the prevalence of HIV and mental disorders in adults aged 15–49 years in South Africa from the Global Burden of Diseases study (IHME, 2018) A literature estimate for excess mental disorders in HIV-positive compared with HIV-negative populations (Adewuya <i>et al.</i>, 2007)
Mental health service utilisation among PLWH receiving ART			
Rates of treatment for mental disorders	For (1) pharmacological, (2) inpatient or (3) any treatment by year and type of care	Number of treatment events divided by person-years under follow-up	<ul style="list-style-type: none"> HIV programme data <ul style="list-style-type: none"> Source: IeDEA (Chammartin <i>et al.</i>, 2020) Variables: Sex, type of care, date of birth, ART initiation, death, transfer, clinic visit dates, CD4 cell count Pharmacy data <ul style="list-style-type: none"> Sources: Dispensing records from PHDC (public care) (Bouille <i>et al.</i>, 2019) and claim data from the medical insurance fund claim database (private care) Variables: Date and ATC code of prescribed medication Hospital data <ul style="list-style-type: none"> Sources: Hospital discharge records from PHDC (public care) (Bouille <i>et al.</i>, 2019) and hospital claim data from the medical insurance fund claim database (private care) Variables: Admission and discharge date, ICD-10 diagnosis, ward information
Adjusted rate ratios for treatment of mental disorders	Comparing (1) the incidence of inpatient treatment of psychotic, mood, anxiety or any mental disorders, and (2) the incidence of pharmacological treatment with antipsychotics, antidepressants, anxiolytics or any psychiatric medication by type of care, sex, age and CD4 cell count	Multivariable Poisson regression adjusted for type of care, sex, age, year and CD4 cell count at baseline	
12-month prevalence of treatment for mental disorders	For (1) pharmacological, (2) inpatient or (3) any treatment by year and type of care	$P_t(y, c) = \frac{T_t(y, c)}{N(y, c)}$ <p>where $T_t(y, c)$ is the number of patients in type of care c who received treatment for a mental disorder of type t in year y, and $N(y, c)$ is the total number of completed 12-month intervals in year y in type of care c</p>	
Treatment gap for mental disorders in PLWH receiving ART			
Treatment gap for mental disorders in PLWH receiving ART	By year and type of care	$\delta(y, c) = 1 - \frac{P_{any}(y, c)}{\alpha(y)}$ <p>where $P_{any}(y, c)$ is the 12-month prevalence of any treatment for a mental disorder in year y and type of care c</p>	<ul style="list-style-type: none"> The estimated 12-month prevalence of mental disorders in PLWH, i.e. $\alpha(y)$ The estimated 12-month prevalence of any treatment for a mental disorder in PLWH, i.e. $P_{any}(y, c)$

PLWH, people living with HIV; ART, antiretroviral therapy; IeDEA, International epidemiology Databases to Evaluate AIDS; PHDC, Western Cape Provincial Health Data Centre.

Data sources

We extracted routine HIV programme data from four treatment programmes from the International epidemiology Databases to Evaluate AIDS (IeDEA) (Chammartin *et al.*, 2020). These data contain clinical, sociodemographic and administrative data of PLWH followed under ART. The Western Cape Provincial Health Data Centre (PHDC) linked HIV programme data from public sector ART programmes to hospitalisation and pharmacy dispensing records from most public sector health facilities in the Western Cape Province using unique person identifiers (Bouille *et al.*, 2019). The AfA programme linked private sector HIV programme data to hospitalisation and pharmacy claims data from the medical insurance fund claim database (Leisegang *et al.*, 2009; Karamchand *et al.*, 2016). The list of variables that we used from each of these data sources is shown in [Table 1](#).

Inclusion criteria

We included PLWH aged 15–49 years at baseline who enrolled in the Gugulethu, Khayelitsha, Tygerberg or AfA ART programmes, and had at least one follow-up visit after baseline and between 1 January 2012 and 31 December 2017.

Statistical analysis

We calculated rates of treatment of mental disorders for inpatient, pharmacological or any treatment in each calendar year and by type of care as the number of treatment events divided by the number of person-years (py) under follow-up. We treated each hospital admission as a separate event. We treated pharmacy refills for psychiatric medication which occurred in the same year as one event. We calculated aRR for factors associated with the incidence of inpatient treatment of a psychotic, mood, anxiety

or any mental disorder, and pharmacological treatment with antipsychotics, antidepressants, anxiolytics or any psychiatric medication using Poisson regression. Models were adjusted for type of care, sex, age, year and CD4 cell count at baseline. Age was treated as a categorical variable (15–24 years, 25–34 years, 35–44 years and 45–49 years). CD4 cell count was measured at baseline (0–99 cells/ μl , 100–199 cells/ μl , 200–349 cells/ μl , 350–499 cells/ μl , ≥ 500 cells/ μl and missing). Age and year were modelled as time-varying covariates. We used robust sandwich estimators of the standard error to account for clustering of data by patients (Zeileis, 2006). We imputed missing data for ICD-10 codes for unclassified hospital admissions (ICD-10 code F99 or missing) using multiple imputation with chained equations (van Buuren and Groothuis-Oudshoorn, 2011) and pooled the analyses from five sets of imputations using Rubin's rule (Little and Rubin, 2002). To estimate the 12-month prevalence of treatment for mental disorders, we split follow-up time into 12-month intervals, assigned each interval to the calendar year in which most days of the interval occurred and calculated the proportion of patients who had received treatment for a mental disorder (pharmacological, inpatient or any) during each completed interval (Table 1). We calculated 95% confidence intervals (CIs) for the 12-month prevalence of treatment for mental disorders based on a binomial distribution.

Estimation of the treatment gap for mental disorders in PLWH receiving ART

We calculated the treatment gap for mental disorders $\delta(y, c)$ in year y and type of care c , using the following equation:

$$\delta(y, c) = 1 - \frac{P_{any}(y, c)}{\alpha(y)},$$

where $P_{any}(y, c)$ is the 12-month prevalence of any treatment (inpatient or pharmacological) for a mental disorder in year y and type of care c , and $\alpha(y)$ is the prevalence of mental disorders in PLWH in South Africa in year y . We expressed the treatment gap as a percentage throughout our analysis. All statistical analyses were performed using the R Project for statistical computing software.

Results

The prevalence of mental disorders in PLWH in South Africa

We estimated that in 2012, 39.5% (95% CI 29.2–50.0) of PLWH (15–49 years) in South Africa had a mental disorder. The prevalence was 39.4% (95% CI 29.1–49.8) for 2013, 39.3% (95% CI 29.0–49.7) for 2014, 39.3% (95% CI 28.9–49.5) for 2015, 39.2% (95% CI 29.0–49.4) for 2016 and 39.1% (95% CI 29.0–49.3) for 2017.

Characteristics of PLWH receiving ART

Of the 363 384 people included in the IeDEA databases of the Gugulethu, Khayelitsha, Tygerberg and AfA ART programmes, 182 285 (50.2%) met our inclusion criteria: 140 322 (77.0%) were from the private sector AfA programme, 39 381 (21.6%) from public primary care programmes and 2582 (1.4%) from the public tertiary care programme (Table 2). Most patients were female (67.5%), the median age at ART initiation was 35

years (interquartile range [IQR] 31–41), median CD4 at ART initiation was 238 cells/ μl (IQR 127–380) and median CD4 at baseline was 359 cells/ μl (IQR 219–548). Patients in the private sector programme initiated ART at an older age and at a higher CD4 cell count than patients in the public sector programmes. CD4 at baseline was higher in the private sector than in the public sector programmes.

The 12-month prevalence of treatment for mental disorders in PLWH receiving ART

Figure 1 shows the 12-month prevalence of inpatient, pharmacological and any (inpatient or pharmacological) treatment for a mental disorder in private care, public primary care and public tertiary care ART programmes. The 12-month prevalence of inpatient, pharmacological or any treatment for a mental disorder was highest in private care, followed by public tertiary care, and lowest in public primary care. In the private sector, the 12-month prevalence of inpatient and pharmacological mental health treatment was higher in women than in men (online Supplementary Fig. S1).

The mental health treatment gap in PLWH receiving ART

Figure 2 and online Supplementary Table S2 show the estimated treatment gap for mental disorders in private care, public primary care and public tertiary care ART patients. In private care, the treatment gap decreased from 63.6% (95% CI 50.5–71.2) in 2013 to 42.7% (95% CI 22.3–54.7) in 2014 (Fig. 2). In public primary care, the treatment gap decreased slightly from 97.4% (95% CI 96.3–98.1) in 2012 to 96.5% (95% CI 95.0–97.5) in 2017. In public tertiary care, the treatment gap decreased from 82.8% (95% CI 74.4–88.4) in 2012 to 65.0% (95% CI 36.5–85.1) in 2017.

Differences in mental health treatment rates by type of care

Online Supplementary Table S3 shows the yearly number of treatment events, p_y at risk and crude rates of treatment for mental disorders among patients followed-up in the ART programmes. Figure 3 shows aRRs comparing rates of treatment for mental disorders between patients enrolled in private care, public primary care and public tertiary care. The rate of inpatient treatment was 25 times (aRR 0.04, 95% CI 0.03–0.05) lower for mood disorders, 14 times lower (aRR 0.07, 95% CI 0.04–0.14) for anxiety disorders and about two times higher (aRR 1.80, 95% CI 1.31–2.47) for psychotic disorders in patients enrolled in public primary care compared to private care. In patients enrolled in public tertiary care compared to private care, the rate of inpatient treatment was five times lower (aRR 0.20, 95% CI 0.11–0.36) for mood disorders, less than two times lower (aRR 0.59, 95% CI 0.22–1.6) for anxiety disorders, but seven times higher (aRR 7.26, 95% CI 3.66–14.41) for psychotic disorders. The rates of treatment with antidepressants, anxiolytics and antipsychotics were 17 (aRR 0.06, 95% CI 0.06–0.07), 50 (aRR 0.02, 95% CI 0.02–0.03) and 2.6 (aRR 0.38, 95% CI 0.35–0.42) times lower in patients enrolled in public primary care than in private care. In patients enrolled in public tertiary care compared to private care, the rates of treatment with antidepressants (aRR 0.48, 95% CI 0.4–0.58) and anxiolytics (aRR 0.16, 95% CI 0.12–0.21) were lower and the rate of treatment with antipsychotics was higher (aRR 1.57, 95% CI 1.27–1.93) (Table 3).

Table 2. Characteristics of patients aged 15 to 49 under active follow-up in private care, public primary care and public tertiary care ART programmes during 2012–2017^a

	Type of care ^b			
	Private care ^c (n = 140 322)	Public primary care ^c (n = 39 381)	Public tertiary care ^c (n = 2582)	Total (n = 182 285)
Characteristics at ART initiation				
Female, n (%)	93 249 (66.5)	28 076 (71.3)	1757 (68.0)	123 082 (67.5)
Median [IQR] age, years	36 [32–41]	32 [28–38]	33 [28–39]	35 [31–41]
Median CD4 cells/μl [IQR]	254 [135–410]	193 [107–302]	162 [87–242]	238 [127–380]
Characteristics at baseline ^d				
Median years on ART [IQR]	0.3 [0.0–2.0]	0.0 [0.0–2.0]	1.2 [0.0–3.7]	0.1 [0.0–2.1]
Median [IQR] age, years	38 [33–43]	34 [29–39]	36 [30–41]	37 [32–42]
Median CD4 cells/μl [IQR] ^e	378 [229–571]	307 [184–454]	320 [189–493]	359 [219–548]
CD4 category at baseline ^e , n (%)				
0–99 cells/μl	11 383 (8.1)	3381 (8.6)	265 (10.3)	15 029 (8.2)
100–199 cells/μl	14 075 (10.0)	4480 (11.4)	358 (13.9)	18 913 (10.4)
200–349 cells/μl	30 171 (21.5)	9224 (23.4)	668 (25.9)	40 063 (22.0)
350–499 cells/μl	26 364 (18.8)	5864 (14.9)	456 (17.7)	32 684 (17.9)
≥500 cells/μl	40 436 (28.8)	5519 (14.0)	563 (21.8)	46 518 (25.5)
Missing	17 893 (12.8)	10 913 (27.7)	272 (10.5)	29 078 (16.0)

ART, antiretroviral therapy; IQR, interquartile range.

^aPatients with at least one follow-up visit between 1 January 2012 and 31 December 2017 were included.

^bAll values in the table represent medians and interquartile ranges unless otherwise stated.

^cPrivate care: AFA programme; public primary care: Gugulethu and Khayelitsha programmes; public tertiary care: Tygerberg Hospital.

^dBaseline was defined as 1 January 2012 or date of ART initiation of the patient, whichever came second.

^eThe CD4 cell count measurement closest to the baseline date, within a 6-month window (before or after).

Patient characteristics associated with mental health treatment rates

Women had a higher incidence of inpatient treatment for mood (aRR 1.56, 95% CI 1.43–1.70), anxiety (aRR 2.21, 95% CI 1.75–2.79) and any mental disorder (aRR 1.49, 95% CI 1.37–1.62) than men (Table 3). Women were also more likely to receive psychiatric medication than men with aRRs of 1.32 (95% CI 1.24–1.40) for antipsychotics, 1.49 (95% CI 1.45–1.53) for antidepressants and 1.60 (95% CI 1.55–1.64) for anxiolytics. Older age was associated with a lower incidence of inpatient treatment for any mental disorders and a higher incidence of pharmacological treatment with antidepressants, anxiolytics and any psychiatric medication. Higher baseline CD4 cell count was associated with a lower incidence of inpatient treatment for a psychotic disorder and with a slightly lower incidence of treatment with antipsychotics and antidepressants (Table 3).

Discussion

Our study showed a large treatment gap for mental disorders in PLWH who enrolled in ART programmes in South Africa. We found substantial disparities in access to mental health services between patients who receive ART in private *v.* public sector programmes. In 2017 the treatment gap for mental disorders in PLWH was 96.5% in public primary care programmes, 65.0% in the public tertiary care programme, and 40.5% in the private programme. The rate of treatment with antidepressants, anxiolytics

and antipsychotics was 17, 50 and 2.6 times lower in the public primary care programmes compared with the private programme. We found considerable gender differences in mental health treatment rates, with women being treated more often than men.

Our estimates for the treatment gap in mental disorders in PLWH in South Africa are largely consistent with data from earlier studies in the general population from various settings. A meta-analysis of studies published between 1980 and 2003 estimated that the global treatment gap was 58% for generalised anxiety and obsessive compulsive disorders, 56% for depression, dysthymia and panic disorder, 50.2% for bipolar disorder and 32% for schizophrenia (Kohn *et al.*, 2004). The World Health Organization (WHO) World Mental Health Survey, conducted between 2001 and 2003, reported a treatment gap for mental health and substance use problems of 76% in less-developed countries (Demyttenaere *et al.*, 2004). The South African Stress and Health Study (SASH), conducted between 2002 and 2004, found that 74% of the people with anxiety disorder, mood disorder, substance use disorder or intermittent explosive disorder received no mental health treatment in the year before the survey (Seedat *et al.*, 2008). Our estimates are also consistent with more recent results from Docrat and colleagues. They estimated a 92% treatment gap in South Africa's public sector, with 86% of the mental health care budget spent on inpatient care and only 8% in the primary care setting (Docrat *et al.*, 2019). The authors concluded that South Africa's public health care system prioritises treating the most severe conditions, while non-severe mental disorders are often overlooked. The high incidence of hospital

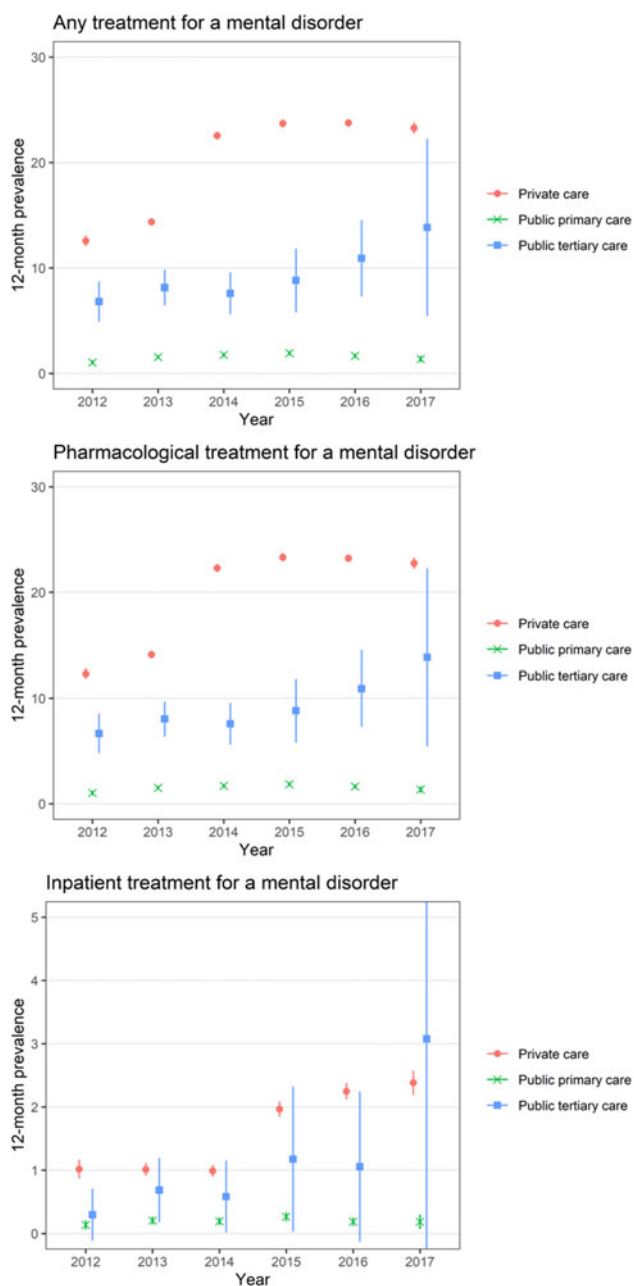


Fig. 1. 12-month prevalence of treatment for a mental disorder in patients aged 15–49 years followed-up in private care (AfA), public primary care (Gugulethu, Khayelitsha), and public tertiary care (Tygerberg) antiretroviral therapy programs programmes, 2012–2017. Patients who had been admitted for a mental disorder or to a psychiatric health facility were considered to have received inpatient treatment for a mental disorder. Patients who had received antipsychotics (Anatomical Therapeutic Chemical [ATC] code N05A), anxiolytics (N05B), antidepressants (N06A), psychostimulants (N06B) or psychiatric combination drugs (N06C) were considered to have received pharmacological treatment for a mental disorder. Patients who received either inpatient or pharmacological treatment were considered to have received any treatment for a mental disorder.

admission for psychotic disorders and the low rates of prescriptions of antidepressants and anxiolytics in the primary care setting provide further support for this conclusion.

The comparison of the rate of inpatient treatments between public and private sector programmes has to be interpreted with caution. According to the South African Mental Health Care Act, all involuntary admissions are handled by state services

(Parliament of the Republic of South Africa, 2002). Our data did not capture involuntary admissions of private care patients. Because admissions for a psychotic disorder are often involuntary (Moosa and Jeenah, 2008; Madala-Witbooi and Adeniyi, 2019), excess rates of inpatient care for psychotic disorders in patients enrolled in public compared to private sector ART programmes are likely to be overestimated. The large increase of inpatient care for psychotic disorders in patients enrolled in public tertiary care may also reflect more advanced HIV disease in these patients. Psychotic disorders secondary to HIV tend to occur at more advanced stages and the lower baseline CD4 cell counts observed in public, particularly tertiary care, programmes could align with this explanation (Owe-Larsson *et al.*, 2009). Furthermore, higher baseline CD4 cell counts were associated with lower rates of treatment for psychotic disorders.

Our study showed substantial disparities in access to mental health services between patients who receive ART in private *v.* public sector programmes. We believe that the lack of resources allocated to treating mental disorders in the public sector (Docrat *et al.*, 2019) is a major factor contributing to the large treatment gap in mental disorders in public sector ART programmes. Disparities in mental health treatment rates between the public and the private sector might also reflect underlying socioeconomic differences between the two patient populations attending public *v.* private care programmes. The public sector ART programmes Gugulethu and Khayelitsha are situated in the most impoverished areas in Cape Town, whereas the AfA programme is a private sector programme for employed people with health insurance. We had no individual patient data on socioeconomic status or related factors that could influence access to care and did not adjust for these variables.

The higher inpatient treatment rates for anxiety and mood, but not psychotic, disorders in women could represent a higher prevalence of common mental disorders in women (Steel *et al.*, 2014; Kuehner, 2017). It could also result from differences in healthcare-seeking behaviour between men and women or discrimination against men in the health care system, for example through a practitioner's subconscious tendency to overlook psychological distress in men (Smith *et al.*, 2018). Lower inpatient treatment rates and higher rates of pharmacological treatment, excluding antipsychotics, in older age groups could potentially be explained by younger individuals presenting with first episodes of illness requiring more intensive investigations and interventions compared to individuals with known or recurring conditions.

Our results must be considered in light of several limitations. We found no estimates for the overall prevalence of psychiatric disorders in PLWH in South Africa. We, therefore, estimated the need for mental health treatment based on data from the GBD (Institute for Health Metrics and Evaluation (IHME), 2018) and literature estimates (Adewuya *et al.*, 2007). Population-based surveys using structured diagnostic interviews (Abas and Broadhead, 1997; Kebede *et al.*, 2003; Demyttenaere *et al.*, 2004; Kohn *et al.*, 2004; Mogga *et al.*, 2006; Seedat *et al.*, 2008) provide more reliable estimates for the need of mental health treatment than our study. We had no data on non-pharmacological outpatient interventions such as psychotherapy and could not consider these therapies when estimating the treatment gap. We believe that this limitation could have led to a slight over-estimation of the treatment gap, given poor access to psychological interventions, particularly in the public sector. Conversely, psychiatric medication is sometimes used for indications not related to mental health, for which reason we might have slightly underestimated the treatment gap. Furthermore, we did not adjust our estimates for underlying differences between different care

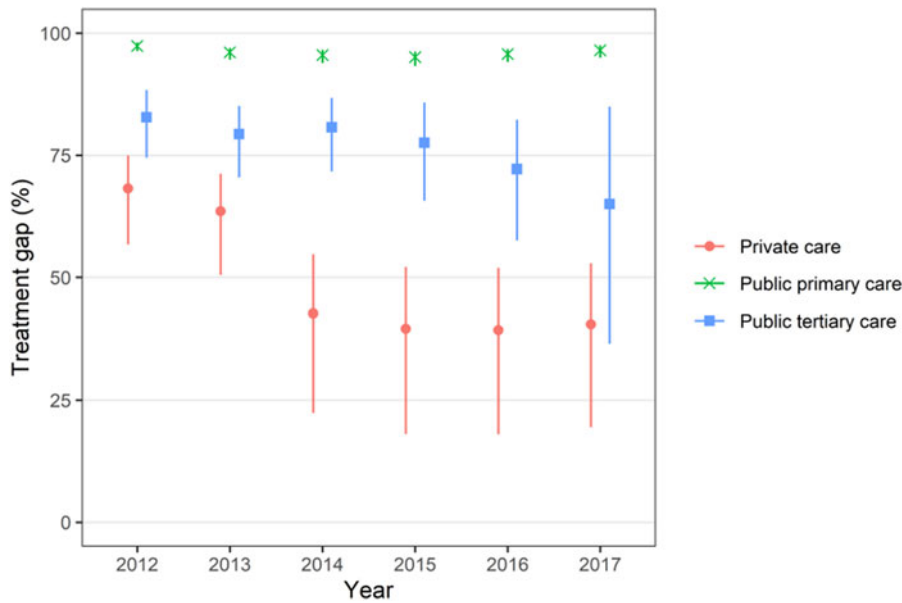


Fig. 2. The treatment gap for mental disorders at private care (AfA), public primary care(Gugulethu, Khayelitsha), and public tertiary care (Tygerberg) antiretroviral therapy programs, 2012-2017.

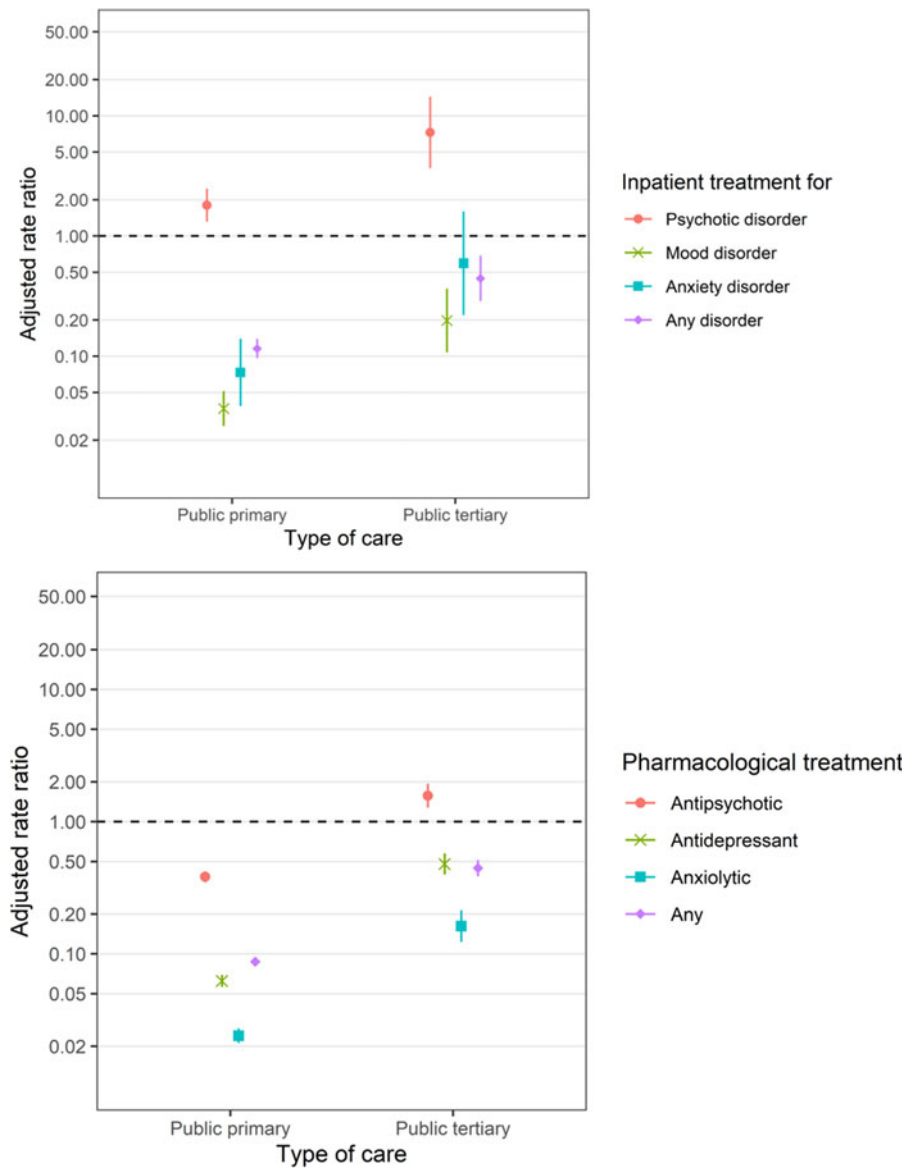


Fig. 3. Adjusted rate ratios comparing rates of treatment for mental disorders by type of care. Rates of inpatient treatment of psychotic, mood, anxiety, or any mental disorder (top) and pharmacological treatment with antipsychotics, antidepressants, anxiolytics, or any psychiatric medication (bottom) are compared between patients in public primary care (Gugulethu and Khayelitsha), public tertiary care (Tygerberg), and a private care (Aid for AIDS [AfA]) antiretroviral therapy programs, 2012-2017. The private care program was the reference group. Incidence rate ratios were adjusted for gender, current age, current year, and baseline CD4 cell count.

Table 3. Adjusted rate ratios for factors associated with treatment for mental disorders in patients aged 15–49 years followed-up in private care, public primary care and public tertiary care ART programmes during 2012–2017^a

	Inpatient treatment of ^{b,c}				Pharmacological treatment with ^{b,d}			
	Psychotic disorders ^e	Mood disorders ^e	Anxiety disorders ^e	Any mental disorder ^e	Antipsychotics ^e	Antidepressants ^e	Anxiolytics ^e	Any psychiatric medication ^e
Type of care								
Private care	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Public primary	1.80 (1.31–2.47)	0.04 (0.03–0.05)	0.07 (0.04–0.14)	0.12 (0.10–0.14)	0.38 (0.35–0.42)	0.06 (0.06–0.07)	0.02 (0.02–0.03)	0.09 (0.08–0.09)
Public tertiary	7.26 (3.66–14.41)	0.20 (0.11–0.36)	0.59 (0.22–1.60)	0.44 (0.29–0.69)	1.57 (1.27–1.93)	0.48 (0.40–0.58)	0.16 (0.12–0.21)	0.44 (0.39–0.51)
Sex								
Male	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.86 (0.59–1.24)	1.56 (1.43–1.70)	2.21 (1.75–2.79)	1.49 (1.37–1.62)	1.32 (1.24–1.4)	1.49 (1.45–1.53)	1.60 (1.55–1.64)	1.43 (1.40–1.46)
Age, years								
15–24	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
25–34	0.86 (0.40–1.85)	0.92 (0.75–1.13)	0.88 (0.52–1.51)	0.90 (0.73–1.10)	1.00 (0.85–1.18)	1.52 (1.37–1.68)	1.62 (1.45–1.80)	1.40 (1.30–1.51)
35–44	0.71 (0.33–1.53)	0.84 (0.69–1.03)	0.68 (0.40–1.15)	0.80 (0.66–0.98)	0.95 (0.81–1.12)	1.75 (1.58–1.94)	1.83 (1.64–2.04)	1.55 (1.44–1.67)
45–49	0.77 (0.34–1.74)	0.76 (0.61–0.94)	0.59 (0.34–1.04)	0.74 (0.60–0.91)	1.05 (0.88–1.24)	2.06 (1.86–2.29)	2.05 (1.84–2.29)	1.76 (1.63–1.90)
Baseline CD4 cell count, cells/ μ l ^a								
0–99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
100–199	0.79 (0.46–1.35)	0.99 (0.84–1.17)	1.56 (1.02–2.40)	0.92 (0.79–1.07)	0.95 (0.85–1.06)	0.95 (0.9–1)	1.01 (0.95–1.08)	0.97 (0.93–1.01)
200–349	0.63 (0.38–1.05)	1.01 (0.87–1.17)	1.37 (0.94–2.01)	0.89 (0.78–1.02)	0.87 (0.79–0.96)	0.93 (0.88–0.97)	0.99 (0.94–1.05)	0.94 (0.91–0.98)
350–499	0.38 (0.22–0.67)	0.92 (0.79–1.07)	1.16 (0.79–1.73)	0.78 (0.68–0.90)	0.89 (0.80–0.99)	0.90 (0.85–0.94)	0.99 (0.93–1.05)	0.93 (0.89–0.96)
≥500	0.49 (0.26–0.93)	1.00 (0.86–1.15)	1.38 (0.95–2.01)	0.85 (0.75–0.97)	0.88 (0.80–0.97)	0.94 (0.90–0.99)	1.00 (0.95–1.06)	0.94 (0.91–0.98)
Missing	0.44 (0.26–0.74)	0.89 (0.76–1.03)	0.93 (0.63–1.37)	0.76 (0.67–0.87)	0.99 (0.90–1.09)	0.88 (0.84–0.92)	0.98 (0.93–1.04)	0.89 (0.86–0.93)

^aPatients with at least one follow-up visit between 1 January 2012 and 31 December 2017 were included.

^bData are aRRs with 95% CIs in parenthesis. Rate ratios were adjusted for ART programme, sex, age, baseline CD4 cell count and year.

^cRepeated hospital admissions were treated as separate events. The incidence of inpatient treatment for mental disorders was modelled as count data.

^dPharmacy refills for psychiatric medication which occurred in the same year were counted as one event. The incidence of pharmacological treatment for a mental disorder was modelled as a binary outcome.

^ePsychotic disorder (ICD-10 codes F20–F29), mood disorder (F30–F39), anxiety disorder (F40–F48) and any mental disorder (F20–F99); antipsychotics (ATC code N05A), anxiolytics (N05B), antidepressants (N06A), any psychiatric medication (antipsychotics, anxiolytics, antidepressants, psychostimulants [N06B] or psychiatric combination drugs [N06C]).

^fBaseline was defined as 1 January 2012 or date of ART initiation of the patient, whichever came second. The CD4 cell count measurement was the one closest to the baseline date, within a 6-month window (before or after).

settings. Mental disorders might be more common in public sector patients who tend to have more socioeconomic stressors. Patients in tertiary care are likely to have more comorbidities and thus may have a higher risk of mental disorders. Because we could not account for these underlying differences, we may have overestimated the treatment gap in private care and underestimated the treatment gap in tertiary care. We could not track patients transferring between ART programmes. Thus we may have slightly underestimated the uncertainty of our estimates because we could not adjust for possible clustering of data within individuals. Finally, we cannot rule out the possibility that observed differences between programmes may have at least partly resulted from heterogeneity of data sources and data quality.

An important strength of our study is that we used medical records to estimate mental health treatment utilisation rates. Most previous studies on the treatment gap relied on self-report data (Abas and Broadhead, 1997; Kebede *et al.*, 2003; Demyttenaere *et al.*, 2004; Kohn *et al.*, 2004; Mogga *et al.*, 2006; Seedat *et al.*, 2008). Users of mental health services might underreport service utilisation due to mental health stigma (Furnham, 1986; Thornicroft *et al.*, 2007). A further strength of our study is that we could account for mental health treatment received outside the HIV treatment setting because we linked public and private sector ART programme data to province-wide and private data on mental health treatment. Finally, the inclusion of data from public primary care, public tertiary care and private care settings adds to the robustness and generalisability of our findings.

The integration of evidence-based interventions for diagnosing and managing mental disorders in primary care ART programmes holds great promise for closing the treatment gap in PLWH (Remien *et al.*, 2019). This could lead to an improvement of outcomes across the treatment cascade. WHO and the South African government have published guidelines for managing mental disorders in non-specialised settings (World Health Organization, 2016; Department of Health of the Republic of South Africa, 2020). Our study suggests that the implementation of mental health services in primary care ART programmes is inconsistent. Continued efforts to close the treatment gap for people with mental disorders are needed. Strategies to strengthen task-shifting, training and capacitation of primary health care staff, and models of referral and stepped-care will be crucial to closing the treatment gap (Bhana *et al.*, 2019; Petersen *et al.*, 2019).

Conclusion

There is a large treatment gap for mental disorders in PLWH in South Africa and substantial disparities in access to mental health service between patients receiving care in the public vs the private sector. In the public sector and especially in public primary care, PLWH with common mental disorders remain mostly untreated.

Supplementary material. The supplementary material for this article can be found at <https://doi.org/10.1017/S2045796021000196>

Availability of data and materials. All data were obtained from the IeDEA-SA. Data cannot be made available online because of legal and ethical restrictions. To request data, readers may contact IeDEA for consideration by filling out the online form available at <https://www.iedea-sa.org/contact-us/>.

Acknowledgements. We thank the PHDC for compiling and providing public sector mental health data and Nicki Tiffin, PhD, MPH for assisting with data compilation.

Financial support. The study was supported by the US National Institutes of Health (NIAID, NICHD, NCI, NIMH, NIDA, NHLBI, NIAAA, NIDDK and FIC, grant number U01AI069924), the Swiss National Science Foundation (grant numbers P2BEP3_178602 and 180083) and the South African Medical Research Council.

Conflict of interest. The authors declare no conflicts of interests.

Ethical standards. The Human Research Ethics Committee of the University of Cape Town, South Africa and the Cantonal Ethics Committee, Bern, Switzerland granted ethical permission for the analysis and waived the requirement to obtain informed consent.

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Appendix A: Estimation of the prevalence of mental disorders (MD) in people living with HIV (PLWH) and the treatment gap for MD

Estimation of the prevalence of MD in PLWH

Our target quantity of interest is $\alpha(y) = P_y(\text{MD} + | \text{HIV} +)$, i.e. the prevalence of MD in PLWH in a given year y . We define $\beta(y) = P_y(\text{MD} + | \text{HIV} -)$ as the prevalence of MD in HIV-negative people in year y . We have data on the following quantities, with associated 95% confidence intervals (CIs):

- the prevalence of MD in the general population in year y , $p_{m,y} = P_y(\text{MD} +)$,
- the prevalence of HIV in the general population in year y , $p_{h,y} = P_y(\text{HIV} +)$,
- the odds ratio for the prevalence of MD in HIV-positive compared to HIV-negative populations in year y

$$r(y) = \frac{P_y(\text{MD} + | \text{HIV} +) / \{1 - P_y(\text{MD} + | \text{HIV} +)\}}{P_y(\text{MD} + | \text{HIV} -) / \{1 - P_y(\text{MD} + | \text{HIV} -)\}}$$

We obtain the following system of two equations, which we will solve for $\alpha(y)$ and $\beta(y)$:

$$p_{m,y} = \alpha(y)p_{h,y} + \beta(y)(1 - p_{h,y}) \quad (\text{A1})$$

$$r(y) = \frac{\alpha(y)/(1 - \alpha(y))}{\beta(y)/(1 - \beta(y))} \quad (\text{A2})$$

Equation (A1) results from the total probability rule, and leads to $\beta(y) = (p_{m,y} - \alpha(y)p_{h,y}) / (1 - p_{h,y})$. Inserting this into (A2), we obtain:

$$(p_{h,y}r(y) - p_{h,y}\alpha(y))^2 + (p_{h,y} + p_{m,y} - 1 - p_{h,y}r(y) - p_{m,y}r(y))\alpha(y) + p_{m,y}r(y) = 0$$

If $r(y) = 1$, then $\alpha(y) = \beta(y) = p_{m,y}$. We assume that $r(y) \neq 1$, i.e. that $r(y)$ is not exactly 1. Our desired $\alpha(y)$ is a solution to this second-degree equation.

Setting $a = p_{h,y}r(y) - p_{h,y}$, $b = p_{h,y} + p_{m,y} - 1 - p_{h,y}r(y) - p_{m,y}r(y)$, $c = p_{m,y}r(y)$ and $\Delta = b^2 - 4ac$, the solution of interest is

$$\alpha(y) = \frac{-b - \sqrt{\Delta}}{2a} \quad (\text{A3})$$

We discard the other solution to the second-degree equation, as it does not lie between 0 and 1.

Estimation of the treatment gap for MD and 95% CI

The treatment gap for MD in PLWH followed-up on antiretroviral therapy (ART) is estimated as

$$\delta(y, c) = 1 - \frac{P_{any}(y, c)}{\alpha(y)} \quad (\text{A4})$$

where $P_{any}(y, c)$ is the 12-month prevalence of any treatment for MD (inpatient or pharmacological) in year y and type of care c . To obtain a 95% CI for $\alpha(y)$, we use a sampling method. Specifically, we assume that $p_{m,y}$ and $p_{h,y}$ follow beta distributions, with parameters calibrated so that the 2.5%- and 97.5%-quantiles of the distributions match the bounds of their respective 95% CIs. We assume that $\log(r(y))$ follows a normal distribution, with similarly calibrated mean and variance, and that $P_{any}(y, c)$ follows a binomial distribution $\text{Binom}(\hat{P}_{any}(y, c), N(y, c))$ where $\hat{P}_{any}(y, c)$ is the observed 12-month prevalence of treatment for MD and $N(y, c)$ is the number of patients at risk in year y and in type of care c .

We independently simulated a large sample of values ($N = 100\,000$) for $p_{m,y}$, $p_{h,y}$, $r(y)$ and $P_{any}(y, c)$ based on the distributions described above, thereby generating a sample of values for $\alpha(y)$ using (A3) and $\delta(y, c)$ using (A4). The bounds of the 95% CI for $\delta(y, c)$ are estimated as the 2.5%- and 97.5%-quantiles of the sample for $\delta(y, c)$.