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Prevalence of Mental, Behavioural and Neurodevelopmental Disorders among People Living with HIV

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Abstract

Background: Diagnosis of Mental, Behavioural and Neurodevelopmental Disorders among people living with HIV is common health condition. However, there is significant ethnic disparity of proportion.

Methods: We conducted a statistical analysis of blood test results, demographic, social and diagnoses features of people living with HIV in South London Hospital. The data was extracted from Electronic Patient Record (EPR) database covering the period from 2012 to 2023 (12 years). We performed analysis on a cohort of 897 people living with HIV, who are retained in care from 2020 up to 2023. Diagnoses of diseases of the cohort was identified and analysed using International Classification of Diseases (ICD-10-CM) coding system, a classification system of diagnosis codes representing conditions and diseases, related health problems, abnormal findings, signs and symptoms, injuries, and external causes of injuries and diseases.

We performed statistical observation and analysis of diagnoses codes across demographic and social features including age groups, gender, ethnicity, sexual orientation, route of infection and commercial sex worker features. Moreover, we analysed microbiology and biochemistry blood test results of the cohort over the past 12 years including Estimated GFR, Gamma- glutamyl Transferase, Globulin, CD4, Viral load etc.

Results: Our analysis showed that there is ethnic disparity of proportion of Diagnosis of Mental, Behavioural and Neurodevelopmental Disorders among people living with HIV.

White people have higher rate of experiencing mental health issues compared to the other ethnic groups. Comparing the two major ethnic groups of HIV patients - Black and White, White people are almost twice at higher risk of experiencing Mental, Behavioural and Neurodevelopmental Disorders.

Overall, 49% of White people living with HIV have been diagnosed with some form of Mental, Behavioural and Neurodevelopmental Disorders compared to 26% of Black people. Both White and Black ethnic groups represent 82% of the cohorts and have major sample size. Mental health conditions are coded under F01-F99 diagnoses codes of ICD-10-CM coding system.

Conclusions: More research is needed to investigate the risk of mental health conditions among people living with HIV and the proportion of the risk across ethnic groups in larger and diverse sample size. Support programmes are needed to improve mental health conditions in the wider population of people living with HIV, and specifically in ethnic groups with the highest rate of the condition through routine screening and integrated mental health services.

Introduction

People Living with HIV (PLHIV) have a higher risk of mental health issues than the public. HIV and related infections can affect the brain and the rest of the nervous system. This may change how a person thinks and behaves. In addition, some medications used to treat HIV may have side effects that affect a person's mental health [1]. HIV causes significant inflammation in the body. This inflammation can cause neurological complications by damaging the spinal cord and brain, which form the central nervous system. Despite effective Antiretroviral (ART), people with HIV are still at risk for central nervous system diseases associated with HIV. These diseases can be neurological (affecting the nervous system) or neurocognitive (affecting cognition or mental processing).

People living with HIV may also experience situations that negatively affect their mental health including stigma, discrimination, managing HIV medicines and medical treatment. Diagnoses of Mental, Behavioural and Neurodevelopmental Disorders are categorised under code F01- F99 of ICD-10-CM Codes. The diagnoses include the following conditions [2].

- F01-F09 Mental disorders caused by known physiological conditions
- F10-F19 Mental and behavioural disorders resulting from psychoactive substance use
- F20-F29 Schizophrenia, schizotypal, delusional, and other non-mood psychotic disorders
- F30-F39 Mood [affective] disorders
- F40-F48 Anxiety, dissociative, stress-related, somatoform and other nonpsychotic mental disorders
- F50-F59 Behavioural syndromes associated with physiological disturbances and physical factors
- F60-F69 Disorders of adult personality and behaviour
- F70-F79 Intellectual disabilities
- F80-F89 Pervasive and specific developmental disorders
- F90-F98 Behavioural and emotional disorders with onset usually occurring in childhood and adolescence
- F99-F99 Unspecified mental disorder

According to a survey in 2022 by Positive Voices, stigma and mental health problems remain highly prevalent among people living with HIV. Rates of mental health conditions are substantial, with many individuals reporting symptoms of anxiety and/or depression. Among those experiencing such symptoms, approximately half have received a formal mental health diagnosis. HIV-related stigma continues to play a significant role in the life experiences of people with HIV, with reports of verbal abuse, physical violence, exclusion from family activities, and resulting social isolation and loneliness. The combined effects of stigma, anxiety, and depression negatively impact the overall wellbeing of people living with HIV and act as major barriers to accessing HIV care, treatment services, and healthcare [3].

A systematic review study found that psychiatric disorders and sleep disturbances are significant comorbidities among people living with HIV, influencing both individual wellbeing and the selection of antiretroviral therapy (ART) [4]. Data were collected and analysed for people living with HIV (PLHIV) and the UK general population for comparison. In the UK, depression affects a higher proportion of people living with HIV than the general population. A similar disparity was observed in the preva-

lence of anxiety (22%-49% PLHIV versus 4%-5% general population), depression or anxiety (50%-58% PLHIV versus 27% general population), difficulty sleeping (61% PLHIV versus 10% population), and suicide ideation (31% PLHIV versus 1% general population) (Table 1). This review of UK data shows higher rates of psychiatric illness and sleep disturbance among people living with HIV than in the general population [4].

Table 1: Summary of systematic review of psychiatric illness in PLHIV vs UK general public Chaponda, et al [4]

Psychiatric illness	PLHIV	UK General Population
Depression	17% - 47%	2% - 5%
Anxiety	22% - 49%	4% - 5%
Sleep Disturbance	61%	10%
Suicide Ideation	31%	1%

A study by Lancet reported a higher risk of mental illness among people living with HIV compared with those without HIV [5].

It has been well documented that the prevalence of mental illness (including depression, anxiety, and severe mental illness) is higher amongst people living with HIV. Higher rates of depression, anxiety, and severe mental illness, including psychosis, schizophrenia, and bipolar disorder, were observed among people living with HIV compared with those without HIV [5].

Increased risk of mental illness was reported among people living with HIV who were White, not obese, and who did not engage in drug use or heavy alcohol consumption, relative to those from ethnic minority backgrounds [5]. HIV and mental health are closely interrelated, with poor mental health acting as both a risk factor for and a consequence of HIV. Therefore, people living with HIV should be routinely screened for mental health symptoms and supported through effective prevention, management, and outreach interventions [5].

Despite major progress in treating and preventing HIV, HIV stigma remains high, contributing to poor mental health, isolation and loneliness, and often preventing people from getting the help they need [6-9]. Evidence suggests that good mental health promotes adherence to ART (HIV treatment), contributing to sustained health and viral suppression. Despite huge progress in treatment and care, HIV remains a highly stigmatised condition. It has been recommended that HIV services include a psychologist or mental health professional within multidisciplinary teams, with psychological support integrated into national HIV service provision due to the high burden of mental health problems among people living with HIV [10].

Positive Voices 2022 is a national survey explored the lives, experiences, and healthcare needs of people living with HIV in the United Kingdom. The survey was conducted to measure psychosocial and health related factors, including mental & physical health, wellbeing, social support, Socioeconomics and stigma (Figure 1). A total of 4,618 people living with HIV participated in the survey, having been invited through local HIV clinics between April 2022 and March 2023. According to the survey mental health conditions were more prevalent among White people living with HIV than among Black people [11,12].

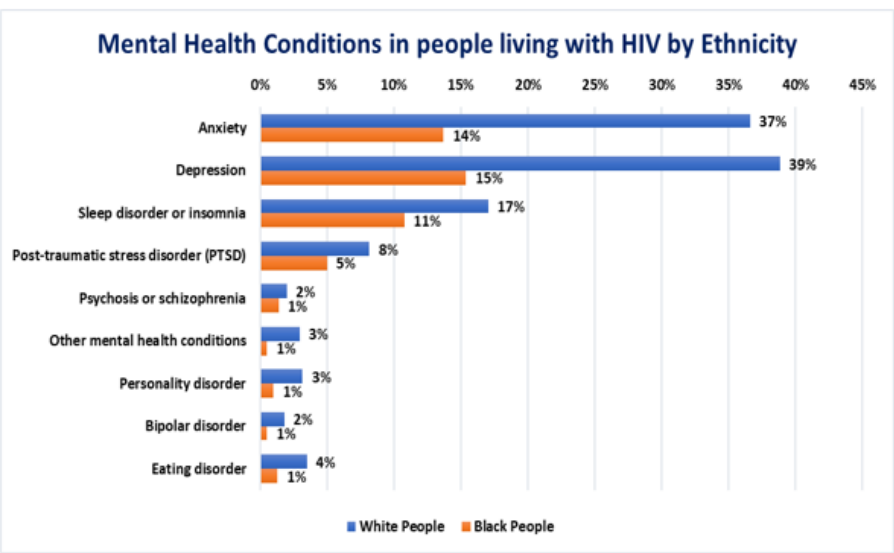

Figure 1: Positive voices 2022 national survey results

It is important for people providing psychological support to people living with HIV to understand the specific ways that HIV and mental health issues can manifest in different populations, as well as the different cultural attitudes towards them. People living with HIV are disproportionately affected by mental health problems and this can be due to a number of reasons including HIV stigma, the burden of HIV on already marginalised communities, and the challenges of living with a long-term health condition [9].

Methods

Study design and data source

The study was conducted on HIV patients who have been actively attending HIV care consultations from 2020 up to 2023 in Southeast London Hospital. The HIV patients' data used for the study was extracted and collected from various networked SQL Servers, Databases,

Tables and Views built as the backend of Electronic Patient Record (EPR) system architecture covering the period from 2012 to 2023 (12 years observations). Major data cleansing and auditing was performed at source for data type mismatch, removal of nonnumeric values, duplicate features etc.

Basic blood test results, demographics and social variables are used for the study, producing a dataset of HIV patients' microbiology and biochemistry observations mapped against diagnosis of health problems using ICD-10 (International Classification of Diseases 10th Revision) coding system.

Regular consultations, as an ongoing retention in-care, are conducted at Sexual Health and HIV Services Department Clinics using specialty EPR for recording details of the consultations. In addition, HIV patients often have consultations with other specialties of hospitals.

Demographic and Social features of the HIV patients was used to analyse the prevalence of Mental, Behavioural and Neurodevelopmental Disorders among the patients, categorized under Block Code F01-F99. The study was designed to analyse and understand the distribution of Mental, Behavioural and Neurodevelopmental Disorders across the various groups of demographic and social features of patients.

In addition to demographic and social features, CD4 and Viral Load counts has also been analysed to understand the pattern across the demographic and social groups of HIV patients. The CD4 count and viral load are the two main measures which are most commonly used to determine how HIV may be impacting on the immune system and how much HIV is in the body [7].

The demographic and social features used for the study include Age, Gender, Ethnic group, Place of birth (categorised by continents), Sexual orientation, Commercial sex worker and Route of infection. These features are further split into subgroups of common classes for the purpose of statistical analysis and interpretation (Table 2).

Table 2: Patients sociodemographic information

	Total = 897		**CD4 < 200**		**CD4 200 - 500**		**CD4 > 500**		**VL Undetected**		**VL 51 - 1,000**		**VL > 1,000**		**Code F01-F99**	
	N	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Age, years																
16 - 30	49	5%	13	27%	15	31%	21	43%	17	35%	7	14%	25	51%	18	37%
31 - 40	123	14%	33	27%	56	46%	34	28%	48	39%	13	11%	62	50%	47	38%
41 - 50	252	28%	74	29%	92	37%	86	34%	145	58%	28	11%	79	31%	72	29%
51 +	473	53%	116	25%	184	39%	173	37%	272	58%	78	16%	123	26%	173	37%
Gender																
Female	386	43%	99	26%	144	37%	143	37%	213	55%	40	10%	133	34%	102	26%
Male	510	57%	137	27%	202	40%	171	34%	268	53%	86	17%	156	31%	208	41%
Trans	1	0%	0	0%	1	100%	0	0%	1	100%	0	0%	0	0%	0	0%
Ethinicity																
White	238	27%	52	22%	88	37%	98	41%	138	58%	26	11%	74	31%	116	49%
Black	499	56%	127	25%	208	42%	164	33%	272	55%	75	15%	152	30%	128	26%
Asian	8	1%	5	63%	1	13%	2	25%	3	38%	2	25%	3	38%	3	38%
Mixed	49	5%	11	22%	16	33%	22	45%	23	47%	7	14%	19	39%	23	47%
Other	103	11%	41	40%	34	33%	28	27%	46	45%	16	16%	41	40%	40	39%
Place of Birth																
Europe	314	35%	75	24%	112	36%	127	40%	168	54%	39	12%	107	34%	153	49%
Africa	389	43%	92	24%	164	42%	133	34%	229	59%	57	15%	103	26%	71	18%
Carribean	44	5%	10	23%	15	34%	19	43%	24	55%	11	25%	9	20%	19	43%
South_America	22	2%	3	14%	12	55%	7	32%	10	45%	2	9%	10	45%	4	18%
Asia	9	1%	3	33%	3	33%	3	33%	5	56%	1	11%	3	33%	3	33%
Middle-East	2	0%	0	0%	0	0%	2	100%	1	50%	0	0%	1	50%	2	100%
North_America	3	0%	1	33%	0	0%	2	67%	1	33%	0	0%	2	67%	1	33%
Oceania	6	1%	0	0%	3	50%	3	50%	5	83%	1	17%	0	0%	1	17%
Not_Stated	108	12%	52	48%	38	35%	18	17%	39	36%	15	14%	54	50%	56	52%
Sexual Orientation																

Heterosexual	471	53%	120	25%	186	39%	165	35%	261	55%	75	16%	135	29%	130	28%
Homosexual	191	21%	25	13%	69	36%	97	51%	119	62%	22	12%	50	26%	85	45%
Bisexual	25	3%	2	8%	13	52%	10	40%	14	56%	5	20%	6	24%	6	24%
Not_Stated	209	23%	88	42%	79	38%	42	20%	88	42%	24	11%	97	46%	88	42%
Not_Defined	1	0%	1	100%	0	0%	0	0%	0	0%	0	0%	1	100%	1	100%
Route of Infection																
Sex between men	251	28%	47	19%	94	37%	110	44%	148	59%	29	12%	74	29%	110	44%
Sex between men and women	554	62%	150	27%	223	40%	181	33%	292	53%	82	15%	180	32%	157	28%
Injected drug use	21	2%	8	38%	8	38%	5	24%	10	48%	3	14%	8	38%	13	62%
Contact with blood products	6	1%	3	50%	0	0%	3	50%	2	33%	1	17%	3	50%	1	17%
Exposure via health care work	1	0%	0	0%	1	100%	0	0%	1	100%	0	0%	0	0%	1	100%
Mother to Child transmission	22	2%	7	32%	6	27%	9	41%	7	32%	4	18%	11	50%	6	27%
Not_stated	42	5%	21	50%	15	36%	6	14%	22	52%	7	17%	13	31%	22	52%
Commercial Sex Worker																
No	748	83%	172	23%	290	39%	286	38%	434	58%	103	14%	211	28%	248	33%
Current	2	0%	0	0%	1	50%	1	50%	1	50%	1	50%	0	0%	0	0%
Previous	4	0%	1	25%	2	50%	1	25%	2	50%	0	0%	2	50%	4	100%
Not_Stated	143	16%	63	44%	54	38%	26	18%	45	31%	22	15%	76	53%	58	41%

Analysis

We performed analysis of the prevalence of Mental, Behavioural and Neurodevelopmental Disorders among people living with HIV in a cohort of 897 patients actively retained in HIV care. Detailed distribution of Age Group, Gender, Ethnicity, Place of Birth, Sexual Orientation, Commercial Sex Worker and Route of Infection categories of the cohort is shown in Table1.

The cohort of 897 patients is headcount of HIV patients, and their latest CD4 and Viral Load results are also considered for the study to assess how the HIV infection is impacting the patients. All HIV patients actively retained in care, who have had latest CD4 and Viral Load results and have had diagnosis of any form of health problems are considered for the research. Therefore we haven't applied any sampling or selection criteria.

The highest proportion of the cohort are Black and White Ethnic groups, constituting 82% of the cohort with 56% Black and 27% White ethnic groups. The other 18% are Asian, Mixed and Other ethnic groups. Therefore, we have excluded Asian, Mixed and Other ethnic groups from our analysis of mental health issues as they are minorities in number.

The proportion of F01-F99 diagnosis among Black ethnic groups is 26% while the proportion among White people is 49%. The analysis shows that White ethnic groups living with HIV experience Mental, Behavioural and Neurodevelopmental Disorders almost twice as much as Black people (Figure 2).

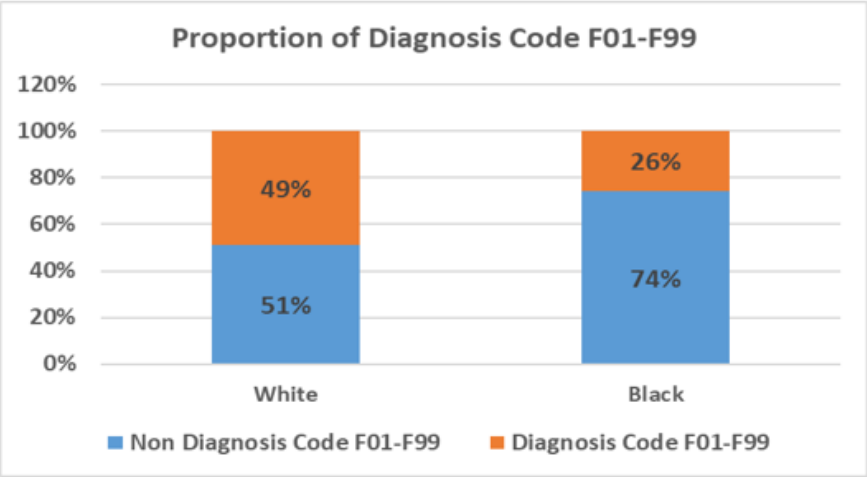

Figure 2: Prevalence of Mental, Behavioural and Neurodevelopmental Disorders among White and Black ethnic groups

Density plot of CD4 and Viral Load distribution of White and Black ethnic groups is presented to show the pattern, results and the effect of adherence to Antiretroviral Therapy (Figures 3 and 4).

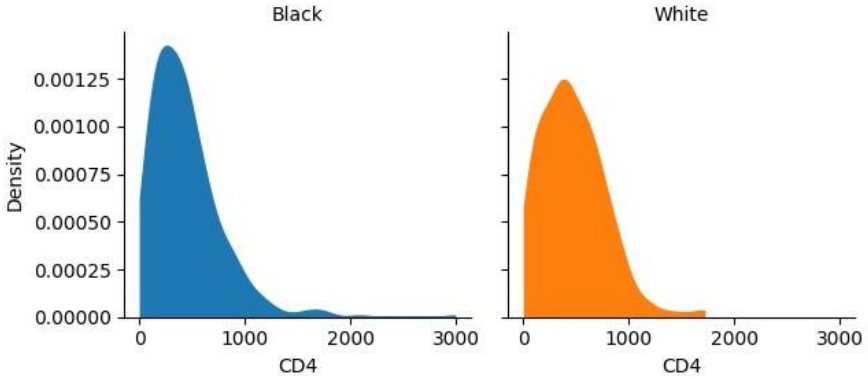

Figure 3: Last test result of CD4 distribution across White and black ethnic groups

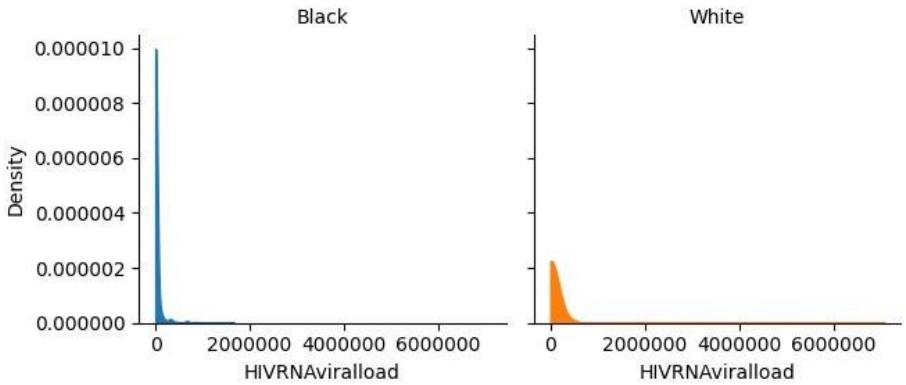

Figure 4: Last test result of Viral Load distribution across White and black ethnic groups

Age group and gender distribution of Mental, Behavioural and Neurodevelopmental Disorders among Black and White people living with HIV is summarised in the following charts. Generally, there is similarity with age group distribution, however, female White people with the condition are extremely low compared to male White people while Black male and female people are proportionally distributed (Figure 5).

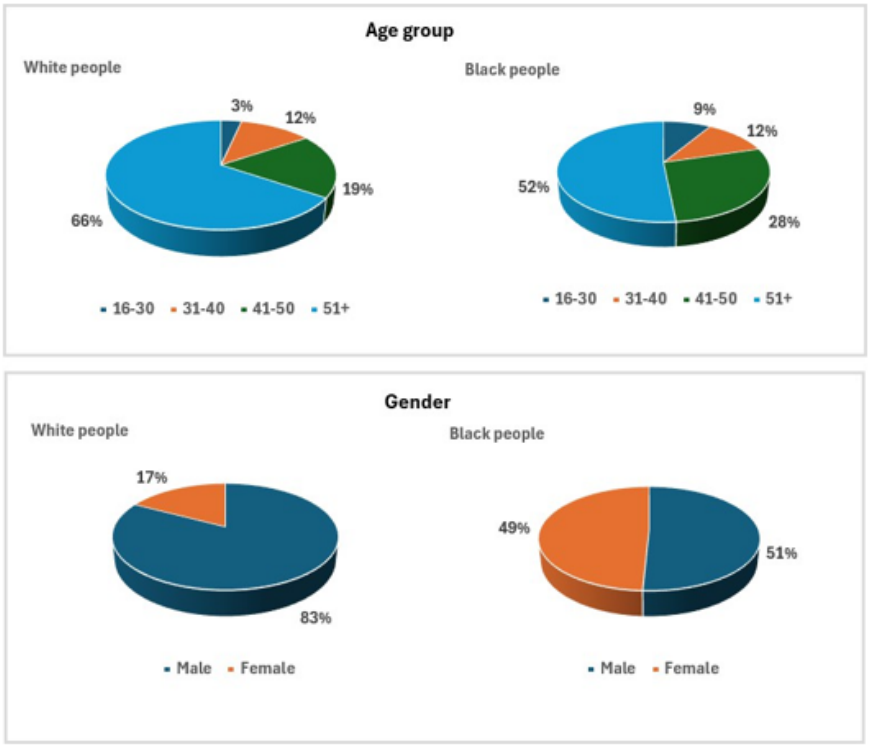

Figure 5: Distribution of Mental, Behavioural and Neurodevelopmental Disorders among people living with HIV

Cross-sectional analysis of male and female people living with HIV; diagnosed with Mental, Behavioural and Neurodevelopmental Disorders in Black and White people across various age group is summarised in the following Figure 6. The trend is that more than half percent of both Black and White people diagnosed with Mental, Behavioural and Neurodevelopmental Disorders are older people. With advances in antiretroviral therapy, people living with HIV can expect to live longer and healthier than ever before if treatment is started at the time of diagnosis and taken as prescribed.

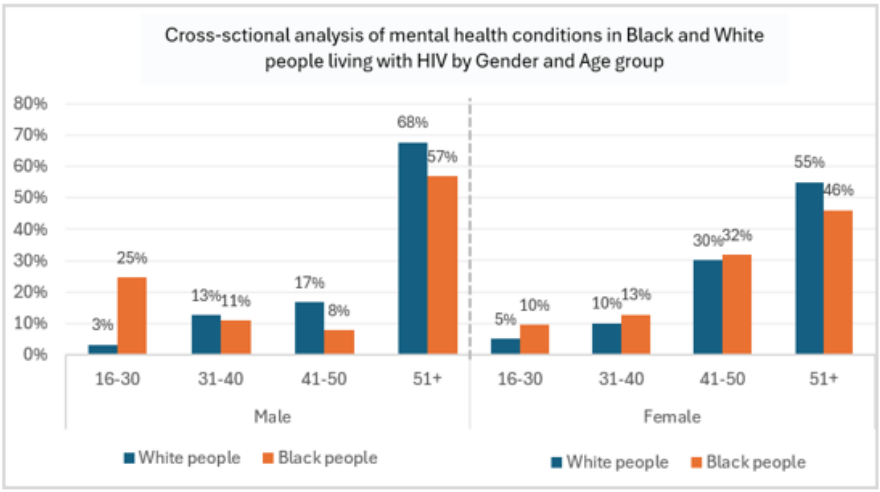

Figure 6: Cross-sectional analysis of Mental, Behavioural and Neurodevelopmental Disorders in Black and White people living with HIV by Gender and Age group

Statistical hypothesis test

Our data indicates that 116 out of 238 White people have experienced Mental, Behavioral and Neurodevelopmental Disorders while 128 out of 499 Black people experienced the same mental health issues. We are testing two proportions of independent groups, therefore, we use the Z- score statistic test.

The difference of two proportions follows an approximate normal distribution. We are testing whether mental health issues in White people is significantly greater than Black people.

Given:

N_W (number White people) = 238

N_B (number of Black people) = 499

$\hat{P}_W$ (proportion of White people) = 116/238 = 49%

$\hat{P}_B$ (proportion of Black people) = 128/499 = 26%

Hypothesis test

The null hypothesis, H_O, states that the two proportions are the same: H_O: $P_W = P_B$ or $P_W - P_B = 0$

The alternative hypothesis, H_a, states that the proportion of white people is greater than Black people.

H_a: $P_W > P_B$ or $P_W - P_B > 0$

Random variable

$\hat{P}_W - \hat{P}_B$ is the difference in the proportions of White and Black people, and follows an approximate normal distribution.

$\hat{P}_W - \hat{P}_B = 0.4G - 0.26 = 0.23$ Or 23%

Result

At 95% confidence level the result of Z-score, P-value, Lower Boundary (LB) and Upper Boundary (UB) calculations shows as follows:

Z-score = 6.227G; P-value = 0.0000000002363'; LB = 0.15822; UB = 0.30354

Interpretation

Since $\hat{P}_W - \hat{P}_B$ is significantly greater than the P-value, we reject H_O.

The Z-score of 6.2279 indicates that the observed result is 6.23 standard deviations away from the mean proportion, which is an exceptionally high deviation from what would be expected under the null hypothesis. The high Z-score suggests that the observed effect or test statistic is far from the mean and thus unlikely to be due to random chance if the null hypothesis were true.

The p-value is very close to zero, meaning the probability of observing such an extreme Z-score by random chance (assuming

the null hypothesis is true) is extremely small—effectively near zero. Since the p-value is well below any conventional significance level (e.g., 0.05, 0.01, or even 0.001), it strongly indicates that the null hypothesis can be rejected with confidence. There is strong evidence that the observed effect is statistically significant.

With 95% confidence, the true value of the population parameter (such as a proportion difference) lies between 0.15822 (16%) and 0.30354 (30%).

In Summary High Z-score and extremely low p-value provide strong evidence to reject the null hypothesis. This strongly suggests that the observed effect is not due to random chance. The positive range of the confidence interval (0.15822 to 0.30354) indicates that the effect is positive. This interval suggests that the true effect size likely falls within this range at a 95% confidence level. The combination of a very high Z-score and near-zero p-value reflects a highly significant result, implying a strong degree of confidence that there is a real effect.

Discussion

Various research indicate that mental health issues is higher in people living with HIV than in the general population [8]. Among the most prevalent mental health issues include mood, anxiety, and cognitive disorders. Depression is one of the most common mental health conditions faced by people with HIV. HIV and related infections can also affect the brain and the rest of the nervous system. Some medications used to treat HIV may also have side effects that affect a person's mental health.

HIV causes significant inflammation in the body. This inflammation can cause neurological complications by damaging the spinal cord and brain, which form the central nervous system. Despite effective ART, people with HIV are still at risk for central nervous system diseases associated with HIV. These diseases can be neurological (affecting the nervous system) or neurocognitive (affecting cognition or mental processing) [9].

However, there is significant disparity of mental health issues among various ethnic groups of HIV infected people. Our study shows that White people are twice as much likely to experience mental health issues than Black people. The study was conducted in one hospital of Southeast London. Therefore, extensive research and discussion is required to determine the reason, causes and factors associated with mental health and HIV, and the proportion of the issue among various ethnic groups.

Conclusion

Our research shows that there is disparity of proportion of mental health issues among people living with HIV. Extensive research in various hospitals and locations is required to understand the proportion among various ethnic groups of HIV patients in larger sample size, the causes and determinant factors. Research based evidence would help to develop a strategy for integrating mental health services into routine HIV care. HIV-specialist counselling and psychological therapies are some forms of mental health services commonly used to improve mental health of people living with HIV. Addressing the mental health needs of people living with HIV improves adherence to HIV treatment, helping people to stay healthy and maintain an undetectable viral load.

Conflict of Interest

The authors declare there are no conflicts of interest.

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