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ORIGINAL RESEARCH

High-risk behaviours, and their associations with mental health, adherence to antiretroviral therapy and HIV parameters, in HIV-positive men who have sex with men

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Objectives
To investigate the patterns and frequency of multiple risk behaviours (alcohol, drugs, smoking, higher risk sexual activity) among men who have sex with men (MSM) living with HIV.

Methods
Cross sectional study.

Results
147 out of 819 HIV-positive MSM exhibited a high-risk phenotype (defined as >3 of smoking, excess alcohol, sexually transmitted infection and recent recreational drug use). This phenotype was associated with younger age, depressive symptoms and <90% adherence in multivariable logistic regression.

Conclusion
In a cohort of MSM, a small, but significant proportion exhibited multiple concurrent risk behaviours.

Keywords: adherence, HIV, mental health, recreational drugs, risk behaviours

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Introduction

As life expectancy has increased for people living with HIV (PLHIV), the focus of HIV care has shifted towards the prevention and treatment of noncommunicable diseases (NCDs) [1]. Many NCDs are associated with factors such as tobacco, alcohol and recreational drug use, which are highly prevalent in PLHIV [2]. Although the health effects of these behaviours are established, the pattern and health impact of concurrent behaviours are not well defined among PLHIV.

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Syndemics theory highlights that behaviours do not occur in a vacuum but can be intertwined and mutually enhancing [3]. A strong association between use of alcohol/drugs and condomless sex was demonstrated in the UK general population, and participants exhibiting these behaviours were characterized as socio-economically deprived and of white ethnicity [4]. An increased rate of condomless sex with casual partners has been reported in men who have sex with men (MSM) living with HIV, particularly in the context of chemsex [5,6]. Mental health conditions, particularly anxiety and depression, are disproportionately prevalent among PLHIV [7,8], and strong associations have been reported between alcohol or drug use and psychiatric conditions [9]. However, little is known about the relationship between risk behaviours and mental health conditions in older PLHIV.

In this study, we investigated the patterns and frequency of multiple risk behaviours among MSM PLHIV

participating in the Pharmacokinetic and Clinical Observations in People over Fifty (POPPY) study and investigated whether the presence of multiple risk behaviours was associated with markers of HIV disease or mental health problems.

Methods

POPPY is a prospective, cohort study conducted at seven sites in the UK and Ireland that aims to investigate the impact of HIV on comorbidities and pharmacotherapy among PLHIV as they age [10]. The present analyses used cross-sectional baseline data from HIV-positive POPPY participants only collected at baseline POPPY visits between April 2013 and February 2016.

Four key behaviours were considered: current smoking, recreational drug use in the past 6 months, alcohol consumption > 21 units/week and a diagnosed sexually transmitted infection (STI) within the last 12 months. The 'high-risk phenotype' was defined as exhibiting three or four of these behaviours. As almost all participants who exhibited the high-risk phenotype were MSM (95%), the analysis was restricted to this group.

Current depressive symptoms were measured via the Patient Health Questionnaire (PHQ-9) and Center for Epidemiologic Studies Depression (CES-D) [11,12]. Adherence to antiretroviral therapy (ART) was captured via a self-completed questionnaire, and CD4 count and HIV viral load were collected through linkage with national cohorts [10].

Statistical analysis

We performed univariate analysis of associations with the high-risk phenotype using Pearson's χ^2 test for binary variables and logistic regression for categorical and continuous variables. Logistic regression was also used to investigate if the high-risk phenotype was associated with an increased risk of mental health problems, poorer ART adherence, detectable viral load and low CD4 count. Participants were classified as having a history of mental health outcomes if they reported this in their medical history, whereas a PHQ-9 score ≥ 5 and a CES-D score ≥ 16 were considered as indicating current depressive symptoms. Analyses of these outcomes were adjusted for age, work status, whether the patient had sufficient money, duration of HIV infection and number of ART drugs to which the patient was exposed. ART adherence was categorized as < 90%/≥ 90%, CD4 count as < 350/> 350 cells/μL and viral load as < 50/≥ 50 HIV-1 RNA copies/mL. Analyses of CD4 count and viral load included adjustment for age, duration of HIV infection and work status, whereas analyses of ART adherence included adjustment for work status only because of the low number of participants reporting < 90% adherence. All analyses were conducted in STATA (version 14, StataCorp LLC, College Station, Texas, USA).

Results

The median age of the 819 MSM was 52 (range 20–80) years; 99.6% (816 of 819) were of white ethnicity. The median time since HIV diagnosis was 14.5 (range 0–31) years, 98.1% (803 of 819) were on ART, the median CD4 count was 630 (range 90–2513) cells/μL, and 90.8% (744 of 819) had a viral load < 50 copies/mL. Baseline characteristics are reported elsewhere [10].

Over a quarter of participants (27.7%) were current smokers, and 17.2% drank > 21 units of alcohol/week. Around a third (34.2%) had used recreational drugs within the past 6 months, most frequently cannabis, and three-quarters (74.1%) reported an STI in the past 12 months, most frequently gonorrhoea and syphilis.

Only 103 participants (12.6%) reported no risk behaviours. Overall, 17.9% (147 of 819) participants reported three or four of the behaviours and were defined as exhibiting the high-risk phenotype. Within the high-risk phenotype, the most frequently observed combination of risk behaviours was smoking, drugs and STI, reported by 85 of 103 participants (57.8%). The combination of drugs, alcohol and STI was reported by 29 (19.7%) participants and that of smoking, alcohol and STI was reported by 14 (9.5%) participants. Eleven participants (7.5% within the high-risk phenotype) reported all four risk behaviours.

The prevalence of the high-risk phenotype decreased from 33.3% in those aged < 35 years to 9.1% in those aged > 65 years. In univariate analyses, each 10-year increment in age was associated with a reduction in the odds of the high-risk phenotype of 29% (Table 1). No other factor was independently associated with the high-risk phenotype in adjusted analysis (Table 1).

In total, 320 participants (39.1%) reported a mental health diagnosis, most commonly depression and anxiety; 64 of the 144 participants (44.4%) with the high-risk phenotype and 256 of the 675 participants (37.8%) without it. There was no evidence of an association between the high-risk phenotype and mental health diagnoses either in unadjusted [odds ratio (OR) 1.31; 95% confidence interval (CI) 0.91–1.88; $P = 0.15$] or adjusted (OR 1.29; 95% CI 0.86–1.92; $P = 0.22$) analyses. Of those with complete data, 46.2% and 34.9% had scores consistent with current depressive symptoms for PHQ-9 and CES-D respectively. In contrast to the findings for mental health diagnoses, there was strong evidence of an association

Table 1 Unadjusted and adjusted (for age) associations between participant characteristics and the high-risk phenotype

Characteristic	Total	*n* (%) with high-risk phenotype*	Unadjusted OR (95% CI), *P*	Adjusted OR (95% CI), *P*
Age (years)				
Median (range)		51 (21, 81)	0.71 (0.59, 0.84), < 0.001	0.71 (0.59, 0.84) < 0.001
< 35 years	54	18 (33.3)		
35–45 years	115	26 (22.6)		
45–55 years	330	63 (19.1)		
55–65 years	243	30 (12.3)		
> 65 years	77	7 (9.1)		
Country of birth				
UK	595	100 (16.8)	1	1
Rest of the world	224	44 (19.6)	1.21 (0.82, 1.79), 0.34	1.05 (0.70, 1.57), 0.83
Work				
Employed/full-time education	382	75 (19.6)	1	1
Unemployed	176	37 (21.0)	1.09 (0.70, 1.69), 0.70	1.25 (0.80, 1.97), 0.33
Retired	146	18 (12.3)	0.58 (0.33, 1.00), 0.05	0.99 (0.52, 1.88), 0.97
Unknown	115	14 (12.2)	0.57 (0.31, 1.05), 0.07	0.63 (0.34, 1.17), 0.14
Housing				
Owned/rented	682	125 (18.3)	1	1
Insecurely housed	42	7 (16.7)	0.89(0.39, 2.05), 0.79	0.69 (0.29, 1.62), 0.40
Unknown	95	12 (12.6)	0.64 (0.34, 1.22), 0.18	0.59 (0.31, 1.11), 0.10
Enough money?				
Yes, all the time	404	75 (18.6)	1	1
Yes, mostly	110	17 (15.5)	0.80 (0.45, 1.42), 0.45	0.71 (0.40, 1.28), 0.26
Yes, sometimes	46	13 (28.3)	1.73 (0.87, 3.44), 0.12	1.54 (0.76, 3.09), 0.23
No	10	0 (–)	n/a	n/a
Unknown	249	39 (15.7)	0.81 (0.53, 1.24), 0.34	0.78 (0.51, 1.20), 0.26
Education				
≤ High school	183	31 (16.9)	1	1
A levels/college	198	37 (18.7)	1.13 (0.67, 1.91), 0.66	1.05 (0.62, 1.79), 0.86
≥ University degree	345	64 (18.6)	1.12 (0.70, 1.79), 0.65	1.00 (0.62, 1.62), 0.99
Unknown	93	12 (12.9)	0.73(0.35, 1.49), 0.38	0.63 (0.30, 1.30), 0.21
Time since HIV diagnosis (years) [median (range)]		8 (0, 26)	0.99 (0.96, 1.01), 0.19	1.01 (0.98, 1.03), 0.69
On ART at baseline				
Yes	803	137 (17.1)	1	1
No, ART naïve	6	3 (50.0)	4.86 (0.97, 24.34), 0.05	3.06 (0.60, 15.68), 0.179
No, previous use only	10	4 (40.0)	3.24 (0.90, 11.64), 0.07	2.47 (0.67, 9.08), 0.17
ART start date				
≥ 2004	418	79 (18.9)	1	1
1996–2003	296	46 (15.5)	0.79 (0.53, 1.18), 0.25	1.04 (0.67, 1.60), 0.86
< 1996	95	15 (15.8)	0.80 (0.44, 1.47), 0.48	1.13 (0.60, 2.14), 0.71
Never been on ART	10	4 (40.0)	2.86 (0.79, 10.38), 0.11	2.44 (0.66, 9.06), 0.18
Number of unique ART drugs [median (range)]		6 (0, 19)	0.97 (0.92, 1.03), 0.32	1.00 (0.95, 1.06), 0.98

ART, antiretroviral therapy; CI, confidence interval; OR, odds ratio.
*Unless otherwise stated.

between the high-risk phenotype and current depressive symptoms, with 56.9 and 45.5% of those with the high-risk phenotype reporting a PHQ-9 score > 5 and a CES-D score > 16, respectively, compared with only 43.8 and 32.6% of those without the high-risk phenotype (PHQ-9 > 5: aOR 1.82; 95% CI 1.12–2.75; $P = 0.004$; CES-D > 16: aOR 1.83; 95% CI 1.20–2.79; $P = 0.005$).

Of participants on ART at baseline, only 33 (5%) reported < 90% ART adherence in the past month (9.5% of those with the high-risk phenotype and 3.0% of those without). Participants exhibiting the high-risk phenotype were 3.32 times as likely to report < 90% adherence as those who did not (aOR 3.32; 95% CI 1.61–6.87; $P = 0.001$). Fifty-nine (7.3%) of those on ART at baseline had a detectable viral load (11.1% of those with the high-risk phenotype and 8.3% of those without) and 71 (8.7%) had a CD4 count < 350 cells/μL (6.3% of those with the high-risk phenotype and 9.2% of those without). There was no evidence of an association between the high-risk phenotype and either a detectable viral load (aOR 1.13; 95% CI 0.61–2.07; $P = 0.70$) or a low CD4 count (aOR 0.63; 95% CI 0.29–1.35; $P = 0.23$) in adjusted analyses.

Discussion

In a cohort of HIV-positive MSM, we demonstrated the presence of a 'high-risk phenotype' of multiple concurrent risk behaviours in a small but significant proportion of participants. The likelihood of exhibiting this high-risk phenotype decreased with increasing age, but was demonstrable across all age groups. Such high-risk behaviours are commonly considered to be a phenomenon of youth [4], but these data emphasize that drugs, alcohol, smoking and STIs must be considered in all age groups of HIV-positive MSM.

Mental health conditions and symptoms of depression were common in this cohort; participants reporting the high-risk phenotype had increased risks of all three measures of poor mental health status, consistent with the findings from the general population [4]. Potential mechanisms for this relationship could include use of substances to cope with mental health symptoms, or risk of mental health problems secondary to substance use [5].

In our analyses, participants who exhibited the high-risk phenotype were three times more likely to report < 90% ART adherence, consistent with data from the USA, where alcohol consumption and drug use were associated with poorer reported adherence among older PLHIV [2]. The apparent inconsistency between our findings of an association with 90% adherence but not with viral load suppression may reflect the fact that modern ART regimens do not require such high levels of adherence to maintain viral suppression. Alternatively, our analyses may be affected by responder bias (adherence was self-reported) or by the fact that, while adherence was reported for the month prior to interview, the viral load may have been obtained up to 6 months prior to interview.

The strengths of our study include the large sample size, standardized measurement of mental health conditions, and linkage to national cohorts. While participants were predominantly white cisgender MSM, limiting generalizability to other groups, the sample did broadly reflect the demographics of MSM PLHIV in the UK [13]. We note that the small numbers of participants in some subgroups may have resulted in lack of power, and information on self-reported STIs and mental health diagnoses may have been incomplete. Finally, the cross-sectional nature of this study means that we were unable to establish the direction of any relationships.

Our study provides new evidence of concurrent risk behaviours in HIV-positive MSM. In addition to the identification of clustered high-risk behaviours in older age groups, we have demonstrated associations between this phenotype and current symptoms of depression and poorer adherence, highlighting the clinical relevance of this phenotype. Future research could investigate causality and the direction of the relationships observed through use of longitudinal data.

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Authors' contributions

ERMP, CAS and AW contributed to the study concept and design, analysis and interpretation of data and drafting of the manuscript. EB contributed to analysis and interpretation of data and critical revision of the manuscript. JHV, PWGM, MS, FAP, AP, MB, JA, IW, MJ and LB contributed to the acquisition of data and revision of the manuscript. All authors read and approved the final manuscript.

Justification of the number of contributors

This multi-site study reflects the work of a large number of individuals. The authors listed were all actively involved in the development of the study protocol, the interpretation of study findings, and preparation and approval of the manuscript.

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