Predictors of Physical Activity Recording in Routine Mental Healthcare

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ABSTRACT

Physical activity (PA) is beneficial for those with mental illness. However, it is unclear what influences clinicians' decisions to record PA. We conducted the first study to examine PA recording and its predictors in clinical settings, using data from routine mental health records in a secondary mental health service.

A retrospective study using anonymised electronic health record data was conducted. Patients with any psychiatric diagnosis who had PA recorded were matched to controls (1:5) who were active in hospital at that time and did not have PA recorded. Multivariable logistic regressions were conducted to examine how sociodemographic factors and health status predict PA recording.

5034 patients (839 with PA recorded and 4195 matched controls) with mental disorders were included in the analysis [mean (SD) age=44 (17) years; 50.0% males]. Being hospitalized in the past year (OR=8.9; 95%CI=6.8-11.54) and having hallucinations (OR=1.75; 95%CI=1.37-2.24) were significantly associated with higher odds for PA recording. Mental disorder diagnosis of organic mental disorders, neurotic/stress-related disorders and disorders of psychological development were significantly associated with lower odds of PA recording.

These results highlight which patients were more likely to have PA recorded. These findings can be used to advocate for more training and resources in mental health care around PA counselling and recording.

Key words: Physical activity, electronic patient health records, mental illness, physical health, schizophrenia, bipolar disorder

1. Introduction

Individuals with serious mental illness (SMI) including depression, bipolar disorder and schizophrenia live 10-20 years less than the general population (Walker et al., 2015). This mortality gap has been linked to an increased prevalence of metabolic syndrome, cardiovascular disease, type-2 diabetes, cancer, alongside many physical health side effects of pharmacotherapy (Correll et al., 2017; Firth et al., 2019; Solmi et al., 2019). Other factors related to inequalities in healthcare provision, such as reduced access to services, may also play a role in this large mortality gap (Firth et al., 2019; Lawrence & Kisely, 2010; Solmi et al., 2019). Furthermore, those with SMI encounter many health-related and lifestyle issues, and report limited life satisfaction (Hoffman et al., 2015). Of equal concern, while psychotic disorders are the cause of the largest mortality disparity in mental disorders, more deaths are attributable overall to mood and anxiety disorders (Bradford & Cunningham, 2015). Furthermore, the physical health of those with eating disorders such as anorexia nervosa is poorer; those with anorexia nervosa have lower bone mineral density, and increased odds of osteoporosis and risks of bone fracture, compared to healthy controls (Solmi et al., 2016). Anorexia nervosa is also associated with a substantial increased mortality, compared to other eating disorders (Arcelus et al., 2011). Physical activity (PA) may be one way to improve both the physical and mental health of those with SMI (Ashdown-Franks et al., 2019; Vancampfort et al., 2019). However, individuals with SMI and most mental disorders engage in significantly less PA, compared to the general population (Vancampfort et al., 2017).

It is now well established that PA confers many benefits for individuals with various mental illnesses. For example, PA has been shown to increase exercise capacity, fitness, improve waist circumference and improve metabolic syndrome (Schmitt et al., 2018, Vancampfort et al., 2019, Romain et al., 2018), physical health (Stubbs et al., 2018a), and cognition (Firth et al., 2017) among those with schizophrenia. Furthermore, current evidence suggests that structured PA can improve mental health symptoms in individuals with

depression, pre/postnatal depression, anxiety and stress related disorders (Ashdown-Franks et al., 2019). Given the potential benefits of PA in a range of health domains and diagnoses, and its low-risk nature, PA has recently been outlined as a treatment for mental illness in a number of countries (Stubbs et al., 2018a, Carneiro et al., 2018). However, despite this, and despite mandatory cardiometabolic screening guidelines such as the National Audit of Schizophrenia (2014), those with SMI consistently experience a lack of monitoring of key parameters of ill physical health (De Hert et al., 2011; Firth et al., 2019).

However, various barriers may prevent those with mental illness from becoming or staying active. Importantly, lack of support and of lack of knowledge about PA were commonly cited in a meta-analysis of barriers to PA, and many individuals with SMI report they would exercise more if given advice by a physician (Firth et al., 2016). As such, clinicians may be uniquely situated to provide PA information and support to this population. Researchers and practitioners have recommended that healthcare systems incorporate PA assessment and promotion strategies (Kraus et al., 2015, Patrick et al., 2009, Kohl et al., 2012). Indeed, the American Heart Association recently released a scientific statement underlining the importance of PA (Lobelo et al, 2018) as well as cardiorespiratory fitness assessment and promotion (Ross et al.,2016) in clinical settings. Alongside this, some health care practices have begun to incorporate PA recording in their electronic patient health records (EPHRs) (Grant et al., 2013). It has been suggested that a key first step in the integration of PA as part of treatment in is its routine assessment (Sallis, 2011).

The evidence suggests that the incorporation of the Physical Activity Vital Signs (PAVS, Greenwood et al., 2010) in EPHRs, which involves asking on how many days that week the individual has been active, and for how long, can result in positive health outcomes. Having information about PA in the EPHR provides the opportunity for clinicians to discuss (and potentially counsel on) the PA habits of their patients (Lobelo et al., 2018). In the USA, Kaiser Permanente Southern California imbedded the PAVS alongside checking other vital signs (blood pressure, heart rate etc.) prior to giving patients a room. This was implemented across 5 medical regions in Southern California, and of the centres that

employed this, in 2015, 80-96% of outpatients had the PAVS documented (Lobelo et al., 2018). Finally, when compared to patients in control medical centres, those from PAVS implemented centres showed statistically significant improvements in metabolic outcomes and weight loss, from baseline to follow up (Grant et al., 2014). The routine recording of PA was recently recommended in the European Psychiatric Association position statement on PA and mental illness (Stubbs et al., 2018a).

Despite the benefits of PA for people with mental illness (Ashdown-Franks et al., 2019), the suggestions that PA should form a routine part of mental health care (Stubbs et al., 2018a, Firth et al., 2019) and be recorded in clinical practice (Stubbs et al., 2018a), little is known about PA recording in mental health services and what influences PA reporting. While it is clear that the electronic recording of PA may have positive effects in primary health care, this has yet to be examined in secondary mental health care settings. Thus, among secondary mental health services, it remains unclear whether clinicians are having these discussions, in what context, and among what populations. The purpose of this study was to assess predictors of having PA recorded (i.e. by health status, diagnosis) by mental healthcare clinicians in a large mental health trust in South London. It was hypothesized that poor health status would predict PA recording; as clinicians would record and monitor PA for people they think have some type of health risk.

2. Methods

2.1. Study setting and data source

Using data from the South London and Maudsley NHS Foundation Trust (SLaM) Biomedical Research Centre (BRC) Case Register, a restrospective observational study was conducted. SLaM is one of the largest mental healthcare providers in Europe, serving the South London boroughs of Lambeth, Lewisham, Southwark, and Croydon. These four boroughs have a

population of more than 1.3 million people. Data for this study were obtained from the Clinical Record Interactive Search (CRIS) application, which allows research use of an anonymised version of SLaM's electronic health record within a vigorous governance framework (Perera et al., 2016). The SLaM BRC Case Register has supported a range of studies (Mueller et al., 2018, Kesserwani et al., 2019) and has been described in detail (Perera et al., 2016). Currently, CRIS contains archived data on over 400,000 cases and the database, with associated data linkages, has approval for secondary analysis (Oxford Research Ethics Committee C, reference 18/SC/0372). CRIS contains structured and free text information and a number of natural language processing applications have been developed to identify information from peoples' medical records (Perera et al., 2016).

2.2. Participants and study period

When an individual registers with SLaM, they receive a primary mental health diagnosis according to ICD10 criteria (World Health Organization, 1993). For the purpose of this study, all ICD10 mental, behavioural and neurodevelopmental disorders (F01-F99) were included.

All SLaM patients who had the PA portion recorded as part of a Community Physical Health Screen (CPHS) completed (since its implementation in 2016, to the data extraction in November 2018), and who were over 18 years of age, were included. A control group (5 controls to 1 case) was created of individuals without recorded PA information (i.e. who either had the CPHS Screen filled out, but not the PA component, or who didn't have the screen filled out at all). These individuals were matched based on time active in SLaM services. Specifically, controls were matched to cases if they were both active in any team episode, but not in a ward stay, on the day of the case's most recent CPHS assessment. For both cases and controls, this day was defined as the index date.

2.3. Primary outcome: PA Recording

The primary outcome of the current study was whether PA had been recorded by the clinician in the structured text of the CPHS. Briefly, the CPHS was implemented in 2016, and includes questions on patients' lifestyle behaviours (PA, diet, smoking etc). Based on the PAVS portion of the CPHS (Greenwood et al., 2010), patients were asked two questions: "On how many days in the past week have you engaged in moderate to vigorous physical activity, such as a brisk walk?" (with response options on a 1 to 7 Likert-type scale) and "For how many minutes on average, did you engage in physical activity at this level?" These two questions are recommended in the PA vital sign research (Greenwood, 2010) and enable the calculation of the total amount of moderate-vigorous PA per week and establish if a person is meeting recommended guidelines. Patients were classified as being in the PA-recorded group (case group) if either both questions had been completed, or just the first one. If patients had more than one screen completed, the most recent one was used.

2.4. Covariate measurements of health status and confounders

Additional measurements were obtained from CRIS for all cases and controls. All covariates were defined according to the value on or closest to the index date. Demographic covariates (independent variables) comprised: age, sex, and index of multiple deprivation (IMD 2010) for the neighbourhood of residence (Lower Super Output Area), as used in previous CRIS studies (Das-Munshi et al., 2017; Stubbs et al., 2018b). The IMD assesses and includes area-level deprivation from Census data across several domains including income, employment, health, education, barriers to housing and services, living environment, and crime (Richardson et al., 2009). Information on cohabiting status (Cohabiting: married/civil partner, married, cohabiting; Noncohabiting: single, divorced, civil partnership dissolved,

widowed, separated) was ascertained, and categorizations were based on past papers (Stubbs et al., 2018b). A detailed ethnic category was specified for each patient, which was then aggregated into four ethnic groups for descriptive purposes. The ‘Black’ group refers to ‘African’, ‘Caribbean’, and ‘Any other black background’ categories, the ‘Asian group includes ‘Bangladeshi’, ‘Chinese’, ‘Indian’, ‘Pakistani’, and ‘Any other Asian background’ and the ‘White’ group refers to British’, ‘Irish’, and ‘Any other white background’ ethnic categories. Patients with mixed backgrounds such as “White and Asian’, ‘White and Black African’, ‘White and Black Caribbean’ and ‘Any other mixed backgrounds” were grouped as mixed ethnicity. Ethnicity has been categorized this way in other CRIS work (Kovalchuk et al., 2017). For the final regressions, ethnicity was further condensed into ‘White (White-European’ and ‘Non-White,’ again based on previous CRIS work (Stubbs et al., 2018b). ‘Non-White’ included ‘Black,’ ‘Asian,’ ‘Mixed.’ This was dichotomized as such because preliminary analysis showed that the associations with PA recording were similar for Black, Asian and mixed ethnicities.

The Health of the Nation Outcome Scales (HoNOS) (Wing et al., 1998) are routinely administered measures of illness burden in UK mental health services and are recorded by clinicians in structured fields on the electronic health record. Individual HoNOS item scores (agitated behaviour, self-injury, problem drinking & drugs, cognitive problems, physical illness, hallucinations, depressed mood, other mental health problems, relationship problems, daily living problems, living conditions problems, occupational problems) were obtained within 6 months before or after the index data (date of CPHS completion), with closest scores in time to this date being included in analyses. All individual items were summed up to create a total HoNOS score. Within the individual HoNOS score items, scores 2 or over (possible scores of 0-4), were classified as having a problem on that specific HoNOS score (Stubbs et al., 2018b). Finally, Body Mass Index (BMI), captured either in a structured field or with the Generalised Architecture for Text Engineering (GATE)

application, a natural language processing application (see Perera et al., 2016), was ascertained using the value closest to the index date.

2.5. Diagnosis and Medication

Patients with any mental disorder diagnosis were considered eligible for this study, and diagnosis was ascertained by using the primary ICD10 diagnosis, which was closest to the index date (6 months either side). This is detailed above in section 2.2. Participants were grouped into ICD10 F highest-numeral categories (i.e. F0x, F1x, F2x … F9x) for analysis. Structured medication fields were supplemented by Natural Language Processing applications in the records to ascertain mentions of current medication (Perera et al., 2016). Specifically, presence or not of the following medication groups was gathered on the basis of information closest to the participant index date: antipsychotics, antidepressants, hypnotics and anxiolytics, ADHD medication and dementia medication. Of note, participants could have been taking more than one medication at the same time.

2.6. Hospitalizations

SLaM patient records were linked with national Hospital Episode Statistics (HES). HES are compiled from all NHS Trusts in England (both acute and mental health services), and include statistics on all inpatient episodes, as well as outpatient and emergency care (Perera et al., 2016). Total length of stay (in days) within one year on either side of the index date was ascertained for each patient. For the purpose of this analysis, SLaM hospital admissions were analysed separately. Specifically, if a patient had been an inpatient in SLaM (i.e. mental health services) the 12 months before the index date, they were given a 1 (vs. a 0) for the dichotomous categorization. Furthermore, a continuous variable was also

included for count of inpatient days in the 12 months leading up to (and including the day of) the index date.

2.7. Statistical analysis

The study sample for both cases and controls was initially described in terms of demographic and health status variables, and tested accordingly with either chi-square or independent samples t-test to ascertain significant differences between those with PA recorded and those without. Multivariable logistic regression analyses were conducted to predict PA recording. The predictor variables used in the first model were socio-demographic predictors variables (age, sex, marital status, IMD tertile and ethnicity). Subsequently, the associations between PA recording (outcome) and other predictors [BMI score, HES length of stay, SLaM inpatient stay (yes/no and number of days), HoNOS (mean total and each individual item), diagnosis, and medication, with PA recorded (yes/no)] were assessed with multivariable logistic regression with each of these predictors being included individually in the models, while adjusting for the five sociodemographic variables. This is in line with similar analyses in recent publications (e.g., Koyanagi et al., 2018; Stubbs et al., 2018c; Vancampfort et al., 2018a; Vancampfort et al., 2018b). For mental disorder diagnosis, ICD10 F diagnoses were compared to the grand mean. All analyses were conducted using STATA, version 15.

3. Results

The analysed cohort consisted of 5,034 individuals. Specifically, the case group (those with PA recorded), consisted of 839 community-dwelling patients (47% female), with a mean age of 39 years. The control cohort consisted of 4,195 community dwelling patients (50%

female), with a mean age of 46 years. Briefly, the groups differed significantly in terms of diagnosis, age, ethnicity, marital status and medication usage. **Table 1** fully summarises characteristics of those who had PA recorded compared to those who did not.

3.1. Sociodemographic predictors of PA recording

Table 2 outlines the sociodemographic predictors of PA recording. In the first model which included sex, age, ethnicity, martial status and IMD tertile, age and ethnicity were significant predictors of PA recording. Increasing age (in years) was a significant negative predictor of having PA recorded (OR 0.97, 95% CI .97, .98). Additionally, being of White ethnicity (vs. non-White) was a significant negative predictor of having PA recorded (OR .53, 95% CI .45, .63).

3.2 Health status predictors of PA recording

Table 3 describes the health status predictors of PA recording. Having been a SLaM inpatient in the year before the index date was a significant predictor of PA recording (OR 8.9, CI 6.8, 11.54). Similarly, number of days of SLaM inpatient stay significantly predicted having PA recorded (OR 1.01, 95% CI 1.01, 1.02). While overall HoNOS score did not significantly predict PA recording, many of its sub-items did. The presence of problems in the domains of hallucinations (OR 1.75, CI 1.37, 2.24), living conditions (OR 1.48, 95% CI 1.09,), and occupation (OR 1.02, 95% CI .74, 1.40) significantly predicted PA recording. Conversely, the presence of cognitive problems (OR .72, 95% CI .54, .96) and relationship problems (OR .61, 95% CI .47, .48) were significant negative predictors of PA recording.

Compared with the grand mean, the mental disorders with significantly higher odds for PA recording were schizophrenia and schizotypal disorders (ICD-10 F2x; OR 3.36, 95% CI 2.62, 4.29), mood disorders (ICD-10 F3x OR 2.39, 95% CI 1.80, 3.18), behavioural syndromes

(ICD-10 F5x OR 2.60, 95% CI 1.62, 4.27) and disorders of adult personality and behavior (ICD-10 F6x OR 1.99, 95% CI 1.24, 3.20). Those with organic mental disorders (ICD-10 F0x OR .12, 95% CI .04, .36), neurotic/stress-related/somatoform disorders (ICD-10 F4x OR .59, 95% CI .40, .88), and disorders of psychological development (ICD-10 F8x OR .25, 95% CI .11, .59), had significantly lower odds for PA recording. Those on antipsychotics (OR 3.14, 95% CI 2.56, 3.86), antidepressants (OR 1.42, 95% CI 1.18, 1.72), or hypnotics/anxyiolytics (OR 1.60, 95% CI 1.3, 1.95) were significantly more likely to have PA recorded, while those taking ADHD medication (OR .44, 95% CI .20,.96) were significantly less likely to have PA recorded.

Table 1. Sample characteristics (overall and by PA-recording status)

N (%)	**Overall**	**PA-recorded group**	**Non-PA-recorded group**	**P value***
Age (years) Mean (SD; n)	44.4 (17.1; n=5034)	38.7 (14.2; n=839)	45.6 (17.4; n=4195)	p<0.001
Primary Diagnosis ICD10 Category, n/N (%):				p<0.001
F0x Organic, including symptomatic, mental disorders	99/2343 (4%)	5/807 (1%)	94/1536 (6%)	
F1x Mental and behavioural disorders due to psychoactive substance use	211/2343 (9%)	38/807 (5%)	173/1536 (11%)	
F2x Schizophrenia, schizotypal and delusional disorders	712/2343 (30%)	352/807 (44%)	360/1536 (24%)	
F3x Mood [affective] disorders	372/2343 (16%)	162/807 (20%)	210/1536 (13%)	

F4x Neurotic, stress-related and somatoform disorders	244/2343 (10%)	40/807 (5%)	204/1536 (13%)	
F5x Behavioural syndromes associated with physiological disturbances and physical factors	90/2343 (3%)	43/807 (5%)	47/1536 (3%)	
F6x Disorders of adult personality and behaviour	99/2343 (4%)	34/807 (4%)	65/1536 (4%)	
F7x Mental retardation	55/2343 (2%)	23/807 (3%)	32/1536 (2%)	
F8x Disorders of Psychological Development	73/2343 (3%)	5/807 (1%)	68/1536 (4%)	
F9x Behavioural and emotional disorders with onset usually occurring in childhood and adolescence	388/2343 (17%)	105/807 (13%)	283/1536 (18%)	
Sex				p=0.140
Male	2498/5034 (50%)	442/839 (53%)	2,093/4195 (50%)	
Female	2535/5034 (50%)	397/839 (47%)	2,101/4195 (50%)	
Ethnicity				p<0.001
White	2426/4823 (50%)	321/839 (38%)	2105/3984 (53%)	
Black	1193/4823 (25%)	298/839 (36%)	895/3984 (22%)	
Asian	227/4823 (5%)	64/839 (8%)	163/3984 (4%)	
Mixed	425/4823 (9%)	82/839 (10%)	343/3984 (9%)	

Marital Status				p=0.002
Cohabiting	711/4223 (17%)	91/711 (13%)	620/3512 (18%)	
Non-cohabiting	3512/4223 (83%)	620/711 (87%)	2982/3512(82%)	
Index of Multiple Deprivation: IMD 2010 (M, SD; n)	28.0 (11.8; 4895)	29.21 (10.8; n=805)	27.8 (11.9; n=4090)	p=0.002
Medication:				p<0.001
Antipsychotic	2046/5034 (41%)	584/839 (69%)	2733/4195(65%)	
Antidepressant	1756/5034 (35%)	388/839 (46%)	1368/4195(33%)	
Hypnotics and anxiolytics	987/3054 (20%)	285/839(34%)	702/4195(17%)	
ADHD Medication	179/5034 (4%)	11/839 (1%)	168/4195 (4%)	
Dementia Medication	144/5034 (3%)	3/839 (0.4%)	141/4195 (3%)	
Mean (SD; n) BMI (kg/m^2)	27.9 (8.7; n=1526)	27.2 (7.3; n=700)	28.4 (9.7; n=826)	p=0.01
HoNOS Total score (SD; n)	10.6 (5.9; n=1925)	10.2 (5.6; n=803)	10.9 (6.0 ;n=1112)	p= 0.02
Agitated behaviour	322/1916 (17%)	124/801 (15%)	198/1115 (18%)	p=0.01
Self-injury	181/1915 (9%)	80/801 (10%)	101/1114 (9%)	p=0.052
Problem drinking drugs	298/1911 (16%)	145/800 (18%)	153/1111 (14%)	p= 0.238
Cognitive problems	395/1915 (21%)	127/801 (16%)	268/1115 (24%)	p=0.004
Physical illness	535/1915 (28%)	176/800 (22%)	359/1115 (32%)	p<0.001
Hallucinations	545/1914 (29%)	271/801 (34%)	274/1113 (25%)	p<0.001
Depressed mood	792/1916 (41%)	308/801 (39%)	484/1115 (43%)	p<0.001

Other mental health problems	1136/1919 (59%)	455/802 (57%)	681/1117 (61%)	p=0.11
Relationship problems	716/1913 (37%)	262/800 (33%)	454/1113 (41%)	p=0.032
Daily living problems	574/1914 (30%)	214/799 (27%)	360/1115 (32%)	p= 0.001
Living conditions problem	298/1901 (16%)	144/797 (18%)	154/1104 (14%)	p<0.001
Occupational problems	626/1909 (33%)	275/797 (35%)	351/1112 (32%)	p=0.036
HES Length of Stay (SD; n)	10.1 (30.7; n=304)	8.2 (2.4; n=93)	10.9 (33.7; n=211)	p=0.49
SLaM Pre-index inpatient stay (Yes/No)	348/5034 (7%)	223/839(27%)	125/4195 (3%)	p<0.001
SLaM Pre-index Length of Stay (SD; n)	1.9 (16.8; n=5034)	17.5 days (46.8; n=839)	2.5 (19.3; n=4195)	p<0.001

Notes.
HoNOS:Health of Our Nations Scale
HES: Hospital Admission Statistics
SLaM: South London and Maudsley
PA: Physical Activity
*p <0.05

Table 2. Socioedemographic predictors of Physical Activity recording

Characteristic	Category	Odds Ratio [95% Confidence Interval]
Sex	Male vs. Female	1.02 [.86, 1.22]
Age (years)		.97* [.97, .98]
Ethnicity	White vs. Non-White	.53* [.45,.63]
Marital Status	Cohabiting vs. Non-Cohabiting	.89 [.69,1.14]
Index of Multiple Deprivation Tertile	1- Most Deprived 2 3-Least Deprived	 1.05 [.84,1.30] 1.02 [.45, .63]

Notes.
*p <0.05
N= 3,189
The model was mutually adjusted for all variables in the table.

Table 3. Health status predictors of PA recording

Characteristic	Category	Odds Ratio [95% Confidence Interval]	Number of observations	Adjusted R-squared
Body Mass Index (BMI)	Kg/m^2 (per unit increase)	.99 [.98, 1.01]	N= 1358	6.3%
HES Length of Stay	days	1.00 [.97,1.01]	N=237	6.0%
SLaM Inpatient stay in 12 months before index date	Yes vs. No	8.9* [6.8, 11.54]	N=3819	13.3%
SLaM Days of inpatient stay in 12 months before index date (Days)		1.01* [1.01, 1.02]	N=3819	8.2. %
HoNOS Total Score	Problem (Yes vs. No)	.98 [.97, 1.00]	N=1605	6.5%
HoNOS Item Score Agitated Self-injury Problem drinking/drugs Cognitive problems Physical illness Hallucinations Depressed Mood Other Mental Problems Relationship Problems Daily living problems Living condition problems Occupational problems		 .78 [.57,1.07] 1.18 [.80, 1.73] 1.27 [.93, 1.72] .72* [.54, .96] 1. [.78, 1.32] 1.75* [1.37, 2.24] .97 [.75, 1.26] .83 [.65, 1.07] .61* [.47, .78] .96 [.72, 1.26] 1.48* [1.09, 2.01] 1.02* [.74, 1.40]	 N=1574	 9%

Diagnosis F0x F1x F2x F3x F4x F5x F6x F7x F8x F9x	Yes vs. No	 .12* [.04, .36] .71 [.47, 1.07] 3.36* [2.62, 4.29] 2.39* [1.80,3.18] .59* [.40, .88] 2.6* [1.62,4.27] 1.99* [1.24, 3.20] 1.66 [.89, 3.09] .25* [.11, .59] 1.07 [.78, 1.45]	N= 1813	
Medication Antipsychotics Antidepressants Hypnotics or Anxiolytics ADHD Medications Dementia Medications	Yes vs. No	 3.14* [2.56, 3.86] 1.42* [1.18, 1.72] 1.60* [1.30, 1.95] .44* [.20, .96] .54 [.17, 1.77]	N=3819	12%

Notes.
PA: Physical Activity
*p <0.05
All regressions were adjusted for sex, age, ethnicity, marital status and IMD tertile.
For mental disorder diagnosis, the grand mean was used as the reference group.

4. Discussion

4.1. Main Findings

The current study examined the predictors of PA recording in routine mental healthcare. Those with schizophrenia, mood disorders, behavioural syndromes associated with physiological disturbances and physical factors, and disorders of adult personality and behaviour, were significantly more likely to have PA recorded. Furthermore, those of older age, those who were taking ADHD medication, or those who had problem scores on the sub-items of either cognition or relationships on the HoNOS were less likely to have PA recorded. In addition, those with a diagnosis of organic mental disorder, neurotic/stress-

related disorder or disorders of psychological development were significantly less likely to have PA recorded.

While this is the first study to look at the associations in a mental healthcare context, Coleman and colleagues (2012) assessed the demographic differences between those with PA recorded and without (with physical activity vital signs (PAVS)), in a general primary healthcare context. Similarly to our results, they found those with a PA recording were in worse health, determined by more comorbid conditions and greater outpatient visits. In line with our hypothesis, those with PA recorded were in worse health. Specifically, greater length of hospital stay, reflecting inpatient care for mental illness, predicted having PA recorded. This could be for a variety of reasons, for example that physicians might be more likely to record and monitor PA for people they think have some sort of health risk. It may also be that those in worse health had greater contact with mental health professionals, who as such may have been more concerned about monitoring their patients' health and well-being.

The current study found that certain groups were less likely to have PA recorded. As PA is beneficial for a range of domains, and as PA recording has been linked to discussions of PA, it may be that as a result, these groups are vulnerable populations (Vancampfort et al., 2016a; Vancampfort et al., 2016b). Specifically, those who were taking ADHD medications were less likely to have PA recorded. This is of concern, as some ADHD medications have been known to have a high non-response rate of 10-25% (Banachewski et al., 2006; Taylor et al., 2004), and uncertainties remain regarding the long-term safety of ADHD medications (Den Heijer et al., 2016). As such, PA has recently been suggested as an adjunct treatment for those taking ADHD medication (Den Heijer et al., 2016). Given the fact that PA has been shown to be beneficial for promoting functional recovery in this population (Vysniauske et al., 2016), it is of concern that such discussions of activity appear to not be occurring among those taking ADHD medication in mental health settings.

In addition, specific diagnoses of organic mental disorder, neurotic/stress-related disorder or disorders of psychological development were significantly less likely to have PA recorded. Organic mental disorders include various forms of dementia, mental disorders due to brain damage, and personality and behavioural disorders due to brain disease, damage or dysfunction. Due to the impaired cognitive functioning of those with organic mental disorders, it may be inherently challenging for clinicians to ask questions around PA in this population (Green et a, 2020). These disorders tend to have a significant impact on an individual's ability to function and quality of life (Sun et al., 2017). Despite the fact that PA may be particularly beneficial for these individuals, it may also be of much less importance to the clinicians assessing their health, if they are in a state of very ill mental health. This also highlights the difference in parity between mental and physical health care, and the fact that mental health clinicians (physicians and nurses), may not feel equipped to discuss physical health and health behaviours, or feel like it is their responsibility (Thomas, 2016). Relatedly, the fact that increasing age was a significant negative predictor of recording may be indicative of the fact that older patients may be dealing with various other health issues, and as such their PA levels might not be a clinical priority.

Those with disorders of psychological development were also less likely to have PA recorded. Such disorders include autism, Asperger's syndrome, and some language disorders. Again, it may be that those with these disorders are in generally worse health, so clinicians may not prioritize PA discussions as they have limited time to talk about other health issues. Indeed, among a large sample of American adults with and without autism disorder, those with autism had significantly higher rates of immune conditions, gastrointestinal and sleep disorders, seizures, obesity, hypertension, diabetes and suicide attempts (Croen et al., 2015). In line with our results, previous work has shown that adults with autism were less likely to have received preventive healthcare, perhaps due to communication or deficits in sensory processing, which may partially explain the lower odds of PA recording among those with disorders of psychological development (Nicolaidis et al., 2013). Those with elevated scores on the cognition sub-item of the HoNOS scale were also

less likely to have PA recorded, which may reflect issues of cognitive functioning among those with organic mental disorders and disorders of psychological development. Compared to diagnoses such as depression and schizophrenia, there is also less concrete evidence, and indeed guidelines, regarding the benefits and use of PA and the aforementioned disorders, which may also play a role in the decreased likelihood of PA discussions.

Overall, there was low recording of PA levels among this sample of individuals with mental illness, which is consistent with a broader issue of lack of physical health screening and intervention among those with mental illness (Firth et al., 2019). Based on the National Audit of Schizophrenia (2012), only 50% of those with schizophrenia had their BMI recorded in the past year within mental health services. Similarly, among a sample of individuals at ultra-high risk of psychosis, only 7.5% of them had PA information recorded, compared to more than 80% who had information regarding substance use recorded (Carney et al., 2018). Such results are also in line with Lobelo and colleagues (2018), who noted that cardiovascular risk factors such as blood pressure and smoking are routinely monitored, however PA is very often not assessed. Furthermore, waist circumference is rarely recorded among those with SMI (Rosenbaum et al., 2014; McKenna et al., 2014). The low rates of PA recording are troubling as inadequate monitoring can result in poor health outcomes in the longer-term, which is of great concern considering the well-established mortality gap among those with various forms of mental illness (Carney et al., 2018, Bozymski et al., 2018).

However, current evidence suggests that 80% of UK general practitioners are unfamiliar with national PA guidelines of 150 minutes of moderate-vigorous activity weekly, and most lack the training and/or confidence with respect to assessing and encouraging PA (Chaterjee et al., 2017). Furthermore, in the context of general health care, it was found that 70-80% of professionals do not engage in PA discussions with their patients (Booth et al., 2015). Importantly, clinicians who are more active are more likely to recommend or discuss activity with patients, which could also explain why some patients' PA was recorded, while others' was not (Lobelo et al., 2009). This is of note, as PA recording may result in improved health outcomes in the long term, but may also have economic benefits for healthcare

systems (Marashi et al., 2019). Indeed, assessments and advice about PA, in the context of routine healthcare services, have been flagged as one of the best ways to invest in increasing PA (Global Advocacy for Physical Activity, 2012).

4.2 *Practical action steps*

Research is required to understand at a staff level why there may be low levels of recording of PA. The current results can be used as a baseline and to advocate for more training for mental healthcare clinicians regarding PA discussions, and to encourage improvements in PA referral infrastructures, particularly among patients who are not currently engaging in such discussions. Indeed, physician counseling and exercise (i.e. structured PA) referral schemes have been found to lead to improvements in patients' PA for up to one year (Sanchez et al., 2015, Orrow et al., 2012, Williams et al., 2007). Similarly, the recently released European Psychiatry Guidelines advocated for PA recording as being a fundamental need in mental healthcare (Stubbs et al., 2018a). Our results can furthermore be used to help clinicians focus on patients who are not currently engaging in such discussions and may thereby be at risk. Based on our findings, this includes those with neurotic or stress-related disorders, those with organic mental disorders, those with disorders of psychological development, those with cognitive problems, with relationship problems and those who are older.

Looking forward, an assessment of whether continued medical education (CME), in which mental health care staff are trained on the importance of PA for mental health, brief motivational interviewing, and how to assess PA quickly (for example using the aforementioned PAVS), can improve PA assessment and recording may be warranted. While Gaughran et al. (2017) examined the effectiveness of having a care coordinator undergo lifestyle training and then work with patients with psychosis on various lifestyle areas such as exercise, diet, smoking or alcohol use, this was not shown to be effective. As such, it may be that having a targeted PA focus may be more effective, as may be a focus

on improved fitness as the outcome, rather than reducing BMI or waist circumference (Gaughran et al., 2017). Nurse-led cardiometabolic interventions have however been shown to improve PA (Happell et al., 2014). Additionally, as the interest and integration of digital health into mental health settings continues to grow, particularly with regards to passive data gathering (Firth et al., 2019), there is clear potential for using wearable devices to obtain objective measures of PA in clinical settings. Future research might look to explore whether wearables can predict health outcomes and/or worsening of mental health, such as picking up when someone is becoming more sedentary. Wearable activity monitors have been used in other health care settings as well, such as to monitor the health status of those with cardiovascular risks (Lobelo et al., 2018). Interventions that target PA behaviors of clinicians should also be considered, as these have been shown to influence PA discussions with service users (Lobelo et al., 2009).

4.3. Strengths, limitations and future research

The strengths of this study include the large sample size from a detailed clinical database which represents real-world, observational data. The use of the ICD10 categorization for all mental illness diagnoses is also a strength. Furthermore, this study is novel and to our knowledge is the first to examine predictors of PA recording in secondary mental health care.

However, some limitations should be highlighted. The nature of how the data was collected presents some issues. For example, the data were self-reported (via a clinician), and thus is prone to bias. Furthermore, the way the CPHS was structured may have led to some inconsistencies in recording. Completion of the screen was not mandatory and there may have been trust level and staff level factors (including confidence, perceived importance) that influenced completion of the physical health screen and specifically the physical activity structured questions. In addition, caution must be exercised when interpreting the meaning of recorded PA. Simply having had PA recorded doesn't provide

any information on whether a discussion around this or an intervention/recommendation was provided. Similarly, the fact that the patient does not have PA recorded does not necessarily imply that a conversation around PA didn't occur with the clinician. It may be that PA was discussed, however wasn't recorded in that structured field. For the purpose of this study, among the cases, we only used the most recent version of their CPHS. If they had multiple screens completed, there might be valuable information that was lost. The current study only presents information from one mental health service in the UK, and thus the findings may not generalize broadly. Finally, and importantly, this study was cross-sectional in nature. As such, causality nor directionality can be inferred.

Future studies could look to examine the more longitudinal nature of changes in PA recording and subsequent health outcomes. It is also imperative that future research looks to unveil the underlying reasons for discrepancies in PA recording rates, through research directly with clinicians, as this will have profound training and clinical implications. Future work might also look to examine whether PA is being recorded in other ways in health records, outside of structured forms. Finally, there is a need to examine how health outcomes differ within those with activity recorded, by activity level. Indeed, the findings of this study could be used as a starting point for that type of investigation, and the current PA-recorded cohort could be used for this.

5. Conclusions

The current study found health status differences between community-dwelling mental health service users who have PA recorded vs. those who do not. Non-white ethnicity, younger age and psychiatric hospitalization were predictors of recorded physical activity, as were specific diagnoses. These results can be used to advocate for more training among mental healthcare professionals in terms of PA discussions and counselling, as well

as be used to tailor PA discussions to individuals who aren't currently receiving them. Future research is needed to assess health outcomes by activity level, and to see whether a physical activity counselling intervention can result in meaningful changes in service-users' health.

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