

1 **Cervical and breast cancer screening uptake among women with serious mental illness: A data**
2 **linkage study**

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21 **Abstract**

22 **Background:** Breast and cancer screening uptake has been found to be lower among women with
23 serious mental illness (SMI). This study aims to corroborate these findings in the UK and to identify
24 variation in screening uptake by illness/treatment factors, and primary care consultation frequency.

25 **Methods:** Linked population-based primary and secondary care data from the London borough of
26 Lambeth (UK) were used to compare breast and cervical screening receipt among linked eligible SMI
27 patients (n=625 and n=1393), to those without SMI known only to primary care (n=106,554 and
28 n=25,385) using logistic regression models adjusted first for socio-demographic factors and second,
29 additionally for primary care consultation frequency.

30 **Results:** Eligible SMI patients were less likely to have received breast (adjusted odds ratio (OR) 0.69,
31 95% confidence interval (CI), 0.57 - 0.84, p<0.001) or cervical screening (adjusted OR 0.72, CI: 0.60 -
32 0.85, p<0.001). Schizophrenia diagnosis, depot injectable antipsychotic prescription, and illness
33 severity and risk were associated with the lowest odds of uptake of breast (adjusted ORs 0.46 to
34 0.59, all p<0.001) and cervical screening (adjusted ORs 0.48 - 0.65, all p<0.001). Adjustments for
35 consultation frequency further reduced effect sizes for all subgroups of SMI patient, in particular for
36 cervical screening.

37 **Conclusions:** Women with SMI are less likely to receive breast and cervical cancer screening than
38 comparable women without SMI. Higher primary care consultation rates among SMI patients is likely
39 a mediating factor between SMI status and uptake, particularly for cervical screening - a service
40 organised in primary care. To tackle health disparities linked to SMI, efforts at increasing screening
41 uptake are key and should be targeted at women with other markers of illness severity or risk,
42 beyond SMI status alone.

43

44 **Keywords:** cancer screening; breast cancer; cervical cancer; mammography; psychoses; serious
45 mental illness; data linkage.

46 **Background**

47 People with serious mental illness (SMI), including schizophrenia and bipolar disorder, have higher
48 cancer mortality than others of the same age in the same population without SMI, and there is some
49 evidence that this excess disproportionately affects women.[1-3] Cancer screening reduces cancer
50 mortality; reducing cancer incidence and improving survival.[4] Three recent systematic reviews
51 have found suboptimal cancer screening rates in people with mental disorders. These reviews have
52 included a range of diagnoses, ranging from emotional distress to diagnosed SMI. Where evidence
53 has been disaggregated by type of mental disorder, those with SMI are found to have the lowest
54 odds of screening compared to those without mental ill health.[5-7] Further, the majority of studies
55 reviewed originate from the United States so it is not clear how these results translate into the
56 United Kingdom (UK) context with universal free access to healthcare and organised population-
57 based screening programmes. Absence of cost barriers, and organised screening, have been shown
58 to reduce inequalities in screening coverage,[8,9] hence more equitable coverage for people with
59 SMI might be expected in the UK.

60 The Quality and Outcomes Framework (QOF) is a primary care reward and incentive programme
61 which annually records general practice (GP) achievement against clinical and organisational targets
62 and was introduced in 2004.[10] Targets include measures aimed at improving the physical health
63 care of people with SMI, such as blood pressure monitoring and cervical cancer screening. It is
64 unclear whether such incentivisation results in more widespread uptake of screening.

65 Barriers to participation in screening programmes among people with experience of mental illness
66 include factors at the service, practitioner, and service user level.[11] Routinely available clinical data
67 sources can be used on a larger scale to investigate specific barriers to screening such as lack of

68 contact with a primary care provider, social deprivation, and factors related to the type and severity
69 of mental illness. The ability to investigate these processes has previously been restricted as data on
70 physical health diagnoses, monitoring and management are mainly recorded in primary care, while
71 detailed classification of SMI diagnosis and mental state is mainly recorded in secondary mental
72 health care records.

73 This study uses data from a population-based linkage between primary and secondary care records
74 in the London borough of Lambeth (UK) to extend previous knowledge about the uptake of breast
75 and cancer screening in the SMI population; addressing the following questions:

- 76 1. Is breast and cervical cancer screening uptake lower for people registered in primary care
77 with SMI compared to those without SMI?
- 78 2. Does frequency of contact with primary care explain differences in screening rates between
79 those with and without SMI?
- 80 3. Are there psychological factors that predict lower screening uptake within the SMI group?

81

82 **Methods**

83 **Setting& data sources**

84 Lambeth is an ethnically diverse borough, with a greater number of Black Caribbean and Black
85 African residents, although fewer South Asian residents than most other areas of London.[12] and
86 has high levels of deprivation overall.[13] Pseudonymised primary care data were extracted on 31st
87 October 2013 from the computerised medical records of all except one GP practice (n=48;the
88 missing GP practice had an incompatible IT system) within Lambeth, as part of Lambeth DataNet
89 (LDN). LDN collects demographic data and data on GP consultations, prescriptions, and (QOF)
90 clinical target achievement, as well as clinical information about non-QOF conditions. LDN thus
91 contributed a population of 366,317 registered patients. Secondary care data came from the Clinical

92 Record Interactive Search (CRIS),[14] an application allowing research access to pseudonymised
93 electronic health record data from the South London and the Maudsley NHS Foundation Trust
94 (SLaM). CRIS additionally provides searchable access to de-identified text (unstructured data) from
95 the clinical record, and a range of natural language programming (NLP) applications have been
96 developed to auto-extract structured data from text fields.[15]

97 **Data linkage**

98 CRIS and LDN data were linked and stored by the SLaM Clinical Data Linkage Service (CDLS), which
99 provides a safe haven environment with strict governance arrangements. Data were linked using
100 encrypted NHS numbers, which were subsequently removed and destroyed such that the linked
101 dataset became fully anonymised.

102 **Ethical approval**

103 Approvals for the database linkage were obtained via a Section 251 application to the Health
104 Research Authority (reference: CAG 6-07(f)/2013), from the Lambeth Clinical Commissioning Group
105 Information Governance committee, and as a component of ethical approval for CRIS as a database
106 (Oxford REC C 08/H0606/71+5).

107 **Measures**

108 Primary care data from Lambeth DataNet (LDN)

109 Data extracted from LDN included 2012/13 QOF-defined SMI status (recorded on the QOF Mental
110 Health register with a diagnosis of schizophrenia, bipolar affective disorder and other
111 psychoses),[10] gender, year of birth, ethnicity, and 2011 defined lower super output area (LSOA).
112 These are geographic areas designed to improve the reporting of small area statistics in England and
113 Wales, and include a mean population of 1500.[16] Approximate age was calculated by subtracting
114 year of birth from the year of data extraction; information on the LSOA of each patient was used to

115 determine the level of social deprivation in their area using the Index of Multiple Deprivation (IMD-
116 2010) and a conversion from 2001 LSOA to 2011 LSOA values.[17] Frequency of primary care
117 consultation was calculated as the mean number of primary care consultations (including GP, nurse,
118 face-to-face, and telephone) over the three years between October 2010 and 31 October 2013. A
119 binary variable was created to distinguish low (median or below) and high (above median) mean
120 annual number of consultations. Consultation data were coded as missing for two practices which
121 had incorrectly entered data for 2013 GP face-to-face appointments and for numbers entered as
122 negative values. Lastly, data were extracted to identify those who had ever been recorded as having
123 received breast cancer screening (mammography) and cervical cancer screening. The population
124 eligible for mammography was defined as females aged 50 to 70 years inclusive, while that eligible
125 for cervical cancer screening was defined as females aged 25 to 64 years inclusive. To assess
126 adherence to QOF guidelines, those who had received a mammography screen any time in the last
127 three years were identified as recently screened and distinguished from those who had been
128 recorded as being screened outside of the guideline period. Similarly, those who had received a
129 cervical cancer screen any time in the last three years for those aged up to 49 years, or any time in
130 the last five years for those aged 50-64 were identified as recently screened as per recommended
131 guidelines. For both cervical and breast screening, those with a recent screen were coded as 1, while
132 those never screened were coded as 0.

133 Secondary mental health care measures from CRIS

134 ICD-10 diagnostic codes[18] for any primary or secondary diagnosis of schizophrenia, bipolar
135 affective disorder, and schizoaffective disorder or other non-organic psychoses were extracted (ICD-
136 10 codes F20-29, F25, F31). A binary indicator of higher SMI severity was created which ascertained
137 and coded as 1, any patients with a recorded mental health inpatient stay, treatment under the
138 Mental Health Act, difficulty managing their physical health as recorded in a clinical risk assessment;
139 or contact with Assertive Outreach, Crisis team or A&E liaison team. A separate SMI indicator of 'risk'

140 was developed, identifying patients with a history of violent or offending behavior using data from a
141 risk assessment violence and aggression subscale. This coded SMI patients as 1 if had ever had a
142 recorded history of violence, non-compliance, or a forensic history – and as 0 if none of these issues
143 were recorded. In addition, data were extracted on whether or not the patient had ever been
144 recorded with a prescription of antipsychotics - including a marker of depot injectable medication
145 (Table 1). Figure 1 illustrates a summary of variables, variable descriptions and data sources

146 **[Figure 1]**

147 **Statistical analyses**

148 Primary care records were used to define SMI status. Those identified in primary care with QOF-
149 defined SMI were compared to those without QOF-defined SMI, who were not linked to secondary
150 care records. Those identified in primary care with SMI but who were not linked, and those who
151 were linked but not recorded in primary care with SMI, were not included in these analyses, as the
152 study aimed to extend prior research by examining SMI characteristics recorded in secondary care
153 associated with screening uptake (see Figure 2). Descriptive analyses including Pearson’s chi squared
154 tests were used to compare socio-demographic characteristics and consultation frequency between
155 patients with and without SMI patients who were eligible for mammography and/or cervical cancer
156 screening. Separate logistic regression models were run to compare the likelihood of being recorded
157 with a recent breast or cervical screen (versus those never screened) among patients with SMI
158 overall, among patients recorded with specific SMI characteristics and among non-SMI patients.
159 Including non-SMI patients as the comparator in analyses was designed to ease interpretation across
160 analyses. Unadjusted models and models adjusting for socio-demographic characteristics and
161 additionally for primary care consultation frequency were run. Separate analyses were run, but are
162 not presented, to include those who had ever been screened in the numerator (not necessarily
163 within the guideline period) to examine any differences in patterns of association. P-values,

164 unadjusted and adjusted odds ratios (OR) and 95% confidence intervals (CI) are shown. All analyses
165 were conducted using STATA v12.[19]

166

167 **Results**

168 Linkage sample

169 Overall, data were obtained for LDN patients aged 16 or over on 31st October 2013 (N=295,301); of
170 these, 8.1% (n=23,919) were known to secondary mental health care. Among those patients with
171 linked primary and secondary care records, n=4056 (16.9% of linked sample, 1.37% of LDN
172 population aged 16+ years overall) were recorded as having SMI by their GP in LDN and were
173 denoted as the SMI group. Overall, 270,669 patients (91.7% of LDN population) were not recorded
174 with SMI in primary care or linked to secondary care, comprising the group identified without SMI.

175 **[FIGURE 2]**

176 Study sample

177 *Patients eligible for cancer screening.*

178 Study sample derivation is illustrated in Figure 2. We identified 26,010 women in LDN eligible for
179 mammographic screening and 107,947 women eligible for cervical screening, of whom 625 (2.4%)
180 and 1393 (1.3%) respectively were recorded in primary care records as having SMI and were also
181 known to secondary mental health services (Figure 2). Among the eligible populations for breast and
182 cervical cancer screening, SMI status was associated with belonging to an ethnic minority group,
183 greater deprivation, and more frequent primary care consultations. Among those eligible for cervical
184 cancer screening, SMI status was also associated with older age, although this association was not
185 observed for patient eligible for breast screening (Table 1).

186

[TABLE 1]

187 Cancer screening uptake by SMI status

188 As illustrated in Figure 1; of the eligible population for cancer screening, n=17,981 (70.8%) and
189 n=405 (64.8%) of non-SMI and SMI patients respectively had ever been screened for breast cancer
190 while n=87,196 (65.7%) and n=1184 (85.0%) of non-SMI and SMI patients respectively had ever been
191 screened for cervical cancer. The proportion of eligible patients who had received a recent screen
192 was lower among both SMI and non-SMI patients (Table 2).

193 Comparison of screening according to QOF guidelines indicated that SMI patients were less likely to
194 have a record of recent mammography screening compared to those without SMI (Table 2).

195 Adjustments for socio-demographic characteristics, and additionally, for primary care consultation
196 frequency increased the strength of the negative association such that the odds of recent screening
197 were almost 40% lower among those identified with SMI.

198 In unadjusted models SMI status was positively associated with recent cervical screening according
199 to guidelines (Table 2). Adjustment for socio-demographic differences between the groups reversed
200 this association - such that being recorded with SMI was associated with reduced odds of recent
201 cervical cancer screening, and adjustment for primary care consultation rate further increased the
202 negative effect size such that the odds of cervical screening were almost 60% lower among SMI
203 patients.

204 Variation in screening receipt by mental illness characteristics

205 The odds of screening receipt varied across different sub-groups of women with SMI in adjusted
206 models (Table 3). Those with schizophrenia, those ever prescribed depot injectable medication and
207 those ever identified with any indicator of risk or severity, were the least likely to have been
208 screened for breast cancer. Similarly, a diagnosis of schizophrenia and receipt of depot injectable

209 antipsychotic medication were associated with the lowest odds of cervical cancer screening in
210 adjusted models.

211 [TABLE 2]

212 **Discussion**

213 After accounting for sociodemographic differences (particularly differences in age), women recorded
214 in primary care as having SMI and also known to secondary mental health services were substantially
215 less likely (with 22-28% lower odds) to have been screened for breast or cervical cancer than other
216 women in the same population. Unlike previous studies, we were able to explore how SMI
217 characteristics beyond diagnosis were differentially associated with screening, and to explore any
218 potential impact on primary care consultation frequency on screening uptake. For cervical cancer
219 (but not breast cancer) screening uptake, the frequency of primary care contact is a potential
220 mediating factor in the relationship between SMI and screening receipt and so the best estimates of
221 screening frequency and inequality are those in the models adjusted for sociodemographic factors.
222 However, when the higher rates of primary care consultation for women with SMI were taken into
223 account, the difference in cervical screening receipt between women with and without SMI
224 appeared even greater.

225 The negative effect sizes found in models adjusted for sociodemographic factors were similar for
226 both breast and cervical screening. However, adjusting for frequency of primary care contact had a
227 much greater impact on estimates of cervical than breast screening. This indicates that frequency of
228 primary care contact has a stronger effect on cervical screening rates than mammographic screening
229 rates, as consultation frequency was elevated in the SMI group eligible for both types of screening.
230 This is consistent with differences in the organisation of both national screening programmes,
231 cervical screening being organised within primary care whereas breast screening being organised via
232 a national invitation system. Further, unlike breast screening, cervical screening is incentivised as
233 part of the QOF guidelines for those recorded with SMI. It is unclear whether this has impacted the
234 likelihood of screening uptake, though the adjusted effect size is similar to that reported for women
235 with schizophrenia in a Canadian context without such incentivisation.[20] Nonetheless, breast
236 screening rates were positively associated with frequency of primary care contact suggesting that

237 contact in primary care may promote mammography uptake – perhaps via verbal reminder or
238 encouragement from practitioners. Kodl[21] noted that it is important to take frequency of
239 outpatient care contact into account when assessing screening uptake in people with SMI, as not
240 doing so may obscure differences in screening uptake, although we report reduced screening even
241 without accounting for contact frequency.

242 Although not presented here, we re-ran analyses to assess the possibility that the difference in
243 screening uptake may be less apparent if the comparison included those ever screened in the
244 numerator. However, the odds associated with SMI status of ever receiving a screen for either
245 cancer remained very similar to analyses including just those with a recent screen, and the pattern
246 by SMI characteristics was also very similar (data available from authors upon request).

247 In their review of breast and cervical screening among women with a range of mental disorders,
248 Aggarwal et al.[7] identified a need to examine what impact illness severity and treatment have on
249 the relationship between mental illness and screening uptake. Our data linkage allowed us to
250 examine these factors by assessing predictors of screening rates within the SMI group, including
251 diagnosis, receipt of depot medication, and markers of severity. We found that women with
252 schizophrenia had the lowest screening rates, in keeping with other studies that have found that
253 women with more severe mental illness are less likely to be screened.[22,23] Characterising people
254 with SMI on dimensions other than diagnosis provides a richer understanding of which patients may
255 be most at risk of reduced healthcare including poorer uptake of screening.

256 Receipt of depot medication can be a more specific indicator of severity of mental illness and
257 engagement with health services. This group had the lowest receipt of screening, which may relate
258 to reluctance to engage with health services leading independently to low screening uptake and the
259 need for depot medication, but may equally relate to difficult engagement with mental health
260 services making people less likely to seek out other care such as cancer screening. Further, those
261 prescribed depot injectable medication may comprise a more unwell group which may hinder

262 uptake of screening for other unmeasured reasons. Other markers of risk and severity were also
263 associated with being less likely to attend screening. Markers of risk and severity were more strongly
264 predictive of uptake of mammographic screening than cervical screening. After adjustment for
265 sociodemographic factors, women without indicators of severity or risk and not on depot medication
266 were not significantly less likely than women without SMI to be screened for breast or cervical
267 cancer. When frequency of primary care visits was taken into account, women without these
268 indicators remained not significantly less likely to receive mammographic screening (with the
269 exception of those with no indicators of risk), but were less likely to receive cervical cancer
270 screening. This difference may be related to mammographic screening being offered at an unfamiliar
271 location with unfamiliar staff, factors which may make attendance more difficult for those with more
272 severe illness.

273 The finding of a 22-28% reduction in screening uptake in women with SMI after accounting for
274 demographic factors is in keeping with the international literature.[6,5,7] For example, a pooled
275 meta-analysis of studies of mammography uptake in the context of mental illness found a 29%
276 reduction in the odds of mammography in women with mental illness, and a 46% reduction in
277 women with SMI.[5] However, as noted in the introduction, the majority of studies on which this
278 meta-analysis and other reviews are based were conducted in the United States, where there are no
279 population based organised screening programmes. In a previous UK study,[22] breast screening
280 registrations were linked to mental health service use and no difference in mammography receipt
281 for women known to mental health services was found overall, but women with a psychosis
282 diagnosis (OR 0.33) or a history of compulsory treatment (OR 0.40) had reduced screening receipt.
283 This study focused on mammography and dates from nearly a decade prior to ours, suggesting that
284 the situation has not changed markedly over this time. Other UK evidence suggests that late
285 diagnosis of cancers may not be a significant factor in poor cancer survival people with SMI, but this
286 evidence comes from a study which examined all cancers combined, and all ages, and so it is not

287 possible to draw conclusions about stage at diagnosis of breast or cervical cancers in screening age
288 populations from these results.[24]

289 Strengths and limitations

290 This study is strengthened by the availability of linked primary and secondary care data, which
291 provides information on mental health symptom severity, mental health service receipt, and
292 diagnosis to enable investigation of differences within the group of people with SMI. Further, linkage
293 with population-based primary care records allowed the identification of a direct comparison
294 population. Information held by general practice on cervical screening is likely to be complete. Since
295 mammography is not performed in primary care, information may be less complete, particularly for
296 those who consult less often, although we were able to adjust for consultation frequency.

297 This study did not include all those who were identified as having SMI in primary care data, but was
298 restricted to those who were also known to secondary mental health services. This group may fare
299 better (because of higher rates of health service contact providing more opportunities for reminders
300 about screening) or worse (because of having more severe illness or more fragmented care) than
301 those not in current contact with secondary services, and so these findings may not apply to the
302 entire group registered with SMI in general practice. However, the decision to compare just those
303 with SMI known to secondary care was made in order to extend currently available knowledge by
304 enabling us to examine the role of illness/secondary mental health care factors not available for
305 those known only to primary care. Whether screening rates are different for SMI patients known
306 only to primary care may be explored in a later study. Lastly, while our findings are representative of
307 a limited geographic area characterised by high levels of deprivation – potentially limiting
308 generalisability – our effect sizes are consistent with those reported in studies internationally, and
309 indicate that screening uptake is reduced for SMI patients even in a setting where screening, primary
310 care and secondary care are provided free at the point of access.

311 Conclusions

312 This study provides up to date information about cancer screening in adults using mental health
313 services in the UK, showing that breast and cervical cancer screening receipt is lower in women with
314 SMI than other women even in the context of free primary care, organised screening and incentives
315 to provide screening, and despite more frequent contact with primary care. It also demonstrates
316 that individual and treatment related factors beyond diagnosis are associated with reduced
317 likelihood of screening. Efforts to improve screening coverage for women with SMI will be important
318 for improving cancer survival for this group. If we are to tackle health disparities linked to SMI status
319 then increasing uptake of cancer screening for women with SMI must be a key element. Our findings
320 indicate the potential benefits of incorporating policies which target efforts at encouraging greater
321 screening uptake among women with other markers of severity or risk, beyond SMI status alone.

322 **Declarations**

323

324 **Ethics approval and consent to participate**

325 The linkage was a service evaluation and did not require ethical approval. Approvals for the database
326 linkage were obtained via a Section 251 application to the Health Research Authority (reference:
327 CAG 6-07(f)/2013) and from the Lambeth Clinical Commissioning Group (CCG) Information
328 Governance committee.

329

330 **Consent to publish**

331 Not applicable

332

333 **Availability of data and materials**

334 The terms of access to the data are governed by a Data Sharing Agreement with the Data Controllers
335 (the GP practices) which does not permit wider access to the data. However, the codes used and
336 syntax would be available to researchers.

337

338 **Competing interests**

339 The authors declare that they have no competing interests.

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342

343 **Authors' Contributions**

344 RC, CW, MA and MH conceived and designed the study. CW analysed the study data. CW and RC
345 wrote the draft manuscript. MA, EB, RS and MH commented on and critically revised the manuscript.
346 All authors read and approved the final manuscript.

347

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358

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434 **Table 1 Characteristics of patients eligible for mammography screening for breast and/or cervical screening, by serious**
 435 **mental illness (SMI) status**

		Mammography eligible population			Cervical smear eligible population		
		Non-SMI (n=25,385)	SMI (n=625)	p	Non-SMI (n=106,554)	SMI (n=1393)	p
		n (%)			n (%)		
Age group (years)¹							
Mammography	Cervical smear			0.709			<0.001
-	25-34	-	-		47449 (44.5)	261 (18.7)	
-	35-44	-	-		27579 (25.9)	382 (27.4)	
50-54	45-54	9035 (35.6)	218 (34.9)		19910 (18.7)	454 (32.6)	
55-64	55-64	11616 (45.8)	296 (47.4)		11616 (10.9)	296 (21.3)	
65-70	-	4734 (18.7)	111 (17.8)		-	-	
Ethnicity							
				<0.001			<0.001
	British/mixed British	7742 (35.8)	189 (33.4)		30953 (33.7)	362 (28.8)	
	Irish	528 (2.4)	24 (4.2)		1972 (2.2)	31 (2.5)	
	Indian/Bangladeshi/Pakistani	1423 (6.6)	44 (7.8)		5870 (6.4)	75 (6.0)	
	Caribbean/mixed Caribbean	3309 (15.3)	142 (25.1)		8880 (9.7)	300 (23.9)	
	African/mixed African	2957 (13.7)	71 (12.5)		11382 (12.4)	227 (18.1)	
	Chinese/other	991 (4.6)	8 (1.4)		4608 (5.0)	30 (2.4)	
	Other white	3741 (17.3)	59 (10.4)		23848 (25.9)	135 (10.7)	
	Other black	620 (2.9)	21 (3.7)		2586 (2.8)	73 (5.8)	
	Other mixed	307 (1.4)	8 (1.4)		1826 (2.0)	24 (1.9)	
Deprivation quintile							
				<0.001			<0.001
	Most deprived	4706 (19.1)	165 (26.5)		18464 (18.0)	365 (26.4)	
	2	5188 (21.1)	123 (19.7)		21223 (20.7)	303 (21.9)	
	3	4891 (19.8)	120 (19.3)		21544 (21.0)	272 (19.7)	
	4	5024 (20.4)	118 (18.9)		22554 (22.0)	247 (17.9)	
	Least deprived	4838 (19.6)	97 (15.6)		18904 (18.4)	197 (14.2)	
Consultations							
				<0.001			<0.001
	Median/below median	7222 (30.8)	64 (10.5)		42642 (44.1)	184 (13.7)	
	Above median	16238 (69.2)	545 (89.5)		53982 (55.9)	1158 (86.3)	

436 ¹Eligible age range for breast screening (mammography) 50-70 years; eligible age range for cervical cancer
 437 screening (cervical smear) 25-64 years.

Table 2 Associations between serious mental illness (SMI) status and recent receipt of breast and/or cervical screening overall and by SMI characteristic sub-group

	Mammography eligible population (N=26,010)				Cervical smear eligible population (N=107,947)			
	Recorded mammography in last 3 years n (%)	Unadjusted OR (95% CI)	Adjusted for socio-demographics OR ^a (95% CI)	Additionally adjusted for consultation rate OR ^b (95% CI)	Recorded cervical smear in last 3/5 yrs n (%)	Unadjusted OR (95% CI)	Adjusted for socio-demographics OR ^a (95% CI)	Additionally adjusted for consultation rate OR ^b (95% CI)
Non-SMI	14205 (65.7)	1.00	1.00	1.00	67823 (77.8)	1.00	1.00	1.00
SMI overall	305 (58.1)	0.72 (0.61 - 0.86)***	0.69 (0.57 - 0.84)***	0.60 (0.49 - 0.73)***	848 (80.2)	1.16 (0.99 - 1.35)	0.72 (0.60 - 0.85)***	0.35 (0.29 - 0.42)***
SMI by diagnosis								
Schizophrenia	136 (55.1)	0.64 (0.50 - 0.82)***	0.59 (0.45 - 0.78)***	0.52 (0.40 - 0.69)***	270 (76.9)	0.95 (0.74 - 1.22)	0.48 (0.36 - 0.63)***	0.24 (0.18 - 0.32)***
Bipolar affective disorder	67 (62.0)	0.85 (0.58 - 1.26)	0.89 (0.59 - 1.35)	0.72 (0.47 - 1.10)	231 (87.2)	1.94 (1.35 - 2.78)***	1.23 (0.84 - 1.80)	0.50 (0.33 - 0.74)**
Other non-organic psychoses	34 (50.8)	0.54 (0.33 - 0.87)*	0.53 (0.31 - 0.90)*	0.47 (0.27 - 0.80)**	153 (74.3)	0.82 (0.60 - 1.13)	0.57 (0.40 - 0.80)**	0.33 (0.22 - 0.47)**
Depot injectable								
No	191 (64.3)	0.94 (0.74 - 1.20)	0.97 (0.75 - 1.26)	0.83 (0.64 - 1.09)	524 (82.3)	0.32 (1.08 - 1.62)**	0.82 (0.65 - 1.02)	0.36 (0.29 - 0.46)***
Yes	80 (49.1)	0.50 (0.37 - 0.68)***	0.46 (0.33 - 0.64)***	0.39 (0.27 - 0.54)***	199 (76.3)	0.92 (0.69 - 1.22)	0.48 (0.35 - 0.66)***	0.26 (0.18 - 0.36)***
Any indicator of severity¹								
No	168 (65.6)	1.00 (0.77 - 1.29)	0.91 (0.69 - 1.21)	0.79 (0.59 - 1.06)	411 (82.2)	1.32 (1.05 - 1.66)*	0.82 (0.63 - 1.06)	0.40 (0.31 - 0.53)***
Yes	137 (50.9)	0.54 (0.43 - 0.69)***	0.54 (0.42 - 0.70)***	0.46 (0.36 - 0.61)***	437 (78.5)	1.04 (0.85 - 1.27)	0.65 (0.52 - 0.81)***	0.31 (0.25 - 0.40)***
Any indicator of risk²								
No	205 (61.8)	0.84 (0.67 - 1.05)	0.81 (0.63-1.03)	0.70 (0.55 - 0.90)**	535 (82.1)	1.31 (1.07 - 1.60)**	0.79 (0.63 - 1.00)*	0.38 (0.30 - 0.49)***
Yes	100 (51.8)	0.56 (0.42 - 0.74)***	0.53 (0.39 - 0.73)***	0.46 (0.34 - 0.63)***	313 (77.3)	0.97 (0.77 - 1.23)	0.62 (0.48 - 0.80)***	0.31 (0.24 - 0.41)***

Eligible population includes non-linked non-SMI and linked SMI group

*p<0.05, **p<0.01, ***p<0.001

1 Includes any of: ever had an inpatient stay, any record of being treated under the Mental Health Act, any record of difficulty managing their physical health, or any record of an Assertive Outreach/Crisis/A&E episode. 2 Includes any of: recorded history of violence, recorded history of non-compliance, and any record of a forensic history.

a Adjusted for age (continuous), ethnicity, and borough-level deprivation; b additionally adjusted for mean annual number of primary consultations

