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Patients presenting to an acute general hospital with acute mental health needs. A retrospective observational cohort study.

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4 1 **Patients presenting to an acute general hospital with acute mental health**
5 2 **needs. A retrospective observational cohort study.**
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42 39
43 40 Word count: 2055

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46 43

44 **ABSTRACT**

45 **Objectives**

46 To examine the numbers and patterns of patients presenting to an urban acute general hospital with
47 acute mental health presentations and to further investigate any variation related to the covid
48 pandemic.

50 **Design**

51 Retrospective observational cohort study.

53 **Setting**

54 An urban acute general hospital in London, United Kingdom, comprising of five sites and two emergency
55 departments. The hospital provides tertiary level general acute care but is not an acute mental health
56 services provider. There is an inpatient liaison psychiatry service

58 **Participants**

59 358131 patients attended the emergency departments of our acute general hospital during the study
60 period. Of these, 14871 patients attended with an acute mental health presentation. A further 14947
61 patients attending with a physical illness were also noted to have a concurrent recorded mental health
62 diagnosis.

64 **Results**

65 Large numbers of patients present to our acute general hospital with mental health illness even though
66 the organisation does not provide mental health services other than inpatient liaison psychiatry. There
67 was some variation in the numbers and patterns of presentations related to the Covid-19 pandemic.

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3 68 Patient numbers reduced to a mean of 9.13 (SD 3.38) patients presenting per day during the first
4
5 69 'lockdown' compared with 10.75 (SD 1.96) patients per day in an earlier matched time period ($t=3.80$,
6
7 70 $p<0.01$). Acute mental health presentations following the third lockdown increased to a mean of 13.84 a
8
9 71 day.
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12 72

13 14 73 **Conclusions**

15
16 74 Large numbers of patients present to our acute general hospital with mental health illness. This suggests
17
18 75 a need for appropriate resource, staffing and training to address the needs of these patients in a non-
19
20 76 mental health provider organisation and subsequent appropriate transfer for timely treatment . The
21
22 77 Covid-19 pandemic and the resulting lockdowns have resulted in variation in the numbers and patterns
23
24 78 of patients presenting with acute mental health illness but these presentations are not new.
25
26 79 Considerable work is still needed to provide integrated care which addresses the physical and mental
27
28 80 healthcare needs of patients presenting to acute and general hospitals
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32 81 33 34 82 **Strengths and limitations of this study**

- 35
36
37 83
- 38 • This is a retrospective study.
 - 39 84 • Lockdown and inter-lockdowns were compared with pre-covid-19 matched time periods.
 - 40 85 • A large and reliable data set strengthens this study however diagnostic coding is open to error
41
42 86 and interpretation.
 - 43 87 • This study cannot capture the interactions and presentations occurring in the community with
44
45 88 primary care teams where it is expected that large numbers of patients will also present.
 - 46 89 • There is implicit risk in using routinely collected data to evaluate a research question where the
47
48 90 data may not have been collected for this specific purpose
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92 KEY WORDS

93 Mental health, Covid-19, lockdown, emergency department, acute general hospital

95 INTRODUCTION

96
97 There is significant overlap in the mental and physical health needs for patients and for some time it has
98 been an aspiration to offer integrated care. The National Confidential Enquiry into Patient Outcome and
99 Death (NCEPOD) investigated and reported on the mental health needs of patients treated in acute
100 general hospitals for physical illnesses in 2017 and made several recommendations.[1] Key among these
101 were that all hospital staff who have interaction with patients, including clinical, clerical and security
102 staff, should receive training in mental health conditions in general hospitals. Training should be
103 developed and offered across the entire career pathway from undergraduate to workplace based
104 continued professional development. The report also recommended that in order to overcome the
105 divide between mental and physical healthcare, liaison psychiatry services should be fully integrated
106 into general hospitals. The structure and staffing of the liaison psychiatry service should be based on the
107 clinical demand both within working hours and out-of-hours so that they can participate as part of the
108 multidisciplinary team. These recommendations have only been adopted in part in many places and still
109 represent a challenge several years later.

110
111 The delivery of truly integrated assessment and care for patients presenting to acute general hospitals
112 where mental health services are not normally provided requires careful planning and an understanding
113 of the numbers and types of patients presenting. This is so that an assessment can be made as to what is
114 required to meet their needs and to provide high-quality care and patient experience.

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3 116 We undertook this study to examine the numbers and patterns of patients presenting to an urban acute
4
5 117 general hospital with acute mental health presentations via the emergency department. This hospital
6
7 118 does not provide any routine mental health services other than an inpatient liaison psychiatry service.
8
9
10 119 We hypothesised that our study would confirm a large number of patients presenting with acute
11
12 120 episodes of mental health conditions despite the fact that the hospital does not provide mental health
13
14 121 services. We further hypothesised that our study would demonstrate increasing numbers of patients
15
16 122 presenting in this way over time and that this might be representative of the situation more generally
17
18
19 123 and beyond our organisation.
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21 124
22
23 125 The period of our study included the first waves of the global covid-19 pandemic and so we also
24
25 126 examined whether there was any effect on the patterns and numbers of patient presentations as a
26
27 127 result of the pandemic and the social restrictions associated with the mandated periods of social
28
29 128 lockdown where normal mixing and social interaction were severely restricted. We hypothesised that
30
31 129 the periods of the social lockdown would result in increasing numbers of patients presenting via the
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33 130 emergency department with acute mental health needs.
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140 **METHODS**

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142 **Data and setting**

143 We conducted a retrospective observational cohort study of all patients presenting to an urban acute
144 general hospital with an acute mental health illness presentation. Our hospital organisation is made up
145 of 5 hospital sites served by 2 acute emergency departments. Presentations to both emergency
146 departments were included. All hospital attendances, admissions and treatments are recorded and
147 coded to form data for Hospital Episode Statistics (HES) and are also recorded in the electronic patient
148 record (EPR).

149

150 We used the United Kingdom government website to confirm the dates of mandated social lockdown (L)
151 periods.[2] We included the 3 periods of national lockdown in the United Kingdom which occurred
152 during the study period.

153

154 Lockdown 1 (L1) was defined between 23 March 2020 and 15 June 2020. Lockdown 2 (L2) was defined
155 between 5 November 2020 and 2 December 2020. Lockdown 3 (L3) was defined between 6 January
156 2021 and 12 April 2021. For analysis and comparison, we defined the periods between the statutory
157 periods of lockdown to be 'inter-lockdown' (IL) periods. Inter-lockdown 1 (IL1) was therefore defined
158 between 16 June 2020 and 4 November 2020. Inter-lockdown 2 (IL2) was defined between 3 December
159 2020 and 5 January 2021. Inter-lockdown 3 (IL3) was defined between 13 April 2021 and 30 June 2021,
160 when the study period ended after the final national lockdown.

161

162 Numbers and patterns of presentation were examined longitudinally to identify trends. We also
163 examined and compared data for lockdown (L) and inter-lockdown (IL) periods with matched time

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3 164 periods (MTP) between March 2018 and June 2019 in order to examine for any effects related to the
4
5 165 covid-19 pandemic.
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8 167 **Patients**

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10 168 We included all adult patients aged 18 years and older. We examined the hospital coding records and
11
12 169 electronic patient records for all adult patients attending our emergency departments with an acute
13
14 170 mental health presentation between 1 January 2018 and 30 June 2021. HES data and patient records
15
16 171 were examined to collate demographic information, diagnosis, details of initial referral and treatment,
17
18 172 waiting times and admission.
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22 174 **Statistical analysis**

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25 175 We analysed data using SPSS Statistics version 26.0. We present data as means with standard deviations
26
27 176 or median values with interquartile ranges. We used the standard t-test, Chi-squared tests, and ANOVA
28
29 177 with post-hoc Tukey test to compare categorical and continuous data between matched time periods.
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33 179 **Patient and public involvement**

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35 180 Patients and the public were not involved in framing or designing this research question. As it is a
36
37 181 retrospective cohort study there was no patient impact. We did ask strategic lay forum members at our
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39 182 hospital to read and comment on our manuscript.
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188 RESULTS

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190 Numbers of patients

191 358131 patients attended our emergency departments between 1 January 2018 and 30 June 2021. Of
192 these, 14871 patients (4.2%) presented to our emergency departments with an acute mental health
193 diagnosis (fig 1). In addition, 14947 patients (4.2%) who presented with a physical complaint also had a
194 concurrent recorded mental health diagnosis.

195

196 Presentations

197 The numbers of patients presenting during the covid-19 pandemic varied considerably. The numbers of
198 patients presenting with acute mental health illness was at the lowest level during the first lockdown
199 (L1) period (fig 2). When compared with a matched time period (MTP) in 2018, 761 patients presented
200 acutely in L1 compared with 897 patients in MTP1 (figs 2 and 3). This represents a mean of 9.13 (SD
201 3.38) patients presenting per day during L1 compared with 10.75 (SD 1.96) patients per day during MTP1
202 ($t=3.80$, $p<0.01$).

203

204 Following the first lockdown there was a significant increase in acute mental health presentations during
205 IL1 compared with a MTP in 2018 ($t=-5.34$, $p<0.01$). There was a similar increase in acute mental health
206 presentations following the third lockdown in IL3, with a mean 13.84 acute mental health presentations
207 per day which was significantly greater than the number of attendances for the MTP in 2019 ($t=-10.79$,
208 $p<0.01$)

209

210

211

212 **Age**

213 The mean age of patients presenting to the department was 38.57 years (n= 14871, SD= 15.041). There
214 was no significant difference in the age of presentation when different time periods were compared.
215 (ANOVA, $f=2.0357$, $p=0.0574$).

217 **Diagnoses and patterns of illness**

218 There was variation in the pattern of mental health illness presenting to our emergency departments
219 (fig 4). We noted a significant increase ($t=-13.62$, $p<0.01$) in patients presenting with psychosis in L1.
220 There were a mean 2.11 (SD 0.85) presentations of psychosis per day during L1 compared with a mean
221 0.77 (SD 0.30) of such presentations during the respective MTP. In contrast, we saw a significant
222 decrease in presenting rates of self-harm ($t=-2.45$, $p=0.02$) and substance misuse ($t=6.28$, $p<0.01$) per
223 day in L1 when compared to the MTP.

225 IL1 saw an increase in patients presenting with acute psychosis ($t=-8.56$, $p<0.01$), anxiety ($t=-4.41$,
226 $p<0.01$), overdose ($t=-11.7$, $p<0.01$), and suicidal presentations ($t=-7.34$, $p<0.01$), compared to the
227 respective MTP, whilst substance misuse presentations decreased ($t=2.56$, $p=0.01$). In L2 we recorded a
228 continuing increase in patients attending with anxiety ($t=-3.50$, $p<0.01$), self-harm ($t=-2.25$, $p=0.03$), and
229 suicidal presentations ($t=-6.82$, $p<0.01$), whilst presentations of overdoses ($t=2.58$, $p=0.02$) and affective
230 disorders decreased ($t=5.60$, $p<0.01$). IL2 showed decreased rates of substance misuse, affective
231 disorders, and suicidal presentations.

233 Overall, the broad patterns and relative distributions of key diagnosis groups did not change when study
234 periods (lockdown and inter-lockdown periods) were compared with MTPs (Figs 2 and 3) except for
235 during L1 when psychosis became the most common acute mental health diagnosis.

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3 **236 Emergency Department assessment and outcome**
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5 237 Patients attending with an acute mental health presentation spent a considerable amount of time in the
6
7 238 emergency department before transfer was arranged to an appropriate inpatient mental health facility
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10 239 or they were assessed and discharged by the community mental health assessment team. Overall, the
11
12 240 mean time spent in the department for these patients was 6 hours 52 minutes (n= 14871, SD= 376.80)
13
14 241 with no significant variation when lockdown and inter-lockdown periods were compared (fig 5).
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16 242

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18 243 There were no significant differences in the proportions of patients being discharged directly or
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20 244 transferred to an inpatient mental health care facility from the emergency department during the
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23 245 lockdown and inter-lockdown periods.
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254 **DISCUSSION**

255 There was considerable concern during the covid-19 pandemic that social isolation resulting from
256 statutory lockdown periods would result in a considerable burden of mental health illness and
257 morbidity.[3,4] There are several reports that patients have been making increased self-reports of
258 symptoms of anxiety, depression and other acute mental health disorders since the beginning of the
259 covid-19 pandemic.[5,6] The associated economic recession may also be an important factor.

260
261 There is longstanding evidence that patients with acute mental health illness present to the emergency
262 departments of acute general hospitals;[1] illness is not always specifically identified as physical or
263 mental and the emergency department is identified as a place of safety where assessment and
264 treatment can be started. Our study showed that considerable numbers of patients attend our
265 emergency departments each week with acute mental health presentations. The covid-19 pandemic
266 resulted in some variations in the patterns of mental health illness that were seen; mental health
267 presentations during the first lockdown period fell as did all non-covid-19 related presentations in our
268 emergency departments. The reasons for this are multi-factorial and likely include reduced social
269 movement during lockdown as well as patient concern and fears about attending a hospital during a
270 pandemic. These factors may mean that while the numbers presenting to the emergency department
271 are reduced during the lockdown, this may underrepresent the true level of mental health morbidity in
272 the community that is simply not presenting to hospital during the pandemic. This is possibly one
273 explanation for the rebound increase in acute mental health presentations seen following a lockdown in
274 the inter-lockdown period.

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3 276 Our study showed that 4% of patients attending our emergency departments had an acute mental
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5 277 health problem and 4% of patients although attending for a physical health complaint, were known to
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7 278 have a concurrent mental health diagnosis. This supports the findings of the 2017 NCEPOD report and
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9
10 279 specifically the recommendations that there is a need for training and resource to equip staff in acute
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12 280 general hospitals to address the needs of patients presenting with mental health illness. In the years
13
14 281 since the publication of the NCEPOD report, Treat as One. Bridging the gap between mental and physical
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16 282 healthcare in general hospitals, our findings suggest that there is still considerable work to do in order to
17
18 283 achieve the standards and recommendations that it made.[1]
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23 285 The fact that patients presenting with acute mental illness still suffer extended waiting times in the
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25 286 emergency department is indicative of this failing. Again, this is likely to be multifactorial and may
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27 287 represent delays in initial assessment or in the ability to exclude and treat physical illness appropriately
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29 288 as well as a lack of capacity to transfer patients to an appropriate mental health care facility for timely
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31 289 treatment but mean waiting times in the emergency department of 6-7 hours do not suggest that
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33 290 mental and physical care are well integrated and suggest that there are opportunities to improve the
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35 291 quality of care and experience for these patients.
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3 300 **CONCLUSION**
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8 302 Patients present to acute general hospitals with both physical and mental health complaints. Our study
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10 303 shows that while the covid-19 pandemic and the use of lockdowns may have had some impact on the
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12 304 patterns and specific mental health diagnoses that were seen in our emergency departments, the
13
14
15 305 mental health workload and need in acute general hospitals is longstanding and has not been grossly
16
17 306 changed by the covid-19 pandemic.
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21 308 Our study does show that several years later, considerable work is still needed to provide integrated
22
23 309 care which addresses the physical and mental healthcare needs of patients presenting to acute general
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26 310 hospitals. The recommendations of the National Confidential Enquiry into Postoperative Outcome and
27
28 311 Death, 'Treat as One' remain as valid and important today as they were in 2017.
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11 351 **Contributorship statement**

12 352 All authors contributed to the study design. RA and JS conceived the study design. JC, RB and JB
13
14
15 353 collected and analysed the data. JB undertook the statistical analysis. JC, RB, JB and JS contributed to the
16
17
18 354 drafting and critical review of the manuscript. RA revised and edited the manuscript. All authors
19
20
21 355 approved the final draft. The corresponding author attests that all listed authors meet authorship
22
23
24 356 criteria and that no others meeting the criteria have been omitted. RA is the guarantor of this study.
25

26 357

27
28 358 JC, RB and JB contributed equally to this study and are recognised as joint first authors.
29

30 359

31 360 **Competing interests**

32
33 361 The authors have no competing interests to declare
34
35
36 362

37 363 **Funding**

38
39 364 None
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43 366 **Ethical approval**

44
45 367 Ethical approval was not sought for this work. It was registered as a clinical audit in line with institutional
46
47
48 368 policy and conducted in line with the Declaration of Helsinki as revised in 2013. The study was approved
49
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51 369 by the institutional clinical audit and effectiveness group.
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What is already known about this topic

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Patients often present to acute general hospitals with acute mental health illness or complex health needs combining physical and mental health elements which cannot always be easily separated.

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Resources, training and experience in caring for acute mental health illness are not always readily available in acute general hospitals

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What this study adds

376

Large numbers of patients continue to attend acute general hospitals with acute mental health presentations.

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Several years after the publication of the 'Treat as One' report by the National Confidential Enquiry into Patient Outcome and death, considerable work is still required to provide integrated care for patients presenting to acute general hospitals with acute mental health illness.

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The covid-19 pandemic did affect the patterns and presentations of patients with acute mental health illness attending acute general hospitals.

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Figures and Legends

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Figure 1 Mean number of presentations with acute mental health illness per week
1 January 2018 - 30 June 2021

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Figure 2 Patterns of diagnosis and presentation. Mean presentations per day during the covid-19 pandemic

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Figure 3 Diagnosis patterns for acute mental health presentations
1 January 2018-30 June 2021

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Figure 4 Patterns of diagnosis and presentation. Mean presentations per day during the matched time periods (MTP)

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Figure 5 Waiting time in the emergency department for patients attending with acute mental health presentations 1 January 2018 – 30 June 2021

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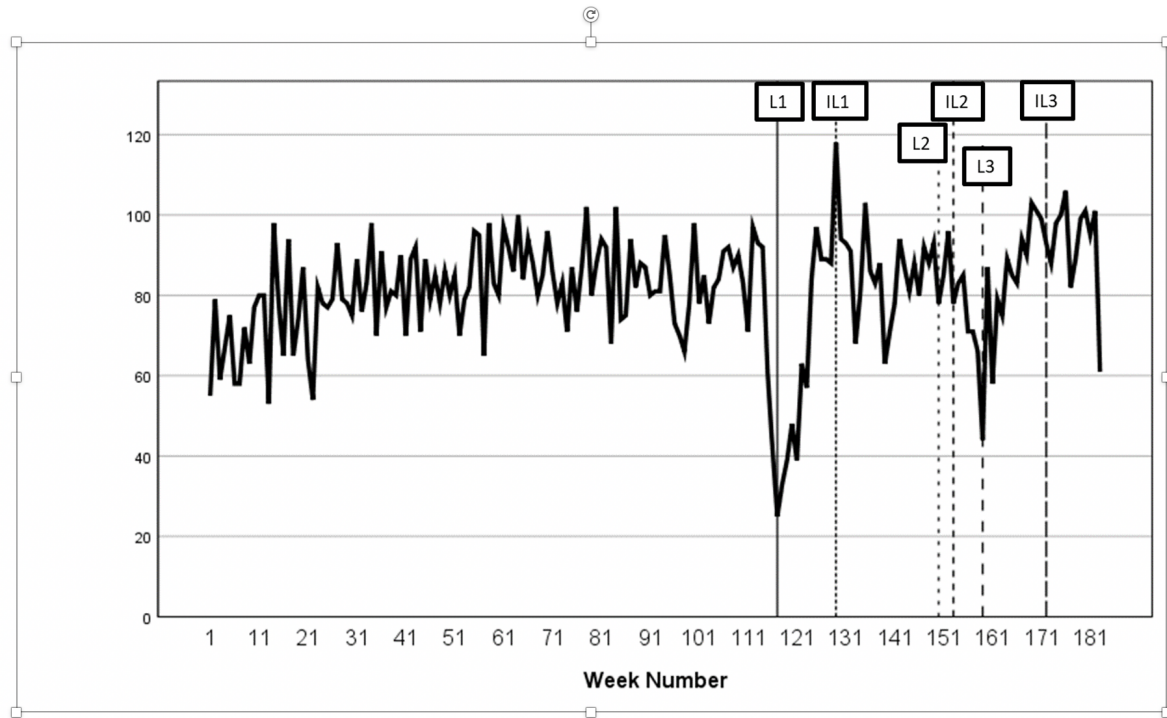
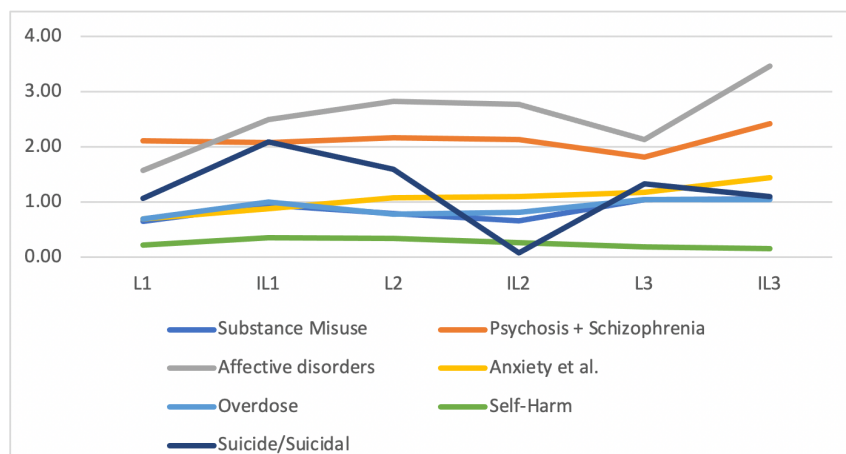
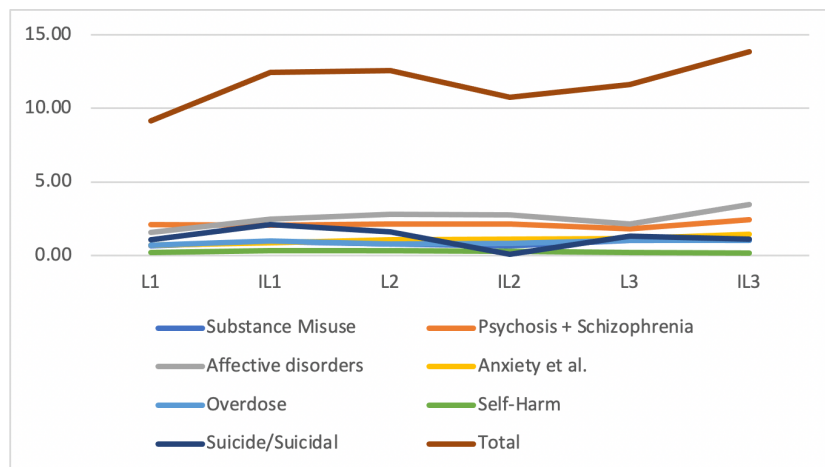


Figure 1 Mean number of presentations with acute mental health illness per week 1 January 2018 - 30 June 2021

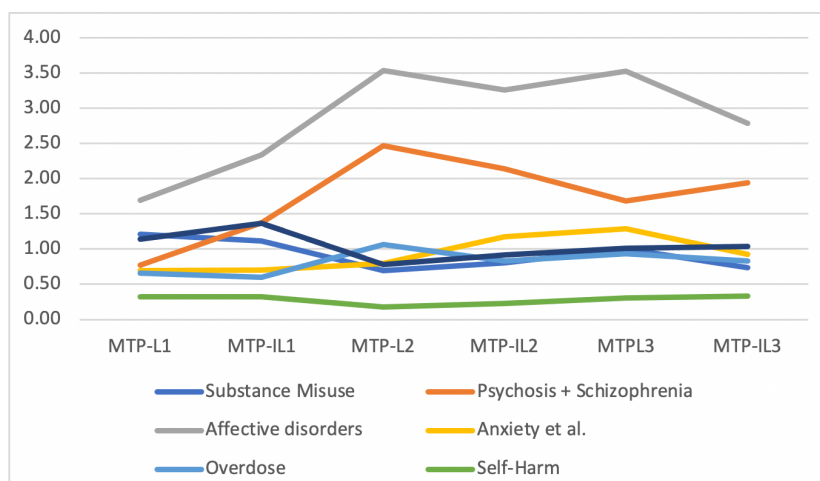
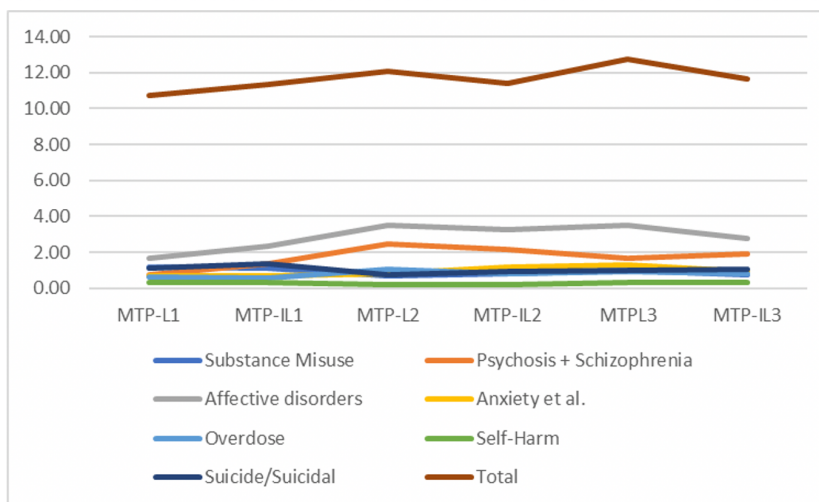
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Figure 2 Patterns of diagnosis and presentation. Mean presentations per day during the covid-19 pandemic



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Figure 3 Patterns of diagnosis and presentation. Mean presentations per day during the matched time periods (MTP)



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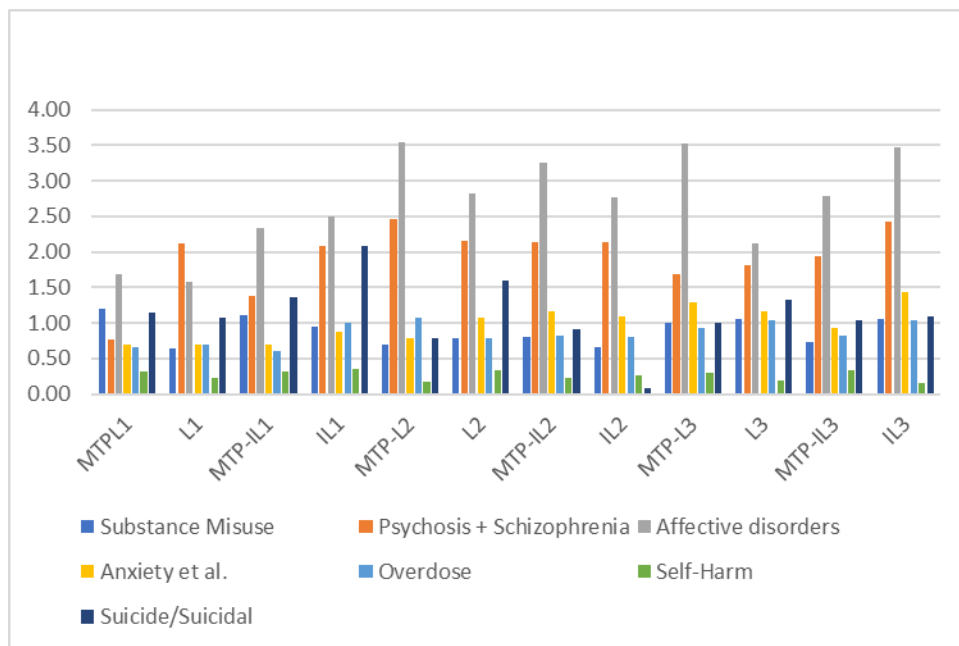


Figure 4 Diagnosis patterns for acute mental health presentations 1 January 2018-30 June 2021

Peer review only

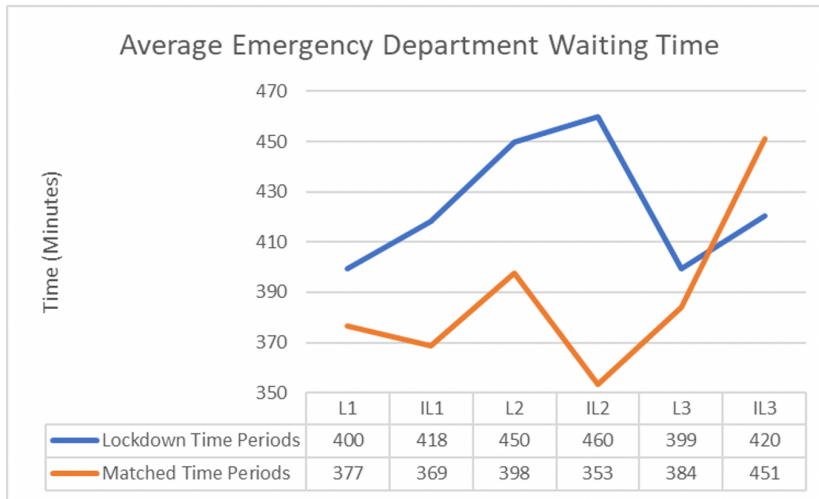


Figure 5 Waiting time in the emergency department for patients attending with acute mental health presentations 1 January 2018 – 30 June 2021

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The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title Line 1 Abstract Line 49	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Methods Lines 143-145 Abstract Lines 51-54 Not applicable
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction Lines 92-125		
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction Lines 92-125		
Methods					
Study Design	4	Present key elements of study design early in the paper	Methods Lines 140-162		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Abstract Lines 51-54 Methods Lines 140-162		

Participants	6	<p>(a) <i>Cohort study</i> - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i> - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p>(b) <i>Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> - For matched studies, give matching criteria and the number of controls per case</p>	<p>Methods/Patients Lines 164-169</p> <p>Methods Matched time periods described lines 159-162</p>	<p>RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.</p> <p>RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.</p> <p>RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.</p>	<p>Methods/Patients Lines 164-169</p> <p>Not applicable</p> <p>Not applicable</p>
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Methods/Patients studied outcomes recorded Lines 165-170	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Not applicable
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods/Patients Lines 165-170 Lines 140-145		

Bias	9	Describe any efforts to address potential sources of bias	The use of HES data which is nationally collected and validated lines 140-145 and lines 165-170		
Study size	10	Explain how the study size was arrived at	Methods Lines 140-145		
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Methods/Statistical analysis Lines 171-174		
Statistical methods	12	<p>(a) Describe all statistical methods, including those used to control for confounding</p> <p>(b) Describe any methods used to examine subgroups and interactions</p> <p>(c) Explain how missing data were addressed</p> <p>(d) <i>Cohort study</i> - If applicable, explain how loss to follow-up was addressed</p> <p><i>Case-control study</i> - If applicable, explain how matching of cases and controls was addressed</p> <p><i>Cross-sectional study</i> - If applicable, describe analytical methods taking account of sampling strategy</p> <p>(e) Describe any sensitivity analyses</p>	<p>Methods/Statistical analysis Lines 171-174</p> <p>Not applicable</p>		
Data access and cleaning methods		..		RECORD 12.1: Authors should describe the extent to which the investigators had access to the database	Not applicable 12.1 and 12.2

				population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Not applicable
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (<i>e.g.</i> , numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Methods All patients selected Lines 140-169	RECORD 13.1: Describe in detail the selection of the persons included in the study (<i>i.e.</i> , study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Methods Lines 140-169
Descriptive data	14	(a) Give characteristics of study participants (<i>e.g.</i> , demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) <i>Cohort study</i> - summarise follow-up time (<i>e.g.</i> , average and total amount)	Results lines 186-243 Not applicable Study period defined lines Methods/Patients Lines 165-170		

1 2 3 4 5 6 7 8 9 10 11	Outcome data	15	<i>Cohort study</i> - Report numbers of outcome events or summary measures over time <i>Case-control study</i> - Report numbers in each exposure category, or summary measures of exposure <i>Cross-sectional study</i> - Report numbers of outcome events or summary measures	Results lines 186-243		
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included (b) Report category boundaries when continuous variables were categorized (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Results lines 186-243		
28 29 30 31 32	Other analyses	17	Report other analyses done— e.g., analyses of subgroups and interactions, and sensitivity analyses	Statistical analysis lines 172-175		
33	Discussion					
34 35	Key results	18	Summarise key results with reference to study objectives			
36 37 38 39 40 41 42 43 44	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Limitations and strengths of study lines 80-86	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over	Limitations and strengths of study lines 80-86

				time, as they pertain to the study being reported.	
1 2 3 4 5 6 7 8 9	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion lines 251-288	
10 11 12 13 14 15 16 17 18 19 20	Generalisability	21	Discuss the generalisability (external validity) of the study results	Limitations and strengths of study lines 80-86 Generalisability and previous studies/NCEPOD report cited lines 275-280	
21	Other Information				
22 23 24 25 26 27	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	No funding Funding statement Lines 357-358	
28 29 30 31 32 33	Accessibility of protocol, raw data, and programming code		..	RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Not applicable

*Reference: Benchimol EI, Smeeth L, Guttman A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.

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4 1 **Patients presenting to an acute general hospital with acute mental health**
5 2 **needs. A retrospective observational cohort study.**
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44 **ABSTRACT**

45 **Objectives**

46 To examine the numbers and patterns of patients presenting to an urban acute general hospital with
47 acute mental health presentations and to further investigate any variation related to the covid
48 pandemic.

50 **Design**

51 Retrospective observational cohort study.

53 **Setting**

54 An urban acute general hospital in London, United Kingdom, comprising of five sites and two emergency
55 departments. The hospital provides tertiary level general acute care but is not an acute mental health
56 services provider. There is an inpatient liaison psychiatry service

58 **Participants**

59 358131 patients attended the emergency departments of our acute general hospital during the study
60 period. Of these, 14871 patients attended with an acute mental health presentation. A further 14947
61 patients attending with a physical illness were also noted to have a concurrent recorded mental health
62 diagnosis.

64 **Results**

65 Large numbers of patients present to our acute general hospital with mental health illness even though
66 the organisation does not provide mental health services other than inpatient liaison psychiatry. There
67 was some variation in the numbers and patterns of presentations related to the Covid-19 pandemic.

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2
3 68 Patient numbers reduced to a mean of 9.13 (SD 3.38) patients presenting per day during the first
4
5 69 'lockdown' compared with 10.75 (SD 1.96) patients per day in an earlier matched time period (t=3.80,
6
7 70 p<0.01). Acute mental health presentations following the third lockdown increased to a mean of 13.84 a
8
9 71 day.
10
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12 72

14 73 **Conclusions**

16 74 Large numbers of patients present to our acute general hospital with mental health illness. This suggests
17
18 75 a need for appropriate resource, staffing and training to address the needs of these patients in a non-
19
20 76 mental health provider organisation and subsequent appropriate transfer for timely treatment. The
21
22 77 Covid-19 pandemic and the resulting lockdowns have resulted in variation in the numbers and patterns
23
24 78 of patients presenting with acute mental health illness but, these presentations are not new.
25
26 79 Considerable work is still needed to provide integrated care which addresses the physical and mental
27
28 80 healthcare needs of patients presenting to acute and general hospitals
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34 82 **Strengths and limitations of this study**

- 36
37 83
- 38 • This is a retrospective study
 - 39 84 • The study examines a large number of patient care episodes.
 - 40 85 • Diagnostic coding is open to error in recording and interpretation.
 - 41 86 • There is implicit risk in using routinely collected data to evaluate a research question where the
 - 42 87 data may have not been collected for this specific purpose
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51 89 **KEY WORDS**

53 90 Mental health, Covid-19, lockdown, emergency department, acute general hospital

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92 **DATA SHARING STATEMENT**

93 Data are available upon reasonable request.

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For peer review only

114 INTRODUCTION

115
116 There is significant overlap in the mental and physical health needs for patients and for some time it has
117 been an aspiration to offer integrated care. The National Confidential Enquiry into Patient Outcome and
118 Death (NCEPOD) investigated and reported on the mental health needs of patients treated in acute
119 general hospitals for physical illnesses in 2017 and made several recommendations.[1] Key among these
120 were that all hospital staff who have interaction with patients, including clinical, clerical and security
121 staff, should receive training in mental health conditions in general hospitals. Training should be
122 developed and offered across the entire career pathway from undergraduate to workplace based
123 continued professional development. The report also recommended that in order to overcome the
124 divide between mental and physical healthcare, liaison psychiatry services should be fully integrated
125 into general hospitals. The structure and staffing of the liaison psychiatry service should be based on the
126 clinical demand both within working hours and out-of-hours so that they can participate as part of the
127 multidisciplinary team. These recommendations have only been adopted in part in many places and still
128 represent a challenge several years later.

129
130 The delivery of truly integrated assessment and care for patients presenting to acute general hospitals
131 where mental health services are not normally provided requires careful planning and an understanding
132 of the numbers and types of patients presenting. This is so that an assessment can be made as to what is
133 required to meet their needs and to provide high-quality care and patient experience.

134
135 We undertook this study to examine the numbers and patterns of patients presenting to an urban acute
136 general hospital with acute mental health presentations via the emergency department. This hospital
137 does not provide any routine mental health services other than an inpatient liaison psychiatry service.

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3 138 We hypothesised that our study would confirm a large number of patients presenting with acute
4
5 139 episodes of mental health conditions despite the fact that the hospital does not provide mental health
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7 140 services. We further hypothesised that our study would demonstrate increasing numbers of patients
8
9 141 presenting in this way over time and that this might be representative of the situation more generally
10
11 142 and beyond our organisation.
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14 143

16 144 The period of our study included the first waves of the global covid-19 pandemic and so we also
17
18 145 examined whether there was any effect on the patterns and numbers of patient presentations as a
19
20 146 result of the pandemic and the social restrictions associated with the mandated periods of social
21
22 147 lockdown where normal mixing and social interaction were severely restricted. We hypothesised that
23
24 148 the periods of the social lockdown would result in increasing numbers of patients presenting via the
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26 149 emergency department with acute mental health needs.
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161 **METHODS**

163 **Data and setting**

164 We conducted a retrospective observational cohort study of all patients presenting to an urban acute
165 general hospital with an acute mental health illness presentation. Our hospital organisation is made up
166 of 5 hospital sites served by 2 acute emergency departments. Presentations to both emergency
167 departments were included. All hospital attendances, admissions and treatments are recorded and
168 coded to form data for Hospital Episode Statistics (HES) and are also recorded in the electronic patient
169 record (EPR).

171 We used the United Kingdom government website to confirm the dates of mandated social lockdown (L)
172 periods.[2] We included the 3 periods of national lockdown in the United Kingdom which occurred
173 during the study period.

175 Lockdown 1 (L1) was defined between 23 March 2020 and 15 June 2020. Lockdown 2 (L2) was defined
176 between 5 November 2020 and 2 December 2020. Lockdown 3 (L3) was defined between 6 January
177 2021 and 12 April 2021. For analysis and comparison, we defined the periods between the statutory
178 periods of lockdown to be 'inter-lockdown' (IL) periods. Inter-lockdown 1 (IL1) was therefore defined
179 between 16 June 2020 and 4 November 2020. Inter-lockdown 2 (IL2) was defined between 3 December
180 2020 and 5 January 2021. Inter-lockdown 3 (IL3) was defined between 13 April 2021 and 30 June 2021,
181 when the study period ended after the final national lockdown.

183 Numbers and patterns of presentation were examined longitudinally to identify trends. We also
184 examined and compared data for lockdown (L) and inter-lockdown (IL) periods with matched time

185 periods (MTP) between March 2018 and June 2019 in order to examine for any effects related to the
186 covid-19 pandemic.

187

188 **Patients**

189 We included all adult patients aged 18 years and older. We examined the hospital coding records and
190 electronic patient records for all adult patients attending our emergency departments with an acute
191 mental health presentation between 1 January 2018 and 30 June 2021. HES data and patient records
192 were examined to collate demographic information, diagnosis, details of initial referral and treatment,
193 waiting times and admission.

194

195 **Statistical analysis**

196 We analysed data using SPSS Statistics version 26.0. We present data as means with standard deviations
197 or median values with interquartile ranges. We used the standard t-test, Chi-squared tests, and ANOVA
198 with post-hoc Tukey test to compare categorical and continuous data between matched time periods.

199

200 **Patient and public involvement**

201 Patients and the public were not involved in framing or designing this research question. As it is a
202 retrospective cohort study there was no patient impact. We did ask strategic lay forum members at our
203 hospital to read and comment on our manuscript.

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209 RESULTS

210

211 Numbers of patients

212 358131 patients attended our emergency departments between 1 January 2018 and 30 June 2021. Of
213 these, 14871 patients (4.2%) presented to our emergency departments with an acute mental health
214 diagnosis (fig 1). In addition, 14947 patients (4.2%) who presented with a physical complaint also had a
215 concurrent recorded mental health diagnosis.

216

217 Presentations

218 The numbers of patients presenting during the covid-19 pandemic varied considerably. The numbers of
219 patients presenting with acute mental health illness was at the lowest level during the first lockdown
220 (L1) period (fig 2). When compared with a matched time period (MTP) in 2018, 761 patients presented
221 acutely in L1 compared with 897 patients in MTP1 (figs 2 and 3). This represents a mean of 9.13 (SD
222 3.38) patients presenting per day during L1 compared with 10.75 (SD 1.96) patients per day during MTP1
223 ($t=3.80$, $p<0.01$).

224

225 Following the first lockdown there was a significant increase in acute mental health presentations during
226 IL1 compared with a MTP in 2018 ($t=-5.34$, $p<0.01$). There was a similar increase in acute mental health
227 presentations following the third lockdown in IL3, with a mean 13.84 acute mental health presentations
228 per day which was significantly greater than the number of attendances for the MTP in 2019 ($t=-10.79$,
229 $p<0.01$)

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231

232

233 **Age**

234 The mean age of patients presenting to the department was 38.57 years (n= 14871, SD= 15.041). There
235 was no significant difference in the age of presentation when different time periods were compared.
236 (ANOVA, $f=2.0357$, $p=0.0574$).

237

238 **Diagnoses and patterns of illness**

239 There was variation in the pattern of mental health illness presenting to our emergency departments
240 (figs 4a and 4b). We noted a significant increase ($t=-13.62$, $p<0.01$) in patients presenting with psychosis
241 in L1. There were a mean 2.11 (SD 0.85) presentations of psychosis per day during L1 compared with a
242 mean 0.77 (SD 0.30) of such presentations during the respective MTP. In contrast, we saw a significant
243 decrease in presenting rates of self-harm ($t=-2.45$, $p=0.02$) and substance misuse ($t=6.28$, $p<0.01$) per
244 day in L1 when compared to the MTP.

245

246 IL1 saw an increase in patients presenting with acute psychosis ($t=-8.56$, $p<0.01$), anxiety ($t=-4.41$,
247 $p<0.01$), overdose ($t=-11.7$, $p<0.01$), and suicidal presentations ($t=-7.34$, $p<0.01$), compared to the
248 respective MTP, whilst substance misuse presentations decreased ($t=2.56$, $p=0.01$). In L2 we recorded a
249 continuing increase in patients attending with anxiety ($t=-3.50$, $p<0.01$), self-harm ($t=-2.25$, $p=0.03$), and
250 suicidal presentations ($t=-6.82$, $p<0.01$), whilst presentations of overdoses ($t=2.58$, $p=0.02$) and affective
251 disorders decreased ($t=5.60$, $p<0.01$). IL2 showed decreased rates of substance misuse, affective
252 disorders, and suicidal presentations.

253

254 Overall, the broad patterns and relative distributions of key diagnosis groups did not change when study
255 periods (lockdown and inter-lockdown periods) were compared with MTPs (figs 2 and 3) except for
256 during L1 when psychosis became the most common acute mental health diagnosis.

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3 257 **Emergency Department assessment and outcome**
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5 258 Patients attending with an acute mental health presentation spent a considerable amount of time in the
6
7 259 emergency department before transfer was arranged to an appropriate inpatient mental health facility
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10 260 or they were assessed and discharged by the community mental health assessment team. Overall, the
11
12 261 mean time spent in the department for these patients was 6 hours 52 minutes (n= 14871, SD= 376.80)
13
14 262 with no significant variation when lockdown and inter-lockdown periods were compared (fig 5).
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16 263
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18 264 There were no significant differences in the proportions of patients being discharged directly or
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20 265 transferred to an inpatient mental health care facility from the emergency department during the
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22 266 lockdown and inter-lockdown periods.
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275 **DISCUSSION**

276 There was considerable concern during the covid-19 pandemic that social isolation resulting from
277 statutory lockdown periods would result in a considerable burden of mental health illness and
278 morbidity.[3,4] There are several reports that patients have been making increased self-reports of
279 symptoms of anxiety, depression and other acute mental health disorders since the beginning of the
280 covid-19 pandemic.[5,6] The associated economic recession may also be an important factor.

281
282 There is longstanding evidence that patients with acute mental health illness present to the emergency
283 departments of acute general hospitals;[1] illness is not always specifically identified as physical or
284 mental and the emergency department is identified as a place of safety where assessment and
285 treatment can be started. Our study showed that considerable numbers of patients attend our
286 emergency departments each week with acute mental health presentations. The covid-19 pandemic
287 resulted in some variations in the patterns of mental health illness that were seen; mental health
288 presentations during the first lockdown period fell as did all non-covid-19 related presentations in our
289 emergency departments. The reasons for this are multi-factorial and likely include reduced social
290 movement during lockdown as well as patient concern and fears about attending a hospital during a
291 pandemic. These factors may mean that while the numbers presenting to the emergency department
292 are reduced during the lockdown, this may underrepresent the true level of mental health morbidity in
293 the community that is simply not presenting to hospital during the pandemic. This is possibly one
294 explanation for the rebound increase in acute mental health presentations seen following a lockdown in
295 the inter-lockdown period.

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3 297 Our study showed that 4% of patients attending our emergency departments had an acute mental
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5 298 health problem and 4% of patients although attending for a physical health complaint, were known to
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7 299 have a concurrent mental health diagnosis. This supports the findings of the 2017 NCEPOD report and
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10 300 specifically the recommendations that there is a need for training and resource to equip staff in acute
11
12 301 general hospitals to address the needs of patients presenting with mental health illness. In the years
13
14 302 since the publication of the NCEPOD report, Treat as One. Bridging the gap between mental and physical
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16 303 healthcare in general hospitals, our findings suggest that there is still considerable work to do in order to
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18 304 achieve the standards and recommendations that it made.[1]
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23 306 The fact that patients presenting with acute mental illness still suffer extended waiting times in the
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25 307 emergency department is indicative of this failing. Again, this is likely to be multifactorial and may
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27 308 represent delays in initial assessment or in the ability to exclude and treat physical illness appropriately.
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29 309 Patients attending the emergency department may need to have physical disease and illness excluded
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31 310 or treated before or concurrently with their mental health needs and this can take time. Extended
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33 311 waiting times may also reflect a lack of capacity to transfer patients to an appropriate mental health
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35 312 care facility for timely treatment. Mean waiting times in the emergency department of 6-7 hours do not
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37 313 suggest that mental and physical care are well integrated and may indicate that there are opportunities
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39 314 to improve the quality of care and the experience for these patients.
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46 316 Our study has several limitations which include the retrospective nature of the study. Diagnoses were
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48 317 identified and confirmed from the electronic patient record and coding for patient episodes of care
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50 318 which are open to a degree of error in recording and interpretation. This potential for error was partly
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52 319 mitigated because acute mental health diagnoses were confirmed by a psychiatrist in the acute setting.
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3 321 **CONCLUSION**
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8 323 Patients present to acute general hospitals with both physical and mental health complaints. Our study
9
10 324 shows that while the covid-19 pandemic and the use of lockdowns may have had some impact on the
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12 325 patterns and specific mental health diagnoses that were seen in our emergency departments, the
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14
15 326 mental health workload and need in acute general hospitals is longstanding. This has not been
16
17 327 substantially changed by the covid-19 pandemic.
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21 329 Our study does show that several years later, considerable work is still needed to provide integrated
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23 330 care which addresses the physical and mental healthcare needs of patients presenting to acute general
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25
26 331 hospitals. The recommendations of the National Confidential Enquiry into Postoperative Outcome and
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12 372 **Contributorship statement**
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15 373 All authors contributed to the study design. RA and JS conceived the study design. JC, RB and JB
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17 374 collected and analysed the data. JB undertook the statistical analysis. JC, RB, JB and JS contributed to the
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19 375 drafting and critical review of the manuscript. RA revised and edited the manuscript. All authors
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21 376 approved the final draft. The corresponding author attests that all listed authors meet authorship
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23 377 criteria and that no others meeting the criteria have been omitted. RA is the guarantor of this study.
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28 379 JC, RB and JB contributed equally to this study and are recognised as joint first authors.
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33 381 **Competing interests**
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36 382 The authors have no competing interests to declare
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40 384 **Funding**
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43 385 None
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48 387 **DATA SHARING STATEMENT**
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50 388 Data are available upon reasonable request.
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391 Ethical approval

392 This study involves human participants but an Ethics Committee(s) or Institutional Board(s) exempted
393 this study. Data were anonymised before being accessed and used and analysed by the authors for this
394 study.
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399 Figures and Legends

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403 Figure 1 Mean number of presentations with acute mental health illness per week
404 1 January 2018 - 30 June 2021

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407 Figure 2 Patterns of diagnosis and presentation. Mean presentations per day during the covid-19
408 pandemic

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411 Figure 3 Diagnosis patterns for acute mental health presentations
412 1 January 2018-30 June 2021

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415 Figure 4a Diagnosis for acute mental health presentations 1 January 2018 – 30 June 2021.
416 Raw number of admissions over each time period.

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418 Figure 4b Diagnosis for acute mental health presentations 1 January 2018 - 30 June 2021.
419 Numbers expressed as a percentage of overall admissions for each time period.

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422 Figure 5 Waiting time in the emergency department for patients attending with acute mental
423 health presentations 1 January 2018 – 30 June 2021.

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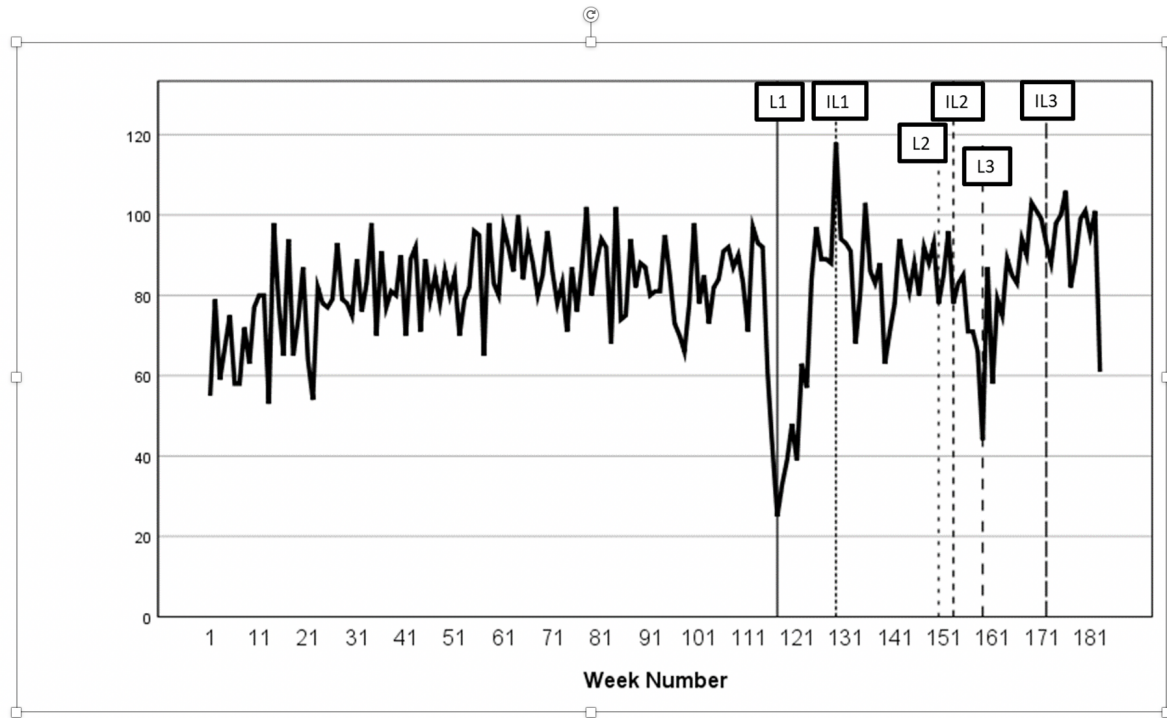
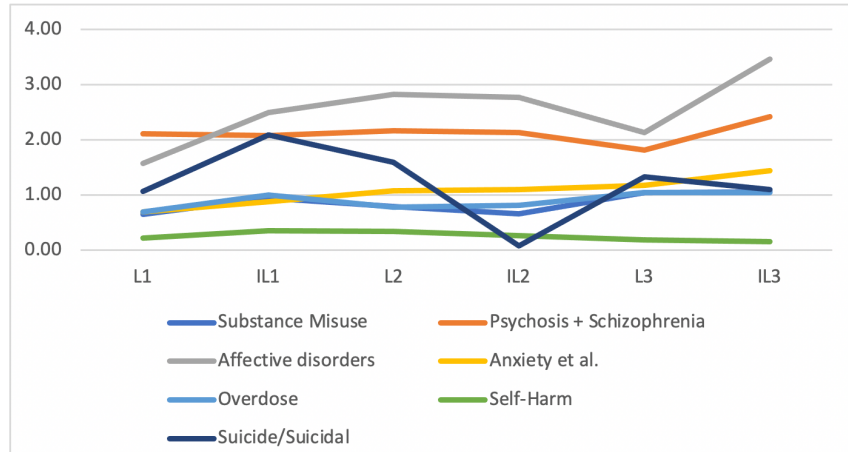
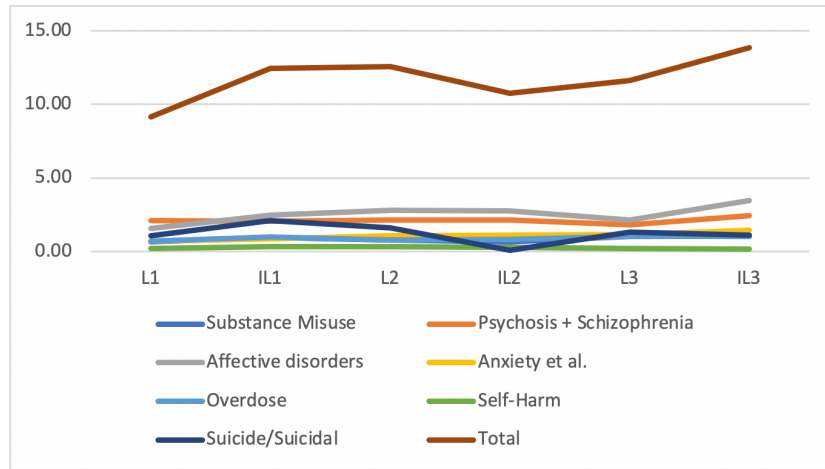


Figure 1 Mean number of presentations with acute mental health illness per week 1 January 2018 - 30 June 2021

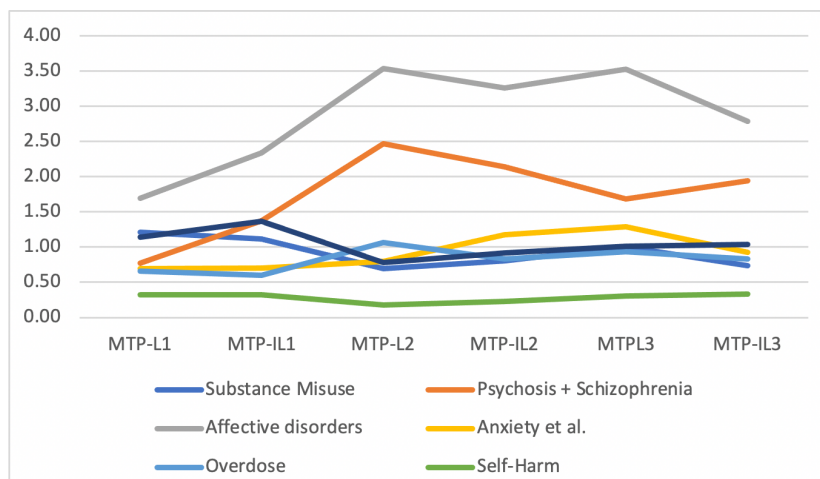
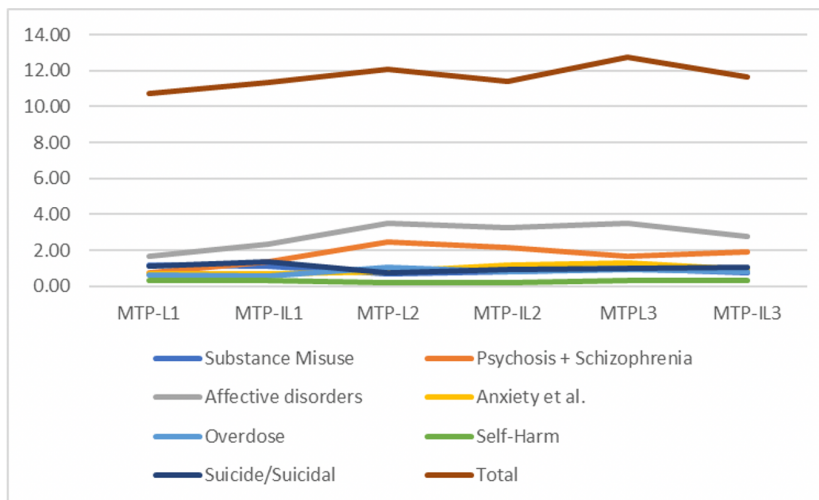
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Figure 2 Patterns of diagnosis and presentation. Mean presentations per day during the covid-19 pandemic



For peer review only

Figure 3 Patterns of diagnosis and presentation. Mean presentations per day during the matched time periods (MTP)



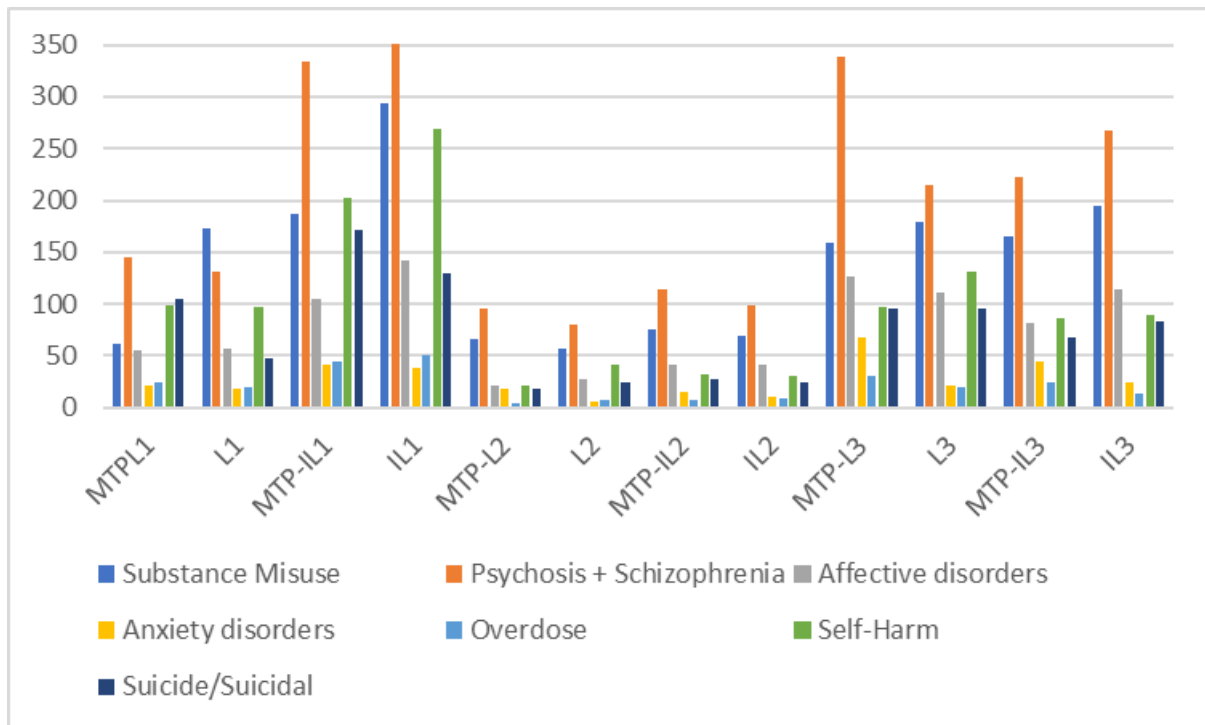


Figure 4a Diagnosis patterns for acute mental health presentations 1 January 2018-30 June 2021.

Raw number of admissions over each time period.

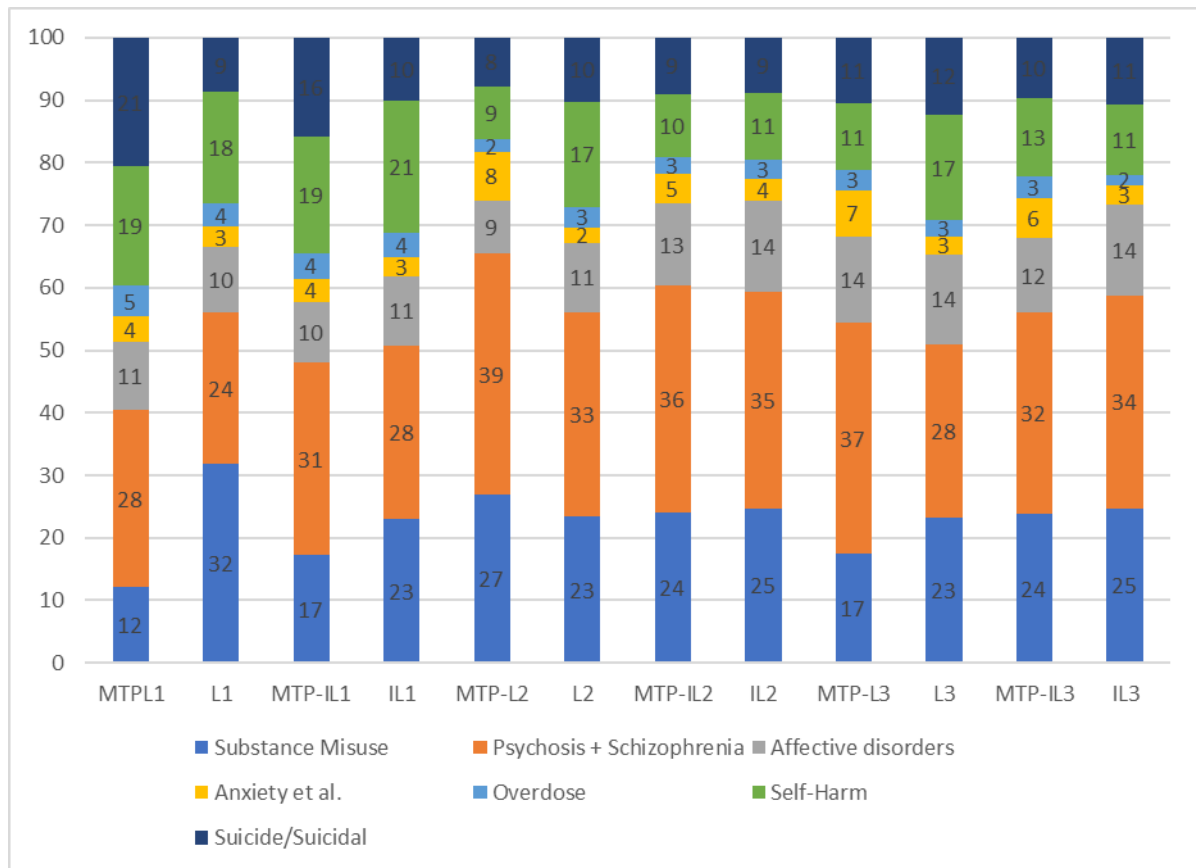


Figure 4b Diagnosis patterns for acute mental health presentations 1 January 2018-30 June 2021.

Each diagnosis as a percentage of overall admissions over each time period.

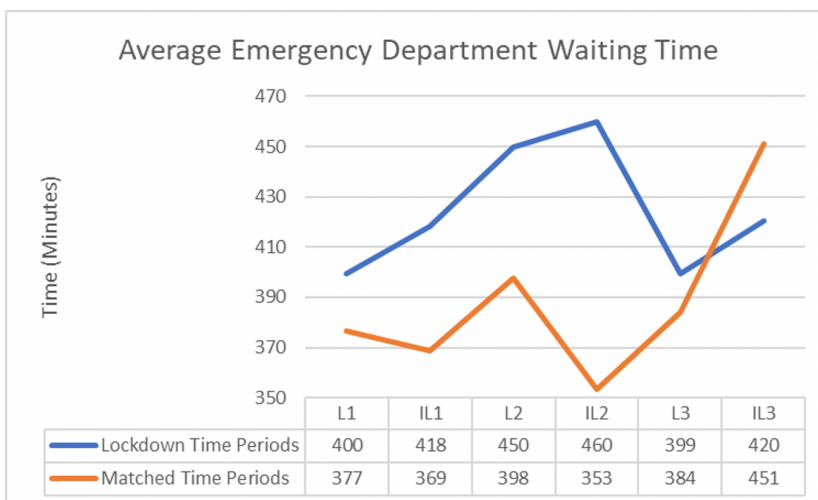


Figure 5 Waiting time in the emergency department for patients attending with acute mental health presentations 1 January 2018 – 30 June 2021

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The RECORD statement – checklist of items, extended from the STROBE statement, that should be reported in observational studies using routinely collected health data.

	Item No.	STROBE items	Location in manuscript where items are reported	RECORD items	Location in manuscript where items are reported
	1	(a) Indicate the study's design with a commonly used term in the title or the abstract (b) Provide in the abstract an informative and balanced summary of what was done and what was found	Title Line 1 Abstract Line 49	RECORD 1.1: The type of data used should be specified in the title or abstract. When possible, the name of the databases used should be included. RECORD 1.2: If applicable, the geographic region and timeframe within which the study took place should be reported in the title or abstract. RECORD 1.3: If linkage between databases was conducted for the study, this should be clearly stated in the title or abstract.	Methods Lines 143-145 Abstract Lines 51-54 Not applicable
Introduction					
Background rationale	2	Explain the scientific background and rationale for the investigation being reported	Introduction Lines 92-125		
Objectives	3	State specific objectives, including any prespecified hypotheses	Introduction Lines 92-125		
Methods					
Study Design	4	Present key elements of study design early in the paper	Methods Lines 140-162		
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Abstract Lines 51-54 Methods Lines 140-162		

Participants	6	<p>(a) <i>Cohort study</i> - Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up</p> <p><i>Case-control study</i> - Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls</p> <p><i>Cross-sectional study</i> - Give the eligibility criteria, and the sources and methods of selection of participants</p> <p>(b) <i>Cohort study</i> - For matched studies, give matching criteria and number of exposed and unexposed</p> <p><i>Case-control study</i> - For matched studies, give matching criteria and the number of controls per case</p>	<p>Methods/Patients Lines 164-169</p> <p>Methods Matched time periods described lines 159-162</p>	<p>RECORD 6.1: The methods of study population selection (such as codes or algorithms used to identify subjects) should be listed in detail. If this is not possible, an explanation should be provided.</p> <p>RECORD 6.2: Any validation studies of the codes or algorithms used to select the population should be referenced. If validation was conducted for this study and not published elsewhere, detailed methods and results should be provided.</p> <p>RECORD 6.3: If the study involved linkage of databases, consider use of a flow diagram or other graphical display to demonstrate the data linkage process, including the number of individuals with linked data at each stage.</p>	<p>Methods/Patients Lines 164-169</p> <p>Not applicable</p> <p>Not applicable</p>
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable.	Methods/Patients studied outcomes recorded Lines 165-170	RECORD 7.1: A complete list of codes and algorithms used to classify exposures, outcomes, confounders, and effect modifiers should be provided. If these cannot be reported, an explanation should be provided.	Not applicable
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Methods/Patients Lines 165-170 Lines 140-145		

1 2 3 4 5 6	Bias	9	Describe any efforts to address potential sources of bias	The use of HES data which is nationally collected and validated lines 140-145 and lines 165-170	
7 8 9	Study size	10	Explain how the study size was arrived at	Methods Lines 140-145	
10 11 12 13 14	Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	Methods/Statistical analysis Lines 171-174	
15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39	Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) <i>Cohort study</i> - If applicable, explain how loss to follow-up was addressed <i>Case-control study</i> - If applicable, explain how matching of cases and controls was addressed <i>Cross-sectional study</i> - If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Methods/Statistical analysis Lines 171-174 Not applicable	
40 41 42 43 44	Data access and cleaning methods		..	RECORD 12.1: Authors should describe the extent to which the investigators had access to the database	Not applicable 12.1 and 12.2

				population used to create the study population. RECORD 12.2: Authors should provide information on the data cleaning methods used in the study.	
Linkage		..		RECORD 12.3: State whether the study included person-level, institutional-level, or other data linkage across two or more databases. The methods of linkage and methods of linkage quality evaluation should be provided.	Not applicable
Results					
Participants	13	(a) Report the numbers of individuals at each stage of the study (<i>e.g.</i> , numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed) (b) Give reasons for non-participation at each stage. (c) Consider use of a flow diagram	Methods All patients selected Lines 140-169	RECORD 13.1: Describe in detail the selection of the persons included in the study (<i>i.e.</i> , study population selection) including filtering based on data quality, data availability and linkage. The selection of included persons can be described in the text and/or by means of the study flow diagram.	Methods Lines 140-169
Descriptive data	14	(a) Give characteristics of study participants (<i>e.g.</i> , demographic, clinical, social) and information on exposures and potential confounders (b) Indicate the number of participants with missing data for each variable of interest (c) <i>Cohort study</i> - summarise follow-up time (<i>e.g.</i> , average and total amount)	Results lines 186-243 Not applicable Study period defined lines Methods/Patients Lines 165-170		

1 2 3 4 5 6 7 8 9 10 11	Outcome data	15	<p><i>Cohort study</i> - Report numbers of outcome events or summary measures over time</p> <p><i>Case-control study</i> - Report numbers in each exposure category, or summary measures of exposure</p> <p><i>Cross-sectional study</i> - Report numbers of outcome events or summary measures</p>	Results lines 186-243		
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	Main results	16	<p>(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included</p> <p>(b) Report category boundaries when continuous variables were categorized</p> <p>(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period</p>	Results lines 186-243		
28 29 30 31 32	Other analyses	17	Report other analyses done— e.g., analyses of subgroups and interactions, and sensitivity analyses	Statistical analysis lines 172-175		
Discussion						
34 35	Key results	18	Summarise key results with reference to study objectives			
36 37 38 39 40 41 42 43 44	Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Limitations and strengths of study lines 80-86	RECORD 19.1: Discuss the implications of using data that were not created or collected to answer the specific research question(s). Include discussion of misclassification bias, unmeasured confounding, missing data, and changing eligibility over	Limitations and strengths of study lines 80-86

				time, as they pertain to the study being reported.	
1 2 3 4 5 6 7 8 9	Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Discussion lines 251-288	
10 11 12 13 14 15 16 17 18 19 20	Generalisability	21	Discuss the generalisability (external validity) of the study results	Limitations and strengths of study lines 80-86 Generalisability and previous studies/NCEPOD report cited lines 275-280	
21	Other Information				
22 23 24 25 26 27	Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	No funding Funding statement Lines 357-358	
28 29 30 31 32 33	Accessibility of protocol, raw data, and programming code		..	RECORD 22.1: Authors should provide information on how to access any supplemental information such as the study protocol, raw data, or programming code.	Not applicable

*Reference: Benchimol EI, Smeeth L, Guttman A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM, the RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. *PLoS Medicine* 2015; in press.

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