

1 **Title**

2 Understanding Suicide Clusters Through Exploring Self Harm Behaviors: a 10-year data-  
3 linkage cohort follow-up study of a Suicide Cluster using the Secure Anonymised Information  
4 Linkage (SAIL) Databank

5 Sze Chim Lee<sup>1</sup>, Olivier Y. Rouquette<sup>1</sup>, Keith Hawton<sup>2,3</sup>, Louise Cleobury<sup>1</sup>, Sarah Spencer<sup>1</sup>,  
6 Keith Lloyd<sup>1</sup>, David Gunnell<sup>4,5</sup>, Jonathan Scourfield<sup>6</sup>, Ann John<sup>1\*</sup>

7 <sup>1</sup>Swansea University Medical School, Swansea University, UK.

8 <sup>2</sup>Centre for Suicide Research, University of Oxford, UK.

9 <sup>3</sup>Oxford Health NHS Foundation Trust, UK.

10 <sup>4</sup>Population Health Sciences, Bristol Medical School, University of Bristol, Bristol, UK.

11 <sup>5</sup>National Institute of Health and Care Research Biomedical Research Centre, University  
12 Hospitals Bristol and Weston NHS Foundation Trust and the University of Bristol, Bristol, UK.

13 <sup>6</sup>Children's Social Care Research and Development Centre (CASCADE), School of Social  
14 Sciences, Cardiff University, UK.

15

16 Corresponding author\*:

17 Ann John: a.john@swansea.ac.uk

18 Adress: Swansea University Medical School: Singleton Park, Swansea SA2 8PP, UK

19 **Abstract**

20 Background

21 There is little information about characteristics and long-term outcomes of individuals who  
22 self-harm during a suicide cluster.

23 Aims

24 To compare characteristics of individuals who self-harmed during a suicide cluster in South  
25 Wales (~10 deaths between Dec 2007 and Mar 2008) with others who self-harmed prior to  
26 the cluster, and to evaluate 10-year self-harm and mortality outcomes.

27 Method

28 Using records from the hospital serving the catchment area of the suicide cluster, enhanced  
29 by national routinely collected linked data, we created two groups: individuals who self-  
30 harmed a) during the suicide cluster, and b) one year before. We compared individuals'  
31 characteristics and performed logistic regression to compute odds ratios of 10-year self-  
32 harm and mortality outcomes.

33 Results

34 Individuals who self-harmed during the cluster were less likely to be hospitalized or have a  
35 mental health history than those who self-harmed prior to the cluster. No significant group  
36 differences were found for 10-year self-harm outcomes, but all-cause mortality was higher  
37 for males.

38 Limitations

39 Sample size was small, and data were lacking on psychological and social proximity to  
40 individuals who died during the suicide cluster.

41 Conclusion

42 Our findings highlight the importance of long-term healthcare follow-up of those who self-  
43 harm during a suicide cluster, particularly males.

44 **Keyword:**

45 self-harm; suicide; suicide cluster; data linkage; mortality

46 **Abbreviations**

47 BC – Before the Cluster

48 CI – Confidence Interval

49 DC – During the Cluster

50 ED – Emergency Department

51 ESM – Electronic Supplementary Material

52 ICD – International Classification of Diseases

53 LAA – Local Authority Area

54 NHS – National Health Service

55 OR – Odds Ratio

56 SAD – SAD PERSONS score

57 SAIL – Secure Anonymised Information Linkage

58 VIF – Variance Inflation Factor

## 59 **Introduction**

60 Although relatively uncommon, suicides may occur in clusters, particularly in young people  
61 (Haw et al., 2013). There are two main types of clusters described in the literature, namely,  
62 mass clusters and point clusters. While for mass clusters, often associated with media  
63 reporting of the death of a celebrity, suicide rates increase across a population within a time  
64 period, point clusters involve a concentration of suicide deaths within time and a specific  
65 locality (Joiner, 1999). There is no doubt that suicide clusters generate high levels of  
66 community distress and often widespread media attention (Hawton et al., 2015).

67 Several non-mutually exclusive mechanisms have been proposed underlying the initiation  
68 and maintenance of suicide clusters (Haw et al., 2013; Hawton et al., 2020). The social  
69 transmission mechanism suggests that exposure to the suicide of a significant other  
70 increases vulnerability to further suicide via imitation and suggestion or projective and  
71 pathological identification (Marchant et al., 2020). Underlying the descriptive norms is the  
72 more prevalent suicidal behavior is perceived to be, the more normalised it becomes. The  
73 assortative relating theory (Joiner, 1999; Robinson et al., 2016) proposes that the clustering  
74 of suicide is explained primarily by a group of individuals sharing certain risk factors who  
75 associate with each other and the social integration and relating mechanism refers to the  
76 effect of close-knit social networks in disseminating news and beliefs about suicides in a  
77 locality.

78 Nonetheless, little is known about the characteristics and long-term outcomes of those who  
79 self-harm during a suicide cluster (Haw et al., 2013). A recent qualitative study of individuals  
80 presenting with near-fatal self-harm during a suicide cluster suggested that the negative  
81 impact of the cluster could have long-term effects (John et al., 2022). We aimed to compare  
82 characteristics and long-term self-harm and mortality outcomes for individuals who self-  
83 harmed during a point cluster, with an estimated 10 deaths, which occurred in South Wales,  
84 UK, between December 2007 and March 2008 in young people aged 15-34 years (Jones et  
85 al., 2013) with those who self-harmed prior to it. This cluster was highly publicised locally  
86 and nationally by media, with a high volume of sensational reporting throughout the cluster  
87 (John et al., 2016; Marchant et al., 2020).

## 88 **Methods**

### 89 **Study design and participants**

90 This was a retrospective data linkage cohort study (RECORD checklist in Electronic  
91 Supplementary Material (ESM) 1) based in the Local Authority Area (LAA; population

92 140,000) of a suicide cluster (December 27, 2007-March 17, 2008). We used paper-based  
93 emergency department (ED) records (Suppl. Methods in ESM 2) from the district general  
94 hospital serving the locality and privacy protected routinely collected data for the Wales  
95 population from the Secure Anonymised Information Linkage (SAIL) Databank  
96 ([www.saildatabank.com](http://www.saildatabank.com)).

97 We derived two groups for this study where each group included individuals who self-  
98 harmed during the period where the suicide cluster occurred (DC group) and those who self-  
99 harmed during the corresponding period one year before (BC group). We excluded  
100 individuals who self-harmed during both periods, i.e., excluding individuals in both BC and  
101 DC groups.

#### 102 ED dataset

103 This dataset consisted of individuals who presented to the ED of the district hospital  
104 following self-harm (index self-harm) between December 27, 2006 and March 17, 2008 by  
105 hand screening for any mention of self-harm (Suppl. Methods in ESM 2). These were then  
106 converted to electronic data by researchers for quantitative analysis. We compared  
107 characteristics and outcomes of individuals ascertained during the suicide cluster, between  
108 December 27, 2007 and March 17, 2008 (DC group, Suppl. Fig. 1 in ESM 3), with those  
109 ascertained between December 27, 2006 and March 17, 2008 (BC group, Suppl. Fig. 1 in  
110 ESM 3).

#### 111 Enhanced dataset

112 We used routinely collected data from SAIL databank covering the Wales population  
113 between January 01, 2000 and March 16, 2018 (Suppl. Fig. 1 in ESM 3). Within the two  
114 ascertainment periods (DC and BC), we identified individuals who resided in the LLA or  
115 presented to health services located in the LAA with self-harm (primary care and hospital  
116 admission data). These individuals and those from the ED dataset were combined creating  
117 enhanced DC and BC groups (Suppl. Fig. 1 in ESM 3). Long-term outcomes were assessed  
118 by following the enhanced datasets for 10 years, starting from the date of the index self-  
119 harm event (Fig. 1A).

#### 120 **Data Linkage**

121 Data from the ED dataset were uploaded to the SAIL databank, a databank that contains  
122 anonymised privacy protecting person-based linkable data from healthcare and public  
123 settings (Ford et al., 2009; Lyons et al., 2009). All data linkage was handled in accordance  
124 with the Data Protection Act 2018 and disclosure control methods were used to restrict the

125 reporting of small numbers (categories containing <5 individuals and related categories  
126 leading to secondary disclosure) to protect vulnerable individuals. Data between database  
127 were linked by identity matching and creation of unique anonymised linking field via a trusted  
128 organisation mandated to hold personally identifiable data. Data encryption using  
129 deterministic matching was based on National Health Service (NHS) number or probabilistic  
130 matching using available demographics (Ford et al., 2009; Lyons et al., 2009). For  
131 probabilistic linkage, a matching score was calculated to reflect the odds of matches of  
132 demographic variables for an individual. We included individuals whose data were either  
133 deterministically linked or probabilistically linked with matching score of  $\geq 0.9$ . Using the  
134 matching criteria, overall accuracies of  $\geq 99.8\%$  could be attained and  $\geq 94.1\%$  of the records  
135 could be successfully linked (Lyons et al., 2009).

136 We used the following SAIL datasets to link the ED dataset at individual level and to identify  
137 individuals for the enhanced dataset: Welsh Demographic Service, General Practice  
138 Database, Patient Episode Database for Wales and deaths register from Office for National  
139 Statistics. Descriptions of each dataset are summarised in Suppl. Table 1 in ESM 3.

## 140 **Measures**

141 Self-harm, suicide risk, and mortality outcome

142 Data for current and history of self-harm, suicide attempts, and 'suicide risk' measured by  
143 the modified SAD PERSONS (SAD) score (Patterson et al., 1983) were extracted from  
144 individuals' ED record. Self-harm events and methods (categorized into overdose/poisoning,  
145 hanging/strangulation, cutting, and others/unknown) were also extracted from the primary  
146 and secondary care SAIL datasets based on previously used Read and International  
147 Classification of Diseases (ICD) version 10 codes (Marchant, Turner, et al., 2020). We  
148 extracted mortality data using ICD-10 codes and classified cause of death into all-cause,  
149 natural, unnatural, and suicide as described previously (John et al., 2018).

150 Other covariates

151 For the ED dataset, we included: sex, age, marital and household status, area deprivation as  
152 proxied by the Welsh Index of Multiple Deprivation, and urban/rural indicator. For the  
153 enhanced dataset, the same variables were used, except marital and household status  
154 (unavailable in the SAIL Databank). Other variables included physical comorbidity, previous  
155 self-harm, mental health diagnoses, alcohol and drug use, and prescription of psychotropic  
156 and opiate medications (see details in Suppl. Methods in ESM 2). These variables were

157 included based on previous studies on suicide and premature mortality following self-harm  
158 (Carr et al., 2017; John et al., 2020).

## 159 **Statistical analysis**

160 Full descriptions of the statistical methods are summarized in Suppl. Method (ESM 2). In  
161 brief, we compared descriptive statistics of individuals' characteristics, self-harm mortality  
162 outcomes between DC and BC groups with 95% confidence intervals (CIs). Due to small  
163 sample size, Fisher's exact tests, likelihood ratio tests and Bayes factors were used to  
164 estimate independence of variables for all contingency tables. Effect modification of stratified  
165 cross-tabulation by sex and age was tested by the homogeneity of odds ratios and Firth  
166 logistic regression model, independent sample *t* test and the associated Bayes factors were  
167 used to compare group means for continuous variables.

168 For the enhanced dataset, we performed univariable and multivariable Firth logistic  
169 regressions to evaluate the odds ratios (ORs) on the long-term mortality outcomes. The use  
170 of Firth regression was to circumvent the small sample bias due to small size and separation  
171 issues (Firth, 1993; Heinze & Schemper, 2002). For reference, we also presented results  
172 from conventional logistic regression for all adjusted analyses. For all adjusted analyses, we  
173 performed diagnostic checks on multicollinearity using the variance inflation factors (VIFs) of  
174 all independent variables. VIF >3 was used as a threshold of presence of multicollinearity  
175 (Miles & Shevlin, 2001).

## 176 **Ethical Approval**

177 Ethical approval was obtained from Southwest Wales NHS Local Research Ethics  
178 Committee (reference 15/WA/0366) and the Swansea University Information Governance  
179 Review Panel (reference 0319).

## 180 **Results**

### 181 **Cohort characteristics**

182 496 individuals were identified in ED records during December 27, 2006-March 17, 2008 and  
183 data for 402 individuals (81.0% out of 496) were successfully linked to the SAIL databank  
184 (Suppl. Fig. 1 in ESM 3). Among the 129 individuals (32.1% out of 402) who self-harmed  
185 either during the suicide cluster (DC) or during the same period a year before (BC), 86  
186 individuals (66.7% out of 129) were from the DC and 43 (33.3%) from the BC group. From  
187 SAIL, we identified 424 additional individuals to form the enhanced dataset (N = 489) with  
188 280 (57.3% out of 489) in the DC and 209 (42.7%) in BC group. Only <5 and 17 individuals



189 were excluded from the ED (<2% out of 129) and enhanced datasets (3.5% out of 489)  
190 respectively as they were ascertained in both DC and BC groups (Suppl. Fig. 1 in ESM 3).

191 There was no statistical evidence of differences in sociodemographic, SAD scores, and  
192 clinical characteristics between the DC and BC groups of the ED dataset (Suppl. Table 1-4  
193 in ESM 3). However, fewer individuals in the DC group were admitted to a general or  
194 psychiatric hospital following self-harm, 7.0% (out of 86; 95% CI: 2.9%-15.1%) vs. 32.6%  
195 (out of 43; 95% CI: 19.5%-48.7%).

196 Sociodemographic and clinical characteristics in the enhanced DC and BC groups were  
197 similar (Suppl. Table 5-8 in ESM 3). Fewer individuals in the enhanced DC group were  
198 hospitalized with self-harm, 20.0% (out of 280; 95% CI: 15.6%-25.3%) vs. 34.0% (out of 209;  
199 95% CI: 27.7%-40.9%); self-harmed by overdosing/poisoning, 66.4% (95% CI: 60.5%-  
200 71.9%) vs. 76.1%; (95% CI: 69.6%-81.6%), and had a history of diagnosis of any mental  
201 health condition, 63.2% (95% CI: 57.2%-68.8%) vs. 74.2% (95% CI: 67.6%-79.8%).  
202 Although not statistically evident, more individuals self-harmed by hanging/strangulation in  
203 the DC group (4.3% vs. <2.0%). Differences in distributions of sex and age group were not  
204 significantly different between DC and BC groups in the ED and enhanced dataset (Suppl.  
205 Table 9 in ESM 3).

## 206 **10-year Self-harm and mortality outcomes**

207 From the enhanced dataset, we identified 157 (56.1% out of 280) in the DC group and 123  
208 (58.9% out of 209) individuals in the BC group who self-harmed during the 10-year follow-up,  
209 with no statistical evidence for group differences (unadjusted OR: 0.9, 95% CI: 0.6-1.3,  $p =$   
210 0.580; Bayes factors: 0.1-0.3, evidence in favor of independence between self-harm and  
211 group, Fig. 1 and Suppl. Table 7-8 in ESM 3). All-cause mortality was higher in the DC than  
212 the BC group (unadjusted OR = 1.9, 95% CI: 1.0-3.6,  $p = 0.047$ ; Bayes factors: 3.9-11.5,  
213 moderate/strong evidence in favor of dependence between all-cause mortality and group).  
214 More individuals in the DC group, died by natural causes. Mean age of death, mortality by  
215 unnatural causes and suicide were similar between groups. Results from Firth logistic  
216 regressions show statistically higher mortality for males in the DC group compared to other  
217 three groups (Suppl. Table 10-11 in ESM 3). Older age group was also statistically  
218 associated with higher mortality.

219 VIFs for all independent variables in all corresponding adjusted regressions for this study  
220 ranged between 1.0 and 2.2, which were lower than the adopted threshold of three. This  
221 suggests that multicollinearity was not an issue for all our adjusted models.

## 222 **Discussion**

223 For the first time to our knowledge, this study compared characteristics of individuals who  
224 self-harmed during a suicide cluster with those who self-harmed one year before and  
225 followed them for up to 10 years for self-harm and mortality outcomes. While our observation  
226 of higher number individuals who self-harmed during the cluster might reflect an actual  
227 increase, it could also be due to the heightened awareness and thus change in behavior of  
228 recording self-harm from clinicians at the time of the cluster in comparison to the situation  
229 where self-harm were under-reported or poorly recorded out of the period of the cluster. We  
230 found an increase in the number of individuals who self-harmed during the cluster but with  
231 less related hospitalisation, which may reflect self-harm severity, methods used or clinical  
232 practice during a cluster with increased demand. It may also reflect policy/practice to reduce  
233 public concerns. SAD scores, and histories of self-harm was similar between groups. There  
234 was some evidence of greater use of hanging as a method for self-harm during the cluster,  
235 consistent with methods widely reported in the media at the time (Marchant, Turner, et al.,  
236 2020). Individuals who self-harmed during the suicide cluster were similarly likely to those  
237 from the non-cluster to repeat self-harm over the 10-years follow-up. Males who self-harmed  
238 during the cluster had higher long-term all-cause mortality risks. Since these findings were  
239 not predicted a priori and require replication and the contributing factors remain unclear,  
240 further investigations on long-term outcomes are warranted (Haw et al., 2013).

## 241 **Strengths and limitations**

242 This unique study compared individuals who self-harmed during a suicide cluster with non-  
243 cluster self-harm cases and evaluating long-term self-harm and mortality outcomes by  
244 linking clinical assessment to routinely collected data. The high data coverage in the SAIL  
245 databank facilitated comparisons of individual characteristics and increased sample size by  
246 identifying individuals using diagnostic codes for self-harm. However, small sample size is  
247 still a huge issue in this study. We used both frequentist and Bayesian approaches to test  
248 our hypotheses and results were in tight agreement between approaches. We collected ED  
249 admission data from a single hospital only as this hospital is the only district general hospital  
250 providing secondary care services covering the relevant LAA. We included individuals based  
251 on geographical proximity only and not on psychological or social proximity, which are  
252 important factors in clustering of suicides (Hawton et al., 2020); data and measures for these  
253 two dimensions are required in future research. We excluded a small number of individuals  
254 who self-harmed during both pre-cluster (BC) and cluster periods (DC) to ensure tenability of  
255 data stratification and statistical analyses. While the corresponding proportions to the whole  
256 datasets were small (<3.5%), such exclusion may still introduce bias particularly for the BC

257 group, which may be less likely to experience outcomes in the 10-year follow-up. As for  
258 other research using routinely collected data, we are likely to underestimate self-harm for  
259 those who do not contact health services or have their conditions misclassified.

## 260 **Implications for policy and practice**

261 Our findings can inform intervention strategies to prepare for, identify, and respond to suicide  
262 clusters (Public Health England, 2019). Increased self-harm risk during a cluster is not  
263 confined to those with pre-existing mental health diagnoses and long-term outcomes of  
264 those who self-harm are broader. We highlight a potential need for long-term monitoring and  
265 intervention in those who self-harm during suicide clusters. While it is crucial to identify and  
266 provide timely interventions/support to vulnerable individuals following suicide clusters,  
267 attention should also be paid to the general health and wellbeing of the whole community,  
268 particularly for males following a cluster.

## 269 **Authors biographies**

270 Sze Chim Lee, PhD, is a senior research data scientist in Medicine, Health and Life Science  
271 at Swansea University Medical School. His research uses administrative data and surveys to  
272 study a range of biological, psychosocial, and environmental circumstances that may be  
273 associated with mental health issues, suicide, and self-harm.

274 Olivier Y. Rouquette, PhD, is researcher and data scientist in the Population Psychiatry,  
275 Suicide and Informatics (PPSI) team at Swansea University Medical School, working in prof.  
276 Ann John's team. Olivier's research encompasses mental health and wellbeing of children  
277 and young people using routinely collected population linked data.

278 Keith Hawton is professor of Psychiatry and Director of Centre for Suicide Research at the  
279 University of Oxford. Professor Hawton has a particular interest in epidemiology and clinical  
280 management of self-harm, suicide and self-harm in adolescents, media influences on self-  
281 harm and evaluation of suicide prevention initiatives.

282 Louise Cleobury, PhD, is Senior Lecturer in Health Data Science and Programme Director  
283 for Population Health and Medical Sciences at Swansea University Medical School. Louise's  
284 areas of interest are in Clinical, Applied, and Health Psychology. Louise Cleobury has over  
285 15 years' experience in multidisciplinary applied health research across settings.

286 Sarah Spencer is retired from a successful career in NHS including: Emergency Medicine  
287 consultant, Head of Postgraduate Training in Emergency Medicine, Clinical Director Acute &  
288 Emergency Services, Deputy Medical Director, Locality Group Director (Primary,  
289 Community, Secondary Acute and Mental Health Services).

290 Keith Lloyd is professor of psychiatry at Swansea University Medical School and a clinical  
291 academic specialising in psychiatry. Keith's research interests are in epidemiology, suicide,  
292 and the use of routine health data in mental health research. He is pro-vice chancellor for  
293 medicine, health, and life science at Swansea University.

294 David Gunnell, FMedSci, is Emeritus Professor of Epidemiology at the University of Bristol,  
295 UK. He is a public health physician and epidemiologist with a longstanding research interest  
296 in the etiology and prevention of suicide and in improving population mental health.

297 Jonathan Scourfield is Professor of Social Work and Deputy Director of CASCADE, the  
298 Children's Social Care Research and Development Centre at Cardiff University. His research  
299 includes child and family services, working with men, social work education, research  
300 capacity-building, the social context of suicide and self-harm, and identity and religion in  
301 children.

302 Ann John is Professor in Public Health and Psychiatry at the Swansea University Medical  
303 School. She chairs the National Advisory Group to Welsh Government on the prevention of  
304 suicide and self-harm. Her research targets suicide, self-harm prevention and mental health  
305 with an emphasis on translating research into policy and practice.

306 **Electronic Supplementary Material**

307 – ESM 1. RECORD checklist (RECORD\_Checklist.docx).

308 – ESM 2. Suppl. Methods (Suppl\_Methods.docx).

309 The document shows additional descriptions of methodology and statistical analysis.

310 – ESM 3. Suppl. Tables 1-11 and Suppl. Fig. 1 (Suppl\_Tables\_Figures.docx).

311 The document shows additional tables and figures not shown in the main text.

312 **References**

- 313 Carr, M. J., Ashcroft, D. M., Kontopantelis, E., While, D., Awenat, Y., Cooper, J., Chew-  
314 Graham, C., Kapur, N., & Webb, R. T. (2017). Premature Death Among Primary Care  
315 Patients With a History of Self-Harm. *The Annals of Family Medicine*, 15(3), 246–254.  
316 <https://doi.org/10.1370/AFM.2054>
- 317 Firth, D. (1993). Bias reduction of maximum likelihood estimates. *Biometrika*, 80(1), 27–38.  
318 <https://doi.org/10.1093/biomet/80.1.27>
- 319 Ford, D. V, Jones, K. H., Verplancke, J., Lyons, R. A., John, G., Brown, G., Brooks, C. J.,  
320 Thompson, S., Bodger, O., Couch, T., & Leake, K. (2009). The SAIL Databank: building  
321 a national architecture for e-health research and evaluation. *BMC Health Services*  
322 *Research*, 9(1), 157. <https://doi.org/10.1186/1472-6963-9-157>
- 323 Haw, C., Hawton, K., Niedzwiedz, C., & Platt, S. (2013). Suicide Clusters: A Review of Risk  
324 Factors and Mechanisms. *Suicide and Life-Threatening Behavior*, 43(1), 97–108.  
325 <https://doi.org/10.1111/j.1943-278X.2012.00130.x>
- 326 Hawton, K., Hill, N. T. M., Gould, M., John, A., Lascelles, K., & Robinson, J. (2020).  
327 Clustering of suicides in children and adolescents. *The Lancet Child & Adolescent*  
328 *Health*, 4(1), 58–67. [https://doi.org/10.1016/S2352-4642\(19\)30335-9](https://doi.org/10.1016/S2352-4642(19)30335-9)
- 329 Hawton, K., Lascelles, K., & Ferrey, A. (2015). *Identifying and responding to suicide clusters*  
330 *and contagion: A practical resource*.  
331 [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachme](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839621/PHE_Suicide_Cluster_Guide.pdf)  
332 [nt\\_data/file/839621/PHE\\_Suicide\\_Cluster\\_Guide.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839621/PHE_Suicide_Cluster_Guide.pdf)
- 333 Heinze, G., & Schemper, M. (2002). A solution to the problem of separation in logistic  
334 regression. *Statistics in Medicine*, 21(16), 2409–2419. <https://doi.org/10.1002/sim.1047>
- 335 John, A., DelPozo-Banos, M., Gunnell, D., Dennis, M., Scourfield, J., Ford, D. V, Kapur, N.,  
336 & Lloyd, K. (2020). Contacts with primary and secondary healthcare prior to suicide:  
337 case-control whole-population-based study using person-level linked routine data in  
338 Wales, UK, 2000–2017. *The British Journal of Psychiatry*, 217(6), 717–724.  
339 [https://doi.org/DOI: 10.1192/bjp.2020.137](https://doi.org/DOI:10.1192/bjp.2020.137)
- 340 John, A., Hawton, K., Gunnell, D., Lloyd, K., Scourfield, J., Jones, P. A., Luce, A., Marchant,  
341 A., Platt, S., Price, S., & Dennis, M. S. (2016). Newspaper Reporting on a Cluster of  
342 Suicides in the UK. *Crisis*, 38(1), 17–25. <https://doi.org/10.1027/0227-5910/a000410>
- 343 John, A., Marchant, A., Hawton, K., Gunnell, D., Cleobury, L., Thomson, S., Spencer, S.,  
344 Dennis, M., Lloyd, K., & Scourfield, J. (2022). Understanding suicide clusters through  
345 exploring self-harm: Semi-structured interviews with individuals presenting with near-  
346 fatal self-harm during a suicide cluster. *Social Science & Medicine*, 292, 114566.  
347 <https://doi.org/https://doi.org/10.1016/j.socscimed.2021.114566>
- 348 John, A., McGregor, J., Jones, I., Lee, S. C., Walters, J. T. R., Owen, M. J., O'Donovan, M.,  
349 DelPozo-Banos, M., Berridge, D., & Lloyd, K. (2018). Premature mortality among  
350 people with severe mental illness — New evidence from linked primary care data.  
351 *Schizophrenia Research*. <https://doi.org/10.1016/j.schres.2018.04.009>
- 352 Joiner, T. E. (1999). The Clustering and Contagion of Suicide. *Current Directions in*  
353 *Psychological Science*, 8(3), 89–92. <https://doi.org/10.1111/1467-8721.00021>
- 354 Jones, P., Gunnell, D., Platt, S., Scourfield, J., Lloyd, K., Huxley, P., John, A., Kamran, B.,  
355 Wells, C., & Dennis, M. (2013). Identifying Probable Suicide Clusters in Wales Using

- 356 National Mortality Data. *PLoS ONE*, 8(8), e71713.  
357 <https://doi.org/10.1371/journal.pone.0071713>
- 358 Lyons, R. a, Jones, K. H., John, G., Brooks, C. J., Verplancke, J.-P., Ford, D. V, Brown, G.,  
359 & Leake, K. (2009). The SAIL databank: linking multiple health and social care  
360 datasets. *BMC Medical Informatics and Decision Making*, 9, 3.  
361 <https://doi.org/10.1186/1472-6947-9-3>
- 362 Marchant, A., Brown, M., Scourfield, J., Hawton, K., Cleobury, L., Dennis, M., Lloyd, K.,  
363 McGregor, J., & John, A. (2020). A Content Analysis and Comparison of Two Peaks of  
364 Newspaper Reporting During a Suicide Cluster to Examine Implications for Imitation,  
365 Suggestion, and Prevention. *Crisis*, 41(5), 398–406. <https://doi.org/10.1027/0227-5910/a000655>  
366
- 367 Marchant, A., Turner, S., Balbuena, L., Peters, E., Williams, D., Lloyd, K., Lyons, R., & John,  
368 A. (2020a). Self-harm presentation across healthcare settings by sex in young people:  
369 an e-cohort study using routinely collected linked healthcare data in Wales, UK.  
370 *Archives of Disease in Childhood*, 105(4), 347 LP – 354.  
371 <https://doi.org/10.1136/archdischild-2019-317248>
- 372 Miles, J., & Shevlin, M. (2001). *Applying regression and correlation: A guide for students and*  
373 *researchers*. Sage.
- 374 Office for National Statistics. (2019). *Suicides in the UK: 2018 registrations*.  
375 [https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deat](https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/suicidesintheunitedkingdom/2018registrations)  
376 [hs/bulletins/suicidesintheunitedkingdom/2018registrations](https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/suicidesintheunitedkingdom/2018registrations)
- 377 Patterson, W. M., Dohn, H. H., Bird, J., & Patterson, G. A. (1983). Evaluation of suicidal  
378 patients: The SAD PERSONS scale. *Psychosomatics*, 24(4), 343–349.  
379 [https://doi.org/10.1016/S0033-3182\(83\)73213-5](https://doi.org/10.1016/S0033-3182(83)73213-5)
- 380 Public Health England. (2019). *Identifying and responding to suicide clusters and contagion:*  
381 *A practice resource*.  
382 [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachme](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839621/PHE_Suicide_Cluster_Guide.pdf)  
383 [nt\\_data/file/839621/PHE\\_Suicide\\_Cluster\\_Guide.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/839621/PHE_Suicide_Cluster_Guide.pdf)
- 384 Robinson, J., Pirkis, J. & O'Connor, R.C. (2016). Suicide Clusters. In R.C. O'Connor and J.  
385 Pirkis (Eds.), *The International Handbook of Suicide Prevention* (2nd ed., pp. 758-774).  
386 Wiley Blackwell. <https://doi.org/10.1002/9781118903223.ch43>

387 **Figure Legends**

388 Fig. 1. (A) Schematic diagram of observation period of this study. DC: Self-harm  
389 ascertainment period during to the suicide cluster (December 27, 2007-March 17, 2008); BC:  
390 Self-harm ascertainment period one year before the suicide cluster (December 27, 2006-  
391 March 17, 2007); X: index self-harm event during ascertainment period. (B) Comparison of  
392 self-harm and mortality outcomes during a 10-year follow-up. Odds ratios (ORs) are  
393 analysed by univariable Firth regression. Error Bars: 95% CIs.