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Original Article

Title: Socio-economic status has a limited association with knowledge and attitudes towards Bystander Cardiopulmonary Resuscitation: A cross-sectional study in North England.

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1 **Abstract**

2

3 **Background**

4 Bystander cardiopulmonary resuscitation (BCPR) is a critical link in the 'Chain of Survival', yet
5 in the UK, is undertaken in only 40% of out of hospital cardiac arrests (OHCA). Lower rates of
6 BCPR have been correlated with lower socio-economic status (SES). This study aimed to
7 explore how knowledge and attitudes about BCPR linked to SES across North East and North
8 Cumbria in England.

9

10 **Methods**

11 Cross-sectional study between July-December 2021 surveying individuals from areas of
12 varying SES.

13

14 **Results**

15 Six hundred and one individuals completed the survey instrument (mean age=51.9 years,
16 range=18-95, standard deviation=17.7; 52.2% (n=313) female). Increased age was associated
17 with being less willing to call 999 (p<0.001) and follow call handler advice (p<0.001). Female
18 respondents were less comfortable performing BCPR than male respondents (p=0.006).
19 Individuals from least deprived areas were less likely to report comfort performing CPR,
20 (p=0.016) and less likely to know what a Public Access Defibrillator (PAD) is for, (p=0.025).
21 Higher education level was associated with increased ability to recognise OHCA (p=0.005) and
22 understanding of what a PAD is for (p<0.001). Individuals with higher income were more likely
23 to follow advice regarding BCPR (p=0.017) and report comfort using a PAD (p=0.029).

24

25 **Conclusion**

26 SES is a poor indicator of knowledge, willingness, and perceived competency to perform BCPR.
27 Policy makers should avoid using SES alone to target interventions and focus more on
28 individual characteristics such as age and ethnicity. Future research should examine how
29 cultural identity and social cohesion intersect with these characteristics to influence
30 willingness to perform BCPR.

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45 Key words: Cardio-pulmonary resuscitation, bystander help, defibrillator, deprivation

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67 **Background**

68 Out of hospital cardiac arrest (OHCA) is a time-critical event. National Health Service (NHS)
69 ambulance services treat approximately 30,000 OHCA's annually in the United Kingdom (UK)¹,
70 but survival rates remain low, around 7-8% in the UK² and 10% in the United States (US).³
71 Bystander cardiopulmonary resuscitation (BCPR), CPR provided by witnesses to an OHCA not
72 part of an organised emergency response system,⁴ is a critical link in the 'Chain of Survival', is
73 known to improve the rate of return of spontaneous circulation (ROSC) and more than
74 doubles the chance of survival.^{5,6} For every 30 patients who receive BCPR, one additional life
75 will be saved.⁶

76

77 The proportion of members of the public trained to deliver BCPR, or use a public access
78 defibrillator (PAD), remains poor^{7,8}; in the UK, BCPR is undertaken in only 40% of OHCA's.⁹ In
79 comparison, King County (Seattle, US)¹⁰ and Norway¹¹, report BCPR rates of 70% and 79%¹²
80 respectively, and there are clear opportunities for improvements in the UK. Community
81 characteristics in which individuals live and work have an important influence on the
82 likelihood they will suffer an OHCA, receive BCPR and survive.¹³ Neighbourhoods with lower
83 rates of BCPR have been correlated with lower income, lower education level, and older or
84 ethnically diverse populations.¹⁴⁻¹⁶

85

86 Across England significant variation exists in the proportion of patients receiving BCPR. North
87 East and North Cumbria (NENC) is one of the most socially deprived regions in England,
88 comprises a large concentration of high-risk neighbourhoods (high incidence of OHCA and low
89 provision of BCPR), and is an outlier in BCPR rates compared to other English regions.^{5, 17} A
90 significant body of evidence exists supporting the effectiveness of BPCR, but initiatives aimed
91 at improving the uptake of CPR training have yet to make an impact in high-risk
92 neighbourhoods.^{18,19} A paucity of evidence exists explaining the factors preventing individuals
93 in these neighbourhoods delivering BCPR, or how markers of socio-economic status (SES) may
94 influence this. These are important considerations when designing interventions to improve
95 the uptake of BCPR, or when targeting initiatives at high-risk populations and
96 neighbourhoods. The aim of this study was to explore knowledge and attitudes of individuals
97 across NENC towards BCPR, including the association between people's individual
98 characteristics and markers of SES.

99

100 **Methods**

101 **Study design**

102 A cross-sectional survey between July and December 2021.

103

104 **Setting**

105 The study was conducted in areas of varying SES across NENC, an area covered by two NHS
106 ambulance services.

107 North East Ambulance Service NHS Foundation Trust (NEAS) covers North East England and
108 serves a population of 2.71 million people across urban and rural locations.²⁰ North Cumbria
109 is covered by North West Ambulance Service NHS Foundation Trust (NWAS) and serves a
110 predominantly rural population of 496,200.²¹

111

112 **Data sources**

113 Postcode areas of interest were identified by the number of OHCA's attended by the
114 ambulance service, the rate of BCPR as reported in the OHCA outcomes registry²² and the
115 areas level of deprivation identified using the Indices of Multiple Deprivation (IMD) (2019).²³
116 Each lower layer super output area (LSOA) in NENC was obtained. The IMD ranks every LSOA
117 by deprivation. The study targeted busy commercial areas within LSOAs from least to most
118 deprived, to approach participants.

119

120 **Design and development of the survey instrument**

121 The survey instrument was based upon the Restart a Heart participant survey 2019¹⁸ and was
122 further developed to meet the specific study aims. The survey captured participant
123 demographics, general health, knowledge and experience of CPR and use of a PAD, willingness
124 and competency to deliver BCPR and use a PAD, and how the Coronavirus pandemic has
125 changed willingness to help. The survey comprised a combination of categorical questions
126 and 10-point Likert scales, chosen to maximise expression of feeling. ²⁴ Questions were
127 separated into four relevant domains: 1) experience of CPR and PAD use, 2) knowledge of CPR
128 and defibrillation, 3) willingness to perform CPR and use a PAD, and 4) competency,
129 confidence and comfort of performing CPR and using a PAD (Supplementary file 1).

130

131 Categories of employment status derived from the UK Household Longitudinal Study²⁵;
132 categories of household income from the Government Statistical Service²⁶ and occupation
133 classifications from the Office of National Statistics.²⁸ Patient/public involvement helped
134 develop relevant questions and piloted the survey instrument to ensure face validity,
135 appropriateness and brevity. Feedback was incorporated into the final version of the survey
136 instrument.

137

138 **Data collection and participants**

139 Research paramedics (RPs) wearing ambulance uniform targeted members of the public
140 regarding study participation. Eligible participants were aged ≥ 18 years and had mental
141 capacity. Potential participants received a verbal explanation of the study and a short
142 participant information sheet with a unique study identification number; participation was
143 voluntary.

144

145

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148 **Statistical analysis**

149 Participants with missing data were excluded from relevant analyses. Answers consisting of
150 'not applicable' or 'prefer not to say' were deemed to be missing data and 'unsure' answers
151 were combined with 'no' where applicable to generate a dichotomous variable ('yes' or 'no
152 or unsure'). Office of National Statistics Standard Occupational Classification²⁷ was used to
153 group occupations into levels 1-4. The age variable met parametric assumptions whilst all
154 other variables were considered to be non-parametric as they were either categorical or
155 ordinal. We used an independent samples t-test when determining differences in
156 dichotomous categorical data by age, with 95% confidence intervals. Pearson correlations
157 were used when examining associations between either ordinal characteristic variables or age
158 and the dependent ordinal variables, and we used either Mann Whitney U with Monte Carlo
159 Simulation or Kruskal-Wallis with Monte Carlo Simulation (Dunn's pairwise test used for post-
160 hoc analysis) when examining ordinal characteristic variables and categorical outcome
161 variables. Fisher's Exact Test with Monte Carlo Simulation was used when examining
162 associations between categorical characteristic and categorical outcome variables. All Monte
163 Carlo Simulations used a random seed and 99% confidence intervals. SPSS version 26 was
164 used for all analyses and the alpha level was set at 0.05.

165

166 **Ethics**

167 Health Research Authority approval was not required as participants were members of the
168 public in non-healthcare settings, and were not patients (IRAS: 299065, 4th May 2021). The
169 study received ethical approval from NEAS Research Ethics Committee on 1st July 2021
170 (NEAS/2021/299065). Willing participants provided verbal consent prior to completion of the
171 survey instrument.

172

173 **Results**

174 A total of 603 individuals completed the survey instrument. Two participants later withdrew,
175 resulting in 601 surveys for analysis. Results are reported in relation to participant
176 characteristics and their relationship with the outcome variables, followed by SES
177 characteristics and their relationship with the outcome variables. Outcome variables are
178 reported in tables 1-4, each representing one of the four domains.

179

180 **Participant characteristics**

181 *Age*

182 600 (99.8%) participants reported their age, with a mean age of 51.9 years (range=18 to 95,
183 SD=17.7). Age had a significant negative correlation with all five questions relating to
184 participants' willingness to help; increased age was associated with being less willing to call
185 999 ($r(597)=-1.61$, $p<0.001$), follow advice ($r(597)=-0.158$, $p<0.001$), help a family member
186 ($r(598)=-0.135$, $p<0.001$), help someone familiar ($r(598)=-0.160$, $p<0.001$) and help a stranger
187 ($r(598)=-0.120$, $p<0.003$).

188 Age was not associated with any other aspect of the four domains: experience of CPR,
189 knowledge of CPR or competency, confidence and comfort of performing CPR (all $p>0.05$).

190

191 *Gender*

192 Slightly more respondents ($n=600$, 99.8%) were female ($n=313$, 52.2%) than male ($n=287$,
193 47.8%). There was a significant difference in being comfortable performing CPR ($U=38835.5$,
194 $p=0.006$) with females ($n=311$, median=5) reporting less comfort than males ($n=287$,
195 median=7). Gender was not associated with any aspect of experience or knowledge of CPR,
196 or competency of performing CPR (all $p>0.05$). There were no associations between gender
197 and any other variable across the four domains (all $p>0.05$).

198

199 *Ethnicity*

200 A total of 597 (99.3%) participants reported their ethnicity, with the majority reporting white
201 ethnicity ($n=570$, 95.5%). Ethnicity was significantly associated with knowledge of what CPR
202 is for ($p<0.001$); Asian/Asian British participants only constituted 2.3% of the overall valid
203 sample but constituted 12.2% of respondents who reported not knowing what CPR is for.
204 Ethnicity was also associated with knowledge of what a defibrillator is for ($p<0.001$), where
205 Asian/Asian British participants constituted 10.1% of respondents who reported not knowing
206 what a defibrillator is for. There were no associations between ethnicity and any other
207 variable across the four domains (all $p>0.05$).

208

209 *General health*

210 Participants ($n=600$, 99.8%) reported a median general health rating of 8 (range=1-10, IQR=3),
211 with a statistically significant but very weak positive correlation with participants' comfort
212 using a defibrillator ($r(598)=0.153$, $p<0.001$); those with higher general health were slightly
213 more likely to be comfortable using a defibrillator. There were no associations between
214 general health and any other variable across the four domains (all $p>0.05$).

215

216 **Socio-economic status characteristics**

217 *Indices of Multiple Deprivation*

218 Of participants that provided their postcode ($n=586$, 97.5%), the median IMD score was 4
219 ($n=586$, range=1-10, IQR=5), with results slightly positively skewed with 134 (22.9%)
220 participants from postcodes representing most deprived areas (IMD score of 1), and 52 (8.9%)
221 participants from postcodes representing least deprived areas (IMD score of 10). IMD had a
222 statistically significant but very weak negative correlation with comfort performing CPR
223 ($r(582)=-0.100$, $p=0.016$), with those from least deprived areas being slightly less likely to be
224 comfortable performing CPR.

225

226

227

228 There was also a significant difference in IMD score between those who reported knowing
229 what a PAD is for (n=483, median=4) versus those who didn't (n=103, median=3; U=21349.5,
230 p=0.025), those from more deprived areas were more likely to report knowing what a PAD is
231 for. There were no associations between IMD and any other variable across the four domains
232 (all p>0.05).

233

234 *Highest education level*

235 Almost all participants (n=599, 99.7%) reported their highest education level, the most
236 common of which was GCSE/GCE (n=196, 32.6%). Highest education level (A level,
237 undergraduate degree, postgraduate degree) was associated with participants feeling able to
238 tell if someone was having a cardiac arrest (p=0.005), compared to those with a lower
239 educational level (none, GCSE). Highest education level was associated with knowing what a
240 defibrillator is for (p<0.001); of the respondents reporting this, 16.5% had no education,
241 whereas 33.0% of respondents who did not know or were unsure, had no education. A total
242 of 348 (58.1%) participants said they would like more information about BCPR, with a greater
243 proportion of those with A/AS level and postgraduate education reporting they would like
244 more information (p=0.020). There were no associations between highest education level and
245 any other variable across the four domains (all p>0.05).

246

247 *Employment status*

248 Nearly all participants (n=599, 99.7%) reported their employment status, with most being in
249 paid employment (n=240, 39.9%). There were no associations between employment status
250 and any variable across the four domains (all p>0.05).

251

252 *Occupation level*

253 Only 490 (81.5%) participants reported their occupation level, the most common of which
254 was retired (n=165, 27.5%). Occupation level significantly affected reported willingness to
255 follow advice (H(5)=17.018, p=0.005). The post-hoc test identified strong evidence (p=0.032,
256 adjusted using Bonferroni correction) of a difference between those with level 2 occupations
257 (mean rank=263) and those retired (mean rank=231); being retired was therefore associated
258 with being less likely to be willing to follow advice than those in level 2 occupations (carer,
259 clerical, plant and machine operatives, services and sales). There was no evidence of a
260 difference between the other pairs. There were also no associations between occupation
261 level and any other variable across the four domains (all p>0.05).

262

263 *Income*

264 Only 478 (79.5%) participants reported their income, with the largest number of participants
265 (n=112, 23.4%) reporting an income of between £20,800 to £31,199. Median income was
266 £31,200 to £41,599 (IQR=3). Income was positively but very weakly significantly correlated
267 with willingness to follow advice (r(475)=0.126, p=0.017), so individuals with a higher income
268 were more willing to follow advice.

269 Income was positively but very weakly significantly correlated with being comfortable using
270 a defibrillator ($r(476)=0.100, p=0.029$), meaning those with a higher income were more likely
271 to be comfortable using a defibrillator. There was a significant difference in income based on
272 whether people reported knowing what a defibrillator is ($U=11217, p=0.001$), with those
273 saying yes ($n=406$, median= $£20,800$ to $£31,199$) having a higher income than those saying no
274 or unsure ($n=72$, median= $£10,400$ to $£20,799$).

275

276 **Discussion**

277 This cross-sectional study aimed to explore knowledge and attitudes towards BCPR, and to
278 understand how knowledge and attitudes potentially interact with individual characteristics
279 and SES. We found individual characteristics and markers of SES were inconsistently
280 associated with participants' knowledge and attitudes towards BCPR, with weak associations
281 where present. These findings were unexpected given the previously identified association
282 between BCPR rates and social deprivation in the region^{5,17}, and evidence that individuals
283 experiencing OHCA are less likely to receive BCPR in deprived areas.¹⁴⁻¹⁶ However, the findings
284 support more recent evidence; a review of BCPR in deprived communities identified that
285 willingness to perform or learn BCPR was not influenced by deprivation²⁸, rather a range of
286 contextual and environmental factors determined administration of BCPR.²⁹ Factors other
287 than individual SES are likely to contribute to lower levels of BCPR in deprived communities,
288 such as cultural identity and social cohesion. Social capital, of which social cohesion forms a
289 part, is increasingly linked with health outcomes including being related to improved
290 cardiovascular mortality³⁰ and use of preventative services.³¹ This links to recent theoretical
291 developments in the field of health and care inequalities which emphasise the importance of
292 applying an intersectional lens by looking beyond markers of SES as being solely
293 representative of geographical 'place'.³² It is pertinent to explore whether social cohesion has
294 an interaction with BCPR, and whether it would explain the gap identified in this study.

295

296 Of individual and SES factors, only age was consistently associated with participants'
297 willingness to perform BCPR, where older participants were less willing to call 999, follow
298 advice, or help someone, irrespective of SES. This suggests older individuals are broadly
299 similar in attitude towards BCPR, regardless of SES, may have the same fears, and are subject
300 to the same barriers. Given most OHCA occur in the home and are witnessed by spouses,³³
301 an unwillingness to help family members is problematic, particularly as age is a risk factor for
302 OHCA. Previous research has identified older individuals have lower levels of knowledge and
303 self-confidence regarding BCPR,³⁴ although it is not possible to draw similar conclusions from
304 our study, as we found no difference in knowledge, capability or confidence of performing
305 BCPR based on participant age. Younger age was associated with comfort performing BCPR
306 and has been reported elsewhere.³⁵ With regard to comfort performing BCPR, women were
307 less comfortable than men.

308

309 Women being less likely to receive BCPR is well-documented,³⁶ but our study shows women
310 are also less likely to be willing to deliver BCPR too. There were no further gender disparities
311 regarding understanding of what BCPR is and the importance of delivering it. Ethnicity was
312 associated with poorer knowledge of BCPR. Whilst our study was limited with small numbers
313 of individuals from ethnic minorities, the findings support other studies which have identified
314 ethnic minorities encounter barriers accessing BCPR training, exacerbated by language
315 difficulties.³⁷ Participation in our study was generally reflective of regional ethnicity, but
316 focused studies within the region with ethnic minority study populations would help to better
317 explain these differences.

318

319 Regarding SES markers, participants from more deprived areas were more likely to be
320 comfortable performing CPR and were more likely to know what a defibrillator is for. This may
321 be because OHCA is more likely to occur in deprived areas. Our findings contrast a previous
322 study that reported those in deprived areas believe resuscitation should be carried out by
323 those trained and who have the necessary skills.²⁹ It is possible participants in deprived areas
324 from our study were more likely to have some personal, direct or indirect, experience of
325 OHCA. However, the lack of associations between other SES markers suggests there is some
326 form of community effect rather than individual characteristics that contribute to being
327 comfortable performing BCPR. There is also a perception that patients requiring BCPR may be
328 more likely to be under the influence of illicit drugs or alcohol in areas of higher deprivation
329 and this may influence level of comfort.²⁹ The association identified between higher
330 education and an increased willingness to learn CPR suggests a better understanding of the
331 consequences of not receiving BCPR, although this is not based upon having had delivered
332 BCPR, or having used a PAD, and is not dependent on SES.³⁸ Health literacy is a mechanism
333 that links education and health³⁹, yet there is a need for research to explicitly examine this
334 relationship in relation to OHCA and people's willingness to perform BCPR.

335

336 That participants with higher levels of self-reported general health were more likely to be
337 comfortable using a defibrillator could be explained by the physicality needed to acquire the
338 PAD from community points and bring it to the patient prior to use. However, this
339 interpretation may be placed in doubt as there was no such association identified between
340 general health and comfort performing CPR, which may have been expected, as chest
341 compressions require physical fitness in order to be performed effectively.⁴⁰ There is almost
342 certainly a much more complicated interaction between general health and the physicality
343 required for obtaining PADs or performing chest compressions, which we are unable to
344 explore in this study.

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350 **Limitations**

351 We identified ceiling effects in many of the measures relating to knowledge of BCPR,
352 willingness to help and competence of performing BCPR. This may have been influenced by
353 social desirability bias where survey data were collected by uniformed paramedics, which may
354 have influenced participants' responses to present their knowledge, willingness to help and
355 competence as being higher. Future research should consider including a test of participants'
356 knowledge of OHCA and BCPR. It may also be worthwhile testing whether different data
357 collectors with or without uniforms would result in different results.

358
359 **Conclusion**

360 Markers of SES and deprivation are a poor indicator of knowledge of, and willingness and
361 competency to perform, BCPR. Interventions to improve levels of BCPR should avoid using
362 SES or deprivation to identify target populations but focus on individual characteristic's such
363 as age and ethnicity, though the latter requires further investigation. Future research should
364 examine the role of these characteristics in willingness to perform BCPR and how they
365 intersect with cultural identity and social cohesion.

366
367 **Declaration of interest**

368 None

369
370 **Authorship contribution statement**

371 KC, JS , SS and GM designed the study. AM provided data to facilitate LSOA identification for
372 North East England and TD identified LSOA's in North Cumbria. KC, LB and EB collected
373 study data. JS analysed study data. KC, JS and SS wrote the manuscript. GM, LB, TD, EB and
374 AM provided critical review and comment on the manuscript.

375
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381 manuscript.

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Table 1: Experience of performing CPR and using a defibrillator

Variable	Have you ever performed CPR?				Have you ever used a defibrillator?			
	N	Yes	No or unsure	p value (MD, 95% CI)	N	Yes	No or unsure	p value (MD, 95% CI)
Age, N (mean, SD)	600	64 (50.7, 16.1)	536 (52.1, 17.9)	0.550 (-1.4, -6.0 to 3.2)	599	11 (50.1, 18.9)	588 (52.0, 17.7)	0.721 (-1.9, -12.5 to 8.7)
Gender, N (%)	600	63 (10.5)	537 (89.5)	0.971	600	11 (1.8)	589 (98.2)	0.873
Female N (%)	313 (52.2)	33 (52.4)	280 (52.1)		313	6 (54.5)	307 (52.1)	
Male N (%)	287 (47.8)	30 (47.6)	257 (47.9)		287	5 (45.5)	282 (47.9)	
Ethnicity, N (%)	597	64 (10.6)	533 (89.4)	0.819	597	11 (1.8)	586 (98.2)	0.177
White, N (%)	570 (94.8)	64 (100)	506 (94.9)		570 (94.8)	10 (90.9)	560 (95.6)	
Mixed/Multiple, N (%)	4 (0.7)	0 (0)	4 (0.8)		4 (0.7)	1 (9.1)	3 (0.5)	
Asian / Asian British, N (%)	14 (2.3)	0 (0)	14 (2.6)		14 (2.3)	0 (0)	14 (2.4)	
Black, African, or Black British, N (%)	4 (0.7)	0 (0)	4 (0.8)		4 (0.7)	0 (0)	4 (0.7)	
Other, N (%)	5 (0.8)	0 (0)	5 (0.9)		5 (0.8)	0 (0)	5 (0.9)	
General health, N (MR)	600	64 (286.5)	536 (302.2)	0.491	600	11 (356.1)	589 (299.5)	0.282
Indices of Multiple Deprivation score, N (MR)	586	61 (260.8)	525 (297.3)	0.110	585	10 (260.0)	575 (293.6)	0.531
Highest education level, N (%)	599	64 (10.7)	535 (89.3)	0.630	599	11 (1.8)	588 (98.2)	0.715
None, N (%)	117 (19.5)	10 (15.6)	107 (20.0)		117 (19.5)	1 (9.1)	116 (19.7)	
GCSE / GCE, N (%)	196 (32.7)	18 (28.1)	178 (33.3)		196 (32.7)	3 (27.3)	193 (32.8)	
AS / A level, N (%)	134 (22.4)	17 (26.6)	117 (21.9)		134 (22.4)	3 (27.3)	131 (22.3)	
Undergraduate, N (%)	86 (14.4)	13 (15.1)	73 (13.6)		86 (14.4)	3 (27.3)	83 (14.1)	
Postgraduate, N (%)	40 (6.7)	4 (6.3)	36 (6.7)		40 (6.7)	1 (9.1)	39 (6.6)	
Other, N (%)	26 (4.3)	2 (3.1)	24 (4.5)		26 (4.3)	0 (0)	26 (4.4)	
Employment, N (%)	599	64 (10.7)	535 (89.3)	0.665	599	11 (1.8)	588 (98.2)	0.431
Self-employed, N (%)	61 (10.2)	7 (10.9)	54 (10.1)		61 (10.2)	0 (0)	61 (10.4)	
Paid employment, N (%)	240 (40.1)	28 (43.8)	212 (39.6)		240 (40.1)	5 (45.5)	235 (40.0)	
Unemployed, N (%)	42 (7.0)	3 (4.7)	39 (7.3)		42 (7.0)	1 (9.1)	41 (7.0)	
Retired, N (%)	166 (27.7)	13 (20.3)	153 (28.6)		166 (27.7)	3 (27.3)	163 (27.7)	
Maternity leave, N (%)	4 (0.7)	0 (0)	4 (0.7)		4 (0.7)	0 (0)	4 (0.7)	
Looking after family, N (%)	37 (6.2)	6 (9.4)	31 (5.8)		37 (6.2)	1 (9.1)	36 (6.1)	
Full-time student, N (%)	8 (1.3)	1 (1.6)	7 (1.3)		8 (1.3)	1 (9.1)	7 (1.2)	
Long term sick / disabled, N (%)	37 (6.2)	6 (9.4)	31 (5.8)		37 (6.2)	0 (0)	37 (6.3)	
Something else, N (%)	4 (0.7)	0 (0)	4 (0.7)		4 (0.7)	0 (0)	4 (0.7)	

Occupation, N (%)	490	50 (10.2)	440 (89.8)	0.059	490	9 (1.8)	481 (98.2)	0.566
<i>Level 1, N (%)</i>	63 (13.2)	10 (20.0)	53 (12.0)		63 (13.2)	2 (22.2)	61 (12.7)	
<i>Level 2, N (%)</i>	146 (30.5)	16 (32.0)	130 (29.5)		146 (30.5)	2 (22.2)	144 (29.9)	
<i>Level 3, N (%)</i>	57 (11.9)	2 (4.0)	55 (12.5)		57 (11.9)	0 (0)	57 (11.9)	
<i>Level 4, N (%)</i>	49 (10.3)	9 (18.0)	40 (9.1)		49 (10.3)	2 (22.2)	47 (9.8)	
<i>Retired, N (%)</i>	165 (34.5)	12 (24.0)	153 (34.8)		165 (34.5)	3 (33.3)	162 (33.7)	
<i>Other, N (%)</i>	10 (2.1)	1 (2.0)	9 (2.0)		10 (2.1)	0 (0)	10 (2.1)	
Income, N (MR)	478	53 (246)	425 (239)	0.724	478	10 (241)	468 (239)	0.973

522 * significant at p<0.05

523 CI = confidence interval, CPR = cardiopulmonary resuscitation, MD = mean difference, MR = mean
524 rank, SD = standard deviation

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Table 2: Knowledge of cardiac arrest, CPR and defibrillator

Variable	Do you know how to tell if someone is having a cardiac arrest?				Do you know what CPR is for?				Know what a defibrillator is for?				Would you like more information on CPR?			
	N	Yes	No or unsure	p value (MD, 95% CI)	N	Yes	No or unsure	p value (MD, 95% CI)	N	Yes	No or unsure	p value (MD, 95% CI)	N	Yes	No or unsure	p value (MD, 95% CI)
Age, N (mean, SD)	600	144 (50.2, 16.2)	456 (52.5, 18.2)	0.182 (-2.3, -5.6 to 1.1)	600	526 (51.9, 7.4)	74 (52.6, 20.0)	0.740 (-0.7, -5.1 to 3.6)	600	491 (51.9, 17.3)	109 (52.3, 19.7)	0.818 (-0.4, -4.1 to 3.3)	600	348 (48.9, 7.2)	252 (56.1, 17.7)	<0.001 (-7.2, -10.0 to -4.4)*
Gender, N (%)	600	143 (23.8)	457 (76.2)	0.443	600	526 (87.7)	74 (12.3)	0.063	600	491 (81.8)	109 (18.2)	0.751	600	348 (58.0)	252 (42.0)	0.246
Female, N (%)	313 (52.2)	79 (55.2)	234 (51.2)		313 (52.2)	244 (46.4)	43 (58.1)		313 (52.2)	258 (52.5)	55 (49.5)		313 (52.2)	189 (54.3)	124 (49.2)	
Male, N (%)	287 (47.8)	64 (44.8)	223 (48.8)		287 (47.8)	282 (53.6)	31 (41.9)		287 (47.8)	233 (47.5)	54 (50.5)		287 (47.8)	159 (45.7)	128 (50.8)	
Ethnicity, N (%)	597	144 (23.8)	457 (76.2)	0.520	597	523 (87.6)	74 (12.4)	<0.001 *	597	488 (81.7)	109 (18.3)	<0.001 *	597	345 (57.8)	252 (42.2)	0.135
White, N (%)	570 (95.5)	139 (97.9)	431 (94.7)		570 (95.5)	508 (97.1)	62 (83.8)		570 (95.5)	476 (97.5)	94 (86.2)		570 (95.5)	323 (93.6)	247 (98.0)	
Mixed/Multiple, N (%)	4 (0.7)	0 (0)	4 (0.9)		4 (0.7)	4 (0.8)	0 (0)		4 (0.7)	4 (0.8)	0 (0)		4 (0.7)	3 (0.9)	1 (0.4)	
Asian / Asian British, N (%)	14 (2.3)	1 (0.7)	13 (2.9)		14 (2.3)	5 (1.0)	9 (12.2)		14 (2.3)	3 (0.6)	11 (10.1)		14 (2.3)	12 (3.5)	2 (0.8)	
Black, African, or Black British, N (%)	4 (0.7)	1 (0.7)	3 (0.7)		4 (0.7)	3 (0.6)	1 (1.4)		4 (0.7)	2 (0.4)	2 (1.8)		4 (0.7)	3 (0.9)	1 (0.4)	
Other, N (%)	5 (0.8)	1 (0.7)	4 (0.9)		5 (0.8)	3 (0.6)	2 (2.7)		5 (0.8)	3 (0.6)	2 (1.8)		5 (0.8)	4 (1.2)	1 (0.4)	
General health, N (MR)	600	144 (310.3)	456 (297.4)	0.429	600	526 (301)	74 (298)	0.878	600	492 (300)	108 (303)	0.850	600	349 (307)	251 (292)	0.305
Indices of Multiple Deprivation score, N (MR)	586	140 (277)	446 (299)	0.176	586	517 (294)	69 (287)	0.717	586	483 (301)	103 (259)	0.025*	586	343 (295)	243 (291)	0.748
Highest education level, N (%)	599	143 (23.9)	456 (76.1)	0.005*	599	525 (87.6)	74 (12.4)	0.059	599	490 (81.8)	109 (18.2)	<0.001 *	599	348 (58.1)	251 (41.9)	0.020*
None, N (%)	117 (19.5)	23 (19.7)	94 (20.6)		117 (19.5)	95 (18.1)	22 (29.7)		117 (19.5)	81 (16.5)	36 (33.0)		117 (19.5)	59 (17.0)	58 (23.1)	
GCSE / GCE, N (%)	196 (32.7)	36 (18.4)	160 (35.1)		196 (32.7)	168 (32.0)	28 (37.8)		196 (32.7)	167 (34.1)	29 (26.6)		196 (32.7)	110 (31.6)	86 (34.3)	

<i>AS / A level, N (%)</i>	134 (22.4)	41 (30.6)	93 (20.4)		134 (22.4)	123 (23.4)	11 (14.9)		134 (22.4)	118 (24.1)	16 (14.7)		134 (22.4)	89 (25.6)	45 (17.9)	
<i>Undergraduate, N (%)</i>	86 (14.4)	23 (26.7)	63 (13.8)		86 (14.4)	80 (15.2)	6 (8.1)		86 (14.4)	75 (15.3)	11 (10.1)		86 (14.4)	48 (13.8)	38 (15.1)	
<i>Postgraduate, N (%)</i>	40 (6.7)	17 (42.5)	23 (5.0)		40 (6.7)	37 (7.0)	3 (4.1)		40 (6.7)	35 (7.1)	5 (4.6)		40 (6.7)	30 (8.6)	10 (4.0)	
<i>Other, N (%)</i>	26 (4.3)	3 (11.5)	23 (5.0)		26 (4.3)	22 (4.2)	4 (5.4)		26 (4.3)	14 (2.9)	12 (11.0)		26 (4.3)	12 (3.4)	14 (5.6)	
Employment, N (%)	599	143 (23.9)	456 (76.1)	0.534	599	525 (87.6)	74 (12.4)	0.242	599	490 (81.8)	109 (18.2)	0.215	599	348 (58.1)	251 (41.9)	0.136
<i>Self-employed, N (%)</i>	61 (10.2)	19 (13.3)	42 (9.2)		61 (10.2)	48 (9.1)	13 (17.6)		61 (10.2)	48 (9.8)	13 (11.9)		61 (10.2)	34 (9.8)	27 (10.8)	
<i>Paid employment, N (%)</i>	240 (40.1)	57 (39.9)	183 (40.1)		240 (40.1)	215 (41.0)	25 (33.8)		240 (40.1)	206 (42.0)	34 (31.2)		240 (40.1)	148 (42.5)	92 (36.7)	
<i>Unemployed, N (%)</i>	42 (7.0)	11 (7.7)	31 (6.8)		42 (7.0)	36 (6.9)	6 (8.1)		42 (7.0)	33 (6.7)	9 (8.3)		42 (7.0)	27 (7.8)	15 (6.0)	
<i>Retired, N (%)</i>	166 (27.7)	33 (23.1)	133 (29.2)		166 (27.7)	148 (28.2)	18 (24.3)		166 (27.7)	137 (28.0)	29 (26.6)		166 (27.7)	84 (24.1)	82 (32.7)	
<i>Maternity leave, N (%)</i>	4 (0.7)	1 (0.7)	3 (0.7)		4 (0.7)	4 (0.8)	0 (0)		4 (0.7)	3 (0.6)	1 (0.9)		4 (0.7)	2 (0.6)	2 (0.8)	
<i>Looking after family, N (%)</i>	37 (6.2)	11 (7.7)	26 (5.7)		37 (6.2)	34 (6.5)	3 (4.1)		37 (6.2)	28 (5.7)	9 (8.3)		37 (6.2)	25 (7.2)	12 (4.8)	
<i>Full-time student, N (%)</i>	8 (1.3)	2 (1.4)	6 (1.3)		8 (1.3)	6 (1.1)	2 (2.7)		8 (1.3)	5 (1.0)	3 (2.8)		8 (1.3)	7 (2.0)	1 (0.4)	
<i>Long term sick / disabled, N (%)</i>	37 (6.2)	7 (4.9)	30 (6.6)		37 (6.2)	31 (5.9)	6 (8.1)		37 (6.2)	27 (5.5)	10 (9.2)		37 (6.2)	20 (5.7)	17 (6.8)	
<i>Something else, N (%)</i>	4 (0.7)	2 (1.4)	2 (0.4)		4 (0.7)	3 (0.6)	1 (1.4)		4 (0.7)	3 (0.6)	1 (0.9)		4 (0.7)	1 (0.3)	3 (1.2)	
Occupation, N (%)	490	119 (24.3)	371 (75.7)	0.113	490	430 (87.8)	60 (12.2)	0.829	490	407	83	0.353	490	276 (56.3)	214 (43.7)	0.413
<i>Level 1, N (%)</i>	63 (12.9)	16 (13.4)	47 (12.7)		63 (12.9)	55 (12.8)	8 (13.3)		63 (12.9)	51 (12.5)	12 (14.5)		63 (12.9)	38 (13.8)	25 (11.7)	
<i>Level 2, N (%)</i>	146 (29.8)	38 (31.9)	108 (29.1)		146 (29.8)	129 (30.0)	17 (28.3)		146 (29.8)	118 (29.0)	28 (33.7)		146 (29.8)	89 (32.2)	57 (26.6)	
<i>Level 3, N (%)</i>	57 (11.6)	11 (9.2)	46 (12.4)		57 (11.6)	48 (11.2)	9 (15.0)		57 (11.6)	47 (11.5)	10 (12.0)		57 (11.6)	33 (12.0)	24 (11.2)	
<i>Level 4, N (%)</i>	49 (10.0)	18 (15.1)	31 (8.4)		49 (10.0)	43 (10.0)	6 (10.0)		49 (10.0)	46 (11.3)	3 (3.6)		49 (10.0)	29 (10.5)	20 (9.3)	
<i>Retired, N (%)</i>	165 (33.7)	32 (26.9)	133 (35.8)		165 (33.7)	147 (34.2)	18 (30.0)		165 (33.7)	136 (33.4)	29 (34.9)		165 (33.7)	82 (29.7)	83 (38.8)	
<i>Other, N (%)</i>	10 (2.0)	4 (3.4)	6 (1.6)		10 (2.0)	8 (1.9)	2 (3.3)		10 (2.0)	9 (2.2)	1 (1.2)		10 (2.0)	5 (1.8)	5 (2.3)	

Income, N (MR)	478	122 (255)	356 (234)	0.164	478	428 (243)	50 (208)	0.093	478	406 (248)	72 (191)	0.001*	478	284 (244)	194 (234)	0.446
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* significant at $p < 0.05$

CI = confidence interval, MD = mean difference, MR = mean rank, SD = standard deviation

Table 3: Willingness to seek help, follow advice and help someone experiencing OHCA

Variable	Willingness to call 999		Willingness to follow advice		Willingness to help family		Willingness to help someone familiar		Willingness to help a stranger	
	<i>N</i>	<i>p value</i>	<i>N</i>	<i>p value</i>	<i>N</i>	<i>p value</i>	<i>N</i>	<i>p value</i>	<i>N</i>	<i>p value</i>
Age, N (CC)	599 (-1.61)	<0.001*	599 (-0.158)	<0.001*	600 (-0.135)	0.001*	600 (-0.160)	<0.001*	600 (-0.120)	0.003*
Gender, N	599	0.178	599	0.238	600	0.146	600	0.888	600	0.664
Female, N (MR)	313 (304)		313 (305)		313 (306)		313 (300)		313 (298)	
Male, N (MR)	286 (296)		286 (294)		287 (295)		287 (301)		287 (303)	
Ethnicity, N	596	0.570	596	0.590	597	0.150	597	0.278	597	0.501
White, N (MR)	569 (299)		569 (298)		570 (299)		570 (299)		570 (301)	
Mixed/Multiple, N (MR)	4 (317)		4 (347)		4 (335)		4 (348)		4 (233)	
Asian / Asian British, N (MR)	14 (296)		14 (283)		14 (293)		14 (309)		14 (264)	
Black, African, or Black British, N (MR)	4 (244)		4 (347)		4 (186)		4 (199)		4 (229)	
Other, N (MR)	5 (317)		5 (347)		5 (335)		5 (348)		5 (320)	
General health, N (CC)	599 (0.024)	0.563	599 (-0.008)	0.851	600 (-0.030)	0.461	600 (-0.011)	0.791	600 (-0.032)	0.432
Mean Indices of Multiple Deprivation score, N (CC)	586 (-0.051)	0.214	585 (-0.011)	0.792	586 (-0.056)	0.173	586 (-0.010)	0.812	586 (-0.025)	0.547
Highest education level, N	599	0.250	599	0.435	599	0.608	599	0.333	599	0.604
None, N (MR)	117 (287)		117 (285)		117 (290)		117 (282)		117 (286)	
GCSE / GCE, N (MR)	196 (304)		196 (307)		196 (299)		196 (302)		196 (304)	
AS / A level, N (MR)	134 (305)		134 (294)		134 (311)		134 (309)		134 (307)	
Undergraduate, N (MR)	86 (297)		86 (302)		86 (300)		86 (310)		86 (309)	
Postgraduate, N (MR)	40 (311)		40 (320)		40 (306)		40 (306)		40 (298)	
Other, N (MR)	26 (294)		26 (311)		26 (289)		26 (279)		26 (268)	
Employment, N	599	0.352	599	0.223	599	0.210	599	0.108	599	0.310
Self-employed, N (MR)	61 (303)		61 (310)		61 (311)		61 (316)		61 (305)	
Paid employment, N (MR)	240 (303)		240 (305)		240 (305)		240 (306)		240 (306)	
Unemployed, N (MR)	42 (297)		42 (284)		42 (286)		42 (294)		42 (298)	
Retired, N (MR)	166 (289)		166 (283)		166 (287)		166 (282)		166 (286)	
Maternity leave, N (MR)	4 (318)		4 (349)		4 (336)		4 (270)		4 (283)	
Looking after family, N (MR)	37 (318)		37 (308)		37 (328)		37 (341)		37 (340)	
Full-time student, N (MR)	8 (282)		8 (315)		8 (261)		8 (274)		8 (240)	
Long term sick / disabled, N (MR)	37 (310)		37 (333)		37 (295)		37 (289)		37 (285)	
Something else, N (MR)	4 (318)		4 (269)		4 (336)		4 (349)		4 (377)	
Occupation, N	489	0.068	489	0.005*	490	0.064	490	0.095	490	0.182

<i>Level 1, N (MR)</i>	<i>63 (238)</i>		<i>63 (240)</i>		<i>63 (248)</i>		<i>63 (245)</i>		<i>63 (242)</i>
<i>Level 2, N (MR)</i>	<i>145 (256)</i>		<i>145 (263)</i>		<i>146 (256)</i>		<i>146 (252)</i>		<i>146 (255)</i>
<i>Level 3, N (MR)</i>	<i>57 (240)</i>		<i>57 (234)</i>		<i>57 (231)</i>		<i>57 (243)</i>		<i>57 (235)</i>
<i>Level 4, N (MR)</i>	<i>49 (251)</i>		<i>49 (267)</i>		<i>49 (265)</i>		<i>49 (273)</i>		<i>49 (269)</i>
<i>Retired, N (MR)</i>	<i>165 (237)</i>		<i>165 (231)</i>		<i>165 (235)</i>		<i>165 (231)</i>		<i>165 (233)</i>
<i>Other, N (MR)</i>	<i>10 (261)</i>		<i>10 (189)</i>		<i>10 (249)</i>		<i>10 (261)</i>		<i>10 (283)</i>
Income, N (CC)	477 (0.039)	0.397	477 (0.126)	0.006*	478 (0.037)	0.416	478 (0.069)	0.131	478 (0.037) 0.420

* significant at $p < 0.05$

CC = correlation coefficient, MR = mean rank

Table 4: Competency, confidence and comfort of performing CPR or using a defibrillator

Variable	Capable of helping		Confident of helping		Comfortable performing CPR		Comfortable using a defibrillator	
	N	p value	N	p value	N	p value	N	p value
Age, N (CC)	601 (-0.058)	0.153	598 (-0.055)	0.184	599 (-0.097)	0.018*	601 (-0.001)	0.980
Gender, N	600	0.084	597	0.083	598	0.006*	600	0.178
Female, N (MR)	313 (289)		311 (287)		311 (281)		313 (291)	
Male, N (MR)	287 (313)		286 (312)		287 (320)		287 (310)	
Ethnicity, N	597	0.341	594	0.461	595	0.434	597	0.136
White, N (MR)	570 (302)		567 (299)		568 (299)		570 (301)	
Mixed/Multiple, N (MR)	4 (276)		4 (356)		4 (388)		4 (315)	
Asian / Asian British, N (MR)	14 (218)		14 (221)		14 (243)		14 (197)	
Black, African, or Black British, N (MR)	4 (314)		4 (340)		4 (347)		4 (218)	
Other, N (MR)	5 (218)		5 (288)		5 (227)		5 (374)	
General health, N (CC)	600 (0.035)	0.390	597 (0.005)	0.898	598 (0.067)	0.103	600 (0.153)	<0.001*
Indices of Multiple Deprivation score, N (CC)	586 (-0.068)	0.098	585 (-0.071)	0.088	584 (-0.100)	0.016*	586 (0.020)	0.630
Highest education level, N	599	0.963	596	0.459	597	0.594	599	0.551
None, N (MR)	117 (293)		116 (301)		117 (291)		117 (285)	
GCSE / GCE, N (MR)	196 (301)		194 (294)		196 (293)		196 (293)	
AS / A level, N (MR)	134 (302)		134 (320)		132 (317)		134 (308)	
Undergraduate, N (MR)	86 (311)		86 (296)		86 (312)		86 (327)	
Postgraduate, N (MR)	40 (284)		40 (260)		40 (288)		40 (305)	
Other, N (MR)	26 (309)		26 (280)		26 (264)		26 (286)	
Employment, N	599	0.886	596	0.822	597	0.422	599	0.581
Self-employed, N (MR)	61 (306)		61 (310)		60 (299)		61 (316)	
Paid employment, N (MR)	240 (307)		240 (302)		240 (316)		240 (303)	
Unemployed, N (MR)	42 (287)		41 (301)		42 (288)		42 (256)	
Retired, N (MR)	166 (294)		165 (295)		165 (278)		166 (296)	
Maternity leave, N (MR)	4 (386)		4 (317)		4 (312)		4 (314)	
Looking after family, N (MR)	37 (267)		36 (255)		37 (266)		37 (280)	
Full-time student, N (MR)	8 (298)		8 (262)		8 (311)		8 (283)	
Long term sick / disabled, N (MR)	37 (316)		37 (325)		37 (328)		37 (325)	

<i>Something else, N (MR)</i>	<i>4 (269)</i>		<i>4 (244)</i>		<i>4 (234)</i>		<i>4 (300)</i>	
Occupation, N	490	0.508	487	0.705	488	0.090	490	0.150
<i>Level 1, N (MR)</i>	<i>63 (261)</i>		<i>63 (260)</i>		<i>63 (283)</i>		<i>63 (267)</i>	
<i>Level 2, N (MR)</i>	<i>146 (246)</i>		<i>144 (243)</i>		<i>146 (246)</i>		<i>146 (229)</i>	
<i>Level 3, N (MR)</i>	<i>57 (228)</i>		<i>57 (228)</i>		<i>57 (232)</i>		<i>57 (240)</i>	
<i>Level 4, N (MR)</i>	<i>49 (273)</i>		<i>49 (263)</i>		<i>49 (267)</i>		<i>49 (287)</i>	
<i>Retired, N (MR)</i>	<i>165 (237)</i>		<i>164 (240)</i>		<i>164 (226)</i>		<i>165 (241)</i>	
<i>Other, N (MR)</i>	<i>10 (249)</i>		<i>10 (217)</i>		<i>9 (238)</i>		<i>10 (255)</i>	
Income, N (CC)	478 (0.055)	0.232	476 (0.028)	0.536	476 (0.066)	0.150	478 (0.100)	0.029*

* significant at <0.05

CC = correlation coefficient, MR = mean ra

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