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''IMPACT OF COMMUNITY INITIATIVES ON NON-EMS BYSTANDER CPR RATES''

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ABSTRACT

AIM

Bystander CPR rates have steadily increased in England between 2014 and 2018. In West Yorkshire, there are two important developments during now. We aimed to explain whether postcode districts (PCDs) with more cumulative annual 'Restart a Heart' (RSAH) and/or Community First Responder (CFR) scheme activity between 2014 and 2018 were related to greater improvements in non-EMS bystander CPR rates for out-of-hospital cardiopulmonary arrest (OHCA) in comparison with PCDs within the same region with lesser or no such historic activity during the identical fundamental measure.

METHOD

We collated data from the OHCA Outcomes Registry for all non-EMS witnessed OHCA in West Yorkshire treated by Yorkshire Ambulance Service. We analyzed clusters of PCDs with high and low levels of RSAH and CFR activity between 2014 and 2018 using descriptive statistics, and comparisons were made between groups using chi-square and t-test.

RESULTS

The reported bystander CPR rate for non-EMS witnessed OHCA cases for West Yorkshire rose from 38.4% in 2014 to 69.7% in 2018. the biggest increases were seen in PCDs with high RSAH activity (+34.3%) and within the combination of high RSAH and low CFR activity (+38.5%). There was no significant difference when considering the interaction between RSAH and CFR groups.

CONCLUSION

The data infer the likelihood of a non-significant association between improved non-EMS bystander CPR rates and RSAH training and CFR scheme activity. We recom-

mend coordinated mass training, specifically for youngsters in regions where CPR isn't a compulsory a part of the varsity curriculum.

KEYWORDS

Out of hospital cardiac arrest EMS Mass training Bystander emergency procedure

INTRODUCTION

Out-of-hospital pathology (OHCA) may be a leading explanation for premature mortality in England.1 Survival relies upon swift initiation of the four links within the Chain of Survival; namely recognition of the arrest and calling for help, instigation of bystander cardiac resuscitation (CPR), early defibrillation, and access to high-quality post-resuscitation care.2 The role of the bystander is critical during this situation3, and efforts to strengthen the primary two links of the chain are particularly important in ensuring patient survival.4

In England, there has been an increase in bystander CPR rates over recent years. When specifically considering OHCA cases that aren't witnessed by Emergency Medical Service (EMS) personnel in England, the bystander CPR rates rose steadily from 58.2% in 2014 to 69.5% in 2018.5 There are various potential reasons for this, including more widespread CPR training, greater awareness of the advantages of CPR, and a greater willingness to produce bystander CPR. within the English county of Yorkshire, two important developments during now period were the delivery of a coordinated mass training initiative (Restart a Heart) and increased coverage of Community First Responder (CFR) schemes.

Restart a Heart (RSAH) was introduced throughout Europe because the results of a Written Declaration gone by the ecu Parliament in 2012 that called on member states to market CPR training through an annual awareness campaign.6 The initial audience for this training initiative was schoolchildren, and also the aim was to extend the quantity of laypeople with the potential to perform bystander CPR. Yorkshire Ambulance Service

(YAS) first delivered mass CPR training to schoolchildren as a part of European RSAH day in October 2014. To our knowledge, no other similar initiatives existed on this scale within the UK at the time. In 2016, the work by YAS was used as an exemplar to develop a national UK approach, coordinated by Resuscitation Council UK and supported by all 14 UK Ambulance Services, British Heart Foundation (BHF), St John Ambulance, and also the British Red Cross.

CFR schemes are a partnership between the ambulance service and community volunteers. They were first established in Yorkshire in 2000, and between 2014 and 2018 the quantity of active schemes in West Yorkshire increased from 52 to 62. it's possible that having these trained members of the general public in a very community may additionally impact bystander CPR rates if, instead of being dispatched by the ambulance service, they happen to be present at the time of the cardiopulmonary arrest.

The additional two years of organized RSAH activity in Yorkshire compared with the remainder of the United Kingdom affords the unique opportunity to analyses the impact of RSAH on bystander CPR rates over that longer period of intervention. The aim of this study was, therefore, to check the a priori hypothesis that postcode districts (PCD) within the study population with more cumulative annual RSAH and/or CFR scheme activity between 2014 and 2018 were related to greater improvements in bystander CPR rates for non-EMS witnessed OHCA compared with PCDs within the same region with lesser or no such historic activity during the identical period.

METHODS

Study design

This retrospective observational study descriptively analyses fully anonymised data routinely collected as a part of an ongoing clinical plan and so ethical approval wasn't required. the first outcome analysed was the bystander CPR rate for non-EMS witnessed OHCA cases in West Yorkshire treated by YAS personnel. Demographics for the study population are described.

Data sources

The OHCA Outcomes (OHCAO) Registry, based at the University of Warwick,7 collates data regarding OHCA from UK Ambulance services and was used because the data source for demographics and bystander CPR rates for 2014 and 2018. Data is unavailable for 2015 to 2017 as YAS failed to submit data to the OHCAO Registry during that point. Details of RSAH event and CFR scheme locations for every year from 2014 to 2018 were obtained from YAS.

Study setting

the study setting comprised the residents of the PCDs beginning with BD, HX, HD, WF and LS. This region was selected thanks to the greater accuracy of location records for CFR schemes compared with other parts of Yorkshire. These PCDs lie predominantly in and are centered around West Yorkshire, which is an inland metropolitan county within the north of England. The population has increased from 2.264 million in 2014 to 2.325 million in 2018.8 its areas of high population density (in particular in Leeds and Bradford), an outsized proportion of ethnic group populations, and areas of considerable deprivation.

Study population

the study population included patients sustaining a non-EMS witnessed OHCA treated by YAS in these PCDs (hereafter said as West Yorkshire). Cases that weren't treated by YAS were excluded. Data was also excluded for OHCAs that was witnessed by the EMS (as this doesn't reflect the direct impact of mass training initiatives), or where no bystander CPR was performed. Data submitted to the OHCAO Registry doesn't specifically identify cases that were subsequently attended to by a dispatched CFR.

The final study population was stratified and clustered in keeping with ‘Low’ and ‘High’ PCDs for RSAH and CFR scheme activity between 2014 and 2018. We elected to

match high and low activity PCDs within the identical region, instead of compare with a neighboring region or county, to minimize cultural, ethnic, and socio-economic confounding factors. The year 2014 was used as a baseline for this study as RSAH training commenced in West Yorkshire in October 2014, that the annual figure for that year indicates bystander CPR rates immediately before the intervention. We categorized each PCD by the quantity of years an RSAH campaign was held therein location between 2014 and 2017 inclusive, no matter whether or not they were consecutive or not. The categories were Low (0−2 years) and High (3−4 years). The presence or absence of RSAH training in October 2018 was deemed to not have impacted bystander CPR rates for that year. Similarly, PCDs were categorized consistent with the quantity of years a CFR programmed was operative between 2014 and 2018. Here the categories were Low (0−3 years) and High (4−5 years). The areas of high and low RSAH and CFR activity are shown in Fig. 1.

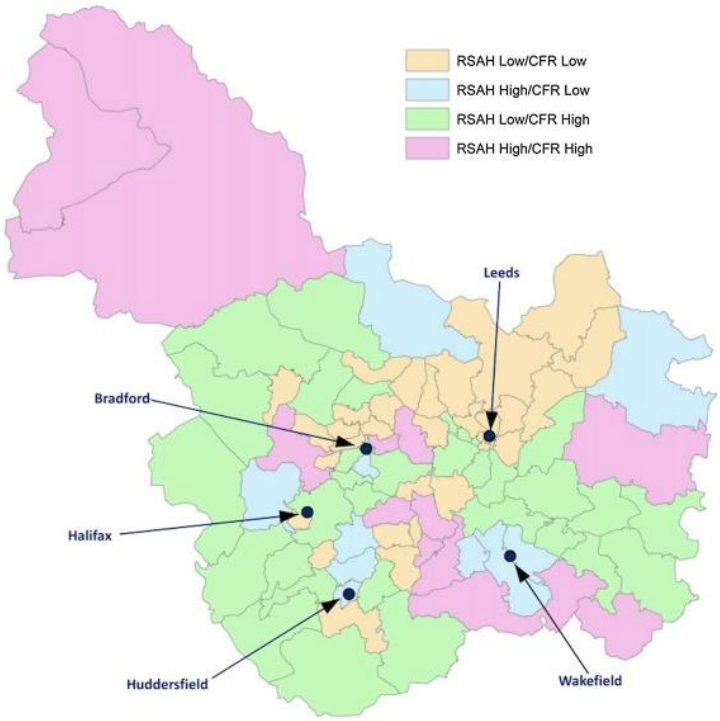

Fig. 1. Areas of high and low RSAH and CFR activity in county.

STATISTICAL ANALYSIS

The data was analyzed using descriptive statistics, and comparisons made between groups using chi-square and t-test. Logistic multivariate analysis was dispensed to assess the link between the likelihood of receiving bystander CPR in 2018 and also the number of years RSAH training and CFR schemes had been running within the PCD during which the OHCA had occurred. A significance level was set at $p < 0.05$.

RESULTS

Anonymised data were analyzed for OHCAs in West Yorkshire treated by YAS personnel that occurred in 2014 and 2018. a complete of 2387 OHCAs in 2014 and 2464 OHCAs in 2018 were treated by YAS throughout all of Yorkshire (Fig. 2). it had been unacceptable to see the PCD of the OHCA location in precisely 12 cases (2014: 10; 2018: 2). a complete of 1002 (42.2%) and 1072 (43.5%) of the OHCAs occurred in West Yorkshire in 2014 and 2018 respectively. All cases where the OHCA was witnessed by the EMS (2014: 94; 2018: 128) wouldn't, altogether probability, receive CPR by a bystander, and then were excluded from the analysis as were those with insufficient information. Consequently, a complete of 908 and 944 cases were analyzed.

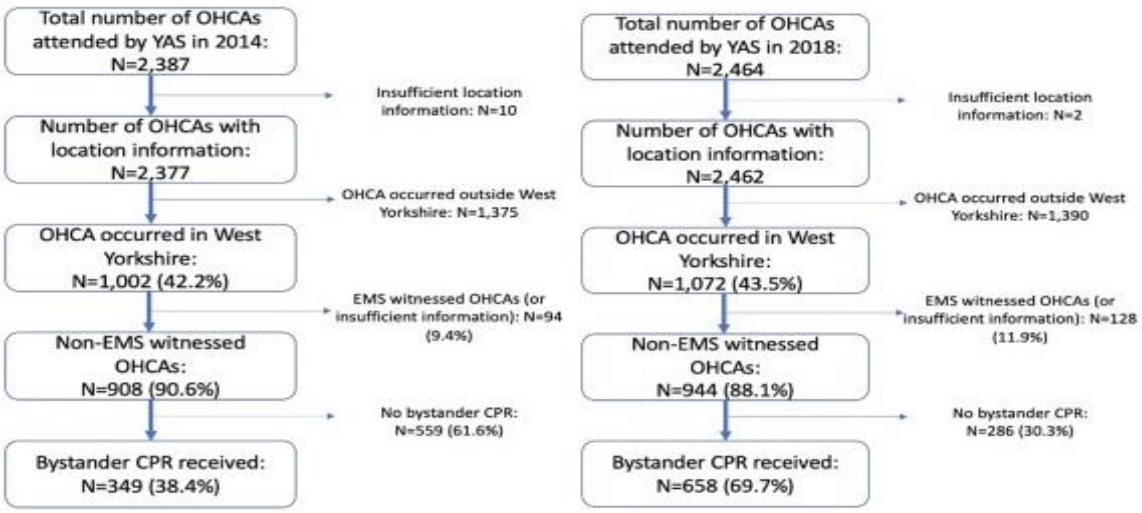

Fig. 2. flow chart of OHCA cases receiving bystander CPR in 2014 and 2018.

Table 1 shows the demographic information of non-EMS witnessed OHCA cases treated by YAS personnel from 2014 and 2018 that occurred in county. Cases within

the area in 2014 were significantly older compared to those in 2018 ($p < 0.05$). In 2018, a significantly greater proportion of cases were reached by EMS staff in 8 minutes or less ($p < 0.001$)

Table 1. Demographic details of non-EMS witnessed OHCA cases treated by YAS in county 2014 and 2018.

	2014 (n = 908)	2018 (n = 944)
Gender (%):		
Male	373 (41.1)	615 (65.2)
Female	219 (24.1)	301 (31.9)
Unknown	316 (34.8)	28 (2.9)
Age (years):	(n = 864)	(n = 912)
Mean (sd)	65.4 (20.8)[a]	63.4 (21.4)[a]
Median	69.0	68.4
Initial rhythm (%)[b]:		
VF/VT	64 (7.1)	210 (22.3)
Asystole		511 (54.1)
PEA		194 (20.5)
Proportion (%) of cases reached by EMS in 8 min	**52.0 (n = 542)**	73.5[c] (n = 937)

NB: No statistical difference was observed between years ($p > 0.05$) with following exceptions: [a] Mean age of cases in West Yorkshire in 2014 significantly greater than in 2018 ($p = 0.046$); [b] Data for initial rhythm in 2014 is incomplete; [c] Proportion in 2018 significantly greater than 2014 ($p < 0.001$).

In county, the bystander CPR rate in 2014 for non-EMS witnessed OHCA cases was 38.4% (Fig. 2). The corresponding figure for 2018 was 69.7%. National figures for by-stander CPR in non-EMS witnessed OHCA cases for 2014 to 2018, obtained from the OHCAO Registry, were 58.2%, 56.6%, 62.3%, 68.1%, and 69.5% respectively. This

demonstrates that county had considerably less reported bystander CPR activity for this group in 2014 as compared with the remainder of the country, but that by 2018 rates were marginally exceeding the national picture.

Table 2 gives the difference in bystander CPR rates in clustered PCDs between categories of cumulative RSAH and CFR activity by 2018. it's apparent that bystander CPR rates significantly increased over the five years all told groups, no matter the quantity of years RSAH or CFR programmers had been operating. The rise was slightly higher in PCDs where RSAH campaigns had been running for 3 to 4 years, although the difference wasn't statistically significant when put next with the opposite groups. The bystander CPR rates for the 'high' group for both RSAH and CFR activity were marginally greater than the national mean for 2018 (69.5%).

Table 2. Comparison of OHCA case numbers and bystander CPR rate between the quantity of years RSAH campaigns and CFR schemes are running.

	RSAH activity		CFR scheme activity	
	Low (0–2 yrs)	High (3–4 yrs)	Low (0–3 yrs)	High (4–5 yrs)
2014				
Non-EMS witnessed OHCAs (n)	663	245	412	496
OHCAs receiving bystander CPR (n)	257	92	151	198
Bystander CPR rate	38.8%	37.6%	36.7%	39.9%
2018				
Non-EMS witnessed OHCAs (n)	652	292	423	521
OHCAs receiving bystander CPR (n)	448	210	285	373
Bystander CPR rate	68.7%	71.9%	67.4%	71.6%
Difference in bystander CPR rate 2014–2018	+29.9%	+34.3%	+30.7%	+31.7%

NB: Difference in bystander CPR rate 2014–2018 significant ($p < 0.001$). No statistical difference in the increase between groups.

Table 3 gives the bystander CPR rates for combinations of RSAH and CFR groups. the

speed amongst those OHCAs that occurred in PCDs in 2018 with high historic RSAH and CFR scheme activity was 6.5% better than in those who occurred in PCDs with low historic RSAH and CFR scheme activity, although the difference wasn't statistically significant. In OHCAs that occurred with high/low or low/high categories in 2018, the bystander CPR rate was over 5.5% greater than those with low/low activity.

Table 3. Comparison of bystander CPR rates between different combinations of years RSAH campaign and CFR programmes have been running.

RSAH category	CFR category	Number of non-EMS witnessed cases	Bystander CPR		
			Number	Rate	
2014					
Low (0–2 yrs)	Low (0–3 yrs)	321	121	37.7%	
High (3–4 yrs)	Low (0–3 yrs)	91	30	33.0%	
Low (0–2 yrs)	High (4–5 yrs)	342	136	39.8%	
High (3–4 yrs)	High (4–5 yrs)	154	62	40.3%	
					Difference
2018					2014–2018
Low (0–2 yrs)	Low (0–3 yrs)	300	197	65.7%	+28%
High (3–4 yrs)	Low (0–3 yrs)	123	88	71.5%	+38.5%
Low (0–2 yrs)	High (4–5 yrs)	352	251	71.3%	+31.5%
High (3–4 yrs)	High (4–5 yrs)	169	122	72.2%	+31.9%

NB: Difference in bystander CPR rate 2014–2018 significant ($p < 0.001$). No statistical difference in the increase between groups.

When comparing groups between 2014 and 2018, very cheap positive trend was seen within the group with low activity in both RSAH and CFR throughout the entire fundamental measure. Increased positive trends were seen in PCDs that had low RSAH activity and high CFR scheme activity (+31.5%) and people with both high RSAH

and CFR scheme activity (31.9%). the very best increase in bystander CPR rates, however, was seen within the PCDs that had low CFR activity between 2014 and 2018 but high levels of RSAH activity (+38.5%). None of those differences was statistically significant between the groups.

Logistic multivariate analysis of whether an OHCA received bystander CPR or not and also the number of years RSAH and CFR schemes had been running within the PCD where the OHCA had occurred, showed a non-significant increase within the odds of receiving bystander CPR with an increasing number of years (see Table 4). There was also no significant difference when considering the interaction between RSAH and CFR groups, although the group with high RSAH and CFR activity had 1.49 times more chance of receiving bystander CPR than other areas with the difference approaching statistical significance (p = 0.08).

Table 4. Results of logistic regression analysis of bystander CPR on RSAH and CFR years, and categories.

	Odds ratio	P>|z|	95% Confidence intervals
Bivariate analysis			
RSAH years	1.03	0.58	0.92–1.17
CFR years	1.03	0.41	0.96–1.12
Interaction			
RSAH years	1.03	0.60	0.92–1.17
CFR years	1.03	0.41	0.96–1.11
RSAH/CFR category combinations			
Low/Low	Reference		
High/Low	1.20	0.46	0.74–1.96
Low/High	1.21	0.29	0.85–1.72
High/High	1.49	0.08	0.95–2.36

DISCUSSION

The 2021 European Resuscitation Guidelines emphasise the importance of coach-

ing non-healthcare professionals, including children, to extend CPR rates.9 it's known that CPR training may positively improve confidence in CPR skills.1, 10 Mass training of scholars has been used successfully in other parts of the planet,11 and this strategy is usually recommended as a way to enhance willingness to produce bystander CPR.12 The rationale behind training children is according to the aspirations of the planet Restart a Heart and youngsters SAVE LIVES initiatives to coach whole generations with life-long skills.13, 14 it's also known that, given the right instructional media, children can cascade such training to many household members likewise.15 In some parts of the globe, CPR training has become a compulsory a part of the varsity curriculum,16 with a positive impact on bystander CPR and survival rates as a result.3 within the UK, the RSAH initiative was an annual event that was historically wont to target schoolchildren within the absence of any inclusion within the curriculum. From 2020, CPR training has become a compulsory requirement in schools in England and Scotland which can further broaden the access to training.

By stander CPR rates for non-EMS witnessed OHCAs have risen steadily in England, from 58.2% in 2014 to 69.5% in 2018.5 Before 2016, there had been occasional position national media campaigns, like the **tv** advert by the BHF promoting compression-only CPR in 2012. However, until the instigation of the RCUK RSAH initiative in 2016, there have been no other comparable national face-to-face mass training approaches. Many other potential factors could have contributed to the current increase, including targeting relations of patients in danger, community CPR training, and accidental training in schools and workplaces.17 Local and regional public awareness campaigns make a crucial contribution to public education, including those occurring as a results of either successful or tragic individual outcomes from OHCA. Following the national roll-out of RSAH in 2016, these case stories were more likely to be strategically shared widely as a collateral benefit to the RSAH program. In Yorkshire, case stories of successful patient outcomes formed a crucial component of the regional RSAH initiative between 2014 and 2016, thus adding to the success of this approach.

The situation in county in 2014 was bleak. Bystander CPR rates reported to the OHCAO

Registry for non-EMS witnessed OHCA cases were 38.6%, which were significantly below national mean rates. At that point, the Yorkshire region had many areas with increased rates of OHCA let alone low rates of bystander CPR.18 it had been against this backdrop that RSAH training in Yorkshire was introduced by YAS on 16 October 2014. in this first year, 23 schools in county participated and 3016 children were taught CPR in someday. By 2018, this had risen to 44 schools and 11,155 trained respectively, with a cumulative total of 39,413 children trained over five years in county. The regional bystander CPR rates in 2018 had increased to 69.7%, which now marginally exceeded the national mean. This represented a rise of 31.6%, as compared with the national difference of 11.3%. it's postulated that RSAH training played a big role during this improvement in county.

In this study, the foremost pronounced increase in bystander CPR rates in county between 2014 and 2018 were within the PCDs with high levels of RSAH activity (+34.3%). the bottom increase (+29.9%) was seen within the PCDs with minimal RSAH training. In contrast, there was minimal difference between PCDs with high and low CFR scheme activity (31.7% vs 30.7%), suggesting a lesser impact on bystander CPR in non-EMS witnessed OHCAs than we had hypothesized. OHCAs, where a CFR was dispatched to help by YAS, were excluded from this study, that the minimal difference in impact could also be explained by the tiny number of trained CFRs (n = 363) and also the low probability of 1 of them coincidentally being an on the spot bystander for an arrest.

When analyzing combinations of groups, PCDs with low levels of both RSAH and CFR scheme activity had the tiniest increase in rates (+28%) between 2014 and 2018. the foremost pronounced increase (+38.5%) over the identical period of time was seen in PCDs with a mixture of high rates of RSAH activity and low rates of CFR activity. With minimal coexistent CFR scheme activity in these PCDs, the inference is that the sustained delivery of RSAH training over the five-year period played a crucial role within the improvement of bystander CPR rates. Besides, PCDs with both interventions had increased odds of receiving bystander CPR with multivariate analysis showing results approaching statistical significance. Whilst none of those results achieved statistical

significance compared with one another, it might appear that annual RSAH training, particularly, is also a beneficial intervention to boost bystander CPR rates in non-EMS witnessed OHCA cases.

LIMITATION

The main limitation of this study is that it's observational in nature. The analysis is additionally reliant upon the accuracy of information submitted to the OHCAO Registry. This ultimately implies that the authors are only ready to suggest causality and a degree of caution should be used because the trends may additionally have occurred through random variation.

There is a really small chance that participants who received RSAH training on 16 October 2014 witnessed an OHCA within the remainder of that year, thus influencing the baseline bystander CPR rate. Similarly, participants who received RSAH training for the primary time in October 2018 may have influenced the annual rates for that year. We feel that the possibilities of this are extremely small and unlikely to own made any material difference to the reported annual bystander CPR rates.

RSAH training was allocated to the PCD of the college where training was delivered. a number of the youngsters who participated during this training may have lived in another PCD or witnessed an OHCA in another a part of the region. Similarly, CFR schemes were allocated to the PCD of their base location but may have covered broader geographical areas. We were unable to accurately map RSAH and CFR trained bystander status with individual OHCAs. If this had been achievable, there's an opportunity that the association between the variables and non-EMS bystander CPR rates may are stronger than presented during this study. Finally, there is also other factors that influenced the advance in bystander CPR rates in West Yorkshire that we've not considered.

CONCLUSION

Bystander CPR rates for OHCA cases in West Yorkshire have improved from a foot-

hold in 2014 once they were markedly below national mean levels to slightly better than national mean levels in 2018. it absolutely was postulated that the delivery of annual RSAH training and/or CFR scheme activity over a 5-year period of your time may are related to greater improvements in bystander CPR rates for non-EMS witnessed OHCAs when put next with PCDs with no such historic activity. Whilst other factors may have impacted upon these changes, the analysis presented during this descriptive study of Registry data infers the likelihood of a non-significant association between improved bystander CPR rates and RSAH training and CFR scheme activity.

This finding is of importance because it infers that coordinated mass training of the general public (and schoolchildren in particular) in CPR can cause improved bystander CPR rates, which can hopefully then cause improved patient outcomes. this is often particularly relevant to other regions and parts of the planet where CPR training isn't a compulsory aspect of the varsity curriculum, and so represents a successful interim strategy that's in concordance with the principles promoted by World Restart a Heart and children SAVE LIVES.

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