

ORIGINAL RESEARCH

# Association of Psychological Distress, Contextual Factors, and Individual Differences Among Citizen Responders

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**BACKGROUND:** Little is known about the psychological risks of dispatched citizen responders who have participated in resuscitation attempts.

**METHODS AND RESULTS:** A cross-sectional survey study was performed with 102 citizen responders who participated in a resuscitation attempt from July 23, 2018, to August 22, 2018, in the Capital Region of Denmark. Psychological distress, defined as symptoms of posttraumatic stress disorder, was assessed 3 weeks after the resuscitation attempt and measured with the Impact of Event Scale-Revised. Perceived stress was measured with the Perceived Stress Scale. Individual differences were assessed as the personality traits of agreeableness, conscientiousness, extraversion, neuroticism, and openness to experience with the Big Five Inventory, general self-efficacy, and coping mechanisms (Brief Coping Orientation to Problems Experienced Inventory). Associations between continuous variables were examined with the Pearson correlation. The associations between psychological distress levels and contextual factors and individual differences were analyzed in multivariable linear regression models to determine factors independently associated with psychological distress levels. The mean overall posttraumatic stress disorder score was 0.65 of 12; the mean perceived stress score was 7.61 of 40. The most common coping mechanisms were acceptance and emotional support. Low perceived stress was significantly associated with high general self-efficacy, and high perceived stress was significantly associated with high scores on neuroticism and openness to experience. Non-healthcare professionals were less likely to report symptoms of posttraumatic stress disorder.

**CONCLUSIONS:** Citizen responders who participated in resuscitation reported low levels of psychological distress. Individual differences were significantly associated with levels of psychological distress and should be considered when engaging citizen responders in resuscitation.

**Key Words:** citizen responders ■ individual differences ■ out-of-hospital cardiac arrest ■ posttraumatic stress disorder ■ psychological distress ■ stress

Out-of-hospital cardiac arrest (OHCA) occurs annually in >900 000 people in the United States and Europe, and survival rates vary widely between regions.<sup>1–3</sup> Efforts to improve outcomes include programs to dispatch citizen responders to perform cardiopulmonary resuscitation (CPR) and defibrillation with an automated external defibrillator (AED), as recommended by the American

Heart Association resuscitation guidelines.<sup>4,5</sup> Citizen-responder intervention holds the potential to increase bystander defibrillation and survival.<sup>6–8</sup> However, asking the public to volunteer as citizen responders requires thorough consideration of the psychological risks involved.<sup>9–11</sup> To date, the psychological risk of those who participate in such programs is not well understood.<sup>9,11,12</sup>

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## CLINICAL PERSPECTIVE

### What Is New?

- This study of a complete cohort of citizen responders who attempted resuscitation showed citizen responders are capable of handling the psychological risks of participating in resuscitation.
- Most citizen responders were capable of coping with their experience on their own and showed few symptoms that could be related to posttraumatic stress disorder.

### What Are the Clinical Implications?

- Our findings support the implementation of citizen responder programs.
- Our results show systematic follow-up of citizen responders may identify the few who are likely to benefit from professional follow-up.
- Personality traits are inversely associated with the likelihood of psychological distress and should be considered when engaging citizen responders in resuscitation.

## Nonstandard Abbreviations and Acronyms

<b>BFI-10</b>	Big Five Inventory, 10-Item Short Version
<b>COPE</b>	Coping Orientation to Problems Experienced Inventory
<b>GSE-10</b>	General Self-Efficacy Scale
<b>IES-R</b>	Impact of Event Scale-Revised
<b>OHCA</b>	out-of-hospital cardiac arrest
<b>PSS</b>	Perceived Stress Scale

Resuscitation attempts can be stressful and chaotic events with little relation to the controlled environments of CPR courses with clean and silent manikins.<sup>11–14</sup> Qualitative research on psychological reactions among bystanders involved in a resuscitation attempt has shown that some experience flashbacks, difficulty sleeping, and social withdrawal.<sup>15–17</sup> However, most bystanders perceived their experience with resuscitation as generally positive.<sup>10,12,13</sup> To date, few studies have measured citizen-responder psychological distress.<sup>10,18</sup> Only one study has used a validated tool to measure psychological impact and found that few dispatched citizen responders reported symptoms of posttraumatic stress disorder (PTSD) at 4 to 6 weeks after the attempted resuscitation.<sup>10</sup> Notably, citizen responders included in this study were required to have completed a CPR

course before registration, and more than half were healthcare professionals.

Although it is well established that individual differences, such as personality traits, self-efficacy, and coping mechanisms, partly explain differences in reactions to stressful events, none of the existing research on bystander helpers has systematically analyzed individual differences.<sup>19–21</sup> Including contextual factors and individual differences will forward understanding not only of the extent of psychological risk among citizen responders in general, but also of *who* is at risk in the first place. Understanding this may be helpful when designing programs to screen which citizen responders are particularly at risk of developing severe distress and who should be offered systematic follow-up after being dispatched to an OHCA.

This cross-sectional study had 2 aims: (1) to investigate the level of psychological distress among an unselected cohort of citizen responders who participated in resuscitation attempts and (2) to assess which contextual factors and individual differences might explain the variation in level of psychological distress. We hypothesized associations between psychological distress, contextual factors, and individual differences among citizen responders who have participated in a resuscitation attempt.

## METHODS

Because of the sensitive nature of the data collected for this study, requests to access the data set from qualified researchers trained in human subject confidentiality protocols may be sent to Emergency Medical Services Copenhagen at [astrid.marie.rolin.kragh.01@regionh.dk](mailto:astrid.marie.rolin.kragh.01@regionh.dk).

### Study Setting

The Danish citizen responder program “HeartRunner” (Heartrunner app) was implemented in the Capital Region of Denmark in September 2017 and has recently been described in detail.<sup>18</sup> Anyone aged ≥18 years can register as a citizen responder. Prior CPR/AED training is recommended but not mandatory. The program includes off-duty healthcare professionals, fire and police personnel, as well as lay people. At present, 24% of the registered citizen responders are healthcare professionals. In cases of suspected cardiac arrest, the emergency medical dispatch center activates the citizen responder program along with a 2-tiered emergency medical services system, including an ambulance (basic life support) and a mobile emergency care unit (physician staffed), which provides advanced life support. Up to 20 citizen responders located within a radius

of 1.8 km (1.1 miles) from a suspected OHCA are dispatched to start CPR or to retrieve an AED. During the study period, ≈20 000 citizen responders were registered with the program. The program has since expanded, becoming nationwide in May 2020; and by June 2020, the program had reached 80 000 registered citizen responders.

### Study Design

In this cross-sectional survey study, we used a questionnaire consisting of validated measures of individual differences and psychological distress, as well as background and contextual factors. To test for risk of misinterpretation of items, terms, and phrases in our population, the questionnaire was tested on citizen responders in 2 rounds of pilot tests based on cognitive interviewing techniques.<sup>22</sup> To provide the best possible feedback, citizen responders selected for pilot tests were chosen to represent different sexes, ages, professions, and roles at the resuscitation attempt. As suggested by citizen responders in the pilot test, the survey was conducted through structured telephone

interviews with citizen responders based on close-ended questions from the applied questionnaires.

Responses to the questionnaire were typed in REDCap, a secure web application for building online surveys and collecting data.<sup>23</sup> All data were stored in a secure webserver at the Copenhagen Emergency Medical Services. All participants responded to all items.

### Participant Selection

Citizen responders met the inclusion criteria if they had been present at an OHCA location from July 23, 2018, to August 22, 2018, and had participated in resuscitation by performing CPR, using an AED, supporting relatives or random witnesses, or by handling practical tasks. Citizen responders were excluded if they had only briefly or had never seen the person with cardiac arrest (eg, because the ambulance had arrived before them or because they had decided against entering the building) (Figure 1). Furthermore, citizen responders were excluded if they had received debriefing by a healthcare professional, offered by

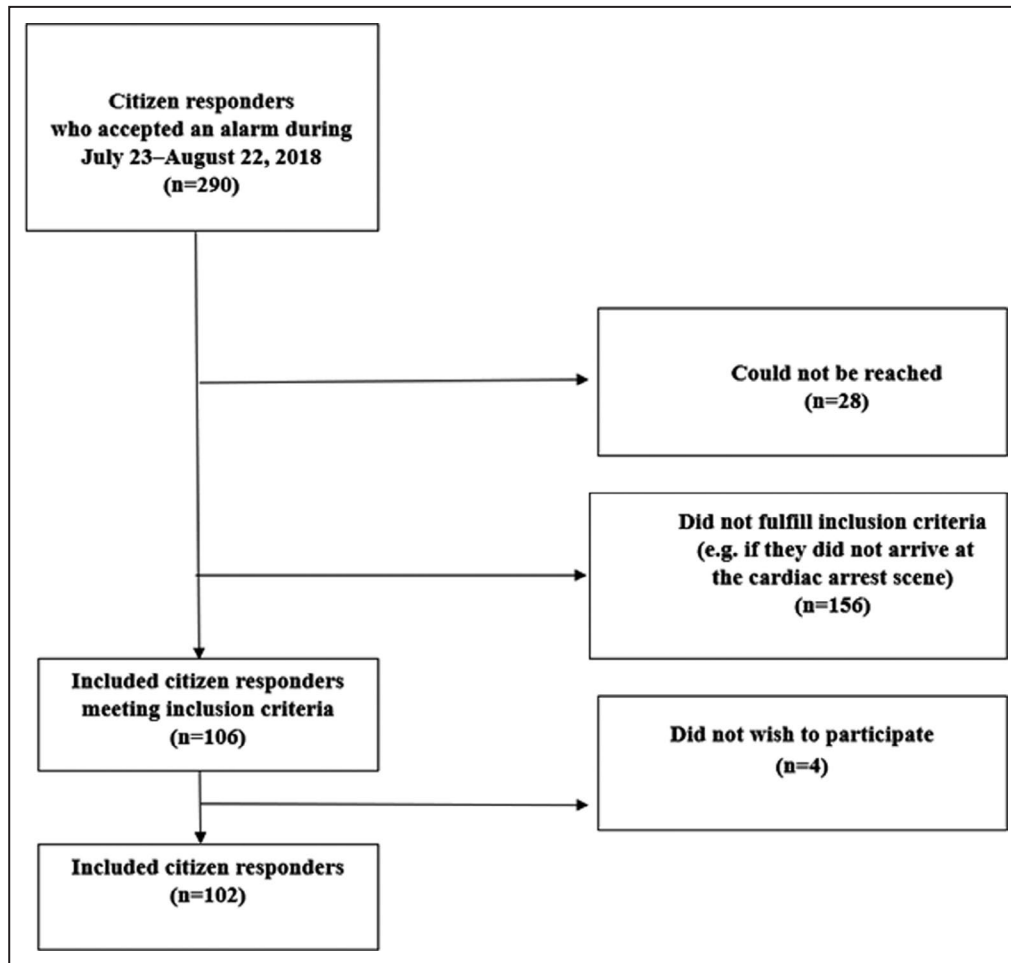


Figure 1. Citizen responder inclusion flowchart.

the Emergency Medical Services Copenhagen. This was decided as debriefing might stimulate reflection, positively influencing the ability to cope with emotional reactions and thus bias the results.<sup>11</sup>

Citizen responders were identified via the HeartRunner server, which holds information on the exact date and time when citizen responders accept an alarm in the Capital Region of Denmark.

All citizen responders who accepted alarms from July 23, 2018, to August 22, 2018, were contacted to prevent self-selection of participants. Contact was via telephone ~3 weeks after accepting the alarm. If the responder did not answer the telephone, a reminder was sent by text message; if there was no response to the text message, a second telephone call was made 2 days later. A third telephone call and a second text message reminder were sent 1 week after the first telephone call if the initial attempts to reach the citizen responder were unsuccessful.

## Measures and Variables

The degree of psychological distress was assessed through 2 different scales.

### Impact of Event Scale-Revised

The Impact of Event Scale-Revised (IES-R) is a 22-item instrument that measures symptoms of PTSD linked to a specific event on 3 subscales: intrusion, avoidance, and hyperarousal.<sup>24</sup> The IES-R has demonstrated adequate internal consistency for each subscale, concurrent and discriminative validity, and absence of social desirability effects.<sup>25</sup> Participants responded to each item on a 4-item scale (0–3). The sum of the means of the subscales was used as a measure of severity of PTSD symptoms (range, 0–12). There are no clinical cutoff scores for the IES-R.<sup>26</sup>

### Perceived Stress Scale

The Perceived Stress Scale (PSS) is a 10-item instrument designed to measure nonspecific appraised stress over the previous month. It measures how unpredictable, uncontrollable, and overloaded individuals consider their lives to be.<sup>27</sup> The instrument includes 6 negatively and 4 positively worded items (reversely scored). The Danish consensus version of the PSS has shown satisfactory face validity, reliability, and internal consistency as well as confirmed convergent construct validity.<sup>28</sup> Summed scores on the PSS are divided into 3 groups: low stress (0–13), moderate stress (14–26), and severe stress (27–40).

### Individual Differences

The term "individual differences" will be used to refer to personality characteristics assessed through

3 validated scales: The Big Five Inventory, the Brief Coping Orientation to Problems Experienced Inventory (COPE), and the General Self-Efficacy Scale.

### Big Five Inventory, 10-Item Short Version

The Big Five Inventory, 10-Item Short Version (BFI-10) measures the Big Five personality traits: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. It is based on the 44-item Big Five Inventory and is designed for contexts where respondents have limited time.<sup>29</sup> The BFI-10 has acceptable psychometric properties, including convergent validity, external validity, and test-retest validity.<sup>29</sup> Items are rated on a 5-point Likert scale. Each trait is measured with 2 items, 1 reversely scored. Scores are reported as the average of the reverse scored and normal scored item, resulting in a score between 1 and 5 for each trait.<sup>29</sup>

### Brief COPE

The Brief COPE is a 28-item short version of the COPE Inventory. It measures 14 coping mechanisms with 2 items each.<sup>30</sup> The Brief COPE has been validated among hurricane victims and shows acceptable test-retest reliability as well as structural validity. Participants respond on a 4-point scale (1–4), and sums of scores for each coping strategy are calculated (range, 2–8).<sup>30</sup>

### General Self-Efficacy Scale

The General Self-Efficacy Scale (GSE-10) is a 10-item scale measuring individuals' general belief in their ability to respond to and control environmental demands and challenges.<sup>31</sup> The scale has demonstrated high reliability and construct validity.<sup>32</sup> All participants respond to statements, such as "*I can usually handle whatever comes my way,*" scored in the same direction and measured on a 4-point scale (1–4). The sum of all items (range, 10–40) is used as an indicator of general self-efficacy. High scores are equal to high self-efficacy.

## Background and Contextual Factors

The following background factors were collected: sex, age, profession, and completed first aid course during the year before registration as a citizen responder. The following contextual factors were collected about the episode and the citizen responder's role: first time in a cardiac arrest situation, hands-on (chest compressions, mouth-to-mouth ventilation, and/or AED use) at the resuscitation attempt, others present at the resuscitation (health professionals, other citizen responders,

relatives, or random bystanders), and CPR attempt successful or unsuccessful/unknown. Participants were also asked whether they wished to continue as citizen responders after their experience, whether they had sought help from a professional (physician or therapist), and whether they considered their own contribution to the resuscitation as vital.

## Ethical Approval

When contacted by telephone, all included citizen responders consented to participating in the study. Data were kept in a secure server at the Copenhagen Emergency Medical Services. This cross-sectional survey study was part of a pilot study for the randomized controlled trial, The HeartRunner Trial (NCT03835403). Patient data collection was approved by the Data Protection Agency (journal No.: 2012-58-0004; VD-2018-28; I-Suite No.: 6222), and the study was registered with the Danish Patient Safety Authority (3-3013-2721/1).

## Statistical Analysis

Statistical analyses were performed with SPSS version 25.0. Psychological distress was the primary outcome in our study, measured by IES-R and PSS. The exposures of interest were individual differences, defined as the Big Five Inventory (BFI-10), general self-efficacy (GSE-10), and coping mechanisms (Brief COPE). Furthermore, background factors (sex, age, profession, and completed first aid course during the year before registration as a citizen responder) and contextual factors (first time in a cardiac arrest situation, hands-on at the resuscitation attempt, others present at the resuscitation, and CPR attempt successful or unsuccessful/unknown) were also considered as exposures. Differences and associations were examined with Mann-Whitney *U* test and the Pearson correlation. Means were compared with Mann-Whitney *U* tests because data for the dependent variables, IES-R and PSS score, were not normally distributed. IES-R had a skewness of 1.7 and a kurtosis of 2.8. For PSS, skewness was 0.7, and kurtosis was 0.5. Effect sizes are reported as  $r=Z/\sqrt{N}$  for Mann-Whitney *U* tests. The association between psychological distress (as measured with IES-R and PSS), contextual factors, and individual differences was analyzed with multivariable linear regression models to determine factors independently associated with psychological distress. Two bootstrapped multivariable linear regression models were constructed to determine factors independently associated with scores on the IES-R and the PSS. Sex and age were added to the models in block 1. Then, individual differences (agreeableness, conscientiousness, extraversion, neuroticism, openness, and general self-efficacy) were added in block 2. Finally, in

block 3, contextual factors were added (profession, hands-on or not, reported outcome, and first time as a citizen responder or not). Multivariable linear regression models were chosen because the outcome variables (the psychological distress measures) in the study are continuous. To meet the assumptions, bootstrapped versions were used of the multivariable linear regression models based on drawing 1000 random samples from the full data set and calculating the parameters.

## RESULTS

### Citizen Responder Characteristics

Of 290 citizen responders who accepted an alarm, 28 (10%) could not be reached (Figure 1). Of 106 citizen responders who met the inclusion criteria and were reached by telephone, 102 (96%) chose to participate in the study. The average time between attempted resuscitation and inclusion in the study was 26 days (range, 16 to 44 days; SD, 8 days).

Table 1 shows characteristics of the citizen responders included in the study. Most citizen responders

**Table 1. Cardiac Arrest and Citizen Responder Characteristics**

Characteristics (N=102)	Value
Sex, n (%)	
Men	68 (67)
Profession, n (%)	
Healthcare or emergency personnel*	55 (54)
Other	47 (46)
Age, median (Q1–Q3), y	42 (32–48)
CPR/AED course during the previous year, n (%)	63 (62)
Role at the resuscitation attempt	
Hands-on†	47 (46)
Other	55 (54)
Who was present when you arrived, n (%)	
Relatives	57 (56)
Random witnesses	37 (36)
Other citizen responders	65 (64)
Healthcare personnel	34 (33)
First time as a citizen responder, n (%)	66 (65)
Received help from a professional to cope with experience, n (%)	1 (1)
Wish to continue as citizen responder, n (%)	101 (99)
Consider own role at the resuscitation attempt vital for the outcome, n (%)	28 (28)

AED indicates automated external defibrillator; CPR, cardiopulmonary resuscitation; Q1, quartile 1; Q3, quartile 3.

\*Includes physicians, nurses, physiotherapists, fire fighters, police, and ambulance personnel.

†Chest compressions, mouth-mouth ventilations, and/or use of AED; N=102, no missing responses.



(67%) were men, most were on their first mission (65%), and more than half (54%) were healthcare professionals. Relatives of the patient experiencing cardiac arrest were present in 56% of the cases, and the citizen responder arrived before the emergency medical services in 69 of 102 cases (67%).

Almost half of the citizen responders (46%) provided CPR. One third (34%) reported that the patient had had return of spontaneous circulation before they had left the cardiac arrest location. All but one citizen responder stated they would continue as a citizen responder, and only one had sought professional help because of psychological distress. Most (72%) reported they did not believe their own role in the resuscitation attempt was vital for the outcome.

## Psychological Distress

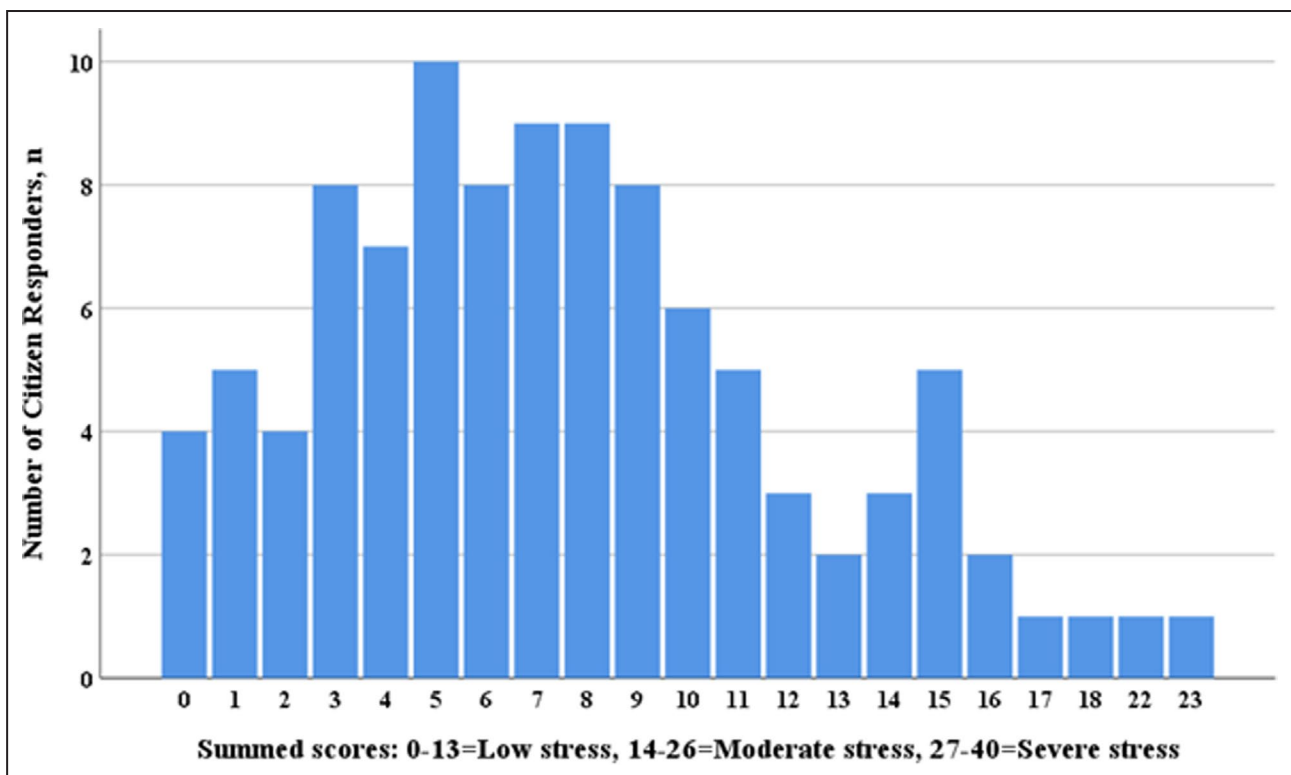
Figures 2 and 3 show psychological distress as reported by citizen responders on the scales used (PSS and IES-R). The mean PSS score was 7.61 (SD, 4.81; scale range, 0–40). Of the participants, 14% were classified with moderate stress (score, 14–26), and the remaining 86% with low stress (score, 0–13). No participant reported symptoms corresponding to severe stress at 4 weeks after resuscitation attempt.

For symptoms of PTSD (using IES-R), the overall mean score was 0.65 (SD, 0.89) of 12. Table S1 shows the distribution of scores according to subscales in the IES-R.

No background or contextual factors (sex, age, profession, hands-on CPR, outcome of resuscitation, first time as a citizen responder, or consideration of own role at the resuscitation attempt) were significantly associated with psychological distress measures on PSS. The only background or contextual factor significantly related to IES-R score was profession, with healthcare professionals or emergency personnel reporting significantly lower IES-R scores compared with other professions (median, 0.13 versus 0.58;  $P<0.001$ ).

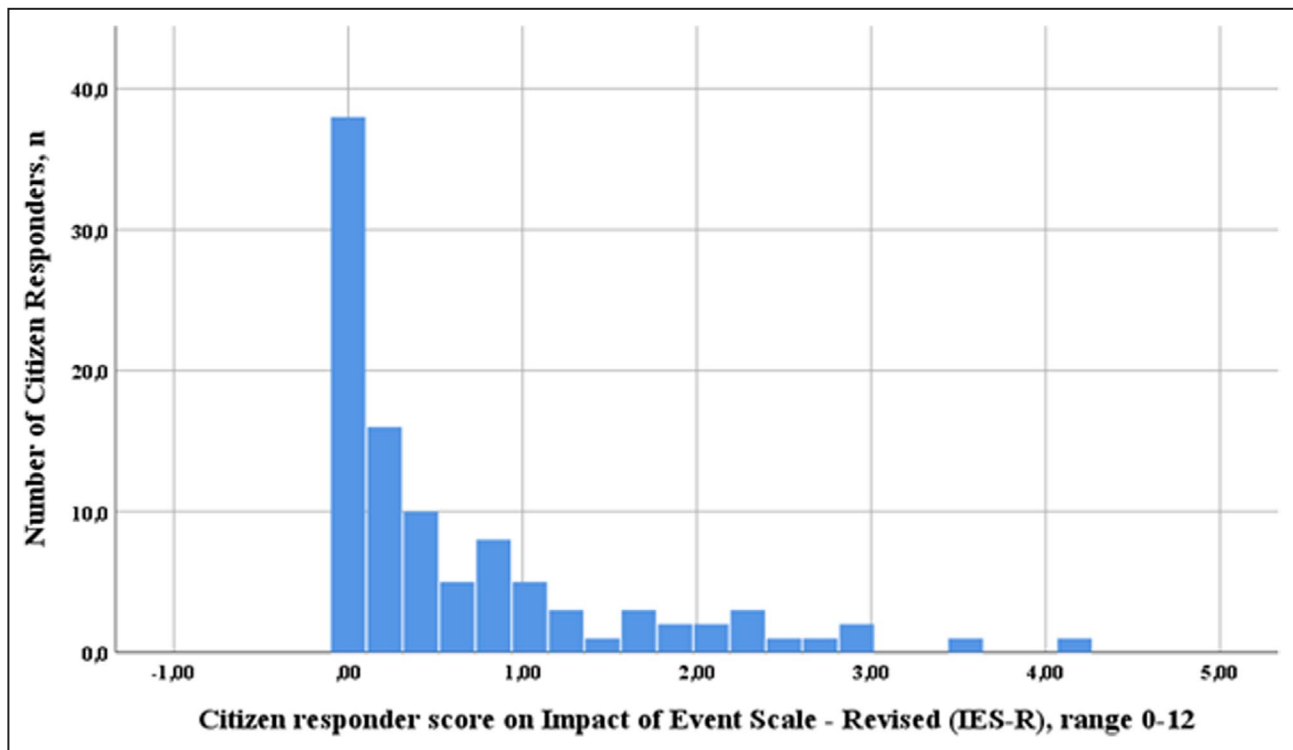
## Individual Differences and Psychological Distress

Individual differences that were significantly correlated with psychological distress are displayed in Figures 4 (PSS) and 5 (IES-R). Citizen responders reported high levels of self-efficacy (mean, 34.54; SD, 3.68; range, 10–40) and openness to experience (mean, 3.15; SD, 0.86; range, 1–5) and low levels of neuroticism (mean, 1.92; SD, 0.73; range, 1–5). Conscientiousness and extraversion were not



**Figure 2.** Citizen responder psychological distress, reported on the Perceived Stress Scale.

This figure illustrates citizen responder reported scores ~4 weeks after participating in a resuscitation attempt. The scale ranges from 0 to 40 and is a 10-item instrument designed to measure nonspecific appraised stress over the last month. N=102. Mean score, 7.61; SD, 4.81.



**Figure 3. Citizen responder psychological distress, reported on the Impact of Event Scale-Revised (IES-R).**

This figure illustrates citizen responder reported scores  $\approx$ 4 weeks after participating in a resuscitation attempt. The scale ranges from 0 to 12 and is a 22-item instrument designed to measure symptoms of posttraumatic stress disorder linked to a specific event (in this case, a resuscitation attempt).  $N=102$ . Mean score, 0.6467; SD, 0.8854.

significantly correlated with psychological distress. The Pearson correlation for conscientiousness was as follows: PSS,  $r=-0.12$ ,  $P=0.231$ ; IES-R,  $r=-0.17$ ,  $P=0.087$ . The Pearson correlation for extraversion was as follows: PSS,  $r=-0.09$ ,  $P=0.389$ ; IES-R,  $r=-0.04$ ,  $P=0.721$ . Personality traits and general self-efficacy scores among citizen responders are available in Table S2.

The most frequently reported coping mechanisms were acceptance (mean, 7.66; SD, 0.80; range, 2–8) and positive reframing (mean, 4.43; SD, 2.07; range, 2–8). Healthcare professionals or emergency personnel scored significantly lower on the coping mechanism self-blame (median, 2.0) than the other professions (median, 2.0) ( $U=1038$ ;  $P=0.031$ ;  $r=-0.21$ ). High general self-efficacy and agreeableness scores were both significantly related to low perceived stress scores (PSS). High neuroticism scores were associated with high scores on both PSS and IES-R. Frequency of scores on the 14 different coping mechanisms is available in Table S3.

### Multivariable Linear Regression Models

In the multivariable linear regression models, age and sex were not significantly associated with PSS or IES-R scores. Profession was the only factor significantly

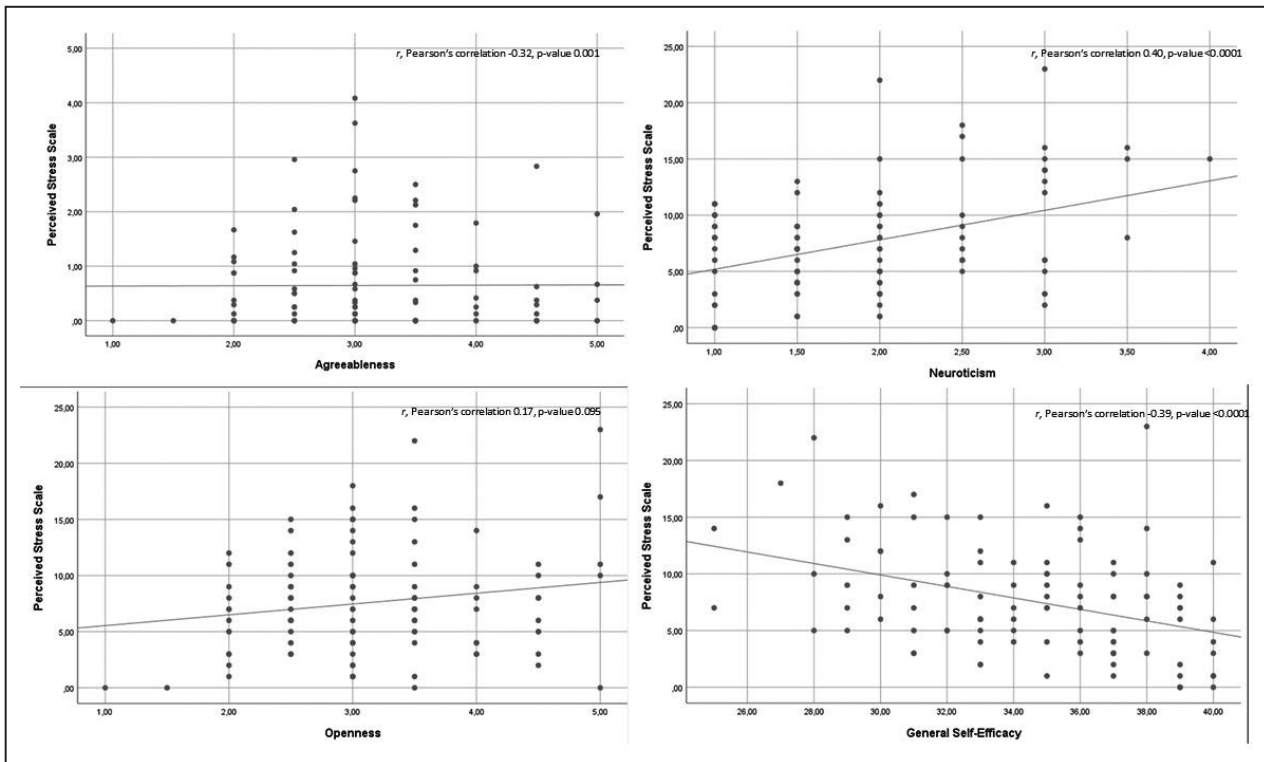
associated with IES-R score (Table 2). General self-efficacy and the personality traits openness to experience and neuroticism were significantly associated with PSS score. Only results for the final models are reported.

### Nonrespondents

Nonrespondents did not differ from respondents for sex, profession, or previous number of accepted or declined alarms. However, nonrespondents were significantly younger (mean, 34.04 years; SD, 13.69 years) than respondents (mean, 39.37 years; SD, 12.64 years) ( $U=2583.5$ ;  $P=0.017$ ;  $r=-0.14$ ).

## DISCUSSION

This study of psychological distress and the association with contextual factors and individual differences among 102 citizen responders who attempted resuscitation in OHCA had several main findings. We found citizen responders who participated in resuscitation attempts generally reported low levels of psychological distress, no need to seek professional help, and wished to continue as citizen responders. Furthermore, low perceived stress was significantly associated with high general self-efficacy, whereas high perceived stress



**Figure 4. Correlation between psychological distress, measured on the Perceived Stress Scale (PSS), and individual differences.**

This figure presents correlations between citizen responder stress, as reported on the PSS, 4 weeks after participating in a resuscitation attempt and individual differences (agreeableness, openness, neuroticism, and general self-efficacy). PSS: range, 0 to 40. Summed scores on the PSS are divided into 3 groups: low stress (0–13), moderate stress (14–26), and severe stress (27–40). General self-efficacy: range, 10 to 40. Agreeableness, openness, and neuroticism: range, 1 to 5.

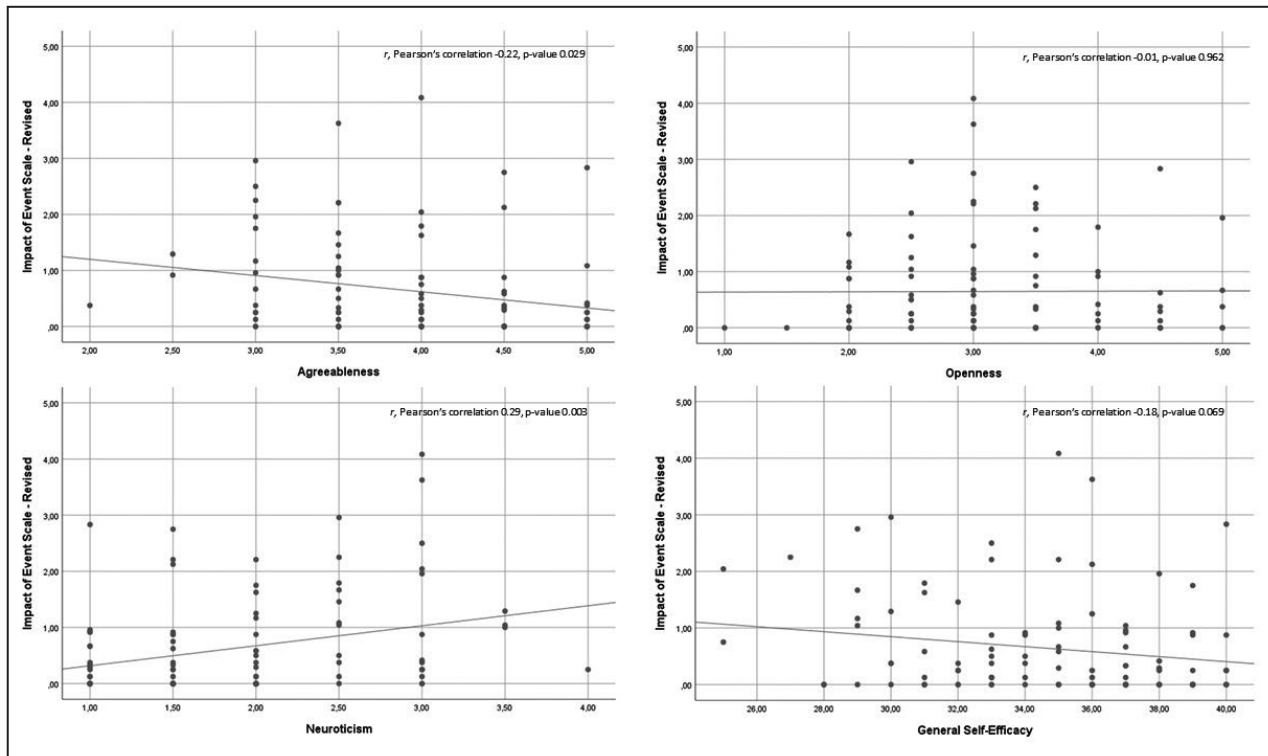
was significantly associated with high neuroticism and openness to experience.

These findings add important knowledge to the rapidly evolving field of activating citizen responders to OHCA.<sup>33</sup> Activating a relatively high number of citizen responders is necessary to ensure a responder arrives before the emergency medical services<sup>18,34</sup> and it is thus paramount we understand the psychological risks associated with these efforts, including the proportion of citizen responders who may require professional follow-up.<sup>9</sup> This has recently been highlighted in resuscitation guidelines.<sup>5</sup> Little is known about citizen responders and how they react following a resuscitation attempt. This study of a (nearly) complete cohort of citizen responders who attempted resuscitation showed citizen responders had personality traits that were inversely associated with the likelihood of psychological distress. Furthermore, most citizen responders reported healthy coping mechanisms and showed few symptoms that could be related to PTSD. Taken together, our results show systematic follow-up of citizen responders may identify the few who are likely to benefit from professional follow-up.<sup>11</sup> These findings

support the implementation of citizen responder programs as well as systematic follow-up of those who have been dispatched to OHCA. It is also important to provide proper preparation material (eg, instruction videos) about what citizen responders may encounter and experience, including the possibility of psychological distress.<sup>35</sup> This should be available at registration with local citizen responder programs.

Our findings are in accordance with the only existing study that has examined psychological distress at 4 to 6 weeks in a cohort of citizen responders who attempted resuscitation.<sup>10</sup> Notably, citizen responders included in the Dutch study were interviewed for research purposes shortly after the resuscitation attempt, which could have served as debriefing. Our program also differs from the Dutch cohort in the sense they required completed CPR/AED training before citizen responder registration. However, our cohort is comparable to the Dutch cohort in terms of participant age, sex distribution, and proportion of healthcare professionals, even though only 24% of our registered citizen responders were healthcare professionals. More important, we included all citizen responders who participated in resuscitation during





**Figure 5.** Correlation between psychological distress, measured on the Impact of Event Scale-Revised, and individual differences.

This figure presents correlations between citizen responder stress, as reported on the Impact of Event Scale-Revised, 4 weeks after participating in a resuscitation attempt and individual differences (agreeableness, openness, neuroticism, and general self-efficacy). Impact of Event Scale-Revised: range, 0 to 12. There are no clinical cutoff scores. General self-efficacy: range, 10 to 40. Agreeableness, openness, and neuroticism: range, 1 to 5.

the study period, whereas the Dutch study interviewed only the first citizen responder on the scene among a proportion of cases.

Our study found a significant difference in IES-R score between healthcare professionals and other professionals, suggesting healthcare professionals were less likely to experience psychological distress than were non-healthcare professionals. Healthcare professionals are less likely to be shocked by the appearance of patients experiencing cardiac arrest compared with lay bystanders and less likely to blame themselves for patient outcome.<sup>11,15–17</sup> More important, the population included in this study (citizen responders who accepted an alarm and participated in a resuscitation attempt) comprised a higher proportion of healthcare professionals (54%) compared with the baseline proportion of registered citizen responders (24%). This could, in part, explain the low levels of psychological distress. Thus, a higher proportion of non-healthcare professionals in a citizen responder population may elicit higher levels of psychological distress and indicates a systematic follow-up of non-healthcare professionals may be needed. Interestingly, no significant difference in PSS

scores between healthcare personnel and other professions was found in our study. The reason might be that profession is not associated with perceived stress after resuscitation, but the finding could also be explained by different baseline levels or other factors. Future studies would benefit from using longitudinal research, with stress measured both before and after participating in resuscitation.

Research has indicated that bystanders, especially those who do not have a healthcare background, have a tendency to overestimate their own role in resuscitation attempts and consider themselves responsible for the outcome.<sup>15</sup> However, we found 72% of citizen responders reporting that they did not believe their role in the resuscitation attempt was vital for the outcome. The relationship between the citizen responders' role and the outcome may result in guilt, if the effort fails. The high percentage of citizen responders who did not believe their role was vital may thus reflect a coping strategy to minimize guilt. The median value for self-blame in our study was 2.0, which is the lowest possible score; thus, self-blame was generally not common among the citizen responders. This suggests citizen responders

**Table 2. Multivariable Linear Regression Models of Variables Associated With PSS Score and IES-R Score**

Variable	Associations With PSS Score					Associations With IES-R Score				
	$\beta$	SE	T	P Value	R <sup>2</sup>	$\beta$	SE	t	P Value	R <sup>2</sup>
Block 1					0.03					0.03
Age	-0.01	1.01	0.60	0.548		0.10	0.01	-0.99	0.325	
Sex	0.04	0.04	0.40	0.083		0.12	0.20	0.14	0.258	
Block 2					0.30					0.13
Agreeableness	-0.17	0.73	-1.66	0.101		0.13	0.14	-1.16	0.248	
Conscientiousness	-0.01	0.73	-0.12	0.907		0.09	0.14	-0.94	0.348	
Extraversion	0.05	0.53	0.51	0.609		0.06	0.11	0.55	0.585	
Neuroticism	0.27	0.70	2.51	0.014*		0.14	0.14	1.26	0.212	
Openness	0.21	0.51	2.25	0.027*		0.02	0.10	0.21	0.832	
Self-efficacy	-0.28	0.13	-2.81	0.006*		0.04	0.03	-0.36	0.717	
Block 3					0.31					0.21
Profession	0.02	0.90	0.17	0.867		0.29	0.18	-2.89	0.005*	
Hands-on	0.06	0.91	0.60	0.552		0.08	0.18	0.85	0.399	
Resuscitation outcome	-0.08	0.94	-0.86	0.394		0.03	0.19	0.31	0.754	
First time	-0.02	0.95	-0.25	0.802		0.02	0.19	0.22	0.829	

The models significantly predicted PSS score ( $F[12, 89]=3.51; P<0.000; R^2=0.31$ ) and IES-R score ( $F[12, 89]=1.98; P=0.035; R^2=0.21$ ). IES-R indicates Impact of Event Scale-Revised; and PSS, Perceived Stress Scale.

\* $P<0.05$ .

do not entirely link their resuscitation effort with the patient’s outcome.

Our findings that low perceived stress was significantly correlated with high general self-efficacy and that high perceived stress was significantly correlated with high scores on neuroticism and openness to experience are consistent with existing research.<sup>36–38</sup>

There are no norms available about general self-efficacy and personality traits among citizen responders; nevertheless, a study among 3471 residents of Denmark, aged 18 to 69 years, sampled randomly from 11 municipalities in the southwestern part of Copenhagen, measured general self-efficacy with the GSE-10.<sup>39</sup> In that study, the mean score on the GSE-10 was 29.62 (SD, 5.16). Compared with this, the citizen responders’ general self-efficacy (mean, 34.54; SD, 3.68) was significantly higher ( $t[3571]=9.56; P<0.0001; d=1.01$ ). The BFI-10 has been administered in a study of 2427 people in Germany representative of the adult population in terms of age, sex, and education.<sup>40</sup> The difference between the German sample and our citizen responders was the largest for neuroticism and extraversion. Citizen responders scored lower on neuroticism (mean, 1.92; SD, 0.7) than did the German sample (mean, 2.57; SD, 0.8) ( $t[2527]=8.08; P=0.0001; d=0.86$ ), and higher on extraversion (mean, 4.00; SD, 0.88) compared with the German sample (mean, 3.40; SD, 0.9) ( $t[2527]=6.60; P=0.0001; d=0.67$ ). Seemingly, compared with the general population, individuals who have a lower

score on neuroticism, a higher score on extroversion, and a higher score on self-efficacy potentially self-select into the citizen responder program. However, without a control group or norms for comparison, this conclusion is premature.

**Limitations**

This study has some limitations. Of citizen responders, 10% were missing in the initial outreach, and some of these may have had severe psychological distress. This is unlikely because nonrespondents were largely comparable to those who participated in the study, apart from their younger age, which was not associated with increased levels of psychological distress. Also, none of the missing citizen responders contacted the program through the designated contact form to request follow-up. Because of its cross-sectional design, our study can only establish associations and not cause and effect, and the lack of a control group limits interpretation of the results. However, it would not be possible to compare dispatched citizen responders with those who were not dispatched, as the latter would not have had an exposure to be measured (dispatch and participating in a resuscitation attempt). The other possibility would be comparing dispatched citizen responders with bystanders "by chance." This would be insightful, but probably substantially biased because most bystanders are related to patients experiencing cardiac arrest and would thus inherently experience

psychological distress because of the relationship to the patient rather than performing CPR. Because of multiple comparisons in this study, there is an increased risk of type 1 error for some of the findings reported in this study. However, as described in the Statistical Analysis section, the models were performed in 3 blocks to make this explicit to the reader. Furthermore, we acknowledge the linear constraint of our models. It could be that there is a nonlinear association (ie, threshold association that would more accurately capture the relationship between predictors and outcome). Last, relying on self-reported items alongside administering the questionnaire by telephone could have increased the risk of social desirability bias. Current existing studies on citizen responder programs are from European populations. Our study was conducted in an urban area in a northern European population. Studies should be conducted in other populations to understand the generalizability of the current findings.

## CONCLUSIONS

Citizen responders are capable of handling the psychological risks of participating in resuscitation: they showed few symptoms of perceived general stress and PTSD 4 weeks after participating in resuscitation. Symptoms of PTSD were significantly associated with citizen responders' profession, whereas perceived general psychological distress was significantly related to openness to experience, neuroticism, and self-efficacy. These findings may help identify those citizen responders who would benefit from systematic professional follow-up after a resuscitation attempt.

## ARTICLE INFORMATION

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### Supplementary Material

Tables S1–S3

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# **Supplemental Material**



**Table S1. Citizen Responder Reported Psychological Distress According to Subscales of the Impact of Event Scale – Revised.**

	<i>Mean</i>	<i>SD</i>
Intrusion	0.32	0.44
Avoidance	0.17	0.30
Hyperarousal	0.16	0.32
Overall	0.65	0.89

Scores as measured on the 3 subscales which comprise the Impact of Event Scale, Revised. The scores can range from 0 to 12. N=102.

**Table S2. Personality traits and general self-efficacy scores among citizen responders.**

Individual difference	<i>Mean</i>	<i>SD</i>
<i>Personality traits</i>		
Agreeableness*	3.91	0.68
Conscientiousness*	4.26	0.62
Extraversion*	4.00	0.88
Neuroticism*	1.92	0.73
Openness*	3.15	0.86
General Self-Efficacy †	34.54	3.68

\*range 1–5, † range 10–40.

**Table S3. Coping mechanisms applied by the participants.**

Coping mechanism*	<i>Mean</i>	<i>SD</i>
Self-distraction	2.27	0.71
Active coping	3.42	1.86
Denial	2.02	0.14
Substance use	2.02	0.20
Emotional support	3.93	1.84
Behavioral disengagement	2.07	0.32
Venting	3.33	1.67
Instrumental support	3.35	1.64
Positive reframing	4.43	2.07
Self-blame	2.51	0.99
Planning	3.74	1.97
Humor	2.48	1.16
Religion	2.18	0.74
Acceptance	7.66	0.80

\* range 2–8.