

## The Crossroads of Wellness and Second Victim Syndrome: Identifying Factors that Alter the Pathway of Caregiver Recovery Following an Unanticipated Adverse Patient Outcome

Kimia Zarabian, BS<sup>1</sup>, A. Katharine Hindle, MD<sup>2</sup>, Ivy Benjenk, MPH<sup>2</sup>, Anita Vincent, MD<sup>2</sup>, Jamil M. Kazma, MD<sup>3</sup>, Benjamin Shambon, BS<sup>4</sup>, Raymond Pla, MD<sup>2</sup>, Eric Heinz, MD, PhD<sup>2</sup>

### Abstract

**Introduction:** Second Victim Syndrome (SVS) describes the phenomenon in which a caregiver experiences a traumatic psychological and emotional response to an adverse patient event or medical error. Using quantitative survey analysis, we aim to better understand the personal factors that affect SVS development and recovery.

**Methods:** Caregivers at a small urban academic medical center who had experienced an adverse patient event in the past six months were invited to take part in this institution-wide, voluntary, quantitative, cross-sectional study. Three surveys were administered; the Holmes-Rahe Life Stress Inventory (HRLSI) was used as a surrogate to measure stressful life events. The Impact of Event Scale-Revised (IES-R) was used as a measure of the stress a provider senses following a traumatic event. The Second Victim Experience and Support Tool (SVEST) was used to assess the medical provider's emotional response and level of institutional support in response to an adverse clinical event.

**Results:** Analysis of SVEST vs. IES-R demonstrated that respondents with greater self-perception of personal distress reported increased psychological ( $p=0.0008$ ) and physical ( $p=0.0015$ ) distress. Respondents who reported higher HRLSI scores had a greater perception that non-work-related support ( $p=0.04$ ) such as family support was inadequate; however, these respondents were less likely to perceive institutional support ( $p=0.04$ ) as inadequate. The results indicate that caregivers with more perceived life stresses believe that they do not have strong non-work-related support services, which is a known protective factor; thus, they may perceive any institutional support as more adequate.

**Conclusion:** This study suggests that personal life risk factors, institutional support, and non-work related support may play an important role in the development of SVS and the perception of stress and wellness in the setting of SVS.

DOI: 10.18297/jwellness/vol3/iss1/1

Received Date: Sept 10, 2020

Accepted Date: Nov 11, 2020

Publication Date: Dec 18, 2020

Website: <https://ir.library.louisville.edu/jwellness/>

Recommended Citation: Zarabian, Kimia; Hindle, A. Katharine; Benjenk, Ivy; Vincent, Anita; Kazma, Jamil M.; Shambon, Benjamin; Pla, Raymond; Heinz, Eric; (2020) "The Crossroads of Wellness and Second Victim Syndrome: Identifying Factors that Alter the Pathway of Caregiver Recovery Following an Unanticipated Adverse Patient Outcome" *Journal of Wellness*: Vol. 3 : Iss. 1, Article 1.

Affiliations: <sup>1</sup>The George Washington University School of Medicine and Health Sciences, <sup>2</sup>The George Washington University Department of Anesthesiology and Critical Care, <sup>3</sup>The George Washington University Department of Obstetrics and Gynecology, <sup>4</sup>The George Washington University Milken Institute School of Public Health



## INTRODUCTION

Altruism is one of the major driving forces in a caregiver's decision to pursue a career in healthcare. The desire to help others in a time of need drives medical students to spend innumerable hours in the anatomy lab, in the medical school library, and in clinical wards. The Hippocratic Oath imparts the value of altruism and is built upon the dictum "do no harm." However, inadvertent medical errors that result in patient harm are a reality. Current studies suggest that medical errors result in 210,000 to 440,000 deaths in the United States each year [1]. Albert Wu states "Physicians will always make mistakes. The decisive factor will be how [they] handle them" [2].

In 2000, Albert Wu coined the term "Second Victim" to describe the provider who is emotionally traumatized by a clinical situation resulting in an adverse patient outcome, and who is further harmed by a lack of institutional support to aid in the aftermath. Previous studies have found the prevalence of this phenomenon, known as "Second Victim Syndrome (SVS)" to be between 10.4% and 43.3% in caregivers who are involved in an adverse clinical event [3]. Most known risk factors for the development of SVS are directly related to

the patient, or "first victim," rather than the provider. These patient-based risk factors include adverse outcomes relating to a young or healthy patient, multiple patients, or a devastating outcome of the error [4]. However, two potential risk factors directly relating to the medical provider rather than the patient have been identified: female sex and the degree of perceived personal responsibility [5, 6]. Other determined factors that impact the outcome of SVS are based on the medical institution's response to the error [5].

The most common psychological manifestations of SVS include anxiety, guilt, and grief, and many second victims may suffer from chronic depression or PTSD as a direct result [5]. Furthermore, second victims can experience caregiver burnout, a topic that has gained much attention from the medical and lay communities [3]. External factors such as work overload, lack of control, breakdown of community, and conflicting values affect the development of burnout [7]. Family problems increase risk of physician burnout, whereas a supportive home life is protective [7, 8]. Therefore, external factors may have profound effects on how a healthcare provider copes with the stress of work. To the same degree, external

\*Correspondence To: Kimia Zarabian  
Email: kimzarabian@gwu.edu

Copyright: © 2020 The author(s). This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

personal factors and environment, such as a practitioner's psychosocial status at the time of the event, may impact the way in which a provider manages an adverse patient outcome [9].

Previous studies that have been done on SVS are ex post facto, focused on treating the provider in the emotional aftermath of the event. Identifying factors that worsen or prolong the effects of this syndrome may prove to be protective in mitigating the outcome for the provider. Our objective is to evaluate these risk factors in order to enhance our understanding of the relationship between life events and adverse patient outcomes in the workplace. With this insight, caregivers who may be at risk for SVS can be identified before any potential adverse patient outcomes, and interventions can be initiated to help avoid potential traumatic psychosocial responses.

## METHODS

### Settings and Participants

This study was conducted at a small urban academic medical center. The survey was widely publicized electronically throughout the institution, and those who had experienced an adverse patient event in the past six months were invited to take part in this voluntary quantitative cross-sectional study. Three surveys were administered to participants to evaluate caregivers' levels of stress at the time of the event, to determine the psychosocial impact of the event, and to investigate the caregivers' desired support mechanisms. Participants were compensated for their time with a gift card. Because the survey was administered at a small academic institution, no identifying factors were asked or reported from participants to ensure anonymity. This study was deemed exempt by our Institutional Review Board.

### Survey Tools

The online survey administered to participants contained three validated tools that evaluated caregivers' levels of stress at the time of the event, the psychosocial impact of the event, and the caregivers' desired support mechanisms. The validated tools were provided in the same order to all participants for survey consistency.

The Second Victim Experience and Support Tool (SVEST) is a validated 29 question survey to assess the medical provider's emotional response and level of institutional support in response to an adverse clinical event [10]. The SVEST measures fields including psychological distress, physical distress, colleague support, supervisor support, institutional support, non-work-related support, professional self-efficacy, turnover intentions, absenteeism, and desired form of support [10]. Participants ranked each field on 5-point Likert scales, ranging from "strongly disagree" to "strongly agree." Previous studies have used the SVEST to assess patient safety culture and the need for implementing support programs for second victims to make healthcare safer [11, 12]. The SVEST has been adopted globally to measure Second Victim Syndrome [13,14].

The Holmes-Rahe Life Stress Inventory (HRLSI), previously referred to as the Social Readjustment Rating Scale (SRRS), consists of 43 different life events that are measured in Life Change Units (LCU) for level of stress induction and are predictors of illness due to increased stress [15, 16]. Each life event is ranked with relative "weight" for stress - more events indicate a higher HRLSI score [16]. Among the highest ranked life events are death of a spouse, divorce, marital separation, jail term, death of a close family member, and personal injury or illness [15]. According to the Holmes-Rahe prediction model, a score below 150 LCU indicates a relatively low amount of life change and a low (30%) susceptibility to stress-induced health problems [16]. A score of 150 to 300 LCU indicates a 50% chance of a major stress-induced health problem in the next 2 years [16]. A score of 300 LCU or more

indicates an 80% chance of a major stress-induced health problem in the next 2 years [16]. The HRLSI inventory has additionally been recognized as a potential tool to identify suicide attempters, measure maternal-fetal health, and assess autoimmune dysfunction [17-19].

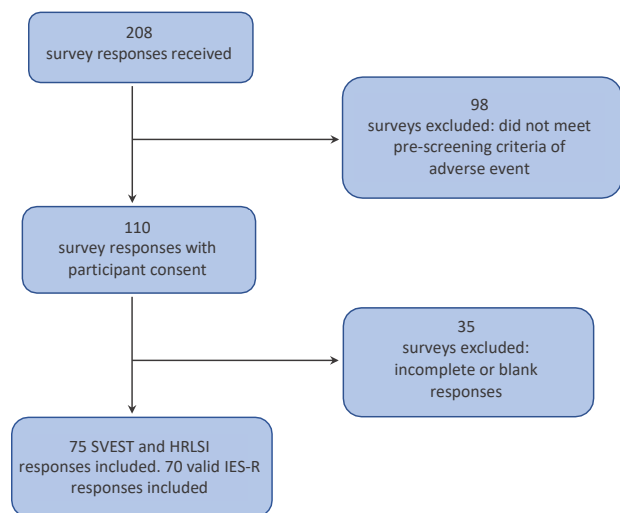
Lastly, the Impact of Event Scale-Revised (IES-R) is a 22 question survey to measure the level of personal distress the caregiver endured following the event [20]. The IES-R is not a diagnostic tool, but has been validated and used as a measure of PTSD in numerous studies on medical injuries and immune suppression [21-25]. Each survey question is rated on a 5-point scale ranging from 0 to 4 in order to determine the presence of three main PTSD symptom categories or subscales: intrusion, avoidance, and hyperarousal [20]. The IES-R contains 8 questions related to the intrusion category, 8 questions related to avoidance, and 6 questions related to hyperarousal [20]. The recommended method of calculation is to sum the means of each subscale to obtain the total score [20]. While there is no cut-off score, a score greater than 1 indicates a moderate to severe level of personal distress [20]. We used this method in our main analysis.

Another proposed method of calculating IES-R is through summation of raw score for each item [23-25]. A raw score above 22 may reflect significant PTSD concerns, while scores above 39 may reflect significant immune system suppression; yet, these cutoffs vary across studies [23-25]. We discuss this method to evaluate for significant immune suppression.

### Data Collection

Survey results were de-identified through the use of REDCap electronic data capture tools. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources.

Surveys were excluded from analysis if responding participants did not meet the pre-screening criteria of adverse event in the last 6 months or if one or more sections of the surveys were incomplete.



**Figure 1: Description of inclusion flow diagram.**

A total of 208 survey responses were received. After analysis for completion of required survey elements, 98 surveys were excluded due to lack of pre-screening criteria, such as lack of involvement in an adverse event. Out of the remaining who consented, 35 submitted blank or incomplete surveys. Thus, a total of 75 valid entries for SVEST and HRLSI inventory scores and 70 valid entries for IES-R were received.

## Data Analysis

Primarily, we calculated each individual's SVEST, HRLSI, and IES-R surveys scores. T-test analyses of the survey results were conducted in order to assess for statistical significance between the various groups. SVEST categories were evaluated against IES-R values; the fields examined included IES-R  $\leq 1$  and IES-R  $>1$ . SVEST categories were additionally evaluated against HRLSI scores, with the fields HRLSI  $<150$  and HRLSI  $\geq 150$ . Furthermore, IES-R subgroups were evaluated against HRLSI categories with the same fields above. Results were obtained and are presented below. Analyses were run through Stata statistical software. All p values were significant at  $<0.05$ .

## RESULTS

Tables 1 and 2 demonstrate demographics of survey respondents. Results of the HRLSI reveal a reported range of 0 LCU to 410 LCU, a 50th percentile score of 112 LCU, and a mean score of 127.7 LCU (Table 1). The highest weighted item reported was divorce (weighted at 73), while the item most commonly reported was vacation (weighted at 35). Only 38.7% of respondents scored HRLSI  $\geq 150$  and 42.9% had IES-R  $>1$  (Table 2). Furthermore, 60% of respondents had a raw score of less than 22, 28.6% had a raw score of 22-38, and 11.4% had a raw score of 39 or greater, which is discussed below as a measure of PTSD.

Table 3 (next page) describes the comparison of SVEST scores, IES-R scores, and HRLSI scores. In the SVEST vs IES-R  $\leq 1$  and IES-R  $>1$  analysis, the psychological distress ( $p=0.0008$ ) and physical distress ( $p=0.0015$ ) categories demonstrated statistically significant differences. Mean value for psychological distress in IES-R  $\leq 1$  ( $2.89 \pm 1.06$ ,  $p=0.0008$ ) was found to be less than that of IES-R  $>1$  ( $3.69 \pm 0.85$ ,  $p=0.0008$ ). Similarly, mean value for physical distress in IES-R  $\leq 1$  ( $2.19 \pm 0.95$ ,  $p=0.0015$ ) was less than that of IES-R  $>1$  ( $2.93 \pm 0.88$ ,  $p=0.0015$ ).

Additionally, the institutional support ( $p=0.04$ ) and non-work-related support ( $p=0.04$ ) categories in the SVEST vs HRLSI  $<150$  and HRLSI  $\geq 150$  analysis demonstrated statistically significant differences (Table 3). Mean value for institutional support in HRLSI  $<150$  ( $3.07 \pm 0.69$ ,  $p=0.04$ ) was found to be greater than that of HRLSI  $\geq 150$  ( $2.79 \pm 0.47$ ,  $p=0.04$ ). In contrast, mean value for non-work-related support in HRLSI  $<150$  ( $3.66 \pm 1.10$ ,  $p=0.04$ ) was less than that of HRLSI  $\geq 150$  ( $4.13 \pm 0.87$ ,  $p=0.04$ ).

The remaining categories of SVEST in comparison with HRLSI and IES-R groups were not found to have statistically significant differences. Similarly, results for IES-R PTSD subgroups were not statistically significant.

## DISCUSSION

The goal of this study was to assess the effects that personal factors have on the second victim experience and recovery from an adverse patient event. The results of the quantitative survey analysis suggest that our population most commonly perceived a lack of supervisor and colleague support in response to the adverse event. This may indicate that the response of the workplace plays an important role in the development and aftermath of SVS. Furthermore, respondents with self-perception of higher life stress reported increased psychological and physical distress, and also perceived that non-work-related support was inadequate; however, this same group was less likely to perceive institutional support as inadequate.

Although all providers within the medical system can experience SVS, medical residents who perceive that they have made an error are particularly vulnerable to this phenomenon and experience significant distress [26, 27]. Thus, recognizing those at risk for SVS and those who will have more difficulty recovering is essential for harm reduction and caregiver wellness.

Table 1: HRLSI Results (n = 75)

HRLSI Category	Life Change Units	Number Reported	HRLSI Category	Life Change Units	Number Reported
Death of spouse	100	0	Son or daughter leaving home	29	2
Divorce	73	1	Trouble with in-laws	29	6
Marital separation	65	1	Outstanding personal achievement	28	11
Jail term	63	0	Spouse beginning or ceasing work outside the home	26	10
Death of a close family member	63	13	Beginning or ceasing formal schooling	26	3
Major personal injury or illness	53	8	Change in living conditions	25	9
Marriage	50	4	Revision of personal habits	24	5
Fired at work	47	0	Troubles with boss	23	9
Marital Reconciliation	45	1	Change in work hours or conditions	20	19
Retirement	45	0	Change in residence	20	14
Major change in health of family member	44	17	Changing to new school	20	3
Pregnancy	40	7	Changes in recreation	19	17
Sexual difficulties	39	6	Change in church activity	19	4
Gaining new family member	39	6	Change in social activities	18	7
Business readjustment	39	7	Mortgage or loan less than \$10,000	17	7
Change in financial state	38	11	Change in sleeping habits	16	15
Death of a close friend	37	7	Change in eating habits	15	13
Changing to different line of work	36	8	Change in number of family get togethers	15	11
Change in number of arguments with spouse	35	9	Vacation	13	35
Mortgage over \$10,000	31	5	Major holidays	12	26
Foreclosure of mortgage or loan	30	0	Minor violations of the law	11	9
Change in responsibilities at work	29	26	HRLSI Totals: Range: 0 LCU-410 LCU Median: 112 LCU Mean: 127.7 LCU		

Table 2: HRLSI (n = 75) and IESR (n = 70) Scores

HRLSI Scores	(%)
$< 150$	61.33%
$\geq 150$	38.67%
IESR Scores	(%)
$\leq 1$	57.1%
$>1$	42.9%

Table 3: Mean Comparisons of SVEST (n = 75) vs. IES-R (n = 70) vs HRLSI (n = 75) Categories

SVEST Category	Mean SVEST Score for IES-R ≤ 1	Mean SVEST Score for IES-R>1	p-value
Psychological Distress	2.89±1.06**	3.69±0.85**	0.0008
Physical Distress	2.19±0.95*	2.93±0.88*	0.0015
Colleague Support	3.26±0.34	3.37±0.46	0.27
Supervisor Support	3.41±0.60	3.43±0.62	0.90
Institutional Support	2.89±0.65	3.01±0.62	0.44
Non-Work-Related Support	3.68±1.14	3.96±0.89	0.25
Professional Self-Efficacy	2.86±0.73	3.16±0.62	0.08
Turnover Intentions	2.47±1.18	2.78±1.58	0.37
Absenteeism	1.84±0.96	2.0±1.13	0.53
SVEST Category	Mean SVEST Score for HRLSI < 150	Mean SVEST Score for HRLSI ≥150	p-value
Psychological Distress	3.09± 0.98	3.40± 1.07	0.20
Physical Distress	2.44±1.09	2.54±0.84	0.63
Colleague Support	3.31±0.36	3.32±0.45	0.73
Supervisor Support	3.47±0.57	3.32±0.62	0.31
Institutional Support	3.07±0.69*	2.79±0.47*	0.04
Non-Work-Related Support	3.66±1.10*	4.13±0.87*	0.04
Professional Self-Efficacy	2.95±0.67	3.01± 0.73	0.73
Turnover intentions	2.42±1.27	2.72±1.49	0.37
Absenteeism	1.89±0.96	1.77±1.13	0.65
IES-R Category	Mean IES-R Score for HRLSI < 150	Mean IES-R Score for HRLSI ≥150	p-value
IES-R Avoidance	0.87±0.81	0.95±0.78	0.67
IES-R Intrusion	0.93±0.86	1.06±0.70	0.50
IES-R Hyperarousal	0.61±0.74	0.73±0.65	0.48
IES-R Total	2.32± 2.25	2.47±2.04	0.76

Mean ± S.D.; 5 missing cases; \*p<0.05; \*\*p<0.01

It has been long understood that stress, especially when chronic, has an adverse impact on somatic and psychiatric wellbeing. This is especially significant in the field of healthcare where job-related stressors can have negative effects on mental and physical health along with decreased engagement and patient outcomes [28, 29]. The HRLSI results suggest that about 38.7% of respondents have a 50% chance or greater risk of developing a major stress-induced health problem in the next 2 years. Furthermore, one participant scored 410 LCU, indicating an 80% chance of developing a major stress-induced health problem in the next 2 years.

Post-traumatic stress disorder (PTSD) is a significant chronic outcome of stress in healthcare workers. It is estimated that about 15% to 25% of healthcare workers suffer from PTSD [30]. Commonly reported symptoms of PTSD can be categorized as intrusive, avoidance, negative symptoms or hyperarousal [20]. Intrusive symptoms refer to intrusive mental imagery and feelings associated with the traumatic event [20, 31]. Avoidance can be characterized by avoidance of feelings, ideas, and triggers relating to the traumatic event [20, 31]. Negative symptoms refer to negative feelings such as anger, guilt, and shame as a direct result of the traumatic event [31]. Hyperarousal refers to symptoms such as insomnia, loss of concentration, extreme irritability, or even violent behavior [20, 31].

The PTSD symptoms associated with SVS can cause adverse health outcomes for second victims, including devastation of the immune system, coronary artery disease, psychosomatic syndromes, metabolic syndromes, depression, substance

abuse, and numerous other physical conditions [32-35]. The IES-R results reveal that 42.9% of respondents had a mean score of greater than 1, placing them at a moderate to severe level of personal distress. Even more alarming is that 28.6% of our respondents raw scores indicated that they were at risk of developing clinical signs of PTSD.

Notably, 11.4% of individuals had a raw score of 39 or greater on the IES-R, suggesting potentially significant decreased immune system function in the future. PTSD's role in suppressed immune function may occur through various mechanisms, including alteration of DNA methylation [36]. Epigenetic analysis reveals an alteration in immune system-specific genes and miRNA expression in patients with PTSD when compared to those without PTSD, suggesting that PTSD instigates changes to the human body at the molecular level [36].

Furthermore, PTSD may be associated with a T cell phenotype that is consistent with increased differentiation of T cells and interpreted as early aging of the immune system [37]. The process of cellular aging and telomere shortening have also been implicated in adverse immune system outcomes [37].

The results of the SVEST and HRLSI analysis demonstrated that respondents who had higher HRLSI scores (i.e. higher life stress and thus increased chance of developing illness) had statistically significant higher perception that non-work-related support, such as family support, was inadequate. In contrast, those with higher HRLSI were less likely to perceive institutional support as inadequate. This suggests that caregivers with more perceived life stresses may not have strong,



non-work-related support services, which is a known protective factor; thus, they may perceive any institutional support as more adequate. This highlights the importance of a support network outside of the workplace. Although the lack of institutional or non-work related support may only be a perception, perception often lends insight into reality and can allow for understanding who is at higher risk of SVS, burnout, and health-related consequences. Institutions likely need to do more for this group, as these victims do not have the personal safety net to support them during the aftermath of an adverse event.

The National Academies of Sciences, Engineering, and Medicine recommend for institutions to combat adverse outcomes and healthcare burnout by creating positive work and learning environments, promoting skilled communication, reducing the administrative burden of healthcare workers, investing in research on the efficacy of burnout reduction methods, reducing the stigma of seeking support, and eliminating barriers for healthcare workers to obtain support [38, 39]. Institutions should ensure that appropriate workplace support systems, such as employee assistance programs, peer support/responder programs, and mental health providers, are in place and accessible to second victims [38-40]. Legal protections may further be implemented to allow healthcare workers to seek and receive help for mental health and emotional concerns without concern for malpractice litigation [38].

This study is especially pertinent for caregivers practicing in the midst of a pandemic. In particular, caregivers who witness the realities of higher fatality rates and adverse outcomes of the COVID-19 pandemic are susceptible to SVS. At the same time, less resources are available as they navigate this novel disease. Considering the multifaceted characteristics of stress-induced healthcare issues and their magnifying costs, it is important to recognize possible methods of reducing the negative effects of SVS through early prevention programs, reformed organizational structure, increased access to mental health services, and many others. Burnout from SVS can cause more medical errors to occur and can further propagate SVS, creating an endless cycle of harm to both patient and provider.

## LIMITATIONS

This study was limited by the number of surveys received and the small sample size, as only a small number of caregivers experienced adverse events. The survey order was kept consistent for all participants, which may have led to incompleteness of the final survey due to fatigue. The study was performed at a single center, thus results may not be applicable to other populations. Per IRB mandate, no identifying information could be collected, hence no subgroup analysis could be completed. One of the limitations of the HRLSI is that each event is weighted according to what the original authors perceived as stressful life events and was originally developed and verified on males. This assumption does not take into account the personal or cultural characteristics of the individuals. Despite this limitation, studies on the HRLSI have established its validity and consistency across various sexes and cultural characteristics [16]. Furthermore, IESR is limited, as it is a screening tool and does not hold clinical diagnostic capabilities.

Future studies must further assess the relationship between personal risk factors and the lifespan of SVS from development to recovery, as well as the chronic effects of SVS on individual providers and the institution. Historically, the healthcare system does not focus sufficient attention on provider wellbeing. Healthcare institutions must address the barriers that prevent second victims from recovery and must provide support mechanisms to ensure the wellness of their caregivers [41].

## CONCLUSION

In this study, we aim to better understand the effects that personal factors have on the second victim experience after unanticipated adverse patient outcomes. Insight into these life aspects will allow for the development of strategies and support to ensure that all caregivers who experience adverse patient events will recover and thrive from the experience. The results of the SVEST and HRLSI analysis demonstrated that respondents who reported higher life stress had statistically significant higher perception that non-work-related support, such as family support, was inadequate. In contrast, those who reported higher life stress were less likely to perceive institutional support as inadequate. This suggests that caregivers with more perceived life stresses may not have strong non-work-related support services, which is a known protective factor, highlighting the importance of a support network outside of the workplace. Institutions likely need to do more for this group, as these caregivers do not have the personal safety net to support themselves during the aftermath of an adverse event.

Acknowledgments: This study was funded through the GWell Center for Healthcare Professionals at The George Washington University School of Medicine and Health Sciences.

## REFERENCES

1. Carver N, Gupta V, Hipskind JE. Medical Error [Internet]. StatPearls. StatPearls Publishing; 2020 [cited 2020 Jul 31]. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/28613514>
2. Wu AW. Medical error: The second victim [Internet]. Vol. 172, Western Journal of Medicine. BMJ Publishing Group; 2000 [cited 2020 Jul 31]. p. 358–9. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1070908/>
3. Seys D, Wu AW, Van Gerven E, Vleugels A, Euwema M, Panella M, et al. Health care professionals as second victims after adverse events: a systematic review [Internet]. Eval Health Prof. 2013 Jun;36(2):135–62. [cited 2020 Jul 31] Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22976126>
4. Coughlan B, Powell D, Higgins MF. The Second Victim: A Review. Vol. 213, European Journal of Obstetrics and Gynecology and Reproductive Biology. Elsevier Ireland Ltd; 2017. p. 11–6. <https://doi.org/10.1016/j.ejogrb.2017.04.002>.
5. Ozeke O, Ozeke V, Coskun O, Budakoglu II. Second victims in health care: current perspectives [Internet]. Adv Med Educ Pract. 2019 Aug;10:593–603. [cited 2020 Jul 31] Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6697646/>
6. Waterman AD, Garbutt J, Hazel E, Dunagan WC, Levinson W, Fraser VJ, et al. The emotional impact of medical errors on practicing physicians in the United States and Canada. Jt Comm J Qual Patient Saf. 2007 Aug;33(8):467–76.
7. Verweij H, van der Heijden FM, van Hooff ML, Prins JT, Lagro-Janssen AL, van Ravesteijn H, et al. The contribution of work characteristics, home characteristics and gender to burnout in medical residents [Internet]. Adv Health Sci Educ Theory Pract. 2017 Oct;22(4):803–18. [cited 2020 Jul 31] Available from: <https://link.springer.com/article/10.1007/s10459-016-9710-9>
8. Spickard A Jr, Gabbe SG, Christensen JF. Mid-career burnout in generalist and specialist physicians [Internet]. JAMA. 2002 Sep;288(12):1447–50.

9. Van Gerven E, Deweer D, Scott SD, Panella M, Euwema M, Sermeus W, et al. Personal, situational and organizational aspects that influence the impact of patient safety incidents: A qualitative study. *Rev Calid Asist.* 2016 Jul;31 Suppl 2:34–46.
10. Burlison JD, Scott SD, Browne EK, Thompson SG, Hoffman JM. The second victim experience and support tool (SVEST): Validation of an organizational resource for assessing second victim effects and the quality of support resources. *J Patient Saf* [Internet]. 2017 [cited 2020 Aug 1];13(2):93–102. Available from: /pmc/articles/PMC4342309/?report=abstract
11. Quillivan RR, Burlison JD, Browne EK, Scott SD, Hoffman JM. Patient safety culture and the second victim phenomenon: connecting culture to staff distress in nurses. *Jt Comm J Qual Patient Saf.* 2016 Aug;42(8):377–86.
12. Dukhanin V, Edrees HH, Connors CA, Kang E, Norvell M, Wu AW. Case: A Second Victim Support Program in Pediatrics: Successes and Challenges to Implementation. *J Pediatr Nurs.* 2018 Jan;41:54–9.
13. Chen J, Yang Q, Zhao Q, Zheng S, Xiao M. Psychometric validation of the Chinese version of the Second Victim Experience and Support Tool (C-SVEST) [Internet]. *J Nurs Manag.* 2019 Oct;27(7):1416–22. [cited 2020 Aug 5] Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/jonm.12824>
14. Kim EM, Kim SA, Lee JR, Burlison JD, Oh EG. Psychometric Properties of Korean Version of the Second Victim Experience and Support Tool (K-SVEST). *J Patient Saf* [Internet]. 2018; Available from: [https://journals.lww.com/journalpatientsafety/Fulltext/9000/Psychometric\\_Properties\\_of\\_Korean\\_Version\\_of\\_the.99386.aspx](https://journals.lww.com/journalpatientsafety/Fulltext/9000/Psychometric_Properties_of_Korean_Version_of_the.99386.aspx)
15. Holmes TH, Rahe RH. The social readjustment rating scale. *J Psychosom Res.* 1967 Aug;11(2):213–8.
16. Noone PA. The Holmes-Rahe Stress Inventory [Internet]. *Occup Med (Lond).* 2017 Oct;67(7):581–2.
17. Blasco-Fontecilla H, Delgado-Gomez D, Legido-Gil T, de Leon J, Perez-Rodriguez MM, Baca-Garcia E. Can the Holmes-Rahe Social Readjustment Rating Scale (SRRS) be used as a suicide risk scale? An exploratory study. *Arch Suicide Res.* 2012;16(1):13–28.
18. Bidaki R, Karimi M, Mojibyan M, Hadi Nodoshan H, Zare A, Rafiee P, et al. Maternal stress in pregnancy based on Holmes-Rahe questionnaire and umbilical cord IgE. *Volume 2. Canadian Journal on Medicine;* 2011.
19. Srivastava S, Boyer JL. Psychological stress is associated with relapse in type 1 autoimmune hepatitis [Internet]. *Liver Int.* 2010 Nov;30(10):1439–47. [cited 2020 Aug 5] Available from: <http://doi.wiley.com/10.1111/j.1478-3231.2010.02333.x>
20. Motlagh H. Impact of Event Scale-Revised. 2010. [https://doi.org/10.1016/S1836-9553\(10\)70029-1](https://doi.org/10.1016/S1836-9553(10)70029-1).
21. Bienvenu OJ, Williams JB, Yang A, Hopkins RO, Needham DM. Posttraumatic stress disorder in survivors of acute lung injury: evaluating the Impact of Event Scale-Revised. *Chest.* 2013 Jul;144(1):24–31.
22. Sveen J, Orwelius L, Gerdin B, Huss F, Sjöberg F, Willebrand M. Psychometric properties of the Impact of Event Scale-Revised in patients one year after burn injury. *J Burn Care Res.* 2010 Mar-Apr;31(2):310–8.
23. Rash CJ, Coffey SF, Baschnagel JS, Drobles DJ, Saladin ME. Psychometric properties of the IES-R in traumatized substance dependent individuals with and without PTSD. *Addict Behav* [Internet]. 2008 Aug [cited 2020 Aug 24];33(8):1039–47. Available from: /pmc/articles/PMC2494706/?report=abstract <https://doi.org/10.1016/j.addbeh.2008.04.006>.
24. Morina N, Ehring T, Priebe S. Diagnostic utility of the impact of event scale-revised in two samples of survivors of war. *PLoS One* [Internet]. 2013 Dec 31 [cited 2020 Aug 24];8(12):83916. Available from: /pmc/articles/PMC3877127/?report=abstract
25. Askari Hosseini SM, Arab M, Karzari Z, Razban F. Post-traumatic stress disorder in critical illness survivors and its relation to memories of ICU. *Nurs Crit Care* [Internet]. 2020 Jul 30 [cited 2020 Aug 24]; Available from: <http://doi.wiley.com/10.1111/nicc.12532> <https://doi.org/10.1111/nicc.12532>.
26. Engel K, Rosenthal M, Sutcliffe K. Residents' Responses to Medical Error: Coping, Learning, and Change. *Acad Med* [Internet]. 2006 Jan [cited 2020 Jul 31];81(1):86–93. Available from: [https://journals.lww.com/academic-medicine/Fulltext/2006/01000/Residents\\_Responses\\_to\\_Medical\\_Error\\_Coping,21.aspx](https://journals.lww.com/academic-medicine/Fulltext/2006/01000/Residents_Responses_to_Medical_Error_Coping,21.aspx)
27. West CP, Huschka MM, Novotny PJ, Sloan JA, Kolars JC, Habermann TM, et al. Association of perceived medical errors with resident distress and empathy: a prospective longitudinal study [Internet]. *JAMA.* 2006 Sep;296(9):1071–8. [cited 2020 Jul 31] Available from: <https://jamanetwork.com/>
28. Fiabane E, Giorgi I, Sguazzin C, Argentero P. Work engagement and occupational stress in nurses and other healthcare workers: the role of organisational and personal factors. *J Clin Nurs.* 2013 Sep;22(17-18):2614–24.
29. Sarafis P, Rousaki E, Tsounis A, Malliarou M, Lahana L, Bamidis P, et al. The impact of occupational stress on nurses' caring behaviors and their health related quality of life. *BMC Nurs.* 2016 Sep;15(1):56.
30. Sendler DJ, Rutkowska A, Makara-Studzinska M. How the exposure to trauma has hindered physicians' capacity to heal: prevalence of PTSD among healthcare workers [Internet]. *Eur J Psychiatry.* 2016;30:•••. [cited 2020 Aug 24] Available from: [http://scielo.isciii.es/scielo.php?script=sci\\_arttext&pid=S0213-61632016000400007](http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S0213-61632016000400007)
31. Yang H, Wang L, Cao C, Cao X, Fang R, Zhang J, et al. The underlying dimensions of DSM-5 PTSD symptoms and their relations with anxiety and depression in a sample of adolescents exposed to an explosion accident. *Eur J Psychotraumatol* [Internet]. 2017 [cited 2020 Aug 24];8(1). Available from: /pmc/articles/PMC5328312/?report=abstract
32. Stoecklein VM, Osuka A, Lederer JA. Trauma equals danger--damage control by the immune system. *J Leukoc Biol* [Internet]. 2012 Sep 1 [cited 2020 Aug 2];92(3):539–51. Available from: /pmc/articles/PMC3427603/?report=abstract
33. McFarlane AC. The long-term costs of traumatic stress: Intertwined physical and psychological consequences. *World Psychiatry* [Internet]. 2010 [cited 2020 Aug 2];9(1):3–10. Available from: /pmc/articles/PMC2816923/?report=abstract
34. Schneiderman N, Ironson G, Siegel SD. Stress and health: psychological, behavioral, and biological determinants [Internet]. *Annu Rev Clin Psychol.* 2005;1(1):607–28.
35. Mccauley JL, Killeen T, Gros DF, Brady KT, Back SE. Post-traumatic Stress Disorder and Co-Occurring Substance Use Disorders: Advances in Assessment and Treatment. *Clin Psychol Sci Pract* [Internet]. 2012 Sep [cited 2020 Aug 24];19(3):283–304. Available from: /pmc/articles/PMC3811127/?report=abstract
36. Bam M, Yang X, Zumbrun EE, Zhong Y, Zhou J, Ginsberg JP, et al. Dysregulated immune system networks in war veterans with PTSD is an outcome of altered miRNA expression and DNA methylation. *Sci Reports* (Nature Publ Group) [Internet]. 2016 Aug;6:31209. Available from: [http://proxygw.wrlc.org/login?url=https://search.proquest.com/docview/1903381298?acco\\_untid=11243](http://proxygw.wrlc.org/login?url=https://search.proquest.com/docview/1903381298?acco_untid=11243) <https://doi.org/10.1038/srep31209>.

37. Neigh GN, Ali FF. Co-morbidity of PTSD and immune system dysfunction: opportunities for treatment. *Curr Opin Pharmacol*. 2016 Aug;29:104–10.
38. Conclusions and Recommendations. *Taking Action Against Clinician Burnout: A Systems Approach to Professional Well-Being*. National Academies Press; 2019.
39. Tamburri LM. Creating Healthy Work Environments for Second Victims of Adverse Events. *AACN Adv Crit Care*. 2017;28(4):366–74.
40. Edrees H, Connors C, Paine L, Norvell M, Taylor H, Wu AW. Implementing the RISE second victim support programme at the Johns Hopkins Hospital: a case study [Internet]. *BMJ Open*. 2016 Sep;6(9):e011708. [cited 2020 Nov 3] Available from: <https://pubmed.ncbi.nlm.nih.gov/27694486/>
41. Wu AW, Boyle DJ, Wallace G, Mazor KM. Disclosure of adverse events in the United States and Canada: an update, and a proposed framework for improvement. *J Public health Res [Internet]*. 2013 Dec 1 [cited 2020 Jul 31];2(3):32. Available from: </pmc/articles/PMC4147741/?report=abstract>