Analysis of the C-SOSI Instrument in a 9-1-1 Telecommunicator Population

Amanda Jones

A thesis

submitted in partial fulfillment of the

requirements for the degree of

MASTER OF PUBLIC HEALTH

University of Washington

2016

Thesis Committee Members:

Ian Painter

Hendrika Meischke

Program Authorized to Offer Degree:

Public Health

University of Washington

Abstract

Analysis of the C-SOSI Instrument in a 9-1-1 Telecommunicator Population

Amanda Jones

Chair of the Supervisory Committee:
Clinical Assistant Professor, Ian Painter, PhD.
School of Public Health

In 2013 an online survey was administered to 9-1-1 telecommunicators in six call centers in an effort to measure variables associated with occupational stress. The survey instrument used, the Calgary Symptoms of Stress Inventory (C-SOSI), has previously successfully measured stress in cancer patients, but had not been used to measure stress in the 9-1-1 telecommunicator population. This project reviewed the instrument, its question groupings, and applied a confirmatory factor analysis to determine if data collected from the 9-1-1 survey factored in a significant manner, as it did with the original study population of cancer patients. The question groupings did display good model fit and strong Cronbach's alpha scores suggesting it was a valid tool to use to measure stress in the 9-1-1 telecommunicator population. Findings for individual questions within the groupings were moderate and suggests that the survey could potentially be strengthened for assessing stress in a 9-1-1 telecommunicator population if certain questions were modified or removed.

Table of Contents

Analysis of C-SOSI Instrument in a 9-1-1 Telecommunicator Population

Amanda Jones

University of Washington, 2016

Background and Significance

Working as a telecommunicator in a 9-1-1 call center is a highly demanding job. Telecommunicators are expected to calmly and professionally field a wide range of calls, from menial to emotionally charged, as well as maintain multiple computer systems.[1] The emotional strain that accompanies calls can cause the telecommunicator to feel intense fear, helplessness, and/or horror.[2] Though not physically present at the scene of an emergency, 9-1-1 telecommunicators must remain calm and perform several functions, including providing guidance to the caller while engaging in emotionally disturbing emergencies and simultaneously arranging for and informing the emergency responders such as paramedics, police officers, and fire crew.

Despite this emotional strain, and array of challenges, 9-1-1 telecommunicators often remain in their job for several years, making a career out of their work. Steiber and Pilcher (2015) suggest that people cope differently with high job demands and recommend that an understanding of job satisfaction can be gained by looking instead at work-related stress and exhaustion.[3] Hours worked and job demands appear to vary per call center across the United States. With formal training only required in less than 20 states in the nation, it is unclear what level of instruction telecommunicators are provided to reduce their own stress levels and reduce work fatigue. [4]

Meischke et al. performed a study to measure the stress experienced by individuals who work in a 9-1-1 call-center. The authors distributed surveys they compiled and tested, and which included the Calgary Symptoms of Stress Inventory (C-SOSI), to six call centers in a state in the US Pacific Northwest.[5] The C-SOSI is an instrument comprising of 56 items that form 8 subscales. It is the shortened version of the original SOSI which was 95 items with 10 subscales. The original, full-length instrument was designed with the instructions to "rate the frequency with which they experience various stress-related symptoms…during a designated time frame."[6] The original SOSI has been cited as used in a variety of populations, including Rabbis and students. In 1987 it was revised and validated with a population of "approximately 300 'normal' adults," though the definition of a "normal" adult is unclear and demographic information is not provided.[7] The instrument's length hindered its utility in measuring multiple forms of stress, leading the authors Carlson and Thomas to create the shortened version.

The full length, 95 question C-SOSI was shortened to a 56 question model by Carlson and Thomas. To shorten the full-length C-SOSI, Carlson and Thomas applied exclusion criteria that would leave the remaining questions with a factoring that was statistically significant, but also allow for continued interpretability and psychological meaningfulness of the factors.[6] The authors applied exploratory factor analysis in an effort to determine the number of factors present in the shortened survey, leading to a result of data centering logically on 8 factors which the authors named "subscales." The questionnaire instructions and 5-point Likert rating scale were identical to the original full-length SOSI. The shortened C-SOSI is the instrument used in the Meischke et al. study.

Other tools use a similar method of questions which capture the subscales present in the C-SOSI. Carlson and Thomas compared their findings to other instruments available for measuring mood states, sleep quality, cancer patient quality of life, and spirituality and found the results they received through distributing their survey to be consistent in their measurement of stress when compared to other tools.[6]

Physiological triggers outside of stress may account for some of the results in the validation of the Carlson and Thomas shortened C-SOSI. The shortened C-SOSI instrument was validated using a population of cancer patients and captures participants' measure of their physical (ex: increased heart rate, weakness, etc.) and emotional self (ex: depressed, anxious, etc.). In the cancer patient population there is the possibility that some symptoms are a result of experiences unique to this population, such as chemotherapy resulting in accelerated heart rate and the physical toll of the disease causing fatigue and weakness.[6] There is a potential for capturing triggers outside of occupational stress in the Meischke et al. study population as well. Using this instrument in a population of 9-1-1 telecommunicators may result in answers influenced by a sedentary work life, such as pain in the neck and shoulders, or getting directions wrong due to a high level of multitasking.

Three different types of factor analysis were performed to assess the data in the Meischke et al. study. Initially and exploratory factor analysis was run to assess how the data factored with Carlson and Thomas's definition of 8 factors. This resulted in the Scree plot (Figure 1). Next, a partial confirmatory factor analysis helped to determine if the model fit was strong enough to perform a confirmatory factor analysis that would produce reliable results. This involved performing the Kaiser-Meyer-Olkin Measuring of Sampling Adequacy (KMO) test, as well as Bartlett's Test of Sphericity (Table 1). Finally, a confirmatory factor analysis was done to assess how well the questions from the C-SOSI survey loaded on each factor and how well the model fit.

The factor loadings are visible in Table 3. The Root Mean Square Error of Approximation (RMSEA), seen in Table 1, measured the model fit.

Exploratory factor analysis is a statistical analysis method employed by researchers who intend to measure data using a survey. It can be used to "explore the possible underlying structure of a set of interrelated variables without imposing any preconceived structure on the outcome."[8] It assists in understanding how different data should be grouped together both for posting questions in the correct order on a survey and for analyzing the data after the fact. It is commonly used by social scientists to measure data that is difficult to capture through other means. Exploratory factor analysis assumes that the sample should be homogeneous, and that some level of normality is present in your data prior to performing this factor analysis.

Confirmatory factor analysis is performed on the data from an existing survey as a method of validating the survey after an exploratory factor analysis has previously identified how many latent variables (also known as factors or, per Carlson and Thomas, subscales) should be assumed. Using this numerical definition, we can then test if there is a relationship between the observed variables (questions) and their underlying latent constructs. The first step in a confirmatory factor analysis involves running statistical analyses to identify if the model, or questionnaire, used was an adequate fit for the data acquired. The Root Mean Square Error of Approximation (RMSEA) is a measure of model fit and is considered a good indicator of how accurately the model predicts the response.[9] Lower values indicate better fit, but a value around .05 is considered ideal.[10] The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity

A confirmatory factor analysis can detect the existence of collinearity between variables, both observed and latent, and can help to identify if certain questions should be removed from a questionnaire due to it measuring with a low level of significance in its relationship with a latent variables or due to its influence over other relationships within the model. The Cronbach's alpha scores in a confirmatory factor analysis identify the strength of relationship between each question and its associated factor. A Cronbach's alpha score of .70 or higher is considered to be acceptable.[11]

Prior to performing the confirmatory factor analysis necessary to answer the questions posited in this paper, an exploratory factor analysis was used to analyze the Meischke et al. study data to determine if the shortened C-SOSI also factored on 8 subscales in the 9-1-1 telecommunicator population. While not a necessary analysis for reviewing data after a survey has been distributed, it provided statistical support for aligning data around 8 factors in the confirmatory factor analysis. A partial confirmatory analysis, defined with 8 factors, was performed to confirm that a confirmatory analysis was the correct data analysis tool for validating the instrument's use on the Meischke et al. population.

Variables included in the confirmatory analysis were each of the 56 questions shortened C-SOSI questions as well as the 8 subscale items (depression, anger, sympathetic arousal, etc.) acting as the latent variables. The observation size of 180 participants is close to the recommendation of 200 participants or more, and creates a dataset suitable to perform factor analysis on.

The Carlson and Thomas study and Meischke et al. study have similarities in the frequency attributes of their population. Both the cancer patients and the 9-1-1 telecommunicator population were primarily females (85% Carlson & Thomas, 78% Meischke et al.), and the majority of the population was married (70% Carlson & Thomas, 93% Meischke et al.). The age of the cancer patient population was not fully described, but represented a mean age of approximately 51 years of age, whereas the majority of participants from Meischke et al. appear to be slightly younger and primarily between the age of 30 and 50. Carlson and Thomas collected data on the number of years of education with the average being 15 years of education, showing an education level that contains higher education. Meischke et al. collected information on the participants' number of years of experience and determined the majority of their population had worked between 5 and 20 years as a 9-1-1 telecommunicator. Due to the lack of formal training necessary for 9-1-1 telecommunicators, this population measurement could be considered comparable to years of education attained.

The purpose of this study is to conduct a confirmatory factor analysis to review if the questions asked on the C-SOSI factor with the same statistical validity when asked to a population of 9-1-1 telecommunicators as it did when asked to its original population of cancer patients.

Methods

Exploratory factor analysis and partial confirmatory analysis was performed using SPSS statistical software (SPSS version 19.0.0, IBM, Armonk, New York); confirmatory factor analysis was performed using AMOS (AMOS version 24.0.0, IBM SPSS, Wexford, PA).

Stochastic regression imputation was used to impute values for missing responses. Forty responses contained at least one missing value. A sensitivity analysis was conducted to compare results with imputations to results obtained by excluding cases with any missing values.

Exploratory factor analysis was run without a factor definition. Two methods of determining the number of factors were examined: using the requirement that the Eigenvalue be greater than or equal to 1 [12], and using a Scree plot. Although the use of an Eigenvalue cutoff of 1 is commonplace, it has been observed to have the tendency to create more groups/factors than are warranted. The Scree plot offers an alternative method that may result in fewer groups, with the disadvantage that interpretation of the Scree plot can be somewhat subjective.[13]

As part of the partial confirmatory factor analysis, a Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was calculated, as well as Bartlett's Test of Sphericity. These tests were performed to confirm that factor analysis was the appropriate method of analysis for this data by assessing the model fit. A KMO above .60 is considered valid and the closer to 1 the KMO result is, the stronger the model fit is. Bartlett's Test of Sphericity allows us to reject the null hypothesis of the C-SOSI questionnaire model does not contain factors. Factor loadings measure the correlations between the observed variables (C-SOSI questions) and the latent variables (the subscales). A factor loading of 0.30 or higher is usually considered to be sufficient for a question to be a useful part of a subscale; a factor loading of less than 0.30 is an indication that a particular question may measure something different than the subscale as a whole.[14] Factor loadings closer to 1 indicate a strong association between the question and the factor the questions are grouped under.

Confirmatory analysis measures model fit and causal path strengths within a model. A good model fit is an indication that the model accurately reproduces the modeled characteristics of the data.[10] The Root Mean Square Error of Approximation (RMSEA) is the most often reported measure of fit and should ideally produce a result at .05 and below to indicate a good fitting model, though anything less than .80 is considered an acceptably fit model.[10]

Reliability analyses use Cronbach's alpha coefficients to measure the extent that the component questions measure the same underlying latent variable, independent of the model as a whole. Reliability analyses were run on each of the subscales, totaling eight, with a minimum number of 6 variables in each analysis, which meets the recommendation of three or more variables present in a factor analysis grouping.[15]

Results

Exploratory factor analysis with an Eigenvalue of 1 or greater created 13 factors instead of the 8 factors the literature would suggest should occur. Expanding the model in this way allowed for the additional factors to explain approximately 10% more of the cumulative percent (64.1% vs. 55.4%) of variance in the model. . The Scree plot (Figure 1) however shows a small drop in Eigenvalues after the 8th factor, suggesting that the 8 factors found by Carlson and Thomas are adequate. Examination of the loadings in the 13 factor model did not show any clear patterns of groups above those specified by the 8 factor model. This in addition to Carlson and Thomas's empirical support for 8 subscales led to continued analysis using 8 factors.

The KMO result was .82, which is close to 1 and above the commonly accepted .60 level for validity, suggesting the degree of common variance is sound and it is a good model fit. This result informs the decision to proceed with a confirmatory analysis due to the confirmation that the model will account for a reliable level of significance due to an acceptable model fit. The Bartlett's Test of Sphericity reported at less than 1% ($p<.001$), successfully rejecting the null hypothesis of the C-SOSI questionnaire model does not contain factors. These results are shown in Table 1. The factor loadings were sufficient with most values at .50 or higher, as seen in Table 3. One item (Wished_Dead1) had an extraction value of less than .30, which is considered to be an indication that this item might be excluded from the factor it is assigned to.

The RMSEA identified an acceptable model fit at .072 with a confidence interval of .068-.076. Both the result and the confidence interval are below .08, and the small size of the confidence interval which, together, indicates a good model fit.

After running the confirmatory factor analysis, the Cronbach's alpha scores showed strong associations for the question groupings on eight factors. A reliability analysis was run on each set of question groupings. All groupings reported a strong Cronbach's alpha score (.76-.91).

Individual question variables did not show as strong a correlation as the overall Cronbach's alpha scores did. As seen in Table 3, of the 56 factor loading values that loaded at a significant value ($\geq$.30), 38 (68%) loaded with a value of .60 or higher, which would indicate a moderate to high correlation between that question and the associated subscale. The factor correlation matrix exclusively contained values of less than .80, indicating that none of our values are sharing their variance between factors.

The results of the reliability analysis provided confirmation that the question groupings created significant findings. Two groupings (neurological & gastrointestinal symptoms and cognitive disorganization) were below the threshold of .80 considered to be a strong correlation. Upon further review, the questions present in these two question groupings also showed lower factor loading scores. For the six Questions related to neurological and gastrointestinal symptoms, three of the five question variables showed moderate factor loading scores (.44-.56). Questions related to cognitive disorganization factored primarily significantly (.77-.81) but also contained two moderate results (.40-.61) and one that was below the value of significance (<.30).

The sensitivity analysis produced a dataset with values that closely resembled the dataset in which stochastic regression imputation was performed, confirming that the missing values did not impact the outcome of our data.

Discussion

The 9-1-1 telecommunicator population responses did validate the C-SOSI as an appropriate tool to measure stress for that group, though not with the same strength as the original exploratory analysis results showed for the cancer patient population. Results were moderate, as compared to the strong, significant associations present when the C-SOSI was applied to Carlson and Thomas's cancer patient population. While the overall factor results imply that the question groupings were significant, some of the questions within the grouping did not produce significant scores, while others produced only moderately significant results.

There are a few potential explanations as to why the questions themselves did not factor as well in the 9-1-1 telecommunicator population as they did in the original cancer patient population. Literature around work-place influence outside of stress measurement may allow for alternate explanations for 9-1-1 telecommunicators experiencing some of these cognitive and physiological symptoms, though not as a result of stress. There are also potential explanations for Carlson and Thomas's populations receiving high factor loadings for measuring stress under a certain subscale when there may potentially be an alternate explanation.

The subscale that received the highest Cronbach's alpha score for the 9-1-1 telecommunicator population was muscle tension (.91). This included capturing data on "Excessive tension, stiffness, soreness of cramping" in the muscles of the shoulders, neck, back, jaw, forehead, eyes, hands or arms, or having experienced tension headaches.[6] In a 9-1-1 call center, shift lengths are 8 to 10 to 12 hours, depending on the rules, staffing, and structure of the call center.[16] This requires the 9-1-1 telecommunicators to be sitting relatively stationary in front of a computer while talking on the phone and performing other local tasks for long periods of time. Musculoskeletal discomfort, such as pain in the shoulders, neck, and back, as well as headaches are correlated with working in a sedentary job.[17] Tension in the shoulders, neck, and back were listed with the three highest Cronbach's alpha scores (.93, .94, and .86). Eye strain would also seem to likely show a high score due to telecommunicators viewing multiple computer screens and focusing on items located near to them for extended periods of time, but surprisingly did not (.59).

The Neurological/GI grouping received the lowest Cronbach's alpha score (.76). The original shortened C-SOSI authors removed the question around feeling "weak" because of item redundancy in feeling "faint" and feeling "weak". This question was included in the Meischke et al. study and presented a moderate difference between the score for feeling "faint" (.71) and feeling "weak" (.79), with feeling "weak" presenting a stronger correlation to stress. This grouping may have factored better with the cancer patient population due to the nature of the disease they were experiencing. Cancer is a physically challenging ailment, which can lead to pain, weakness, fatigue, severe stomach pain, and dizziness.[18] The treatment for cancer is often chemotherapy, which can also emulate the symptoms the authors identified with stress: feeling faint, weak, dizzy, nauseated, and blurred vision.[19] Chemotherapy may also explain some of the cancer patients' cognitive disorganization scores. Their questions factored high on "doing things slowly to do them without mistakes" (.76) and "getting directions and orders wrong" (.73). These are potential side effects of chemotherapy known as "Chemo brain" which affects concentration and focus.[19]

This confirmatory factor analysis was performed without any adjustments to the model (ex: questions removed, covarying variables, etc.). Next step recommendations involve removing questions with low factor loadings to see if the remaining questions exhibit a stronger relationship with each other and validating the questionnaire for the specific population of 9-1-1 telecommunicators through exploratory factor analysis. The risk of removing questions is potentially increasing the correlation between the subscales. Preliminary work shows removing questions specifically from the Anger and Muscle Tension subscales may serve to strengthen the overall results. As mentioned earlier, there is potentially an alternate explanation for the Muscle Tension responses in the 9-1-1 telecommunicator population as compared to the cancer patient population.

Two subscales (depression and anger) did have a high correlation factor score of .76, suggesting there may be some covariance between the subscales. This may indicate that questions in each of these groups were interpreted to be similar by this population. Alternately, it may imply that one or more questions in each of these subscales is impacting the scores of the others by affecting variance. It may also simply have resulted due to the slightly less than ideal sample size.

In an attempt to increase the model fit, questions which were factoring low and impacting the overall strength of the model were removed. The questions from the subscale Neurological/GI were removed due to concern that these questions may not relate to a healthy population as compared to the original, chronically ill patients. In this test model, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) increased from .82 to .85, but the impact to the factor loadings were minimal. It does not appear to have made a large difference on the model and the Neurological/GI subscale was included in all additional analyses.

A suggestion to strengthen the C-SOSI's validity in a 9-1-1 telecommunicator population is to review the structure of similar surveys targeted at the healthcare population. One example of an instrument designed to measure stress in a healthcare population is the expanded nurse work stress scale (ENSS). It's ability to measure stress in a healthcare population may provide some clarity on interpreting the C-SOSI results for the 9-1-1 telecommunicators population.[20] For example, subscales in the ENSS include death and dying, inadequate emotional preparation, problems with peer support, and others that share the uniqueness of job stressors in a high-paced, life or death decision-making occupation.

The sample size of 180 in the Meischke et al. study is smaller than the ideal value of 200 or more. Literature suggests that a challenge with performing confirmatory factor analysis lies in the fact that a larger sample size may lead to a more statistically significant model fit result, while a smaller sample size may lead to a nonsignificant, or smaller model fit result.

The shortened C-SOSI model does serve to accurately measure stress in a 9-1-1 telecommunicator population. Brief analysis shows that the tool produced more significant factor loadings when used for cancer patients, but that may be the result of their sample size and other physiological and emotional influences outside of normal stress parameters. Small adjustments to the current Meischke et al. model may lead to better model fit and factor loadings. The limited number of instruments designed to measure stress and the accuracy of the shortened C-SOSI supports the idea of further measurement of stress in a 9-1-1 telecommunicator population using this instrument. Adjusting or removing questions may allow for a stronger tool. Given the occupational and societal importance in assessing stress in this population, it is my hope that the research work of assessing stress and identifying stress mediation techniques, will continue.

Tables and Figures

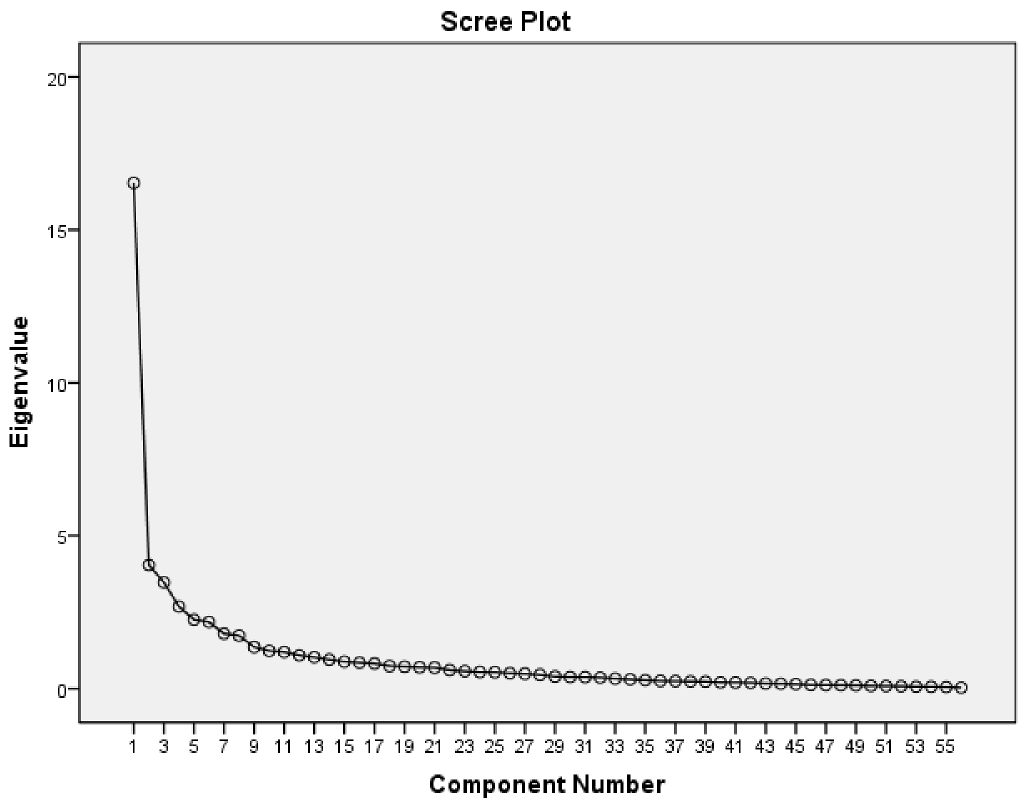

Figure 1: Scree plot of factor results after running an exploratory factor analysis with no factor number defined and the Eigenvalue defined as 1 or greater.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)		0.82
Bartlett's Test of Sphericity		
	Approx Chi Square	5420.32
	df	1540
	p-value	<.001
Root Mean Square Error of Approximation (RMSEA)		0.07

Table 1: Results of model-fit tests as part of confirmatory factor analysis.

Stress is often accompanied by a variety of emotions. During the last week, have you felt:
Like life is entirely hopeless (LifeHopeless_1)
Unhappy and depressed (Unhappy_1)
Alone and sad (Alone_1)
That worrying gets you down (Worrying_1)
Like crying easily (Crying_1)
That you wished you were dead (WishedDead_1)
Frightening thoughts keep coming back (FrighteningThoughts_1)
You suffer from severe nervous exhaustion (NervousExhaustion_1)

Does it seem:
You become mad or anger easily (EasilyMad_2)
When you feel angry, you act angrily toward most everything (ActedAngry_2)
You are easily annoyed and irritated (EasilyAnnoyed_2)
That little things get on your nerves (LittleThings_2)
Angry thoughts about an irritating event keep bothering you (KeptBothering_2)
You let little annoyances build up until you just explode (Exploded_2)
Your anger is so great that you want to strike something (StrikeSomething_2)

Do you experience:
Difficulty in staying asleep at night (DiffStaySleep_3)
Hot or cold spells (HotCold_3)
Having to get up in the night to urinate (NightUrinate_3)
Sweating excessively even in cold weather (Sweat_3)
Having to urinate frequently (FreqUrinate_3)
Early morning awakening (EarlyAwake_3)
Flushing of your face (Flush_3)
Difficulty in falling asleep (DiffFallAsleep_3)
Breaking out in cold sweats (ColdSweat_3)

Have you experienced:
Feeling faint (Faint_4)
Feeling weak (Weak_4)
Spells of severe dizziness (Dizzy_4)
Nausea (Nausea_4)
Blurring of your vision (Blurry_4)
Severe pains in your stomach (Pain_4)

Muscle tension is a common way of experiencing stress. Have you noticed excessive tension, stiffness, soreness or cramping in the muscles in your:
Shoulders (Shoulders_5)
Neck (Neck_5)
Back (Back_5)
Jaw (Jaw_5)
Forehead (Forehead_5)
Eyes (Eyes_5)
Hands or arms (Hands_5)
Have you experienced tension headaches? (Headaches_5)

Have you noticed the following symptoms when not exercising:
Thumping of your heart (Thump_6)
Rapid or racing heart beats (RapiHeartd_6)
Rapid breathing (RapidBreath_6)
Irregular heart beats (IrregularHeart_6)
Difficult breathing (DiffBreath_6)
Pains in your heart of chest (PainHeart_6)

Does it seem:
You must do things very slowly to do them without mistakes (GoSlow_7)
You get directions and orders wrong (Directions_7)
Your thinking gets completely mixed-up when you have to do things quickly (MixedUp_7)
You have difficulty in concentrating (DiffConcent_7)
You become suddenly frightened for no good reason (Fright_7)
You become so afraid you can't move (Immobile_7)

Have you experienced:
Colds (Colds_8)
Hoarseness (Hoarseness_8)
Colds with complications (e.g. bronchitis) (ColdsCompl_8)
Nasal stuffiness (NasalStuf_8)
Having to clear your throat often (ClearThroat_8)
Sinus headaches (SinusHead_8)

Table 2: Shortened C-SOSI questions with the variable name used for analysis listed in parentheses.

Subscale	C-SOSI Question Variable	0.88	0.88	0.88	0.76	0.91	0.88	0.79	0.86
Depression	LifeHopeless_1	0.59							
	Unhappy_1	0.83							
	Alone_1	0.77							
	Worrying_1	0.83							
	Crying_1	0.64							
	WishedDead_1	0.38							
	FrighteningThoughts_1	0.58							
	NervousExhaustion_1	0.75							
Anger	EasilyMad_2		0.79						
	ActedAngry_2		0.76						
	EasilyAnnoyed_2		0.84						
	LittleThings_2		0.88						
	KeptBothering_2		0.70						
	Exploded_2		0.58						
	StrikeSomething_2		0.49						
Sympathetic Arousal	DiffStaySleep_3			0.80					
	HotCold_3			0.70					
	NightUrinate_3			0.68					
	Sweat_3			0.55					
	FreqUrinate_3			0.68					
	EarlyAwake_3			0.67					
	Flush_3			0.65					
	DiffFallAsleep_3			0.72					
	ColdSweat_3			0.54					
Neurological/GI	Faint_4				0.71				
	Weak_4				0.79				
	Dizzy_4				0.55				
	Nausea_4				0.56				
	Blurry_4				0.44				
	Pain_4				0.54				
Muscle Tension	Shoulders_5					0.93			
	Neck_5					0.94			
	Back_5					0.86			
	Jaw_5					0.53			
	Forehead_5					0.56			
	Eyes_5					0.59			
	Hands_5					0.56			
	Headaches_5					0.66			
Cardiopulmonary	Thump_6						0.89		
	RapiHeartd_6						0.90		
	RapidBreath_6						0.74		
	IrregularHeart_6						0.75		
	DiffBreath_6						0.56		
	PainHeart_6						0.63		
Cognitive Disorganization	GoSlow_7							0.61	
	Directions_7							0.77	
	MixedUp_7							0.82	
	DiffConcent_7							0.81	
	Fright_7							0.40	
	Immobile_7							0.28	
Upper Respiratory Symptoms	Colds_8								0.74
	Hoarseness_8								0.73
	ColdsCompl_8								0.66
	NasalStuf_8								0.75
	ClearThroat_8								0.78
	SinusHead_8								0.65

Table 3: Resulting factor loadings for questions within the subscales after confirmatory factor analysis. Reliability analysis Cronbach's alpha scores are present at the top of every column.

References

1. Study.com. *911 Operator: Career Information and Requirements*. 8/8/16 [cited 2016 8/9]; Available from: http://study.com/articles/911_Operator_Career_Information_and_Requirements.html.

2. Pierce, H. and M.M. Lilly, *Duty-related trauma exposure in 911 telecommunicators: Considering the risk for posttraumatic stress.* Journal of Traumatic Stress, 2012. **25**(2): p. 211-215.

3. Steiber, N. and F. Pichler, *Trends in Work Stress and Exhaustion in Advanced Economies.* Social Indicators Research, 2015. **121**(1): p. 215-239.

4. APCO International. *State Training and Certification Survey*. 2010 2/13/13 [cited 2016 7/11]; Available from: http://psc.apcointl.org/2010/09/01/state-training-certification-survey/.

5. Meischke H, P.I., Lilly M, Beaton R, Revere D, Calhoun B, Seeley K, Carslay Y, Moe C, Baseman J., *An Exploration of Sources, Symptoms and Buffers of Occupational Stress in 9-1-1 Emergency Call Centers.* Annals of Emergency Dispatch and Response, 2015. **3**(2): p. 28-35.

6. Carlson, L.E. and B.C. Thomas, *Development of the calgary symptoms of stress inventory (c-sosi).* International Journal of Behavioral Medicine, 2007. **14**(4): p. 249-256.

7. University of Washington, *Interpretation of the Symptoms of Stress Inventory*, in *Department of Psychosocial Nursing*. 1987, University of Washington: Seattle, WA p. 8.

8. Suhr, D.D. *Exploratory or Confirmatory Analysis?* 2006 [cited 2016 8/7/16]; Available from: http://140.112.142.232/~PurpleWoo/Literature/!DataAnalysis/FactorAnalysis_SAS.com_200-31.pdf.

9. Karen. *Assessing the Fit of Regression Models*. 2016 [cited 2016 8/10]; Available from: http://www.theanalysisfactor.com/assessing-the-fit-of-regression-models/.

10. Kenny, D.A. *Measuring Model Fit*. 2015 11/24/15 [cited 2016 8/7]; Available from: http://davidakenny.net/cm/fit.htm.

11. Tavakol M, D.R., *Making sense of Cronbach's alpha.* International Journal of Medical Education, 2011. **2**: p. 53-55.

12. Institute for Digital Research and Education. *Annotated SPSS Output: Factor Analysis*. 2014 10/6/14 [cited 2016 8/7/16]; Available from: http://www.ats.ucla.edu/stat/spss/output/factor1.htm.

13. Costello A, O.J., *Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most From Your Analysis.* Practical Assessment, Research & Evaluation, 2005. **10**(7): p. 9.

14. Albright, J.J. *Confirmatory Factor Analysis Using Amos, LISREL, and MPLUS*. 2008 [cited 2016 8/7]; Available from: http://www.iu.edu/~statmath/stat/all/cfa/cfa2008.pdf.

15. University of Texas at Austin. *Factor Analysis using SAS PROC FACTOR*. 1995 6/26/95 [cited 2016 8/7]; Available from: http://www.ats.ucla.edu/stat/sas/library/factor_ut.htm.

16. Weiner, R., *Emergency dispatchers note long hours and stress of job*, in *The Washington Post*. 2013.

17. Knave, B.G., et al., *Work with video display terminals among office employees: I. Subjective symptoms and discomfort.* Scandinavian Journal of Work, Environment & Health, 1985. **11**(6): p. 457-466.

18. American Cancer Society. *Signs and Symptoms of Cancer*. 2014 8/11/14 [cited 2016 7/28]; Available from: http://www.cancer.org/cancer/cancerbasics/signs-and-symptoms-of-cancer.

19. American Cancer Society. *Chemotherapy Side Effects*. 2016 2/15/16 [cited 2016 7/28]; Available from: http://www.cancer.org/treatment/treatmentsandsideeffects/treatmenttypes/chemotherapy/chemotherapy-side-effects.

20. Johansen, M.L. and E. Cadmus, *Conflict management style, supportive work environments and the experience of work stress in emergency nurses.* Journal of Nursing Management, 2016. **24**(2): p. 211-218.