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Survey Instrument Validity Part II: Validation of a Survey Instrument Examining Athletic Trainers' Knowledge and Practice Beliefs Regarding Exertional Heat Stroke

Laura J. Burton, PhD, Stephanie M. Mazerolle, PhD, ATC

University of Connecticut, Storrs, CT

Context: Instrument validation is an important component to sound survey research methods.

Objective: The purpose of this article is to discuss the process of developing and validating an instrument to investigate an athletic trainer's attitudes and behaviors regarding the recognition and treatment of exertional heat stroke.

Background: Following up from our initial paper, which discussed the process of survey instrument design and validation, we present the practical application of those general guidelines as described by Netemeyer and colleagues.

Description: There are four basic steps to developing a valid survey instrument: (1) defining the construct, (2) item development and judgment, (3) designing and conducting studies to develop a survey, and (4) finalizing the instrument. Following these steps, we present our survey instrument used to evaluate an athletic trainer's knowledge and practice beliefs regarding exertional heat stroke.

Conclusions: Following the process of survey development and validation, we were able to develop an instrument to help understand attitudes held by athletic trainers regarding appropriate clinical practice behaviors in the treatment of exertional heat stroke.

Key Words: environmental illnesses, evidence-based medicine, instrument design

Dr. Burton is an Associate Professor of Sport Management in the Department of Kinesiology at the University of Connecticut. Please address all correspondence to Laura Burton, PhD, University of Connecticut, 2095 Hillside Road, Unit 1110, Storrs, CT 06269-1110. laura.burton@uconn.edu

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Survey Instrument Validity Part II: Validation of a Survey Instrument Examining Athletic Trainers' Knowledge and Practice Beliefs Regarding Exertional Heat Stroke

Laura J. Burton, PhD and Stephanie M. Mazerolle, PhD, ATC

Exertional heat stroke (EHS) is a serious medical condition marked by an elevated core body temperature (>104°F, 40°C) and central nervous system (CNS) dysfunction.[1-2] The condition, although preventable and treatable, has continued to be a leading cause of death for athletes.[3-4] Two key factors, early recognition via an accurate core body temperature assessment (rectal) and immediate treatment by rapid cooling, have been documented as the most effective ways to prevent sudden death from the condition.[1-2,4-7] Despite the documented success of these two strategies,[8-9] athletes continue to die from the condition.[4] These unnecessary deaths are often due to a failure of the medical care provider to accurately diagnosis the condition or the delay in cooling the patient.[3-5]

Athletic trainers (ATs) are often the first responders to exertional heat illness situations in sports; therefore, they play an important role in the recognition and treatment of EHS. Research has demonstrated that ATs possess a strong knowledge base regarding EHS, particularly with the prevention, detection, and treatment of EHS.[10] Unfortunately, ATs rarely assess rectal temperature or employ cold-water immersion (CWI) treatment[10] in spite of actively taking steps to prevent the condition and knowing the recommendations of the National Athletic Trainers' Association (NATA).[1] The data presented by Domek et al[10] was the first to investigate the practice beliefs of ATs as it pertains to EHS; however, the results were reflective of only a small portion of ATs limited to the high school clinical setting. In addition, the researchers did not use a validated instrument, which limited the applicability of their findings. Therefore, our purpose was to develop and validate an instrument to investigate the attitudes and behaviors of ATs regarding the recognition and treatment of EHS regardless of clinical setting. Additionally, our presentation regarding the survey instrument validation process is a follow-up and supplement to **Part I** of our manuscript on survey development and validation in athletic training research.

STEP ONE: DEFINING THE CONSTRUCT

Initially, we conducted a large, structured focus group to develop constructs that were most appropriate for evaluating an AT's knowledge and practice beliefs regarding the prevention, recognition, and treatment of EHS. Members of the focus group included ATs with 5 years of clinical experience, three EHS researchers with more than 15 years of research and educational experience, and four exercise science doctoral students with experience in EHS research. A sport management researcher with a strong understanding of survey development, item generation, and a basic understanding of the topic led the focus group (n = 12). Utilization of a panel of experts is important when a pre-existing scale is not available,[11] as was the case for this research project.

The focus group discussions centered on what influences an AT regarding the implementation of best practices for EHS. The panel agreed upon 3 major constructs: knowledge, preference, and actual behavior regarding best practices. An important step to survey development and validation is to define each construct. The panel of experts discussed and defined each construct during these deliberations (Table 1).[11]

STEP TWO: ITEM DEVELOPMENT AND JUDGMENT

The second step in scale development, as outlined by Netemeyer et al,[11] includes two distinct procedures: item drafting and judgment. In a separate, smaller focus group (n=6), select individuals drafted questions while taking into consideration the existing literature, question style, data analysis, and development of our initial constructs.[11-12] This panel, as described above, collectively agreed to develop a set of Likert-scaled questions. We scaled all questions within each of the 3 main constructs using the most commonly employed 5-level Likert scale (1=strongly disagree, 3=neither agree nor disagree, 5=strongly agree).[11,13] We also selected this style of questioning because Likert scales are effective in measuring attitude and providing a range of responses to a given question or statement,.[11,13]

It is important to note that the selection of a qualified panel of experts is a significant part of the instrument development process because the panel will also determine the appropriate number of instrument questions to fully explore each construct. As a rule of thumb, the panel should attempt to develop a minimum of ten questions for each construct.[14] Table 2 provides examples of the

Table 1. Initial Constructs Defined

Construct	Definition
Knowledge Base Regarding EHS	An AT's level of understanding regarding prevention strategies, recognition of clinical signs and symptoms, diagnostic tools, and treatment options.
Clinical Preference	An AT's first choice regarding the prevention, recognition and treatment of EHS (ie, temperature assessment or cooling modality).
Actual Clinical Practice	An AT's actual daily clinical use regarding the prevention, recognition and treatment of EHS.

Table 2. Likert-Scale Questions

Construct	Statement
Knowledge Base Regarding EHS	1. Assuring adequate hydration status will prevent the occurrence of exertional heat stroke. 2. Reducing exercise intensity on a hot day will prevent the occurrence of exertional heat stroke. 3. When obtaining core body temperature, oral thermometers provide the most accurate measure. 4. Whole body cooling via cold/ice water immersion for the acute treatment of exertional heat stroke is considered the best practice.
Clinical Preference	5. When treating an athlete with exertional heat stroke I would prefer to use cold/water immersion. 6. I would prefer to use an oral temperature when assessing an athlete for exertional heat stroke.
Actual Clinical Practice	7. When treating an athlete with exertional heat stroke, I would immediately use rest in a cool/shaded area. 8. When assessing an athlete for exertional heat stroke, I would use rectal temperature as an accurate measure.

questions.

The panel also decided to ask questions not related to the 3 major constructs. These questions were open-ended as this type of questioning is encouraged in exploratory research or when soliciting personal information or beliefs.[12] The panel also composed a set of demographic questions pertaining to years of experience, geographic location, work setting, and experience with EHS.

Upon completion of the item development process, we recruited a set of judges, independent to the panel that established the questions, to assess the instrument's content and face validity. Our judges (n = 10) included a team physician working in the collegiate setting and ATs working in the high school (n = 4) and NCAA settings (n = 5). We excluded these judges from study participation, but they did complete the survey in its entirety. We instructed the judges to determine whether the items "represented"[11] the constructs and if the items were understandable. Each panel member took notes of the judges' feedback, comments, and concerns as they completed the survey. Panel members also noted the time to complete the survey. We processed and discussed the judges' criticisms and common concerns to further revise the survey prior to pilot testing.

For this step in the validation process, at least 4 judges defined "common concerns/feedback." The judges raised no major concerns regarding face or content validity of the survey; however, the judges provided consistent suggestions to improve grammar and the time to complete the survey. In addition, we removed questions that asked participants to indicate their preferred clinical practice and kept only those questions regarding their actual clinical practice.

STEP THREE: DESIGNING AND CONDUCTING STUDIES TO DEVELOP A SURVEY

After securing face and content validity, the instrument contained 40 close-ended Likert-scale questions and 6 open-ended questions. The survey was transferred from the document format to the electronic format on SurveyMonkey.com™. We used a five-point system for the close-ended Likert scale and anchored the scale with strongly disagree (1) and strongly agree (5). Example items include: (1) "When treating a suspected EHS, continual dosing with cold water does not provide effective cooling;" (2) "The sports medicine budget prevents me from purchasing equipment necessary to assess rectal temperature;" and (3) "Axillary thermometers provide an accurate measure of core body temperature with a suspected EHS." Open-ended questions focused on the respondents' actual clinical practice regarding the recognition and treatment of EHS and barriers to implementation if their current clinical practice did not match the evidence. We placed all demographic items at the start of the survey. We randomly allocated survey questions with the exception of the 6 open-ended questions, which we positioned at the end of the instrument. We designed the format of the survey so participants had to answer each question before moving on to the next question, and we did not allow participants to return to previous questions to make changes.

We used a random sample of NATA members for the study. Sample size recommendations for testing an instrument include either a minimum of 10 respondents per item[15] or a minimum overall sample of 300 respondents.[16-17] We sent each NATA member an e-mail containing an electronic link to the survey on SurveyMonkey.com™. We invited 600 NATA members, 300 from the collegiate setting and 300 from the high school setting, to participate in the pilot study. We sent reminder e-mails to participants three times over a three-month period, with the first one month after the initial email. Prior to the third reminder e-mail, we acquired a random sample of 400 additional participants from the NATA to obtain an adequate number of completed surveys for validating the instrument because we had a low return rate from the previous sample. This additional sample received the same invitation e-mail we sent the first sample. We also sent a reminder e-mail to the sample of 400 additional participants one month after we sent our initial invitation. We closed the survey to all subjects after a period of one month following the reminder e-mail to the sample of 400 participants. Of the 1000 NATA members we invited to participate in the pilot study, 200 members responded for a 20% response rate. Of these 200 participants, we used 175 complete responses for our factor analysis and validation of the instrument. The sample did not reach the recommended minimum number of participants for exploratory factor analysis (EFA); however, we continued with the analysis and examined particular tests to be sure our sample met adequate requirements for EFA as detailed by the Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity.[11]

STEP FOUR: FINALIZING A SURVEY

Exploratory Factor Analysis

Using EFA to validate an instrument investigating the AT's attitudes and behaviors regarding the recognition and treatment of EHS, we included items that evaluated an AT's knowledge of the assessment of EHS, knowledge of the treatment of EHS, actual practices with the treatment of EHS, and perceived external constraints regarding the prevention and treatment of EHS. We followed EFA techniques and conducted four iterations of the survey before reaching a final solution. To reduce confusion in describing the process of EFA, we discuss the final iteration (fourth iteration) in detail; however, all EFA iterations followed this process.

The final iteration of EFA consisted of 22 close-ended Likert scale questions (1-strongly disagree to 5-strongly agree) that assessed the initial constructs (Table 1). We selected principle component analysis (PCA) as the method of factor analysis because we were interested in reducing the number of items in this survey. After selecting PCA, we entered all 22 items into SPSS 17.0 (Chicago, IL) and analyzed the correlation matrix for the items. Prior to evaluating the matrix, we determined it was not an identity matrix (ie, that there is no relationship among the items) by evaluating Bartlett's test of sphericity, which was significant (χ^2 = 1191.36, *df* = 171, *P* < .001). Bartlett's test of sphericity provides information regarding whether items in the correlation matrix are sufficiently correlated, which indicates the items have some relationship and will support the purpose of the instrument. Inspection of the correlation matrix helped us determine unidimensionality for the items.[14] Inter-item correlations for items intended to measure the same construct should be moderate but not high (ie, between .30-.60).[18] Inter-item correlations that are high suggest that the items are contributing something unique to the construct, and therefore, they are not unidimensional. Initial inspection of the item correlation matrix indicated that items in the proposed factor were related (approximately .30) but were not significantly high (approximately .60). We have provided an example of the SPSS output of a correlation matrix (Appendix 1) and an example of the correlation matrix presented in a manuscript for one factor following final analysis (Table 3).

Following inspection of the item correlation matrix, we needed to determine if we reached sample adequacy in order to continue the factor analysis. Measures of sampling adequacy evaluate how strongly an item is correlated with other items in the correlation matrix and help researchers assess whether the items used in the survey are related. Researchers can assess sampling adequacy by examining the KMO output provided in the factor analysis. A KMO correlation above .60-.70 is considered adequate to move forward with an analysis of the EFA output.[11] We calculated a KMO correlation of .83; therefore, we moved forward with the analysis of the EFA output. We selected a varimax rotation as it is the most common form of orthogonal rotation for EFA and provides clear information regarding which items best correlate with a particular factor.[14] The rotation method (ie, varimax rotation) provides researchers with information regarding the items to retain or delete from the instrument.

We then conducted factor retention to move forward with the analysis. We identified factors to retain based on the Kaiser criterion[18] recommendation of retaining factors with eigenvalues greater than 1.0 and by examination of the scree plot. Eigenvalues represent the amount of variance in all of the items that can be explained by a particular factor.[14] Six factors had eigenvalues greater than 1.0 and the scree plot indicated a drop off following the sixth factor (see Appendix 2 for an example of the SPSS output for the total variance explained). After selecting these six factors for retention (based on a prior theory, eigenvalues, and scree test), we used item trimming and item retention to move the survey into its final form. Appendix 3 provides an example of the scree plot from the final iteration (five-factor solution) of the survey.

Table 3. Correlation Matrix for Factor 1 (Attitudes toward Use of Cold Water Immersion)

Item*	1	2	3	4	5	6	7	8
1	1.00							
2	.548	1.00						
3	.754	.446	1.00					
4	.536	.437	.527	1.00				
5	.504	.366	.601	.454	1.00			
6	.419	.234	.426	.406	.224	1.00		
7	.481	.236	.451	.262	.273	.391	1.00	
8	.466	.318	.346	.309	.392	.290	.278	1.00

* Item is the term used to refer to a question in the survey.

We evaluated the output for factor loadings on the varimax rotated component matrix to determine which items should remain in the survey and which items we should review for deletion. Based on this inspection, we identified items with high factor loadings (>.40) on more than one factor for potential deletion. We also evaluated for deletion those items that failed to load on at least one factor at >.30 . We placed those items identified with multiple high factor loadings with the factor that made the best sense conceptually (see Appendix 4 for an example of the SPSS output for the rotated factor matrix).

Finally, we decided to either retain the item or remove it by conducting an alpha reliability analysis on all items for the particular factor. If the alpha coefficient for the factor was positively impacted by removing the questionable item (ie, the alpha coefficient would increase if the item was removed) we removed the respective item. As an example, item 6 ("Because of potential contamination of equipment and water with bodily fluids, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.") loaded on two factors at >.30. Therefore, we placed the item with the factor that made the best sense conceptually (ie, Attitudes toward Use of Cold Water Immersion) and conducted

Table 4. Correlation Matrix for Factor 1 (Attitudes toward Use of Cold Water Immersion)

	Item	Mean ± SD
1.	Because we cannot simultaneously use intravenous fluids, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	2.82 ± 1.7
2.	When exertional heat stroke is identified, the current course of action as my definitive treatment is cold/ice water immersion.	2.75 ± 1.5
3.	Because it causes peripheral vasoconstriction, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	2.06 ± 1.5
4.	Because of the possibility of an athlete drowning, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke	3.10 ± 1.9
5.	Because I would not be able to continuously monitor core temperature, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	2.85 ± 1.6
6.	Because of potential contamination of equipment and water with bodily fluids, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	3.24 ± 1.8
7.	Because it causes cardiovascular shock, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	1.90 ± 1.2
8.	Transportation of an athlete into an immersion tub requires multiple persons. Because of lack of staffing, I would not use cold/ice water immersion for the acute treatment of exertional heat stroke.	3.32 ± 1.6
9.	Coaches at my institution or job setting are not supportive of my suggestions regarding the progression of heat exposure during heat acclimatization.	3.54 ± 1.5
10.	Coaches at my institution or job setting are not supportive of my suggestions regarding modifying time of practice based on risk of exertional heat stroke.	3.16 ± 1.5
11.	Coaches at my institution or job setting are supportive of my suggestions regarding uniform/sport specific protective equipment utilized depending on risk of exertional heat stroke.	2.43 ± 1.5
12.	My state practice act prevents me from assessing body temperature using rectal temperature.	2.72 ± 1.6
13.	I would prefer not to use rectal temperature to assess body temperature when assessing an athlete for exertional heat stroke.	2.97 ± 1.7
14.	The sports medicine budget prevents me from purchasing equipment necessary to assess rectal temperature.	4.89 ± 1.9
15.	When exertional heat stroke is identified, the current course of action as my definitive treatment is the use of a cold shower on the athlete.	4.46 ± 2.9
16.	When exertional heat stroke is identified, the current course of action as my definitive treatment is continual dousing with cold water.	4.49 ± 1.3
17.	When exertional heat stroke is identified, the current course of action as my definitive treatment is spraying the athlete with water in conjunction with the use of a fan.	4.55 ± 1.2
18.	Sleep deprivation is an important risk factor in the cause of exertional heat stroke.	2.86 ± 1.5
19.	Monitoring proper sleeping habits and conditions of athletes will help to decrease the occurrence of exertional heat stroke.	4.81 ± 3.0

the alpha reliability analysis for the factor with the respective item included. In this specific instance, results of the analysis indicated the reliability was higher ($\alpha = .87$) with the item included than with it removed ($\alpha = .86$) (see Appendix 5 for the SPSS output for the alpha reliability analysis for this factor). Therefore, we retained this specific item with the factor. In other situations, we removed the questionable item and conducted a new EFA in SPSS.

We followed the steps for factor identification and item selection for each new EFA. Our fourth iteration of the EFA provided the best solution for the study. Later in this article, we present the results of the fourth EFA as an example of appropriate steps for writing up an EFA in a published manuscript.

EFA Write-up: Evaluation of Clinical Practice Attitudes toward the Treatment of Exertional Heat Stroke

The purpose of the study was to develop and validate an instrument to investigate the attitudes held by ATs regarding appropriate clinical practice behaviors in the treatment of EHS regardless of clinical setting. We used exploratory factor analysis to develop construct validity for this new instrument. The final survey contained 19 items loading onto five factors. We have provided in Table 4 the means and standard deviations for each item. Our assessment of the item correlation matrix indicated that the matrix was not an identity matrix; Bartlett's test of sphericity was significant ($\chi^2 = 1191.36$, $df = 171$, $P < .001$). Measures of sampling adequacy were acceptable (KMO = .83). We used a varimax rotation to rotate the factors and determine items for retention in the final survey. We selected a final solution with five factors accounting for 66.16% of the total variance explained by the survey. We present eigenvalues and variance explained by each factor in Table 5.

The first factor (Attitudes toward Use of Cold Water Immersion) accounted for 26.79% of the variance, and items loading to factor 1 ranged from .812-.611. The second factor (Coaches' Support of EHS Prevention) accounted for 11.17% of the variance, and items loading to factor 2 ranged from .855-.683. The third factor (Attitudes Regarding Rectal Temperature in EHS Evaluation) accounted for 9.11% of the variance, and items loading to factor 3 ranged from .822-.732. Factor 4 (Attitudes toward Use of Other "Cold" Methods) accounted for 7.46% of the variance, and items loading to the factor ranged from .774-.696. The final factor (Perceptions Regarding Non-Exertional Influences on EHS) accounted for 7.11% of the variance, and items loading to factor 5 ranged from .859-.799.

SUMMARY

Following the process of survey development and validation, we developed an instrument to help understand the attitudes held by ATs regarding appropriate clinical practice behaviors in the treatment of EHS. The four steps of survey development

Table 5. Factor Loadings*, Eigenvalues, and Percent Variance Explained for the EHS Attitudes Survey

Item**	Factor 1: Attitudes toward Use of Cold Water Immersion	Factor 2: Coaches' Support of EHS Prevention	Factor 3: Attitudes Regarding Rectal Temperature in EHS Evaluation	Factor 4: Attitudes toward Use of Other "Cold" Methods	Factor 5: Perceptions Regarding Non-Exertional Influences on EHS
1	.812	---	---	---	---
2	.766	---	---	---	---
3	.761	---	---	.274	---
4	.738	---	---	---	---
5	.726	---	---	.257	---
6	.655	---	.255	---	---
7	.639	---	---	.204	---
8	.611	---	---	---	---
9	---	.855	---	---	---
10	---	.842	---	---	---
11	---	.683	---	---	---
12	---	---	.822	---	---
13	---	---	.787	.203	---
14	---	---	.732	---	---
15	---	---	---	.774	---
16	---	---	---	.743	---
17	.273	---	---	.696	---
18	---	---	---	---	.859
19	---	---	---	---	.799
Eigenvalue	5.09	2.12	1.73	1.42	1.35
% Variance	26.79	11.17	9.11	7.47	7.11

* Factor loadings < .20 were not included in this table.
** Item is the term used to refer to a question in the survey.

and validation as outlined by Netemeyer et al[11] include defining the constructs of the survey, developing items to measure each construct, designing and conducting studies to develop a survey, and finalizing the survey using EFA. When a survey has reached its final form, a researcher can calculate items into a mean score for each factor measured by the instrument. The researcher may use these mean scores to examine differences in responses for participants representing diverse populations (eg, experienced ATs, athletic training clinical instructors, newly certified ATs, and students). Parametric statistical techniques (eg, analysis of variance, t-tests, multiple regression) can be used to analyze differences in factor mean scores among various populations. Further analysis of the stability of the survey's factor structure can be tested using confirmatory factor analysis. The process of survey development and validation is lengthy and requires diligence, but it ultimately enhances the quality and richness of the data collected.

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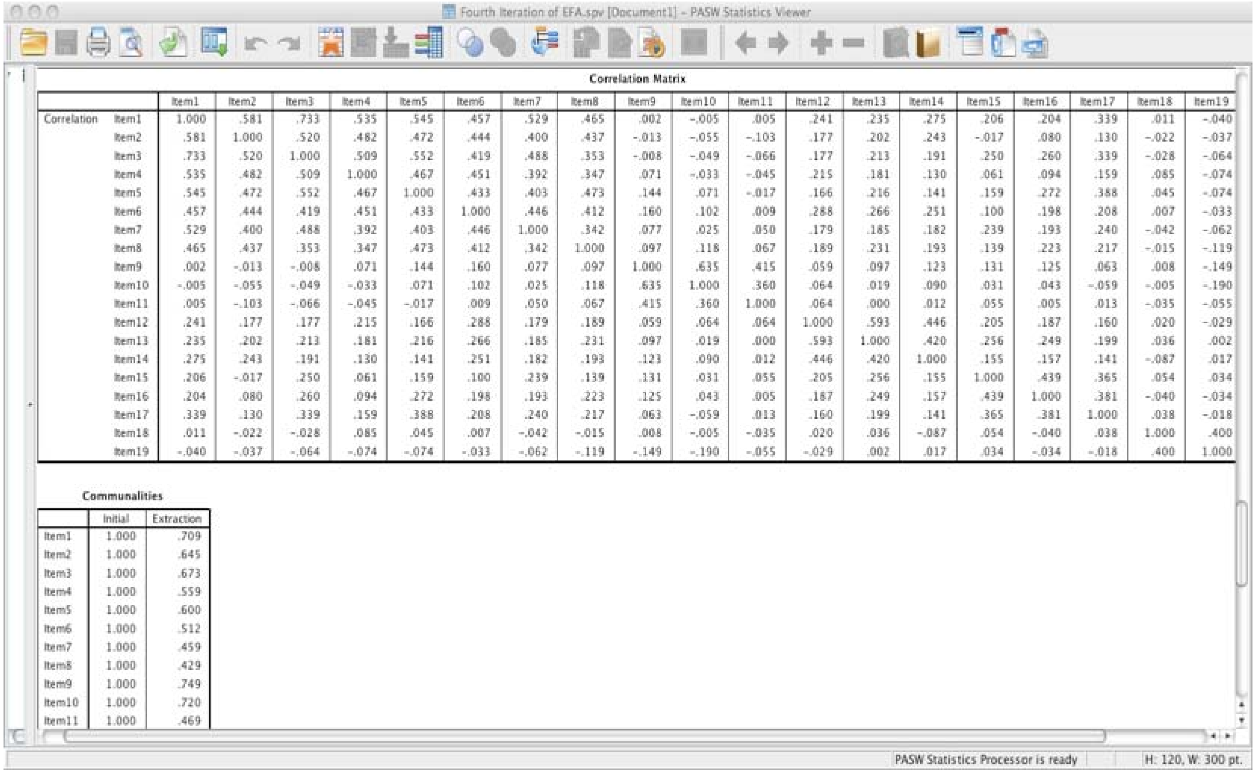
APPENDIX 1. Correlation Matrix Output



Correlation Matrix

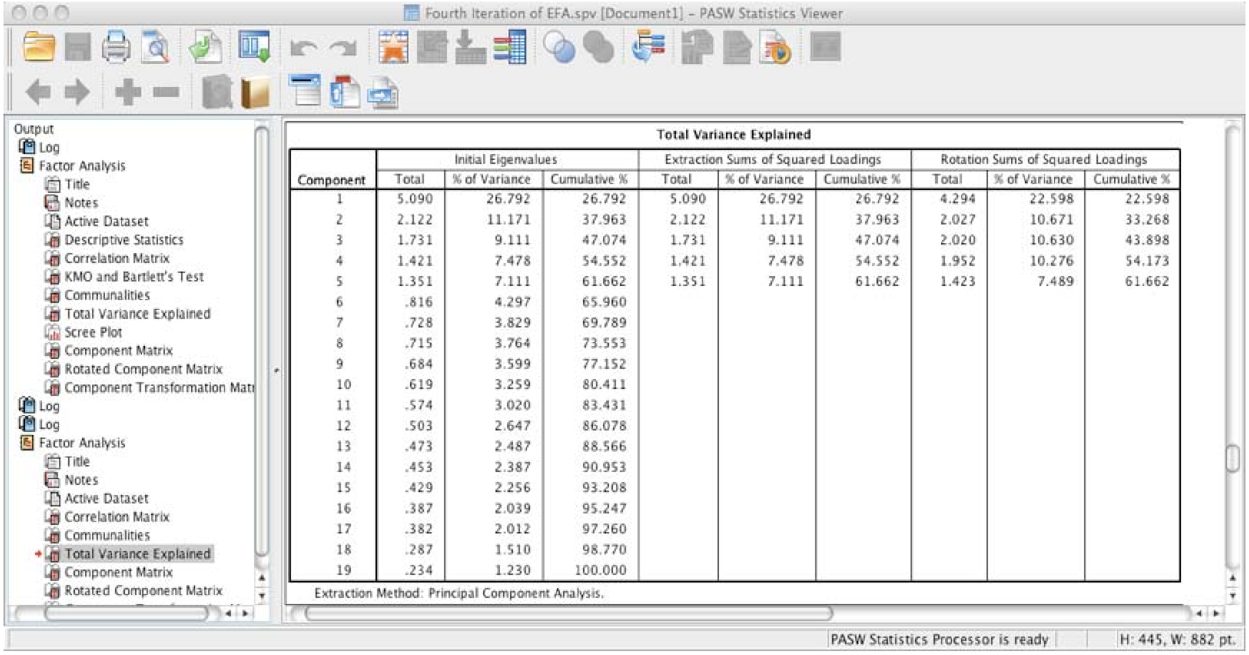
		Item1	Item2	Item3	Item4	Item5	Item6	Item7	Item8	Item9	Item10	Item11	Item12	Item13	Item14	Item15	Item16	Item17	Item18	Item19
Correlation	Item1	1.000	.581	.733	.535	.545	.457	.529	.465	.002	-.005	.005	.241	.235	.275	.206	.204	.339	.011	-.040
	Item2	.581	1.000	.520	.482	.472	.444	.400	.437	-.013	-.055	-.103	.177	.202	.243	-.017	.080	.130	-.022	-.037
	Item3	.733	.520	1.000	.509	.552	.419	.488	.353	-.008	-.049	-.066	.177	.213	.191	.250	.260	.339	-.028	-.064
	Item4	.535	.482	.509	1.000	.467	.451	.392	.347	.071	-.033	-.045	.215	.181	.130	.061	.094	.159	.085	-.074
	Item5	.545	.472	.552	.467	1.000	.433	.403	.473	.144	.071	-.017	.166	.216	.141	.159	.272	.388	.045	-.074
	Item6	.457	.444	.419	.451	.433	1.000	.446	.412	.160	.102	.009	.288	.266	.251	.100	.198	.208	.007	-.033
	Item7	.529	.400	.488	.392	.403	.446	1.000	.342	.077	.025	.050	.179	.185	.182	.239	.193	.240	-.042	-.062
	Item8	.465	.437	.353	.347	.473	.412	.342	1.000	.097	.118	.067	.189	.231	.193	.139	.223	.217	-.015	-.119
	Item9	.002	-.013	-.008	.071	.144	.160	.077	.097	1.000	.635	.415	.059	.097	.123	.131	.125	.063	.008	-.149
	Item10	-.005	-.055	-.049	-.033	.071	.102	.025	.118	.635	1.000	.360	.064	.019	.090	.031	.043	-.059	-.005	-.190
	Item11	.005	-.103	-.066	-.045	-.017	.009	.050	.067	.415	.360	1.000	.064	.000	.012	.055	.005	.013	-.035	-.055
	Item12	.241	.177	.177	.215	.166	.288	.179	.189	.059	.064	.064	1.000	.593	.446	.205	.187	.160	.020	-.029
	Item13	.235	.202	.213	.181	.216	.266	.185	.231	.097	.019	.000	.593	1.000	.420	.256	.249	.199	.036	.002
	Item14	.275	.243	.191	.130	.141	.251	.182	.193	.123	.090	.012	.446	.420	1.000	.155	.157	.141	-.087	.017
	Item15	.206	-.017	.250	.061	.159	.100	.239	.139	.131	.031	.055	.205	.256	.155	1.000	.439	.365	.054	.034
	Item16	.204	.080	.260	.094	.272	.198	.193	.223	.125	.043	.005	.187	.249	.157	.439	1.000	.381	-.040	-.034
	Item17	.339	.130	.339	.159	.388	.208	.240	.217	.063	-.059	.013	.160	.199	.141	.365	.381	1.000	.038	-.018
	Item18	.011	-.022	-.028	.085	.045	.007	-.042	-.015	.008	-.005	-.035	.020	.036	-.087	.054	-.040	.038	1.000	.400
	Item19	-.040	-.037	-.064	-.074	-.074	-.033	-.062	-.119	-.149	-.190	-.055	-.029	.002	.017	.034	-.034	-.018	.400	1.000

Communalities

	Initial	Extraction
Item1	1.000	.709
Item2	1.000	.645
Item3	1.000	.673
Item4	1.000	.559
Item5	1.000	.600
Item6	1.000	.512
Item7	1.000	.459
Item8	1.000	.429
Item9	1.000	.749
Item10	1.000	.720
Item11	1.000	.469

A screen shot of the SPSS output of the correlation matrix for the exploratory factor analysis. Each item represents a question in the survey.

APPENDIX 2. Total Variance Explained



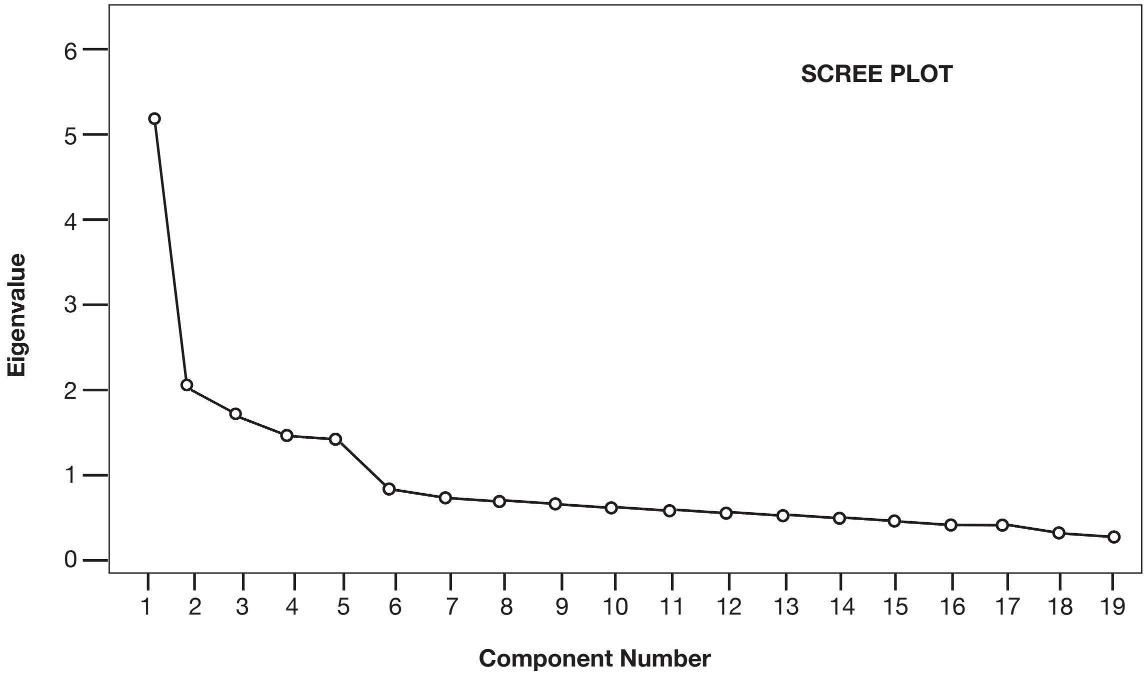
Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.090	26.792	26.792	5.090	26.792	26.792	4.294	22.598	22.598
2	2.122	11.171	37.963	2.122	11.171	37.963	2.027	10.671	33.268
3	1.731	9.111	47.074	1.731	9.111	47.074	2.020	10.630	43.898
4	1.421	7.478	54.552	1.421	7.478	54.552	1.952	10.276	54.173
5	1.351	7.111	61.662	1.351	7.111	61.662	1.423	7.489	61.662
6	.816	4.297	65.960						
7	.728	3.829	69.789						
8	.715	3.764	73.553						
9	.684	3.599	77.152						
10	.619	3.259	80.411						
11	.574	3.020	83.431						
12	.503	2.647	86.078						
13	.473	2.487	88.566						
14	.453	2.387	90.953						
15	.429	2.256	93.208						
16	.387	2.039	95.247						
17	.382	2.012	97.260						
18	.287	1.510	98.770						
19	.234	1.230	100.000						

Extraction Method: Principal Component Analysis.

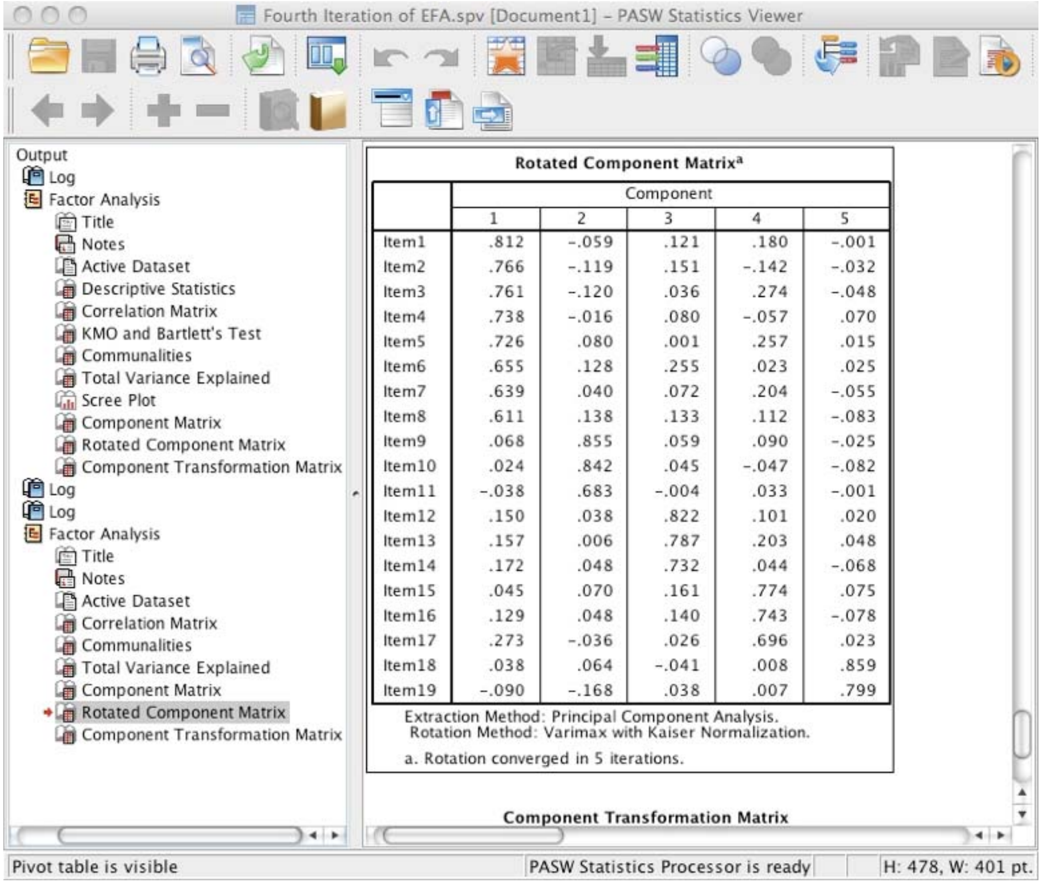
A screen shot of the SPSS output for the total variance explained in the exploratory factor analysis. Components represent the factors extracted in the analysis.

APPENDIX 3. Scree Plot of the Final EFA Solution for the EHS Attitudes



Scree plot provided in the SPSS exploratory factor analysis output.
X-axis = factor number; Y-axis = eigenvalues for each factor

APPENDIX 4. Rotated Factor Matrix



Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
Item1	.812	-.059	.121	.180	-.001
Item2	.766	-.119	.151	-.142	-.032
Item3	.761	-.120	.036	.274	-.048
Item4	.738	-.016	.080	-.057	.070
Item5	.726	.080	.001	.257	.015
Item6	.655	.128	.255	.023	.025
Item7	.639	.040	.072	.204	-.055
Item8	.611	.138	.133	.112	-.083
Item9	.068	.855	.059	.090	-.025
Item10	.024	.842	.045	-.047	-.082
Item11	-.038	.683	-.004	.033	-.001
Item12	.150	.038	.822	.101	.020
Item13	.157	.006	.787	.203	.048
Item14	.172	.048	.732	.044	-.068
Item15	.045	.070	.161	.774	.075
Item16	.129	.048	.140	.743	-.078
Item17	.273	-.036	.026	.696	.023
Item18	.038	.064	-.041	.008	.859
Item19	-.090	-.168	.038	.007	.799

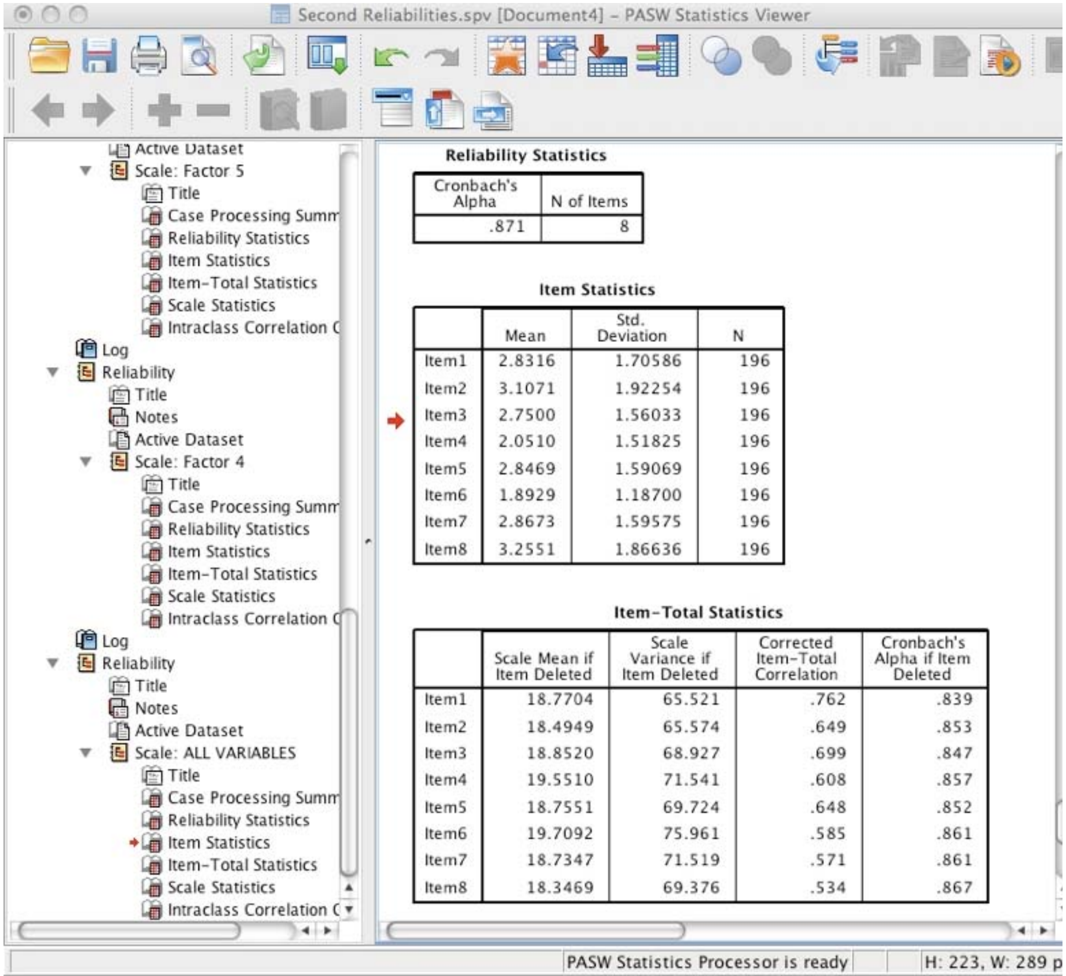
Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Component Transformation Matrix

A screen shot of the SPSS output for the rotated component matrix. Each component represents a factor and each item represents a question in the survey.

APPENDIX 5. Alpha Reliability Analysis



Reliability Statistics

Cronbach's Alpha	N of Items
.871	8

Item Statistics

	Mean	Std. Deviation	N
Item1	2.8316	1.70586	196
Item2	3.1071	1.92254	196
Item3	2.7500	1.56033	196
Item4	2.0510	1.51825	196
Item5	2.8469	1.59069	196
Item6	1.8929	1.18700	196
Item7	2.8673	1.59575	196
Item8	3.2551	1.86636	196

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Item1	18.7704	65.521	.762	.839
Item2	18.4949	65.574	.649	.853
Item3	18.8520	68.927	.699	.847
Item4	19.5510	71.541	.608	.857
Item5	18.7551	69.724	.648	.852
Item6	19.7092	75.961	.585	.861
Item7	18.7347	71.519	.571	.861
Item8	18.3469	69.376	.534	.867

A screen shot of the SPSS output for the alpha reliability analysis. Each item represents a question in the survey.