

Development and Initial Validation of The Addressing Client Needs with Social Determinants of Health survey (ACN: SDH)

Kaprea F Johnson (✉ johnson.9545@osu.edu)

The Ohio State University <https://orcid.org/0000-0001-7127-3370>

Research Article

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Abstract

Background

The purpose of this study was to validate a survey that can be used by healthcare systems, educators, and researchers to assess healthcare provider SDOH competency; with competency defined as their knowledge, awareness-biases, skills, and actual preparedness to address SDOH challenges.

Methods

An Exploratory Factor Analysis (EFA) was conducted with a sample of 220 healthcare providers, and 6 factors were identified. A Confirmatory Factor Analysis (CFA) was conducted with 303 healthcare providers and the 6-factor solution was supported, with 22 items.

Results

The reliability estimates for the 6 factors are as follows: Factor 1, *Action Toward Addressing SDOH* ($a = .848$); Factor 2, *SDOH Knowledge* ($a = .944$); Factor 3, *Negative Attitude toward Addressing SDOH* ($a = .790$); Factor 4, *Systemic Accountability* ($a = .808$); Factor 5, *School Preparation* ($a = .863$); and Factor 6, *Perception of the Cause of SDOH* ($a = .940$).

Conclusion

The ACN:SDH scale is the first validated measure that can be used to systematically appraise healthcare provider SDOH competency.

Background

The social determinants of health (SDOH) are the conditions in which people are born, grow, live, work and age, and the wider set of forces and systems shaping the conditions of daily life.¹ Healthcare providers must have SDOH competence to identify and address patients at risk of poor health outcomes due to SDOH.²⁻³ Competence includes being knowledgeable, feeling prepared, having the skills, and understanding the resources available to address SDOH needs in practice.⁴ The purpose of the present study was to develop and validate a scale for appraising health care providers' competence in addressing SDOH challenges in practice. Of note, in the current study, healthcare providers is a term used to represent both behavioral health and medical health providers. A scale of this nature can be used by healthcare systems to strategically develop a workforce able, prepared, and competent to address SDOH.

Competence

SDOH competence and understanding the relationship to health and wellbeing is critical for a practitioner to address SDOH needs in practice.⁴⁻⁵ Research has shown that physicians continue to lack sufficient training in SDOH, which minimizes their ability to address SDOH needs in practice.⁴ In a qualitative study of pediatric nurse practitioners, observers found that the trainees were able to identify some social health needs but very few intervened.⁶ Feedback from the 2 cohorts of pediatric nurse practitioners (N = 36) found that trainees expressed discomfort in asking SDOH questions that they deemed sensitive and they experienced difficulty in negotiating their priority to address the medical need versus the non-medical social health need.⁶ In a study of civil servants (N = 153), researchers found that only 50% of the respondents were familiar with SDOH, 83% indicated they need more information on effective intervention strategies.⁷ Similarly, another study in Canada investigated the relationship between understanding and attitudes toward SDOH with people who worked at community based organizations.⁸ Results found that support for addressing health inequalities was associated with increased awareness of SDOH and a broad view of the influence of SDOH on overall health and wellness.⁸

Lastly, healthcare systems are eager to effectively address SDOH needs of patients because of the positive impact on population health, healthcare cost, and overall patient experiences.⁹ Healthcare systems are applying frameworks for addressing SDOH, engaging in community collaboration and cross sector partnerships, and using technology for interventions, all to improve health equity and minimize health disparities.⁹⁻¹² However, workforce readiness to address SDOH is a primary driver of program success and better patient outcomes.¹¹ To address workforce readiness, there is a need for a scale to measure provider SDOH competence. Currently, there are no known scales that assess providers competence to address SDOH in practice.

The Current Studies

The of purpose the present study was to develop and validate a SDOH competency assessment for healthcare providers. Competence is related to education and learning, and the scale is developed based on a model of interprofessional education created by the Institute of Medicine (IOM)¹³ along with the Multicultural Counseling Competencies and Standards.¹⁴⁻¹⁵ The research questions include: (1) What is the factor structure and reliability of the ACN: SDH? (2) Is the emergent factor structure of the ACN: SDH confirmed in a second sample?

Methods

Procedures

Data collection began after IRB approval in Fall of 2019 for Study 1(EFA) and Spring of 2020 for Study 2 (CFA). Participants were recruited using an email list of health providers, organizations, and through health professional organization listservs. The following inclusion criteria was used to recruit and select participants for the study: (1) Foundation education in a healthcare field, (2) Professional identity as a

healthcare provider practicing, (3) Experience with healthcare practice as a provider, and (4) over 18. The informed consent from study participants was written. The survey started with a consent form that described the purpose of the study and associated risk, followed by the demographic questionnaire, and the scales.

Participants

Study 1 was completed by 220 participants; full results are in Table 1. As a summary, the largest responses were in the following categories: Females 78.6% (n = 173), White 66.4% (n = 146), residing in the Southeast 29.1% (n = 64), and identifying as mental/behavioral health service professionals 63.2% (n = 139). Study 2 was completed by 303 participants; full results are in Table 1. As a summary, the largest responses were in the following categories: Females 80.5% (n = 244), White 52.8% (n = 160), residing in the Southeast 40.9% (n = 124), and primarily identifying as a mental/behavioral health provider 50.2% (n = 152).

Table 1
Demographics for study 1 and study 2

Study 1 (N = 220)	Study 2 (N = 303)			
Gender				
	N	%	N	%
Female	173	78.6	244	80.5
Male	44	20	54	17.8
Non-Binary	3	1.4	5	1.6
Racial-Ethnic Identity				
Asian	7	3.2	8	2.6
African American/Black	32	14.5	85	28.1
Hispanic/Latinx	30	13.6	35	11.6
White	246	66.4	160	52.8
Multiracial	5	2.3	12	4
Native Hawaiian/Pacific Islander/American Indian	-	-	3	1
Region of the United States				
Northeast	49	22.3	61	20.1
Southwest	42	19.1	47	15.5
West	30	13.6	31	10.2
Southeast	64	29.1	124	40.9
Midwest	30	13.6	30	9.9
Unknown	-	-	10	3
Interprofessional Group of Health Care Providers				
Mental/Behavioral Health Providers	139	63.2	152	50.2
Medical Health Providers	23	10.5	93	30.7
Healthcare Educators	48	21.8	39	12.9
Other Primary Work Industry	10	4.5	18	5.9

Instruments

The Addressing Client Needs with SDH survey (ACN: SDH). Best practice guidelines for scale development were followed ¹⁶, including developing an initial set of items and checking face validity using an expert panel. An initial set of 163 items was created based on the theoretical foundation, recurring themes in the literature, and expert input. The expert panel members participated in three review rounds, and it resulted in 45 items and 94% agreement on the retained items included on the ACN: SDH scale. The scale included items that covered SDOH self-awareness and attitudes, knowledge, skills, and behaviors. The items are scored on a 5-point Likert scale, with 5-strongly agree, 4-agree, 3-neither agree nor disagree, 2-disagree, and 1-strongly disagree. Lower scores indicate less SDOH competency. Study 1 included 45 items, those items were reduced, and Study 2 included 22 items. Access to the full scale is included in a supplementary file connected to this manuscript.

Healthcare Workers Cultural Competency (EMCC). ¹⁹ This scale is a 14-item instrument designed to measure healthcare workers cultural competence. The scale has 3 subscales: sensitivity to own prejudices, cultural knowledge, and skills to work in culturally diverse environments. Responses are collected using 5 response categories: 1-Totally disagree, 2-disagree, 3- neither agree nor disagree, 4-agree, and 5-totally agree. Example questions include, “I believe patients’ beliefs, values, and customs affect their health” and “I am able to set therapeutic goals and/or objectives considering the cultural context (beliefs and customs) of my patients and their needs”. This scale was used in Study 2, and it had a Cronbach alpha of .901.

Results

Study 1. Exploratory Factor Analysis and Initial Reliability

The 45 items of the ACN:SDH scale were subjected to principal components analysis (PCA) using SPSS version 18. Prior to performing the PCA, the suitability of the data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of .3 and above. The Kaiser-Meyer-Olkin value was .920, exceeding the recommended value of .6 ¹⁷ and Bartlett’s Test of Sphericity¹⁸ reached statistical significance, supporting the factorability of the correlation matrix ($t(\chi^2(990) = 6960.55, p = .000)$).

Principal components analysis, initially revealed the presence of 9 components with eigenvalues exceeding 1, explaining a total of 69% of the variance. Inspection of the scree plot revealed the presence of 6 components; however, solutions for 4, 5, and 6 factors were each examined using varimax and oblimin rotations of the factor loading matrix. The 6-factor solution explained a total of 61% of the variance, and it was preferred because of: (a) theoretical relevance and (b) eigenvalues on the scree plot leveled off after 6. The varimax solution was used in subsequent analyses because the component transformation matrix had small values (.220) indicating that components are not highly correlated which is the underlying hypothesis of the varimax solution. Lastly, a total of 20 items were eliminated because they either did not contribute to a simple factor structure and failed to meet a minimum criterion of having primary factor loadings of .4 or above, along with no cross-loadings of .3 or above.

Finally, a principal components analysis, using varimax rotation was used on the 25-item ACN:SDH scale constrained and a 6-factor solution was revealed, explaining 61% of the variance. Factor 1 contained 6 items that represented *Action Toward Addressing SDOH* and accounted for 33.96% of the variance. Factor 2 contained 6 items that represented *SDOH Knowledge* and accounted for 8.01% of the variance. Factor 3 contained 3 items, that represented *Negative Attitude toward Addressing SDOH* and accounted for 5.86% of the variance. Factor 4 contained 3 items that represented *Systemic Accountability* and accounted for 5.35% of the variance. Factor 5 contained 4 items that represented *Perception of the cause of SDOH* and accounted for 4.04% of the variance. Factor 6 contained 3 items that represented *School Preparation* and accounted for 4.19% of the variance.

Table 2. Exploratory and Confirmatory Factor Analysis Matrix for the SDH Provider Competency Scale

	Component						CFA
	1	2	3	4	5	6	
Factor 1: Action Toward Addressing SDOH (AC 1-6)							
b4 I have reviewed policy to address SDOH	.752	.112	.128	.102	.168	-.044	.819*
a6 I am aware of national grants to support SDOH R, IN, P	.709	.190	-.045	-.018	-.057	-.037	.594*
a7 I am aware of a questionnaire I can use to screen a client for SDOH needs	.683	.027	.087	.152	.138	-.011	.643*
b5 I have built relationships with community partners to address SDOH	.659	.114	.230	.012	.136	.087	.675*
s4 I am competent in tracking a clients health outcomes that are influenced by SDOH	.647	.161	.165	.089	.258	.118	.775*
b3 I have used the SDOH framework to address SDOH with clients	.624	.071	.252	.173	.213	.044	.661
Factor 2: SDOH Knowledge (KN 7-12)							
k4 I am knowledgeable about the relationship b/w SDOH & behavioral health	.105	.791	.290	.132	.154	.082	.839*
k2 I am knowledgeable about the relationship b/w SDOH & health	.182	.782	.166	.134	.115	.010	.865*
k3 I am knowledgeable about the relationship b/w SDOH and chronic diseases	.264	.779	.106	.180	.043	-.003	.840*
k6 I am knowledgeable about the relationship b/w SDOH and health promotion	.257	.775	.133	.208	.060	.025	.903*
k1 I am knowledgeable about the drivers of health and mental health	.068	.774	.155	.165	.167	.017	.880*
k7 I am knowledgeable about the relationship between SDOH and resiliency	.314	.719	.168	.084	.104	-.006	.841
Factor 3: Negative Attitude toward Addressing SDOH (NA 13-15)							
att2r It is not my role to address SDOH in practice	.091	.059	.726	.083	-.095	-.152	.921*
att7r Unmet SDOH needs does not impact the work I do with clients	-.098	.115	.639	.115	-.182	-.146	.859*
att1r It is not practical for me to address SDOH in practice	.208	.022	.612	.010	-.045	-.131	.515
Factor 4: Systemic Accountability (SA 16-18)							
att9 I think SDOH should be addressed at the societal level (i.e. policy)	.064	.350	.116	.738	.054	-.015	----
ap1 The shortage of government assistance is a cause of adverse SDOH	.209	-.012	-.032	.735	.068	-.038	.779*
ap2 Unequal educational opportunities is a cause of adverse SDOH	.103	.073	.129	.766	-.015	-.054	.884
Factor 5: Perception of the cause of SDOH (PC 19-22)							
ap3r Irresponsible behavior on the part of individual people is a cause of adverse SDOH	.098	-.055	.178	.355	-.707	-.162	----
ap4r Poor decision making on the part of individual people is a cause of adverse SDOH	.080	-.018	.205	.343	-.738	-.169	----
ap5 Mental illness and or substance abuse is a cause of adverse SDOH	.212	.000	.090	.187	.776	-.212	.950*
ap6 Physical illness and disability is a cause of adverse SDOH	.226	.009	.129	.316	.728	-.172	.932
Factor 6: Preparation (WK 23-25)							
p2 Practicum and internship prepared me to address SDOH in practice	.198	.152	.053	.061	-.056	.826	.825*
p1 The coursework in my program prepared me to address SDOH in practice	.233	.191	-.022	.003	-.029	.791	.844*
p3 Interprofessional collaboration training during my degree program	.303	.074	-.006	.105	-.002	.743	.803

Note. Bold values indicate the highest factor loading for each item; CFA factor loadings significant at the $p < .01 = *$; Reverse-scored item = r.

Reliability analysis

The Cronbach alpha reliability estimate for the 25-item total scale was .809. Item total correlations ranged from $r = -.28$ to $r = .88$ with a mean item-total correlation of $r = .25$. The 6 subscales demonstrated the following satisfactory internal consistency estimates: Factor 1, ($\alpha = .844$); Factor 2, ($\alpha = .923$); Factor

3, ($a = .741$); Factor 4, ($a = .793$); Factor 5, ($a = .867$); and Factor 6, ($a = .373$). The study 1 results showed that the 25-item SDH: ACN has 6 dimensions which is concordant with the theoretical model.

Study 2. Confirmatory Factor Analysis

The purpose of Study 2 was to confirm the dimensionality and evaluate the nomological network of the ACN: SDH. Confirmatory factor analysis was conducted using maximum likelihood estimation as implemented in SPSS 28 AMOS. Table 2 shows the CFA model comparisons; in the first model, all 25 items were allowed to load on a single factor (SDH provider competence). The second model is a first order orthogonal model where all items are loaded on the defined dimensions from the EFA (i.e., the 6 factors) and these dimensions were not correlated. The third model is the same as the second model except the 6 factors were allowed to correlate (i.e., oblique). The fourth model is a second order model in which all items were allowed to load on their defined dimensions and all dimensions loaded on a second order factor of 'SDH provider competence'. All 4 models showed poor model fit; 3 indicators were identified as having a modification index larger than 20 causing the poor model fit. The items deleted included AP3, AP4, and ATT9. The fifth model is a first order oblique model where all items are loaded on the defined dimensions (i.e., 6 factors); this model showed acceptable model fit. The fit indices for each model are presented in Table 3. MLR was used to estimate model parameters and goodness-of-fit of all the CFA models was examined with: $RMSEA \leq 0.06$ (90% CI ≤ 0.06), $SRMR \leq 0.08$, $CFI \geq 0.90$, and $TLI \geq 0.90$.²⁰⁻²¹ Additionally, the chi-square/df ratio ≤ 3 rule was also used.²²

Model 5 first order oblique 6 factor model showed better fit than the other models. Fitting the oblique model indicates that specific domains of provider SDOH competency are not interrelated. The chi square, CFI, RMSEA, and SRMR values indicate good to reasonable fit of model 5 ($\chi^2 = 460.281$, $df = 194$, $CFI = .937$, $RMSEA = .067$, $SRMR = .0475$). The factor loadings for the preferred first order model (i.e., model 5) are presented in Table 3.

Table 3
Fit Indices for Confirmatory Factor Analysis of the ACN: SDH

Model	χ^2	df	CFI	RMSEA (90%CI)	SRMR
Model 1: One factor model	2947.2	275	.454	.17 [.161, .178]	.1461
Model 2: First-order orthogonal six factor model	1071.9	260	.834	.10 [.095, .108]	.0864
Model 3: First order oblique six factor model	1101.8	269	.830	.10 [.095, .108]	.0916
Model 4: Second order factor model	1223.8	274	.806	.10 [.101, .113]	.1633
Model 5: First-order oblique six factor model (22 items)	460.281	194	.937	.067 [.059, .075]	.0475
<p><i>Note.</i> ACN:SDH = Social Determinants of Health Provider Competency Scale; CFI = comparative fit index; RMSEA = root mean square error of approximation; 90% CI = 90% Confidence Interval for RMSEA (lower limit, upper limit); SRMR = standardized root mean square residual.</p>					

Reliability analysis

Internal consistency estimates of the ACN: SDH total score and subscale scores for Study 2 were high. The Cronbach alpha reliability estimate for the 22-item total score was .867. Item total correlations ranged from $r = -.27$ to $r = .89$ with a mean item-total correlation of $r = .23$. The 6 subscales demonstrated satisfactory internal consistency estimates, listed in Table 4: Factor 1, ($\alpha = .848$); Factor 2, ($\alpha = .944$); Factor 3, ($\alpha = .790$); Factor 4, ($\alpha = .808$); Factor 5, ($\alpha = .863$); and Factor 6, ($\alpha = .940$). The total 22 item scale demonstrated satisfactory internal consistency. Study 2 results indicate that the 22-item ACN: SDH has 6 dimensions which is concordant with the theoretical model.

Scoring. The ACN: SDH items are scored on a scale from 1 to 5, with items with a 'r' being reversed-coded. The mean scores and standard deviations for the total 22 item ACN:SDH scale and subscale scores are presented in Table 4. Lower scores indicate less competency.

Table 4
Descriptive statistics and alpha for 22 item ACN:SDH (Study 2)

	Mean	Min	Max	SD	Cronbach alpha	EMCC Correlation
Measure						
ACN:SDH total scale	77.73	42.00	102.00	11.46	.867	.473**
AC	18.89	6	30	4.99	.848	.292**
KN	25.05	6	30	4.74	.944	.410**
NA	12.05	3	15	2.58	.790	.387**
SA	7.85	2	10	1.78	.808	.440**
PC	4.24	2	10	1.81	.940	-.264**
WK	9.63	3	15	2.98	.863	.237**
<i>Note. **=correlation is significant at the 0.01 level (2-tailed); Six subscales = AC, KN, NA, SA, PC, & WK</i>						

Convergent and discriminant validity

Pearson's correlations between the ACN: SDH and the EMCC scales are summarized in Table 4. The ACN: SDH total and 6 subscale scores showed a low to moderate positive correlation to all subscales that are conceptually similar in content, which shows convergent validity. Discriminant validity is indicated by the inverse relationship between the EMCC and the ACN: SDH Perception subscale' which is hypothesized to be conceptually different.

Factor Invariance Analysis (FIA)

Confirmatory factor analysis was used to test whether the ACN: SDH questionnaire is equivalent among the healthcare provider groups (i.e., Behavioral/Mental health & Medical health); 4 factor models were estimated (i.e., configural, metric, scalar, and strict) and The Chi-square difference test was conducted to determine metric invariance. In terms of configural invariance, the ACN:SDH scale maintained the same number of dimensions in each group. The factor loadings and the item means were similar between the groups, supporting both metric and scalar invariance. Lastly, a chi-square difference test was conducted, which tests whether the model represents a significantly worse fit to the data than the previous model (assuming configural invariance) and the p-value is .206679, which is not significant, interpreted to mean that the metric invariance model holds.

Subgroup Analysis

Subgroup analysis was conducted using ANOVA. A one-way between group analysis of variance was conducted to explore 'healthcare provider industry' on levels of SDH competency, as measured by the ACN: SDH. Participants were divided into 4 groups according to their healthcare provider industry (Group 1: Behavioral/Mental health, $n = 152$; Group 2: Medical health services, $n = 93$; Group 3: Educators, $n = 39$; Group 4: Other, $n = 18$). There was a statistically significant difference at the $p < .01$ level in ACN: SDH scores for the 4 groups: $F(3, 301) = 6.499, p = .001$. The effect size calculated using eta squared, was .06, which is a medium effect size.²³ Post-hoc comparisons using Tukey HSD test indicated that the mean score for the Behavioral/Mental health group ($M = 80.03, SD = 10.80$) was statistically different from that of the Medical Health Services ($M = 76.09, SD = 11.49$) and Other group ($M = 69.11, SD = 14.04$). The Education group ($M = 76.67, SD = 10.40$) did not differ significantly from either group.

Discussion

The EFA (study 1) and the CFA (study 2) results supported a six-dimension SDOH provider competency scale with a total of 22 items. In addition, the total scale and the subscales showed good reliability estimates all between .79 and .94, as seen in Table 4. The scale showed good convergent and discriminant validity, interpreted to mean that the scale is measuring what it is intended to measure (i.e., SDOH competency). In addition, measurement invariance was conducted (i.e., FIA) and results suggested that the scale can be used with different healthcare provider groups, making this a highly usable and flexible measure of healthcare provider SDOH competency. It was hypothesized that the scale would measure similar constructs across healthcare providers because underlying values of healthcare providers are similar, such as patient empowerment and patient centered care.²⁴

The subgroup analysis, using ANOVA, was used to determine provider competency with SDOH. SDOH competence, includes awareness, knowledge, and having the skills to address the needs in practice or at your level of influence (i.e., civic engagement, policy, advocacy) and prior research shows that without provider competence SDOH needs fail to be addressed in practice.^{4,6} The provider participants included in the study all showed acceptable SDOH competence, scoring above or at the mean.

In terms of theoretical alignment, the 6 dimensions of the scale are aligned with the theoretical foundation of the multicultural counseling competencies¹⁵ and the Institute of Medicine's framework for understanding collaborative practice and patient outcomes.²⁵ The theoretical foundation would indicate that competency should be examined from multiple dimensions and the ACN: SDH includes 6 factors representing competency through: action (factor 1), knowledge (factor 2), attitudes (factor 3), accountability (factor 4), school preparation (factor 5), and perceptions (factor 6). These findings collectively support the validity of interpretations and inferences that can be made from the scores on the ACN:SDH scale.

Limitations that should be noted include the potential for selection bias. It is assumed that healthcare providers who completed the study voluntarily have some level of care or interest in addressing SDOH challenges. This bias toward addressing the issue could potentially lead to social desirability responses.

Additional studies are needed to contribute more evidence of construct validity. In addition, research is needed to establish test-retest reliability. Lastly, research can also focus on continued tests of measurement invariance for different healthcare provider groups or by other variables that can impact provider SDOH competency.

Implications for Healthcare System

The ACN:SDH scale, is a SDOH competency scale for healthcare providers. Using this tool to understand the gaps in provider competence can help support grant funding for training, revising healthcare curriculum, or whole organization strategic planning. Along with the direct consumer level benefits the scale can also be used in research studies that seek to understand the relationships between SDOH competency and care outcomes, especially important right now amid a Covid-19 recovery effort. Society, and its members are increasingly faced with more economic and social health challenges than before, and it is imperative that the workforce is prepared to manage and address these issues with care and competence.

Conclusion

This study reports on the development and validation of an instrument (i.e., ACN: SDH) to measure health care providers' competence in addressing SDOH challenges in practice. The results support the validity, reliability, and high comparability between healthcare provider groups. The current study contributes to the literature on healthcare providers' competence in addressing SDOH challenges in practice and provides healthcare systems a flexible and valid tool for assessing their workforce and addressing continuing education needs.

Abbreviations

SDOH – Social Determinants of Health

EFA – Exploratory factor analysis

CFA – Confirmatory factor analysis

ACN:SDH - The Addressing Client Needs with SDH survey

EMCC - Healthcare Workers Cultural Competency

Declarations

- Ethics approval and consent to participate
 - Informed consent obtained from study participants was written. Study was approved by the VCU ethics board.

- Consent for publication
 - Not Applicable
- Availability of data and materials
 - The dataset analyzed during the current study are available from the corresponding author on reasonable request.
- Competing interests
 - The author declares that they have no competing interests.
- Funding
 - Not Applicable
- Authors' contributions
 - As the sole author I was responsible for the entire study from design, data collection, analysis, and reporting.
- Acknowledgements
 - Not applicable

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