Original Paper

Understanding Whole-Person Health and Resilience During the COVID-19 Pandemic and Beyond: A Cross-sectional and Descriptive Correlation Study

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Abstract

Background: The COVID-19 pandemic has prompted an interest in whole-person health and emotional well-being. Informatics solutions through user-friendly tools such as mobile health apps offer immense value. Prior research developed a consumer-facing app MyStrengths + MyHealth using Simplified Omaha System Terms (SOST) to assess whole-person health. The MyStrengths + MyHealth app assesses strengths, challenges, and needs (SCN) for 42 concepts across four domains (My Living, My Mind and Networks, My Body, My Self-care; eg, Income, Emotions, Pain, and Nutrition, respectively). Given that emotional well-being was a predominant concern during the COVID-19 pandemic, we sought to understand whole-person health for participants with/without Emotions challenges.

Objective: This study aims to use visualization techniques and data from attendees at a Midwest state fair to examine SCN overall and by groups with/without Emotions challenges, and to explore the resilience of participants.

Methods: This cross-sectional and descriptive correlational study surveyed adult attendees at a 2021 Midwest state fair. Data were visualized using Excel and analyzed using descriptive and inferential statistics using SPSS.

Results: The study participants (N=182) were primarily female (n=123, 67.6%), aged ≥45 years (n=112, 61.5%), White (n=154, 84.6%), and non-Hispanic (n=177, 97.3%). Compared to those without Emotions challenges, those with Emotions challenges were aged 18-44 (P<.001) years, more often female (P=.02), and not married (P=.01). Overall, participants had more strengths (mean 28.6, SD 10.5) than challenges (mean 12, SD 7.5) and needs (mean 4.2, SD 7.5). The most frequent needs were in Emotions, Nutrition, Income, Sleeping, and Exercising. Compared to those without Emotions challenges, those with Emotions challenges had fewer strengths (P<.001), more challenges (P<.001), and more needs (P<.001), along with fewer strengths for Emotions (P<.001) and for the cluster of health-related behaviors domain concepts, Sleeping (P=.002), Nutrition (P<.001), and Exercising (P<.001). Resilience was operationalized as correlations among strengths for SOST concepts and visualized for participants with/without an Emotions challenge. Those without Emotions challenges had more positive strengths correlations across multiple concepts/domains.

Conclusions: This survey study explored a large community-generated data set to understand whole-person health and showed between-group differences in SCN and resilience for participants with/without Emotions challenges. It contributes to the literature regarding an app-aided and data-driven approach to whole-person health and resilience. This research demonstrates the power of health informatics and provides researchers with a data-driven methodology for additional studies to build evidence on whole-person health and resilience.

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The Omaha System is a multidisciplinary health terminology [11] that includes three components, the Problem Classification Scheme and related signs/symptoms, the Intervention Scheme, and the Problem Rating Scale for Outcomes. The 42 problem concepts in the Omaha System are organized within four domains (environmental, psychosocial, physiological, and health-related behaviors). These were simplified in SOST as My Living, My Mind and Networks, My Body, and My Self-care (Textbox 1).

The Omaha System Problem Classification Scheme defines the 42 concepts, each of which has 3 to 18 unique taxonomically assigned signs/symptoms/challenges (Figure 1). The Problem Rating Scale for Outcomes enables measurement of strengths across all concepts. A user rates each concept using the Likert-type ordinal scale, where 1 is very bad and 5 is very good (Figure 1). A rating of 4 (minimal challenges) or 5 (no challenges) is defined as a strength. The Intervention Scheme classifies needs (actions) to address all concepts: surveillance (check-ins); treatments and procedures (hands-on care); teaching, guidance, and counseling (info/guidance); and case management (care coordination). In the MSMH app, needs are expressed in four categories: info/guidance (I could use more information about this or some guidance in deciding what to do), hands-on care (hands-on care or help), check-ins (someone to check in with me); and care coordination (help managing my appointments and connections). A screenshot of SCN assessments for the Exercising concept is portrayed in Figure 1, and Textbox 2 presents the connections across the SOST domains, concepts, strengths, challenges, and needs.

The MSMH is freely available to researchers, educators, and clinicians, and is licensed through the university [16]. MSMH data are housed in a secure computing network from which license holders may download their complete data. Studies based on the MSMH app have detailed the development and pilot testing [18], analyzed women's cardiovascular health using the app [20], described whole-person health of older adults [21], and examined local data on whole-person health and opioids in the community [22]. Recent research has analyzed MSMH data for resilience at the community level [7] and examined the feasibility of using MSMH-aided consumer-generated data for knowledge discovery [23]. Researchers have used the Omaha System data to understand whole-person health [15], characterize strengths of older adults with chronic illness [24], and examine relationships between social determinants and health disparities [25].

With the growing interest in whole-person health, emotional well-being, and strengths-based care, there is a need to build a body of evidence to demonstrate the value of informatics tools such as the MSMH app. The objectives of this research were to use visualization techniques and data from attendees at a Midwest state fair to examine SCN overall and by groups with/without Emotions challenges and explore the resilience of participants.
Textbox 1. MyStrengths + MyHealth domains and concepts.

My Living
- Income
- Cleaning
- Home
- Safe at home and work

My Mind and Networks
- Connecting
- Socializing
- Role change
- Relationships
- Spirituality or faith
- Grief or loss
- Emotions
- Sexuality
- Caretaking
- Neglect
- Abuse
- Growth and development

My Body
- Hearing
- Vision
- Speech and language
- Oral health
- Thinking
- Pain
- Consciousness
- Skin
- Moving
- Breathing
- Circulation
- Digesting
- Bowels
- Kidneys or bladder
- Reproductive health
- Pregnancy
- Postpartum
- Infections

My Self-care
- Nutrition
- Sleeping
- Exercising
- Personal care
Figure 1. MyStrengths + MyHealth app screenshots with challenges, strengths, and needs for exercising.

Textbox 2. Connecting domains, concepts, strengths, challenges, and needs in MyStrengths + MyHealth app.

Domains and number of concepts (total number of concepts: 42)
- My Living (4 concepts)
- My Mind and Networks (12 concepts)
- My Body (18 concepts)
- My Self-care (8 concepts)

Strengths (42 strengths possible/person)
- Each concept is rated on a scale of 1-5, with a 4 or 5 rating noted as a strength

Challenges (335 challenges possible/person)
- Each concept has 2-18 list of challenges

Needs (168 needs possible/person)
- Each concept has 4 needs: check-ins, hands-on care, info/guidance, and care coordination

Methods

Ethics Approval
The cross-sectional visualization survey study received approval from the university’s institutional review board (approval number: #STUDY00009465). Researchers collected deidentified data using the SOST and MSMH app.

Study Setting: Midwestern State Fair
Data collection occurred at a popular Midwest state fair event that is held over 12 days and attracts attendance of more than 2 million annually. This study was conducted in August and September 2021. Participants self-selected to participate in the study. Participation was restricted to adults (18 years or older) who could complete the MSMH app in English. An informed consent was displayed in the app; participants agreed to reuse their anonymous data for research prior to completing the assessment. They completed the MSMH assessment on university-owned iPads. Participants were given a university-branded drawstring backpack (US $1.79 value) as an incentive for participation. At the end of the assessment, a unique code was displayed that participants could use to download a summary of their responses. The link to download the summary along with the participants’ unique code was provided to each participant in a business card format.
Appropriate COVID-19 protocols were followed: masks were mandatory, iPads were sanitized after every use, and hand-sanitizing lotions were available in multiple places.

**Study Tool: MSMH App**

As displayed in Figure 1, the MSMH app presents SCN for each concept as previously described using the SOST [21,23]. If all concepts are rated, there would be a total of 42 strengths, 335 challenges, and 168 needs. Of these, 37 concepts were chosen for analysis based on the study objectives and the setting/sample, excluding 5 concepts that did not apply to the majority of participants (Pregnancy, Postpartum, Family Planning, Consciousness, and Growth and Development). The total time to complete the assessment was approximately 15 minutes per user.

**Study Approach and Data Analysis**

Data were stored in a secure computing environment hosted by the university. Data were analyzed using visualization techniques in Excel (Microsoft Corporation), and descriptive and inferential statistics were analyzed using SPSS (IBM Corp).

For aim 1, the overall SCN were examined for all participants using descriptive statistics and parallel coordinates visualization techniques [7,26]. Two cohorts were then formed for participants with one or more Emotions challenges and those without Emotions challenges. SCN were compared using independent sample t tests and parallel coordinates visualization techniques. In examining whole-person health and the Emotions concept using data visualization techniques, a novel cluster of health-related behaviors domain concepts (Sleeping, Nutrition, and Exercising) were uncovered and were examined in detail. In addition, bubble charts were created to visualize relationships among SCN across the four domains (My Living, My Mind and Network, My Body, and My Self-care).

For aim 2, to examine resilience, a correlational analysis was conducted on the strengths of participants with and without Emotions challenge. Co-occurrences of various strengths across the 37 study concepts were analyzed using the Pearson correlation coefficient. The resulting correlation matrix was conditionally formatted in Excel with blue (most correlated), white (midrange), and red (least correlated).

**Results**

**Overview**

The study participants (N=182) were primarily female (n=123, 67.6%), aged ≥45 years (n=112, 61.5%), White (n=154, 84.6%), and non-Hispanic (n=177, 97.3%). Almost half of the respondents indicated their marital status as married (n=84, 46.2%). The demographics of participants by age, gender, race, ethnicity, and marital status with and without Emotions challenges are presented in Table 1. Compared to those without Emotions challenges, those with Emotions challenges were aged 18-44 years (P<.001), more often female (P=.04), and not married (P=.02). The Emotions challenges identified by participants are highlighted in Table 2, with tired (n=69) and hard to manage my stress (n=46) identified as the top two challenges.

| Table 1. Demographics of participants: overall and by group with and without an emotions challenge. |
|-------------------------------------------------------|--------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Sample characteristic | Sample (N=182), n (%) | Without an Emotions challenge, n (%) | With an Emotions challenge, n (%) | Difference by characteristic and the emotions challenge | Chi-square (df) | P value |
| Age (years) | | | | | | |
| 18-44 | 70 (38.5) | 18 (9.9) | 52 (28.6) | 14.49 (1) | <.001 |
| 45 to ≥65 | 112 (61.5) | 61 (33.5) | 51 (28.0) | | |
| Gender | | | | | | |
| Female | 123 (67.6) | 47 (25.8) | 76 (41.8) | 4.17 (1) | .04 |
| Male/other | 59 (32.4) | 32 (17.6) | 27 (14.8) | | |
| Race | | | | | | |
| White | 154 (84.6) | 70 (38.5) | 84 (46.2) | 1.71 (1) | .19 |
| All other | 28 (15.4) | 9 (4.9) | 19 (10.4) | | |
| Ethnicity | | | | | | |
| Non-Hispanic/ non-Latinx | 177 (97.3) | 77 (42.3) | 100 (54.9) | 0.02 (1) | .88 |
| Hispanic/Latinx | 5 (2.7) | 2 (1.1) | 3 (1.6) | | |
| Marital status | | | | | | |
| Married | 84 (46.2) | 44 (24.2) | 40 (22.0) | 5.12 (1) | .02 |
| Other marital categories | 98 (53.8) | 35 (19.2) | 63 (34.6) | | |
Table 2. Emotions challenges identified by participants.

<table>
<thead>
<tr>
<th>Emotions challenges in participants</th>
<th>Participants, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tired</td>
<td>69</td>
</tr>
<tr>
<td>Hard to manage my stress</td>
<td>46</td>
</tr>
<tr>
<td>Hard to concentrate</td>
<td>31</td>
</tr>
<tr>
<td>Nothing excites me</td>
<td>27</td>
</tr>
<tr>
<td>Mood swings</td>
<td>23</td>
</tr>
<tr>
<td>Very sad, hopeless</td>
<td>16</td>
</tr>
<tr>
<td>Not interested in taking care of myself</td>
<td>16</td>
</tr>
<tr>
<td>Fearful</td>
<td>14</td>
</tr>
<tr>
<td>Hard to not repeat things I do</td>
<td>13</td>
</tr>
<tr>
<td>Strongly annoyed and acting out</td>
<td>11</td>
</tr>
<tr>
<td>Angry</td>
<td>8</td>
</tr>
<tr>
<td>Flashbacks</td>
<td>7</td>
</tr>
<tr>
<td>Hard to understand real life</td>
<td>6</td>
</tr>
<tr>
<td>See or hear things that others cannot</td>
<td>4</td>
</tr>
<tr>
<td>I think about killing myself or others</td>
<td>5</td>
</tr>
<tr>
<td>Self-harm</td>
<td>5</td>
</tr>
</tbody>
</table>

Aim 1: Overall Strengths, Challenges, Needs, and With/Without Emotions Challenges

Figure 2 presents the overall SCN of participants.

Figure 2. Overall strengths, challenges, and needs.

Strengths

Participants had an average of 28 strengths (mean 28.6, SD 10.5). Home (n=152, 83.5%) and Safe at Home and Work (n=152, 83.5%) were the two concepts with the most strengths.

Challenges

Participants had an average of 12 challenges (mean 12, SD 7.5). Common challenges were Nutrition (n=129, 70.9%), followed by Exercising (n=109, 60.4%) and Sleeping (n=106, 58.2%). Figure 2 displays the challenges (red line) exceeding the
strengths (green line) for this cluster of health-related behaviors domain concepts. Over half (n=103, 56.6%) of the participants had one or more challenges in the Emotions concept.

**Needs**

Participants had an average of 4 needs (mean 4.2, SD 7.5). The Emotions concept had the most needs, with info/guidance being the common need for this concept (Figure 3). One out of five (n=35, 19.2%) participants identified a need related to Emotions. Overall, the top five needs were in Emotions, Nutrition, Income, Sleeping, and Exercising (Figure 3).

Overall, participants had more strengths than challenges and needs (Table 3). Compared to those without Emotions challenges, those with Emotions challenges had fewer strengths, more challenges, and more needs than those without Emotions challenges (P<.001 for all; Table 3).

The analysis of strengths across concepts and by group with/without Emotions challenge showed that the group without emotions challenge (indicated in green in Figure 4) had more strengths across all concepts. Compared to those without Emotions challenges, those with Emotions challenges had fewer strengths for Emotions (P<.001) and for the cluster of health-related behaviors domain concepts: Sleeping (P=.002), Nutrition (P<.001), and Exercising (P<.001).

**Figure 3.** Most frequent needs by concepts.

The analysis of needs showed more needs for all concepts in the group with Emotions challenges (Figure 6). Compared to those without Emotions challenges, those with Emotions challenges had more needs for Emotions (P<.001), and health-related behaviors domain concepts: Sleeping (P=.002), Nutrition (P<.001), and Exercising (P<.001).

Additional visual analysis was conducted across the four MSMH domains to understand whole-person health by domain and concept using bubble charts (Figure 7) in which larger bubble size indicated more challenges; being on the left end of the x-axis showed fewer strengths and on the higher end of the y-axis showed greater needs. This is much more pronounced for the group with Emotions challenges (red bubbles) as shown in Figure 7. The combined patterns of location on the two axes and the bubble size show pronounced difference by problem: bubble size and location were notably larger, higher, and more left for Income in the My Living domain; Emotions and Socializing in the My Mind and Networks domain; vision and thinking in My Body; and Sleeping, Nutrition, and Exercising in My Self-care.

**Figure 4.** Strengths by concept.

**Figure 5.** Challenges by concept.

**Figure 6.** Needs by concept.

**Figure 7.** Bubble chart analysis.
### Table 3. Strengths, challenges, and needs: overall and by group with and without an emotions challenge.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Overall (N=182), mean (SD)</th>
<th>Without an Emotions challenge (n=79), mean (SD)</th>
<th>With an Emotions challenge (n=103), mean (SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strengths</td>
<td>28.6 (10.5)</td>
<td>32 (9.6)</td>
<td>26 (10.4)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Challenges</td>
<td>12 (7.5)</td>
<td>6.7 (3.9)</td>
<td>16.2 (7.0)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Needs</td>
<td>4.2 (7.5)</td>
<td>1.4 (2.4)</td>
<td>6.3 (9.2)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

**Figure 4.** Strength by concept and by group with and without an Emotions challenge.

**Figure 5.** Challenges by concept and by group with and without Emotions challenges.
Aim 2: Characterize Resilience for Groups With and Without an Emotions Challenge

The correlational analysis to identify associations in strengths for participants with and without Emotions challenges are presented in Figures 8 and 9, respectively. A higher correlation indicates co-occurrence of strengths [7,27]. A total of 666 boxes are displayed for strength correlations with Emotions challenges and likewise for without Emotions challenges. A red box is an indicator of less correlation and a blue box is an indicator of high correlation, with the white box being in between. For those with Emotions challenges, 22.5% (n=150) are blue boxes out of the total of 666 boxes, and for those without Emotions challenges, 51.7% (n=344) are blue boxes. As shown in Figures 8 and 9, the correlations among concepts are less strong for those with Emotions challenges (more red boxes) and stronger for those without Emotions challenges (more blue boxes indicating more and greater positive correlations). The correlation matrix for the group without an Emotions challenge depicts strengths that extend across concepts/domains as indicated by the blue boxes that span horizontally and vertically.
Findings and Implications

In this descriptive correlational study, SCN data from participants in a Midwest state fair over August-September 2021 were examined using visualization techniques. Overall, participants had more strengths than challenges and more challenges than needs. The data visualization techniques used to examine whole-person health and the Emotions concept revealed a novel cluster of health-related behaviors (My Self-care) domain concepts (Sleeping, Nutrition, and Exercising) with fewer strengths and more challenges and needs. This aligns with the association between sleep, physical activity, and diet during COVID-19 [28-30]. Furthermore, differences in SCN for Sleeping in groups with/without an Emotions challenge aligns with prior research on the impact of sleeping on overall mental health [31,32]. It is notable that more than half of the participants had challenges in the Emotions concept. That those with Emotions challenges had fewer strengths and more...
challenges and needs across all concepts underscores the importance of a whole-person health perspective. Further research is needed to understand nuances related to SCN across and among these concepts in respect to whole-person health.

The finding that more than half of the participants had challenges in the Emotions concept underscores the impact and emotional toll of the pandemic. This aligns with the evidence that emotional issues such as depression, anxiety, and suicidal thoughts have increased since 2020 [2]; for example, the number of US adults who reported symptoms of anxiety or depression in January 2021 increased 4 times compared to June 2019 [2]. The How Right Now communications campaign by the Centers for Disease Control and Prevention [2] aims to promote and strengthen the emotional well-being and resilience of people affected by stress, grief, and loss during the COVID-19 pandemic. Data on whole-person health such as those offered by this study has the potential to provide a quantitative data perspective to add to the qualitative lived experiences/narratives being shared as part of this initiative.

The finding that those with Emotions challenges also had many strengths is promising; and it is important to identify these as a tool to help understand and potentially bolster resilience. These findings align with prior strength-oriented studies [14,15,33-35]. Strengths can be used as tools to counter challenges, as an individual who has strength in Socializing or Spirituality or Faith is more likely to use social support systems to mitigate challenges related to concepts such as Emotions, Relationships, or Grief or loss and use these as their mechanisms to preserve and heal and, hence, build resilience [36,37].

The finding that those with Emotions challenges have fewer strengths and more challenges and needs across all four domains compared to those without Emotions challenges aligns with the literature regarding the impact of mental health on all of health [38,39]. Results align with prior studies that health and disease are a dynamic interconnected state with a ripple effect on other aspects of health [3,40]. Tools such as SOST and MSMH can provide a whole-person assessment and identify areas of strengths to leverage and help boost resilience. The SOST terminology within the MSMH app enabled comparisons across communities and clinical data [7,22], and has been used to analyze community-level resilience [7]. Given the potential for assessment at the individual and community level, powerful tools such as SOST and the MSMH app should be adopted within EHRs and personal health records to generate meaningful data for population health management.

This study examined standardized whole-person data using an app-aided and data-driven approach, quantifying SCN of individuals across all of health (environmental, psychosocial, physiological, and health-related behaviors domains). Examining SCN data for groups with and without Emotions challenges revealed patterns in overall health and for important health-related behaviors concepts. This study lays a foundation for numerous research opportunities, such as metric development to measure resilience and the use of SOST and MSMH in clinical care settings to reframe health care encounters in a whole-person perspective.

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Conflicts of Interest
None declared.

References


Abbreviations

EHR: electronic health record
MSMH: MyStrengths + MyHealth
SCN: strengths, challenges, and needs
SNOMED CT: Systemized Nomenclature of Medicine–Clinical Terms
SOST: Simplified Omaha System Terms


