

# Exploring Age-Related Differences in Mental Health Among Medical Laboratory Professionals

**Brandon Djukic**

Canadian Society for Medical Laboratory Science

**Rosina Mete**

[rmete@yorkvilleu.ca](mailto:rmete@yorkvilleu.ca)

Yorkville University

**Youcef Khelladi**

University of Alberta

**Elizabeth Kwong**

University of Alberta

**Christine Nielsen**

Canadian Society for Medical Laboratory Science

---

## Research Article

**Keywords:** medical laboratory professionals, workplace, age, mental health, Canada

**Posted Date:** October 23rd, 2026

**DOI:** <https://doi.org/10.21203/rs.3.rs-11028760/v1>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

**Additional Declarations:** Competing interest reported. Article development: This article was developed from analyses conducted by master's students as part of a placement. Organizational affiliation: Two of the authors are employees of the organization involved in data collection. Previous consultancy: The second author previously provided consulting services to the organization on projects unrelated to this article.

---

# **Exploring Age-Related Differences in Mental Health Among Medical Laboratory Professionals**

Brandon Djukic<sup>1</sup>, Rosina Mete corresponding author<sup>2</sup>, Youcef Khelladi<sup>3</sup>, Elizabeth Kwong<sup>3</sup>,  
Christine Nielsen<sup>1</sup>

1

CSMLS

33 Wellington St. North

Hamilton, Ontario Canada

L8R 1M7

brandond@csmls.org

ChristineN@csmls.org

## **2 corresponding author**

Yorkville University

Faculty of Behavioural Sciences

Yorkville Landing,

Suite 102 100 Woodside Lane

Fredericton, New Brunswick Canada

E3C 2R9

rmete@yorkvilleu.ca

3

University of Alberta

Department of Laboratory Medicine and Pathology

5-411 Dianne and Irving Kipnes Health Research Academy

11405 87 Avenue NW

Edmonton Alberta Canada T6G 1C9

### **Abstract**

Medical laboratory professionals experience substantial workplace stressors, yet little is known about how mental health varies across age groups. This study examined the relationship between age and mental health using data from national Canadian surveys of laboratory professionals conducted in 2023 and 2025. Participants were categorized into nine age groups. Mental health outcomes were assessed using the Maslach Burnout Inventory–General (MBI), the Mental Health Inventory, and the Kessler Psychological Distress Scale (K6). Age-related differences were evaluated using the Kruskal–Wallis test, followed by Dunn’s post hoc test. The results revealed significant and nonsignificant age-related differences that varied according to the psychometric instrument used and the survey year. Overall, the findings suggest that age does not uniformly influence psychological distress or mental health; rather, it shapes how distress is experienced and expressed across different age groups. These findings have important implications for developing targeted mental health interventions and supporting long-term workforce retention, particularly among younger professionals.

**Keywords:** medical laboratory professionals, workplace, age, mental health, Canada

## Introduction

This study examined the relationship between age and mental health among Canadian medical laboratory professionals (MLPs). It analyzed data from the 2023 and 2025 *Canadian Society for Medical Laboratory Science Mental Health Status of MLPs* surveys (CSMLS-MH2023, CSMLS-MH2025) studies (Author 2, 2025; Author 2 and Author 5, 2022). Additional objectives included organizing CSMLS mental health data and reviewing the literature to develop strategies for addressing mental health challenges among MLPs.

## Literature Review

Mental health has gained increasing global recognition (Peng et al., 2025). It strongly influences daily life, productivity, and quality of life. Growing occupational demands increase vulnerability to mental health challenges, while adverse conditions, such as burnout, may worsen these effects. The COVID-19 pandemic further exacerbated these challenges, causing a marked decline in mental health (Fekih-Romdhane et al., 2025; Magomedova and Fatima, 2025; Mulder et al., 2024).

Burnout is a major mental health challenge, particularly among laboratory professionals (Mulder et al., 2024). It is a persistent state of exhaustion and pessimism that is difficult to resolve. Although burnout can occur at any age, its effects vary across the lifespan (Fekih-Romdhane et al., 2025; Mulder et al., 2024). Among professionals aged  $\leq 43$  years, it can hinder career development and influence decisions to remain in laboratory work, whereas those aged  $>60$  years tend to be more resilient. Butt et al. (2025) found that younger professionals are more susceptible because they have less experience and fewer coping strategies to manage occupational stress.

Reducing burnout can improve psychological well-being, retention, and patient care, but effective strategies require identifying contributing factors. Mulder et al. (2024) examined burnout among laboratory professionals and pathologists, focusing on age-related and generational differences in prevalence, causes, and severity. Generation Z participants (aged 12–27 years) reported the highest stress levels, primarily due to heavy workloads, work-related stress, and poor work–life balance. These findings suggest that younger professionals face greater pressure due to limited work experience, high external expectations, and fewer coping mechanisms.

## Material and Methods

### Survey Design

This study used data from the 2023 and 2025 Canadian Society for Medical Laboratory Science Mental Health Status of Medical Laboratory Professionals studies (CSMLS-MH2023, CSMLS-MH2025). The study population comprised members of the Canadian Society for Medical

Laboratory Science (CSMLS). The survey assessed the mental health and well-being of medical laboratory technologists (MLTs), medical laboratory assistants (MLAs), and related professionals using selected questions from the National Institute for Occupational Safety and Health Quality of Work–Life Survey, the Maslach Burnout Inventory–General (MBI), the Mental Health Inventory (MHI), and the Kessler Psychological Distress Scale (K6). The 2025 and 2023 CSMLS mental health data were compared.

The NIOSH survey contains 76 questions on work organization, including hours, workload, autonomy, job security, satisfaction, stress, and well-being. NIOSH-specific questions were excluded from this analysis. The MBI comprises three scales: emotional exhaustion (EE), which measures work-related exhaustion; depersonalization (DP), which measures detached, impersonal attitudes toward care recipients; and personal achievement (PA), which measures feelings of competence and achievement at work. The MHI assesses mental health using 38 questions on a 6-point Likert scale. The K6 identifies serious mental illness by measuring the frequency of six distress symptoms during the previous 30 days on a 5-point Likert scale.

### **Participants**

In 2023, 939 of 12,974 CSMLS members responded; in 2025, 659 of 13,487 members responded. Respondents included MLTs, MLAs, students, managers or supervisors, and directors/educators. All respondents were older than 19 years, with a broad age distribution in both datasets.

### **Methodology**

The survey was distributed to all CSMLS members in May 2023 and May 2025 and remained open for 3 weeks. Reminder emails were sent during the second and third weeks to members who had not opened or completed the survey. The survey then closed, and no additional data were collected.

### **Statistical Analysis**

Data were entered into Microsoft Excel. Statistical analyses followed the methodology developed by Author 3 (n.d.). After categorizing the data and calculating total scores by age group, Kruskal–Wallis (KW) tests were performed in QImacro2025 to compare medians across nine age groups (KnowWare International, Inc., 2025). KW testing was appropriate because of the ordinal survey data and its suitability for comparing three or more independent groups while minimizing tied-rank effects. Significant results ( $p < 0.05$ ) were followed by Dunn’s post hoc pairwise comparisons without correction using Real Statistics (Zaiontz, 2026). Although Bonferroni correction is commonly recommended for unequal group sizes to reduce Type I error, it was not applied to preserve sensitivity and avoid increasing Type II error through overly conservative adjustment. Given the study’s exploratory nature, the analysis balanced the risks of Type I and Type II errors rather than minimizing only one.

## Qualitative Analysis

### Results

Full descriptive statistics, box plots, and complete Dunn's post hoc pairwise comparisons are provided in Appendix A (figures) and Appendix B (tables) for each subscale. Table 1 summarizes the KW results for all three instruments across both survey years, while the text below highlights the key findings. Response counts varied slightly by instrument because of section-level survey completion: in 2023, N = 751 for the MBI, N = 745 for the MHI, and N = 305 for the K6; in 2025, N = 522 for the MBI, N = 507 for the MHI, and N = 561 for the K6.

**Table 1.** Summary of Kruskal–Wallis results by instrument, subscale, and survey year across nine age groups.

| Instrument | Subscale             | Year | Median range | Overall median | KW H  | p value | Significant |
|------------|----------------------|------|--------------|----------------|-------|---------|-------------|
| MBI        | Emotional Exhaustion | 2023 | 28.00–40.00  | 37.00          | 16.14 | .040    | Yes         |
| MBI        | Depersonalization    | 2023 | 4.50–11.00   | 8.00           | 21.13 | .007    | Yes         |
| MBI        | Personal Achievement | 2023 | 30.00–33.64  | 32.00          | 9.48  | .303    | No          |
| MBI        | Emotional Exhaustion | 2025 | 30.62–36.00  | 34.00          | 10.45 | .235    | No          |
| MBI        | Depersonalization    | 2025 | 4.50–11.50   | 7.50           | 12.92 | .115    | No          |
| MBI        | Personal Achievement | 2025 | 32.00–37.00  | 33.33          | 11.94 | .154    | No          |
| MHI        | Anxiety              | 2023 | 36–64        | 52             | 58.72 | <.001   | Yes         |
| MHI        | Depression           | 2023 | 45–70        | 60             | 43.83 | <.001   | Yes         |
| MHI        | Behavior             | 2023 | 50–75        | 65             | 39.16 | <.001   | Yes         |
| MHI        | Positive Affect      | 2023 | 40–50        | 45             | 20.12 | .010    | Yes         |
| MHI        | Total                | 2023 | 46–63        | 54             | 42.23 | <.001   | Yes         |
| MHI        | Anxiety              | 2025 | 40–64        | 52             | 41.62 | <.001   | Yes         |
| MHI        | Depression           | 2025 | 50–70        | 60             | 21.62 | .006    | Yes         |
| MHI        | Behavior             | 2025 | 55–78        | 65             | 26.77 | .001    | Yes         |
| MHI        | Positive Affect      | 2025 | 45–63        | 50             | 13.36 | .100    | No          |
| MHI        | Total                | 2025 | 50–67        | 56             | 26.54 | .001    | Yes         |
| K6         | Nervous Response     | 2023 | 3–3          | 3              | 6.24  | .620    | No          |
| K6         | Hopeless             | 2023 | 2–3          | 3              | 10.05 | .262    | No          |
| K6         | Restless             | 2023 | 3–3          | 3              | 6.41  | .601    | No          |

|    |                  |      |       |    |       |       |     |
|----|------------------|------|-------|----|-------|-------|-----|
| K6 | Depression       | 2023 | 2–3   | 3  | 11.88 | .157  | No  |
| K6 | Effort           | 2023 | 3–3   | 3  | 8.47  | .389  | No  |
| K6 | Worthlessness    | 2023 | 2–3   | 2  | 12.52 | .129  | No  |
| K6 | Total            | 2023 | 15–17 | 16 | 14.23 | .076  | No  |
| K6 | Nervous Response | 2025 | 1–2   | 2  | 53.14 | <.001 | Yes |
| K6 | Hopeless         | 2025 | 1–2   | 2  | 19.53 | .012  | Yes |
| K6 | Restless         | 2025 | 2–2   | 2  | 25.53 | .001  | Yes |
| K6 | Depression       | 2025 | 1–2   | 1  | 12.36 | .136  | No  |
| K6 | Effort           | 2025 | 2–3   | 2  | 22.08 | .005  | Yes |
| K6 | Worthlessness    | 2025 | 1–2   | 2  | 10.29 | .245  | No  |
| K6 | Total            | 2025 | 7–12  | 10 | 31.83 | <.001 | Yes |

**2023 MBI.** EE was elevated across all age groups and differed significantly by age, with the oldest group (>60 years) reporting the lowest EE. Post hoc comparisons showed the largest differences between this group and all others (Appendix Table B2). DP showed the same pattern, whereas PA did not differ significantly by age.

**2023 MHI.** All five MHI subscales differed significantly by age. Anxiety, depression, behavior, positive affect, and total scores increased with age (total median: 46 for respondents aged ≤25 years vs. 63 for those aged >60 years), indicating better subjective mental health among older respondents. The largest post hoc differences were between the youngest (≤25 years) and the 51–55, 56–60, and >60 years groups (Appendix Tables B3 and B4).

**2023 Kessler Distress Scale (K6).** None of the seven K6 subscales differed significantly by age. However, the overall median total score (16/24) and the median for every age group exceeded the threshold typically used to indicate serious psychological distress (Appendix Tables B5 and B6). Distress therefore appeared uniformly elevated across the workforce regardless of age. This pattern is revisited in the Discussion.

**2025 MBI.** None of the three MBI subscales differed significantly by age. EE remained elevated across all groups, but the age gradient observed in 2023 disappeared, with no significant difference between the oldest (>60 years) and youngest groups. DP and PA also showed no significant age effect, although professionals aged 26–40 years had slightly higher EE than those aged ≥46 years (Appendix Tables B7 and B8).

**2025 MHI.** Anxiety, depression, behavior, and total scores again differed significantly by age, with respondents aged >60 years consistently reporting better scores than those aged ≤50 years.

Positive affect was the only subscale without a significant age effect, unlike in 2023 (Appendix Tables B9 and B10).

**2025 Kessler Distress Scale (K6).** Unlike in 2023, five of the seven K6 subscales differed significantly by age in 2025: nervous response, hopeless, restless, effort, and total score. Depression and worthlessness remained nonsignificant. The youngest group ( $\leq 25$  years) reported the highest total distress (median 12), and the oldest ( $> 60$  years) the lowest (median 7), with post hoc differences concentrated between these groups (Appendix Tables B11 and B12).

## Discussion

This study analyzed data collected from Canadian MLPs in 2023 and 2025 to examine the relationship between age and mental health. By comparing data collected over 2 years, it addresses a gap in understanding age-related mental health among MLPs.

### Burnout Indicators in 2023 Data

The MBI measures occupational burnout using cutoffs of high EE ( $\geq 27$ ), high DP ( $> 12$ ), and low PA ( $< 32$ ) (Bordbar et al., 2025). Burnout is indicated by high EE with either high DP or low PA (Peng et al., 2025). Analysis of the 2023 survey ( $N = 751$ ) showed high EE (median = 37.0) across all age groups. High workload, anxiety, and management-related stress may contribute to elevated EE (Peng et al., 2025). DP remained moderate (median = 8.0), and PA was moderate but near the low cutoff (median = 32.00; Appendix Table B1). Although the criteria for burnout were not fully met, elevated EE combined with borderline low PA suggests an increased risk of burnout.

The MHI measures overall psychological well-being, with higher anxiety, depression, behavior, positive affect, and total scores indicating better mental health (Ten Have et al., 2024). Scores of 75–100 indicate average mental health, 51–74 below-average mental health, and  $\leq 50$  potential mental disorder (Córdova et al., 2023). Analysis of the 2023 MHI data ( $N = 745$ ) showed below-average median scores for anxiety (52), depression (60), behavior (65), and total mental health (54). Positive affect indicated a potential mental disorder (median = 45; Appendix Table B3). Together, these findings further suggest an increased risk of burnout.

The K6 measures nonspecific psychological distress and its impact on mental health and productivity (Prochaska et al., 2012). Higher K6 scores are associated with greater burnout risk (Healey et al., 2025), and scores  $\geq 13$  indicate serious psychological distress (maximum = 24). Sato et al. (2026) reported a significant association between K6 scores and psychological distress among nurses aged approximately 36 years. Higher K6 scores are associated with anxiety and mood disorders, whereas lower scores indicate better mental health. Seeking help and experiencing fewer adverse consequences may reduce EE and disengagement, two components of burnout.

Analysis of the 2023 K6 data ( $N = 305$ ; Appendix Table B4) showed moderate to low symptom levels. Median scores were 3 (“most of the time”) for nervous response, hopeless, restless, and effort, and 2 (“some of the time”) for depression and worthlessness (Appendix Table B5). However, the overall median score of 16 (Appendix Table B5) exceeded the threshold for serious nonspecific psychological distress, indicating that respondents across all age groups were at increased risk. Together with the MBI and MHI findings, these results suggest a substantial risk of burnout among MLPs.

### **Age Factor Impact in 2023 Data**

KW analysis of the 2023 MBI data showed significant age differences for EE ( $p = 0.040$ ) and DP ( $p = 0.007$ ; Appendix Table B2), consistent with Author 3 (n.d.). No significant age difference was found for PA. The oldest group ( $>60$  years) consistently reported lower EE and DP than most younger groups. Dunn’s post hoc test showed the largest median differences between the youngest ( $\leq 25$  years) and oldest ( $>60$  years) groups. Overall, older professionals reported fewer burnout symptoms than younger professionals.

KW analysis of the 2023 MHI data showed significant age differences in anxiety ( $p < 0.001$ ), depression ( $p < 0.001$ ), behavior ( $p < 0.001$ ), positive affect ( $p = 0.010$ ; all values Appendix Table B3), and total score ( $p < 0.001$ ; Appendix Table B10). Median total scores increased from 46 ( $\leq 25$  years) to 63 ( $>60$  years) (Appendix Table B3). Dunn’s post hoc test showed that the oldest group differed significantly from several younger groups, indicating better mental health and lower psychological distress among older professionals.

KW analysis of the 2023 K6 data showed no significant age differences for nervous response ( $p = 0.620$ ), hopeless ( $p = 0.262$ ), restless ( $p = 0.601$ ), depression ( $p = 0.157$ ), effort ( $p = 0.389$ ), worthlessness ( $p = 0.129$ ), or total score ( $p = 0.076$ ; Appendix Table B6).

### **Relationship Between MBI, MHI, and K6 Subscales on Age and Mental Health in the 2023 Data**

For the MBI, age-related differences were driven by EE and DP, whereas PA showed no age effect (Appendix Table B1). EE exceeded the clinical cutoff ( $\geq 27$ ) across all age groups, but professionals aged  $>60$  years had significantly lower EE and DP than those aged  $\leq 25$ – $50$  years. These findings suggest that although exhaustion was universally elevated, older professionals experienced less severe burnout. Thus, age was significantly associated with occupational burnout in the 2023 data.

For the MHI, total and all subscale scores differed significantly by age (Appendix Table B3 and Table B4). Professionals aged  $\geq 56$  years reported better overall mental health than younger groups. Dunn’s post hoc test indicated that this association was primarily driven by anxiety, depression, and behavioral distress, whereas positive affect varied less. These findings suggest

that improved mental health with age mainly reflected reduced distress rather than greater positive emotion.

The 2023 K6 data showed no significant association between age and psychological distress (Appendix Table B6). Although median total scores in each age group met the threshold for moderate nonspecific psychological distress ( $\geq 13$ ), distress appeared widespread across all age groups.

### **Burnout Indicators in 2025 Data**

Analysis of the 2025 MBI data (N = 522; Appendix Table B7) showed high EE (median = 34.0) and moderate DP (median = 7.50) and PA (median = 33.33) across all age groups (Appendix Table B7). Moderate DP reflects increasing detachment and cynicism toward work (Peng et al., 2025), whereas moderate PA may indicate declining self-achievement and work efficiency. Lower PA may also reduce DP because of diminished personal gratitude (Leonforte et al., 2026.). Based on Maslach criteria, burnout was not indicated in 2025 (Dyrbye et al., 2009), and burnout levels were generally stable across age groups.

Younger professionals (aged 26–40 years) had slightly higher EE than those aged  $\geq 46$  years (Appendix Table B7). The oldest group (>60 years) had the lowest EE (30.62) and the highest PA (37.00).

Analysis of the 2025 MHI data (N = 507; Appendix Table B9) indicated below-average mental health, with median scores of 52 for anxiety, 62 for depression, 65 for behavior, 50 for positive affect, and 56 overall (Appendix Table B9). Similar associations between high burnout and below-average MHI scores have been reported elsewhere (Córdova et al., 2023; Martins et al., 2023).

The 2025 K6 data (N = 561; Appendix Table B11) indicated generally low psychological distress. Median scores were 2 (“some of the time”) for nervous response, hopeless, restless, and effort, and 1 (“a little of the time”) for depression and worthlessness (Appendix Table B11). The overall median score of 10 indicated a lower risk of mental disorders and suggested greater resilience among respondents.

### **Age Factor Impact in 2025 Data**

In the 2025 MBI dataset, most MLPs did not meet the criteria for burnout, showing high EE with moderate DP and PA. KW analysis found no significant age differences in EE ( $p = 0.235$ ), DP ( $p = 0.115$ ), or PA ( $p = 0.154$ ) (Appendix Table B8). Although EE, DP, and PA varied across age groups (EE: 30.62–36.00; DP: 4.50–11.50; PA: 32.00–37.00), Figures 16–18 showed narrow distributions with little skew. Younger professionals had slightly higher EE and DP, whereas older professionals had slightly higher PA, but these differences were not significant. Thus, age

did not significantly influence burnout among MLPs. Burnout remained moderate because of high EE and moderate DP and PA scores (Briongos-Figuero et al., 2026).

The 2025 MHI data indicated below-average overall mental health among Canadian MLPs (Appendix Table B9), although this did not imply uniform mental health across individuals or age groups. KW analysis identified significant age differences in anxiety ( $p < 0.001$ ), depression ( $p = 0.006$ ), behavior ( $p = 0.001$ ), and total MHI ( $p = 0.001$ ), whereas positive affect was not significant (Appendix Table B10). Figures 19–21 and 23 showed increasing scores with age. Median scores increased for anxiety (40–64), depression (50–70), and total MHI (50–67) (Appendix Table B9), indicating that age-related differences reflected reduced distress rather than greater positive well-being. Overall, professionals aged  $>60$  years consistently reported lower psychological distress.

The 2025 K6 data showed significant age differences for nervous response ( $p < 0.001$ ), hopeless ( $p = 0.012$ ), restless ( $p = 0.001$ ), effort ( $p = 0.005$ ), and total K6 ( $p < 0.001$ ), but not for depression or worthlessness (Appendix Table B12). Post hoc analysis showed that younger professionals, especially those aged  $\leq 25$  years, reported significantly higher distress than older professionals. Total median scores declined from 12 in the youngest group to 7 in the oldest (Appendix Table B11). Although all group medians remained below the threshold for serious psychological distress ( $\geq 13$ ), some individuals may still have met this criterion. Overall, distress declined with age, indicating greater vulnerability among younger professionals despite within-group variability.

### **Relationship Between MBI, MHI, and K6 Subscales on Age and Mental Health in 2025 Data**

The 2025 MBI results showed no significant age differences, indicating that age did not influence overall burnout. EE remained above the clinical cutoff ( $\geq 27$ ) across all age groups (Appendix Table B7), whereas DP and PA remained within moderate ranges. KW analysis likewise found no significant association between age and MBI subscale scores (Appendix Table B8). These findings suggest that burnout, particularly EE, was widespread and more likely driven by workplace factors than age.

The 2025 MHI results showed a significant relationship between age and mental health. Anxiety, depression, behavior, and total scores improved with age (Appendix Table B9), whereas positive affect did not differ significantly (Appendix Table B10). Dunn's post hoc test showed that professionals aged  $\leq 25$ –50 years reported significantly greater distress than those aged  $>60$  years, indicating better overall mental health among older professionals.

The 2025 K6 results also showed a significant association between age and mental health. Younger and middle-aged professionals (aged  $\leq 25$ –50 years) had higher median total scores than

those aged >60 years (Appendix Table B11). Although group medians remained below the threshold for serious psychological distress ( $\geq 13$ ), some individuals may still have exceeded it. Age-related differences were driven primarily by nervous response, hopeless, restless, and effort, whereas depression and worthlessness did not differ significantly (Appendix Table B12). These findings suggest that age-related mental health differences were concentrated in acute psychological distress rather than mood-related symptoms, making younger professionals more vulnerable to reactive workplace stress.

Overall, younger professionals experienced greater psychological distress, whereas older professionals demonstrated better mental health and resilience. Although occupational exhaustion remained common across all age groups, increasing age was associated with improved mental health despite persistent workplace exhaustion.

### **Comparison of 2023 and 2025 Data in Terms of the MBI-HSS, MHI, and K6 Subscales**

Comparison of the 2023 and 2025 data showed that the relationship between age and mental health among MLPs changed over time. Burnout was associated with age in 2023 but not in 2025. However, EE remained high in both years, indicating persistent EE across all age groups. Anxiety- and mood-related symptoms reflected by EE remained common among both younger and older professionals. In contrast, K6 results in 2025 indicated that psychological distress was concentrated among younger professionals early in their careers, although chronic and acute stress remained evident. Overall, occupational stress remained widespread, general psychological well-being improved with age, and younger professionals consistently showed greater vulnerability to distress, whereas older professionals demonstrated greater resilience. Thus, age did not uniformly affect mental health but influenced how distress was experienced across career stages.

The MBI results shifted from significant age differences in 2023 to no significant differences in 2025, suggesting burnout became more evenly distributed across age groups. Chen et al. (2025) similarly found higher burnout among less experienced professionals, whereas experience improved emotional intelligence, coping, and resilience. Likewise, Liao et al. (2024) reported a nonlinear relationship between experience and EE, with EE peaking around 8 years before declining. The 2023 findings aligned with this pattern, but by 2025, EE, DP, and PA no longer differed significantly by age, suggesting that systemic workplace stressors outweighed any protective effect of experience.

Arslanoğlu et al. (2025) likewise reported declining stress of conscience and burnout with age, consistent with the 2023 findings of lower EE and DP among older professionals. Choi et al. (2025) similarly found greater EE and DP and lower PA among professionals aged <50 years, with burnout highest among those aged 46–50 years. These findings suggest that greater professional competence, stronger coping strategies, and reduced identity insecurity may protect

older professionals. However, EE remained elevated even among older MLPs, indicating persistent chronic occupational stress.

In contrast, the 2025 dataset showed no significant age differences in EE, DP, and PA. Similarly, Popucza et al. (2025) found comparable burnout across age groups, attributing widespread exhaustion partly to “surface acting,” or suppressing emotions to meet workplace expectations. Although older professionals relied more on surface acting, burnout levels remained similar across ages. Likewise, EE remained high across all MLP age groups, suggesting that exhaustion had become a workforce-wide rather than age-specific problem.

Mental health, measured by the MHI, was consistently better among older professionals in both survey years. Similarly, the McKinsey Health Institute (2023) reported more positive mental health among adults aged  $\geq 55$  years despite declining physical health, likely reflecting stronger emotional regulation, stress management, social engagement, and resilience. These findings suggest that older MLPs better manage cumulative psychological strain.

The absence of significant age differences in the 2023 K6 results may reflect uniformly elevated distress across all age groups. This finding is consistent with Ferro (2019), who demonstrated that the K6 functions equivalently across youth and adults without measurement bias. Thus, psychological distress appeared similarly elevated across all age groups rather than varying by age.

In contrast, the 2025 K6 results showed significant age differences. Voth et al. (2022) similarly found greater psychological distress among healthcare workers aged  $\leq 55$  years during the COVID-19 pandemic using the related K10 scale. Likewise, Gresele et al. (2026) reported higher psychological distress and compassion fatigue among younger veterinarians, although age was not directly associated with suicidal intentions. Together, these findings suggest that younger professionals are more vulnerable to psychological distress, even when it does not reach the threshold for serious nonspecific psychological distress. Overall, the 2023 and 2025 K6 findings indicate that age may influence psychological distress, with younger professionals consistently demonstrating greater vulnerability.

### **Potential Causes of Mental Health Challenges**

These findings underscore the importance of retaining MLPs. Elevated EE across all age groups suggests that systemic workplace demands contribute to persistent occupational strain, while greater acute psychological distress among younger professionals highlights their vulnerability early in their careers. Workforce retention is therefore critical. Among Canadian nurses aged  $< 35$  years, approximately 40% leave the profession (Montreal Economic Institute, 2024). Many work overtime, avoid taking sick leave or mental health days, and face poor work–life balance, undesirable working conditions, and high stress. Similarly, cytopathology in the United States faces shortages of cytologists (72.1%), histotechnologists (52.9%), and cytopreparatory

personnel (47.1%) (Satturwar et al., 2025). Prolonged vacancies contribute to staff stress (70.5%), compromised patient care (43.8%), and job turnover (14.4%), with 19.6% expecting to retire within 5 years. By contrast, the 2023 CSMLS survey of newly certified employees reported strong retention intentions (Canadian Society for Medical Laboratory Science, 2023). Most MLTs intended to remain in the same department (39%) and organization (51%) for >5 years, and 86% were not seeking new employment, primarily because of job satisfaction (79%). Similarly, 46% of MLAs intended to remain in the same department and 54% in the same organization for >5 years, while 65% were not seeking new jobs, mainly because they were satisfied with their current positions (68%). Although new MLPs generally intended to remain in the profession, the CSMLS-MH2023 study reported high burnout (Author 2 and Author 5, 2022). If burnout and distress remain unaddressed, younger professionals may leave, worsening laboratory staffing shortages. These findings suggest that age-related mental health differences may affect long-term workforce stability.

Younger healthcare workers generally experience greater psychological distress early in their careers (Chen et al., 2025). Heavy workloads, night shifts, job insecurity, and limited experience contribute to burnout and premature workforce exit. Similar pressures likely affect younger MLPs. Working >50 hours per week because of overtime is another contributor (Mohamed et al., 2025), reflecting staffing shortages that reduce opportunities for adequate sleep and work–life balance. Alansari et al. (2025) found that nurses aged 31–40 years were especially vulnerable to anxiety and burnout. Greater stress, job dissatisfaction, and pursuit of higher qualifications may further increase turnover. Orr et al. (2025) likewise found that nurses aged 18–34 years were more likely to intend to leave because of stress and burnout, whereas those aged  $\geq 55$  years were significantly less likely to do so. Similarly, Chiou and Mulder (2026) reported that older MLPs (aged 51–65 years) had greater loyalty, fewer absences, higher emotional well-being, and greater job satisfaction than younger MLPs (aged 21–50 years). Overall, older MLPs who remain employed may represent individuals who have successfully adapted to workplace demands.

Canadian laboratories also face systemic staffing shortages. The CSMLS identified a serious shortage of MLTs that worsened after the COVID-19 pandemic (Canadian Society for Medical Laboratory Science, 2025). Rising demand for laboratory services, an aging workforce approaching retirement, burnout among newly trained MLPs, and unmanageable workloads contribute to declining retention (Health Sciences Association, n.d.). Staffing shortages also worsen rural–urban workforce maldistribution, international migration, and diagnostic delays (Canadian Society for Medical Laboratory Science, n.d.).

Broader societal trends further explain younger professionals' vulnerability. In Canada, young adults (aged 18–24 years) face slowed hiring, economic uncertainty, and changing labor market demands, with unemployment rising from 10.8% to 14.1% between 2017 and 2019, compared with 5.0%–6.9% among adults aged 25–54 years (Government of Canada, 2023). Job insecurity

contributes to anxiety and psychological strain. National data also show declining mental health and increasing mental illness among youth aged 12–25 years between 2015 and 2021, alongside declining happiness and life satisfaction (Government of Canada, 2015). These challenges likely extend to newly graduated MLPs. Similarly, Mohr et al. (2025) reported worsening mental health and burnout among healthcare professionals from 2018 to 2023, particularly because of staffing and budget pressures. Butt et al. (2025) likewise found that younger professionals were more vulnerable because of limited experience and coping strategies. Other contributing factors include inadequate mental health resources, increasing stressors, and food insecurity (Butt et al., 2025; Government of Canada, 2023; Men et al., 2021; Mohr et al., 2025). Collectively, these findings emphasize the need for strategies that address both systemic workplace pressures and the developmental vulnerabilities of younger MLPs to improve mental health and support long-term workforce sustainability.

## **Strategies**

Growing awareness of burnout in healthcare has increased the need for effective interventions (Freitas et al., 2025). Targeted strategies could improve and support MLP mental health through individual, workplace, and age-specific approaches.

### **Individual-Centered Strategies**

MLPs may benefit from self-care practices such as meditation, exercise, and stress-management techniques (Freitas et al., 2025; Otabil et al., 2025). These activities promote detachment from work, encourage restorative behaviors, and increase burnout awareness, potentially improving perceptions of the work environment.

### **Workplace Strategies**

Organizations can support MLPs through professional development opportunities, including workshops, mentorship programs, and conferences (Otabil et al., 2025). These initiatives enhance self-esteem, help employees navigate workplace challenges, and provide accessible support.

One example is Mental Health First Aid (MHFA), a standardized program that trains participants to recognize, understand, and respond to developing mental health problems until professional care is available (Traylor et al., 2025). MHFA may reduce mental health stigma, increase confidence in addressing concerns, and improve personal coping. The CSMLS reported that MHFA training was highly beneficial for managers, supervisors, and other leaders and recommended expanding participation across the profession (Mental Health First Aid Training, n.d.). Overall, implementing standardized mental health support may improve MLP well-being.

Organizations can also promote organizational equity by redistributing workloads and involving employees in decision-making (Jaber et al., 2025). Supportive leadership improves job satisfaction, reduces EE, and strengthens workplace engagement, helping mitigate burnout.

### **Age-Specific Strategies**

One self-care approach for younger professionals (aged 18–34 years) is viewing short-form videos from credible applications, which may reduce stress and improve life satisfaction (Chung et al., 2025). Such strategies may support healthier mental well-being.

### **Strategies**

Addressing these findings requires strategies at the individual, workplace, and age-specific levels. No single approach is sufficient. Individual strategies help staff cope with demanding work but cannot address the systemic drivers of universally elevated EE, whereas workplace changes require staff engagement and accessible entry points to be effective.

**Individual-centered strategies.** Self-care practices, including meditation, exercise, and other stress-management routines, can help MLPs detach psychologically from work and engage in restorative activities (Freitas et al., 2025; Otobil et al., 2025). Greater awareness of burnout symptoms may also improve perceptions of the work environment. However, because these approaches place responsibility primarily on individuals, they should complement, rather than replace, organizational interventions targeting systemic causes of exhaustion.

**Workplace strategies.** Organizations can expand professional development through workshops, mentorship programs, and conferences, providing MLPs with support while improving confidence and self-esteem (Otobil et al., 2025). MHFA is one practical option. This standardized program trains participants to recognize, understand, and respond to emerging mental health problems until professional care is available (Traylor et al., 2025). CSMLS reports that MHFA training for managers, supervisors, and other leaders has been highly beneficial and recommends expanding participation across the profession (Mental Health First Aid Training, n.d.). Broader implementation could reduce stigma, increase confidence in addressing colleagues' mental health concerns, and improve personal coping.

Managers can also improve organizational equity by redistributing workloads, reducing excessive responsibilities, and incorporating employee perspectives into decision-making (Jaber et al., 2025). Supportive leadership is associated with greater job satisfaction and lower EE. Because elevated EE was the most consistent finding across all age groups and survey years, workplace interventions should receive the greatest organizational priority, as they address the most persistent pattern identified in this study.

**Age-specific strategies.** Because the MHI and K6 identified greater distress among younger professionals, targeted interventions should complement workforce-wide initiatives. For professionals aged 18–34 years, self-care approaches such as viewing short-form content on credible apps have been associated with reduced stress and improved life satisfaction during burnout (Chung et al., 2025), suggesting that age-tailored delivery, as well as content, may improve engagement. Combining these accessible supports with structural measures, including mentorship and workload protection during the early years of practice, could address both acute distress and systemic exhaustion. Because age-related effects changed between survey years, ongoing monitoring, rather than one-time assessment, may be needed to identify the groups requiring the greatest support.

### **Future Research and Limitations**

These findings suggest several directions for future research. Repeating this survey longitudinally would help determine whether the age-related mental health patterns observed here continue to shift, stabilize, or reverse, particularly whether the disappearance of MBI age differences and the emergence of K6 age differences in 2025 were specific to that survey cycle. Evaluating age-specific interventions through follow-up surveys could identify the most effective strategies for different age groups and determine whether reducing distress among younger professionals improves long-term retention. Where feasible, tracking the same respondents over time rather than comparing independent cross-sectional samples would better distinguish within-person changes from differences in survey participation.

Several limitations should be considered. Unequal sample sizes across the nine age groups, particularly the youngest and oldest, may have influenced the KW results and limited generalizability. Because only CSMLS members were surveyed, the findings may not represent all MLPs. All measures were self-reported, introducing the possibility of response bias, inconsistent interpretation of survey items, under- or over-reporting of symptoms, and age-related differences in social desirability or willingness to disclose mental health concerns. No correction for multiple comparisons was applied to the post hoc tests. Although this preserved sensitivity in this exploratory analysis, the pairwise comparisons reported in the appendices should be interpreted cautiously rather than as confirmatory findings. Finally, because CSMLS mental health data collected before 2023 were unavailable, longer-term trends could not be assessed, limiting interpretation of whether the changes observed between 2023 and 2025 reflected a sustained trend or short-term fluctuation.

### **Conclusion**

This study examined the relationship between age, burnout, general mental health, and psychological distress among Canadian MLPs across two survey years using three validated instruments. The central finding is that age does not have a single relationship with mental

health; instead, its effects vary by the construct measured and the survey year. Consequently, studies relying on a single instrument or time point may reach different conclusions about the same workforce.

Two consistent patterns emerged. First, EE remained above the clinical burnout threshold across all age groups in both 2023 and 2025, suggesting that exhaustion reflects a structural workplace issue rather than age or career stage. Second, the MHI consistently indicated better mental health with increasing age, driven primarily by reduced distress rather than greater positive affect, making it the single most stable finding in the dataset.

The second pattern comprised findings that changed substantially over time. The MBI shifted from significant age differences in 2023, with older professionals reporting lower EE and DP, to no age differences in 2025, when burnout was evenly distributed across the workforce.

Conversely, the K6 changed from no age differences in 2023 despite uniformly elevated distress to significant differences in 2025, with distress concentrated among younger professionals.

Unlike when interpreted in isolation, when considered together, these findings show that the same workforce can appear age-uniform on one instrument in one year and strongly age-differentiated on a related instrument the next year.

Rather than representing a limitation, this contrast suggests that the relationship between age and occupational mental health is dynamic, construct-specific, and responsive to changing conditions, including staffing levels, workload distribution, and post-pandemic recovery.

Accordingly, studies using a single instrument or survey wave may capture only one phase of an evolving pattern rather than a stable relationship.

Practically, these findings support two complementary priorities. Because EE remained universally elevated, workplace interventions—including workload redistribution, staffing investment, and structural supports such as MHFA training—are warranted across all age groups. Because age-related differences in burnout and distress can emerge or disappear over time, continued monitoring and targeted support for younger professionals are also important, particularly to improve early-career retention. Longitudinal replication with more balanced age-group sampling would clarify whether the changes observed between 2023 and 2025 represent a lasting shift or part of a broader cycle and help distinguish universal workplace risks from age-specific, time-varying factors.

**Acknowledgements:** N/A

#### **Declarations**

**AI disclosure:** Grammarly was used to assist with spelling, grammar, and language editing. The authors independently reviewed, revised, and verified all content and remain responsible for the accuracy, interpretation, and final text of the manuscript.

**Funding Statement:** N/A

**Data Availability Statement:** The datasets generated during and/or analyzed during the current study are not publicly available due to the CSMLS Research Ethics Board Committee regulations and maintenance of confidentiality but are available from the corresponding author on reasonable request.

**Data Note:** All investigators on this project have signed and dated an agreement with CSMLS to ensure participants' confidentiality is maintained. Participant confidentiality is maintained to the strictest degree at all times during and after the study completion. Personal identifiers were not intended to be collected as part of this study; all of the information participants provide is considered anonymous. As part of the CSMLS Research Ethics Board (REB) Committee requirements, data holdings will be maintained for a period of five years after any publication or presentation of the data/information. After such time, the data will be destroyed and become irretrievable. This is consistent with research practices that are not clinical-trial-based. All information was aggregated before dissemination. Respondents were notified that participation indicates consent to the use of their answers within the aggregation.

**Ethics and Consent to Participate:** The study and its protocol were approved by the Canadian Society for Medical Laboratory Science Research Ethics Board Committee in accordance with the Canadian Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS-2). All human-related procedures were performed in accordance with relevant guidelines and regulations, specifically the Canadian Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans – TCPS 2 document. All information was aggregated before dissemination. Respondents were notified that participation indicates consent to the use of their answers within the aggregation. Informed consent was obtained from all adult participants.

**Consent to Publish:** N/A

**Competing Interests:** Article development: This article was developed from analyses conducted by master's students as part of a placement.

Organizational affiliation: Two of the authors are employees of the organization involved in data collection.

Previous consultancy: The second author previously provided consulting services to the organization on projects unrelated to this article.

## References

Alansari, A.N., Omri, A.E., Singh, K., 2025. Staff shortages linked to burnout, depression, and anxiety among outpatient nurses: a cross-sectional analysis at Hamad General Hospital, Qatar. *BMC Nurs.* 24, 1118. <https://doi.org/10.1186/s12912-025-03758-7>.

Arslanoglu, A., İbrahimoglu, Ö., Mersin, S., Ergül, S., Yavuz, A.E., 2025. Burnout in healthcare workers: the effect of stress of conscience. *J. Eval. Clin. Pract.* 31, 14148. <https://doi.org/10.1111/jep.14148>.

Author 2., 2025. Mental health status of medical laboratory professionals. Canadian Society for Medical Laboratory Science. <https://csmls.org/wp-content/uploads/2025/09/CSMLS-MH2025-1.pdf> (accessed 1 Aug 2025).

Author 2., Author 5., 2022. Mental health status of medical laboratory professionals. *Healthc. Manag. Forum.* 35, 207–212. <https://doi.org/10.1177/08404704221088471>.

Author 3., n.d. Exploring the impact of age on mental health in the medical laboratory. (Internal report).

Bordbar, S., Mousavi, S.M., Samadi, S., 2025. The association between burnout and medical professionalism in medical trainees: a systematic review. *BMC Med. Educ.* 25, 1176. <https://doi.org/10.1186/s12909-025-07687-6>.

Briongos-Figuero, L.S., Hernando Martín, C., Pardo Gutiérrez, M.V., Pérez Pinto, S., Martínez Rodríguez, C.A., Bombín Molinero, Y., de la Higuera Arranz, C., 2026. Beyond exhaustion: characterizing burnout syndrome in medical professionals as an emerging occupational health issue. *J. Health Psychol.* 31, 3924–3931. <https://doi.org/10.1177/13591053251408566>.

Butt, M.K., Grigutytė, N., Petravičiūtė, A., Eimontas, J., 2025. The impact of age on burnout and secondary traumatic stress: examining the moderating roles of detachment and work hours among mental health professionals serving war refugees in Pakistan. *Int. J. Soc. Psychiatry* 72, 160–171. <https://doi.org/10.1177/00207640251355840>.

Canadian Society for Medical Laboratory Science, 2023. [https://csmls.org/wp-content/uploads/2025/04/CSMLS-Employment-Report-1-Year-Post-Certification-2023-\\_edits-DD.pdf](https://csmls.org/wp-content/uploads/2025/04/CSMLS-Employment-Report-1-Year-Post-Certification-2023-_edits-DD.pdf).

Canadian Society for Medical Laboratory Science, n.d. <https://csmls.org/research-advocacy/research/projects-reports-presentations/the-canadian-medical-laboratory-professions-call-to-action/>.

Canadian Society for Medical Laboratory Science, 2025. [https://csmls.org/wp-content/uploads/2025/03/PS\\_EN-Medical-Laboratory-Professional-Recruitment-and-Retention-Strategies-in-Rural-and-Remote-Communities.pdf](https://csmls.org/wp-content/uploads/2025/03/PS_EN-Medical-Laboratory-Professional-Recruitment-and-Retention-Strategies-in-Rural-and-Remote-Communities.pdf).

Chen, Q., Shen, S., Liang, Y., Kong, L., Zhuang, S., Li, C., 2025. Analysis of mental health of healthcare workers and its influencing factors in three consecutive years. *Work* 80, 1296–1303. <https://doi.org/10.1177/10519815241289827>.

Chen, Y.H., Jong, G.P., Yang, C.W., Lee, C.H., 2025. Prolonged overtime predicts worsening burnout among healthcare workers: a 4-year longitudinal study in Taiwan. *Healthcare* 13, 1859. <https://doi.org/10.3390/healthcare13151859>.

Chiou, P.Z., Mulder, L., 2026. Addressing the clinical workforce shortage by retaining the tenured laboratory professionals. *Sage Open Pathol.* 19, 30502098251415113. <https://doi.org/10.1177/30502098251415113>.

Choi, Y.J., Choi, K.U., Lee, Y.M., Lee, H.J., Moon, I., Seo, J., Kim, K., Kim, S.R., Kim, J., Choi, H.M., Gwak, S.Y., Kim, M., Kim, M., Ko, K.Y., Oh, J.K., Choi, J.Y., Cho, D.H., 2025. Evaluation of burnout and contributing factors in imaging cardiologists in Korea. *J. Korean Med. Sci.* 40. <https://doi.org/10.3346/jkms.2025.40.e21>.

Chung, D., Meng, Y., Wang, J., 2025. The role of short-form video apps in mitigating occupational burnout and enhancing life satisfaction among healthcare workers: a serial multiple mediation model. *Healthcare* 13, 355. <https://doi.org/10.3390/healthcare13040355>.

Córdova, P., Gordillo, P.G., Mejía, H.N., La, I., Chacón, A.G., Unzueta, A.S., 2023. Academic stress as a predictor of mental health in university students. *Cogent. Educ.* 10, 2232686. <https://doi.org/10.1080/2331186X.2023.2232686>.

da Cunha Gentil, M.H., Lobo, V.M., dos Santos Florenciano, M.S., Morais, M.A., Barbosa, M., 2023. Burnout in medical students: a longitudinal study in a Portuguese medical school. *Global Mental Health* 10, e72. <https://doi.org/10.1017/gmh.2023.61>.

Dyrbye, L.N., West, C.P., Shanafelt, T.D., 2009. Defining burnout as a dichotomous variable. *J. Gen. Intern. Med.* 24, 440–440. <https://doi.org/10.1007/s11606-008-0876-6>.

Fekih-Romdhane, F., Harb, F., Al Banna, S., Obeid, S., Hallit, S., 2025. Prevalence and risk factors of burnout symptoms among nurses during the COVID-19 pandemic: an updated systematic review and meta-analysis. *Hum. Resour. Health.* 23, 48. <https://doi.org/10.1186/s12960-025-01012-4>.

Ferro, M.A., 2019. The psychometric properties of the Kessler Psychological Distress Scale (K6) in an epidemiological sample of Canadian youth. *Can. J. Psychiatry.* 64, 647–657. <https://doi.org/10.1177/0706743718818414>.

Freitas, C.C., Alves, B.N., de Sousa, J.O., Roseno, D.A., Bittar, S., Falcao, D., Freire, M.A., 2025. Burnout syndrome among healthcare professionals: global evidence and strategies for mitigation. *Am. J. Psychol. Brain Stud.* 2, 92–98.

Government of Canada, 2015. Overview: mental health of youth and young adults — Canada.ca. <https://health-infobase.canada.ca/mental-health/youth-young-adults/>.

Government of Canada, 2023. Building Canada strong: youth in the labour market, discussion paper - Canada.ca. <https://www.canada.ca/en/employment-social-development/programs/youth-employment-strategy/labour-challenges/discussion.html>.

Gresele, B.S., Pereira, J.L., da Silva, A.R., Scavacini, K., Lyrio-Carvalho, H.C., Ulisses, S.M., da Silva, R.A., 2026. Psychological distress as a central mediator of suicidal ideation among Brazilian veterinarians: a study of occupational stress, compassion fatigue, coping strategies, and workplace environment using structural equation modeling. *Vet. World* 19, 604–618. <https://doi.org/10.14202/vetworld.2026.604-618>.

Healey, S.J., Fakes, K., Malau-Aduli, B.S., Leigh, L., Nair, B.R., 2025. Self-reported mental health outcomes of international medical graduates in Australia: a cross-sectional survey. *Front. Med.* 12, 1615471. <https://doi.org/10.3389/fmed.2025.1615471>.

Health Sciences Association., 2023. <https://hsabc.org/sites/default/files/uploads/under-the-microscope-report.pdf>.

Jaber, M.J., Bindahmsh, A.A., Baker, O.G., Alaqlan, A., Almotairi, S.M., Elmohandis, Z.E., Qasem, M.N., AlTmaizy, H.M., du Preez, S.E., Alrafidi, R.A., Alshodukhi, A.M., Al Nami, F.N., Abuzir, B.M., 2025. Burnout combating strategies, triggers, implications, and self-coping mechanisms among nurses working in Saudi Arabia: a multicenter, mixed methods study. *BMC Nurs.* 24, 590. <https://doi.org/10.1186/s12912-025-03191-w>.

KnowWare International, Inc, 2025. QI Macros for Excel [software]. Version 2025. Denver, CO: KnowWare International, Inc. <https://www.qimacros.com/>.

Leonforte, F., Sapienza, M., Ilardo, M., Komici, K., Madaudo, C., Sanfilippo, C., Nicosia, V., Raciti, F., Mistretta, A., Pavone, V., Testa, G., 2026. Burnout among Italian healthcare professionals: a cross-sectional study on emotional exhaustion, depersonalization, and gratification post-COVID-19.

Liao, T., Liu, Y., Luo, W., Duan, Z., Zhan, K., Lu, H., Chen, X., 2024. Non-linear association of years of experience and burnout among nursing staff: a restricted cubic spline analysis. *Front. Public Health* 12, 1343293. <https://doi.org/10.3389/fpubh.2024.1343293>.

Magomedova, A., Fatima, G., 2025. Mental health and well-being in the modern era: a comprehensive review of challenges and interventions. *Cureus* 17, 2. <https://doi.org/10.7759/cureus.77683>.

McKinsey Health Institute, 2023. What healthy aging means to older adults | McKinsey. <https://www.mckinsey.com/mhi/our-insights/age-is-just-a-number-how-older-adults-view-healthy-aging>.

Men, F., Elgar, F.J., Tarasuk, V., 2021. Food insecurity is associated with mental health problems among Canadian youth. *J. Epidemiol. Community Health* 75, 741–748. <https://doi.org/10.1136/jech-2020-216149>.

Mental Health First Aid Training, n.d. Canadian Society for Medical Laboratory Science.

Mohamed, N.A., Mohamed, Y.A., Mohamud, R.Y., Gabow, A.A., 2025. Evaluation of the prevalence and risk factors of burnout syndrome among healthcare workers: a cross-sectional study. *World. J. Psychiatry* 15, 98496. <https://doi.org/10.5498/wjp.v15.i2.98496>.

Mohr, D.C., Elnahal, S., Marks, M.L., Derickson, R., Osatuke, K., 2025. Burnout trends among US health care workers. *JAMA Netw. Open* 8, e255954. <https://doi.org/10.1001/jamanetworkopen.2025.5954>.

Montreal Economic Institute, 2024. MEI ideas for a more prosperous society. Which provinces struggle the most to keep young nurses? [https://www.iedm.org/wp-content/uploads/2024/09/note102024\\_en.pdf](https://www.iedm.org/wp-content/uploads/2024/09/note102024_en.pdf).

Mulder, L., Garcia, E., Sirintrapun, S.J., Kundu, I., Soles, R., 2024. Examining the role of diversity, equity, and inclusion in mitigating workforce burnout in laboratory medicine. *Am. J. Clin. Pathol.* 161, 130–139. <https://doi.org/10.1093/ajcp/aqad123>.

Orr, T., Cheung, E., Saha, M., Balogun, T., Feng, C., Farag, M., 2025. Identifying risk factors for burnout-driven turnover in Canadian healthcare workers during the Covid-19 pandemic. *BMC Health. Serv. Res.* 25, 469. <https://doi.org/10.1186/s12913-025-12522-1>.

Otabil, C., Ma, A., Xin, H., Essuman, M.A., 2025. Professional burnout among medical laboratory workers in Ghana: the moderating role of perfectionism and psychological capital. *J. Life Sci. Public Health* 1, 29–38. <https://doi.org/10.69739/jlsph.v1i2.977>.

Peng, X., Ma, J., Chen, Y., Han, Y., Zhou, H., Gong, A., Peng, F., Sun, X., Wang, X., Xiong, X., Li, L., Huang, M., Zeng, Q., 2025. The moderating effect of psychological capital on the relationship between nurses' perceived workplace bullying and emotional exhaustion: a cross-sectional study. *BMC Nurs.* 24, 103. <https://doi.org/10.1186/s12912-025-02763-0>.

Popucza, T.Z., Eriksson, L., Eriksson, M., 2025. Emotional demands, burnout, and mental wellbeing in healthcare, care, and service work: the mediating role of surface acting across age. *Front. Organ. Psychol.* 3, 1628713. <https://doi.org/10.3389/forgp.2025.1628713>.

Prochaska, J.J., Sung, H., Max, W., Shi, Y., Ong, M., 2012. Validity study of the K6 scale as a measure of moderate mental distress based on mental health treatment need and utilization. *Int. J. Methods. Psychiatr. Res.* 21, 88–97. <https://doi.org/10.1002/mpr.1349>.

Sato, T., Oyama, Y., Aikawa, G., Kakuda, K., Fukunaga, T., Yoshihara, S., Fukushima, A., Fukamachi, Y., Sugishima, K., Naya, K., Okamoto, S., Kaneko, K., Sakuramoto, H., 2026. Psychological safety and mental health among intensive care unit nurses: a multi-institutional cross-sectional study. *Aust. Crit. Care* 39, 101480. <https://doi.org/10.1016/j.aucc.2025.101480>.

Satturwar, S., Compton, M., Miller, D., Goldberg, A., McGrath, C., Friedlander, M., Sharma, A., Hegde, P., Filomena, C.A., Mehrotra, S., 2025. American Society of Cytopathology's cytopathology workforce survey in the United States. *J. Am. Soc. Cytopathol.* 14, 65–77. <https://doi.org/10.1016/j.jasc.2024.12.003>.

Ten Have, M., Van Bon-Martens, M.J.H., Schouten, F., Van Dorsselaer, S., Shields-Zeeman, L., Luik, A.I., 2024. Validity of the five-item mental health inventory for screening current mood and anxiety disorders in the general population. *Int. J. Methods Psychiatr. Res.* 33, 2030. <https://doi.org/10.1002/mpr.2030>.

Traylor, D., Anderson, E., Hodges, A., Kirby, D., 2025. Integrating mental health first aid training into medical education. *Educ. Health* 38, 82–87. <https://doi.org/10.62694/efh.2025.136>.

Voth, J., Jaber, L., MacDougall, L., Ward, L., Cordeiro, J., Miklas, E.P., 2022. The presence of psychological distress in healthcare workers across different care settings in Windsor, Ontario, during the COVID-19 pandemic: a cross-sectional study. *Front. Psychol.* 13, 960900. <https://doi.org/10.3389/fpsyg.2022.960900>.

Zaiontz, C., 2026. Real statistics using excel. <https://www.real-statistics.com>.

## Appendix A. Descriptive Visualization

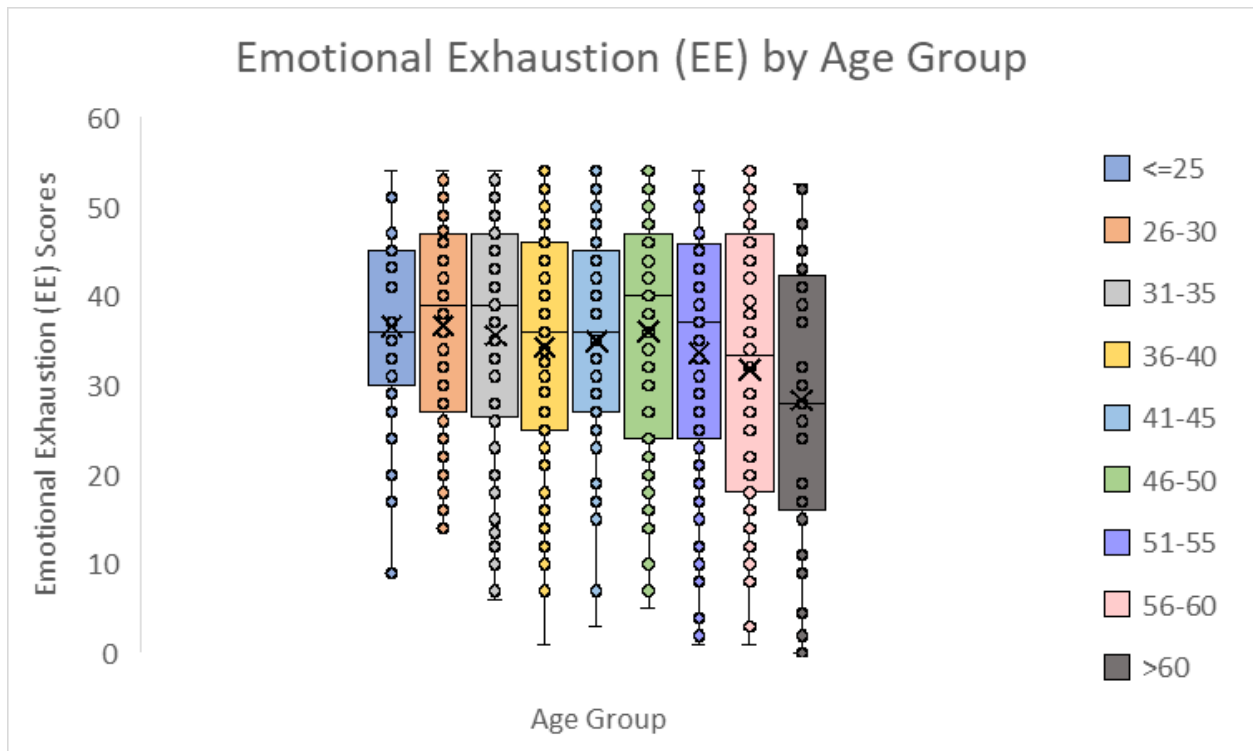


**Figure A1.** Boxplot of 2023 data with jittered dots showing MBI-HSS emotional exhaustion scores across age groups.

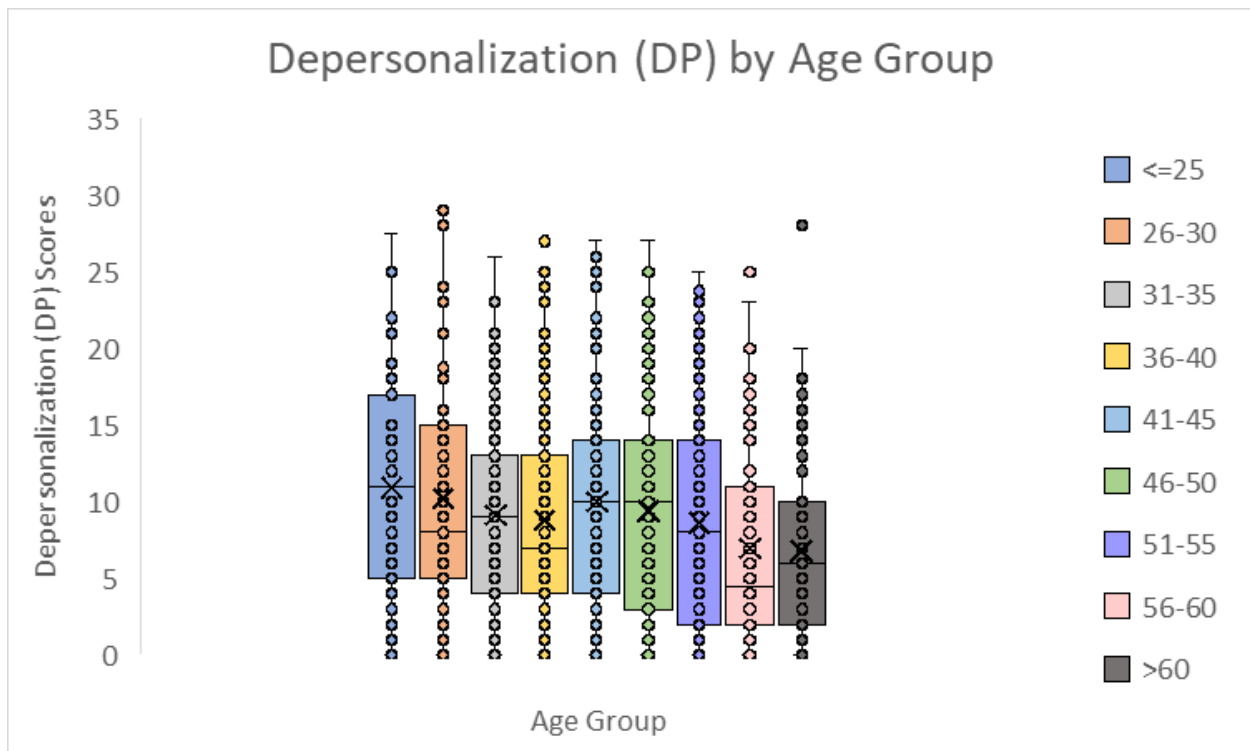


**Figure A2.** Boxplot of 2023 data with jittered dots showing participants' MBI-HSS depersonalization scores.

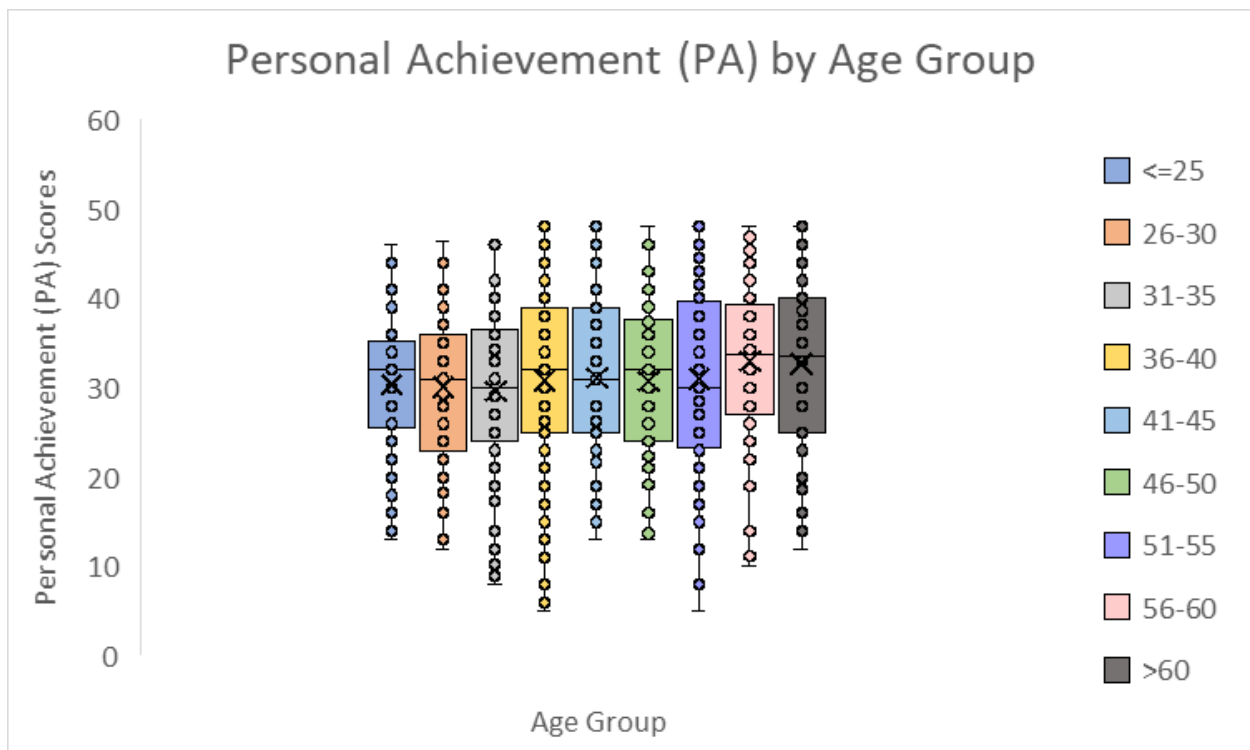


**Figure A3.** Boxplot of 2023 data with jittered dots showing MBI-HSS personal achievement scores across age groups.

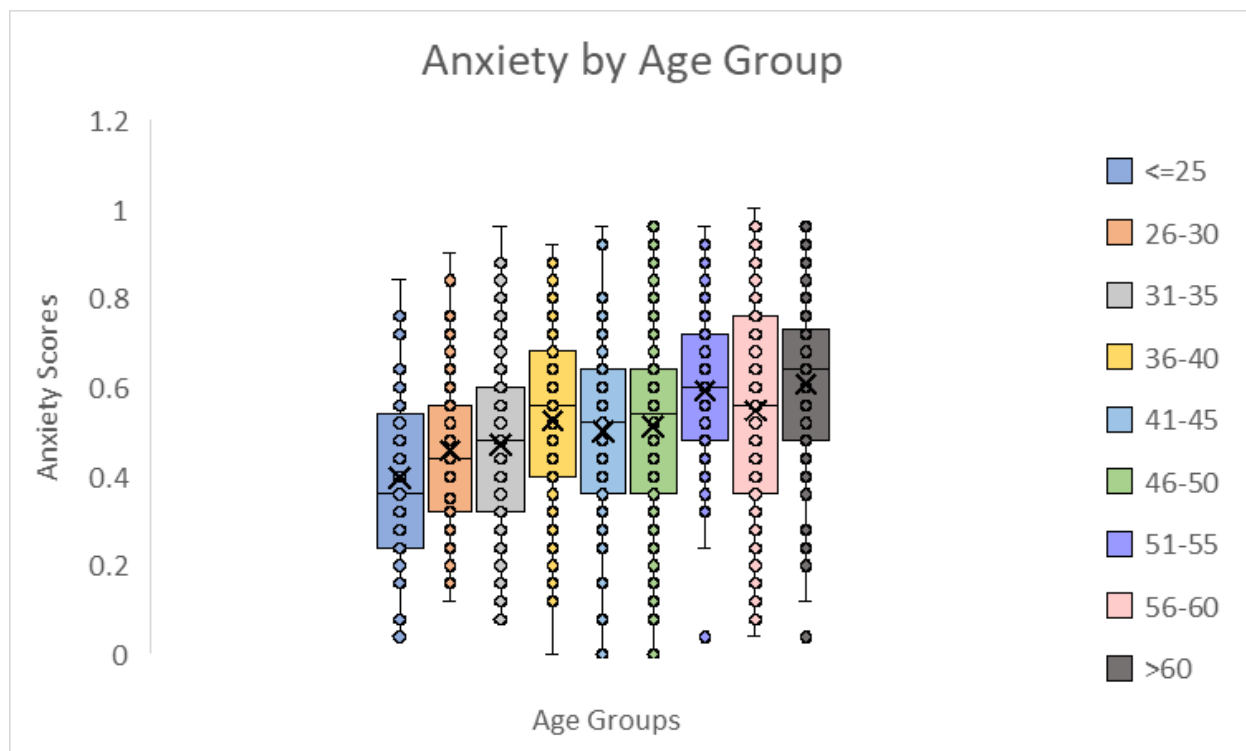


**Figure A4.** Boxplot of 2023 data with jittered dots showing MHI anxiety scores.

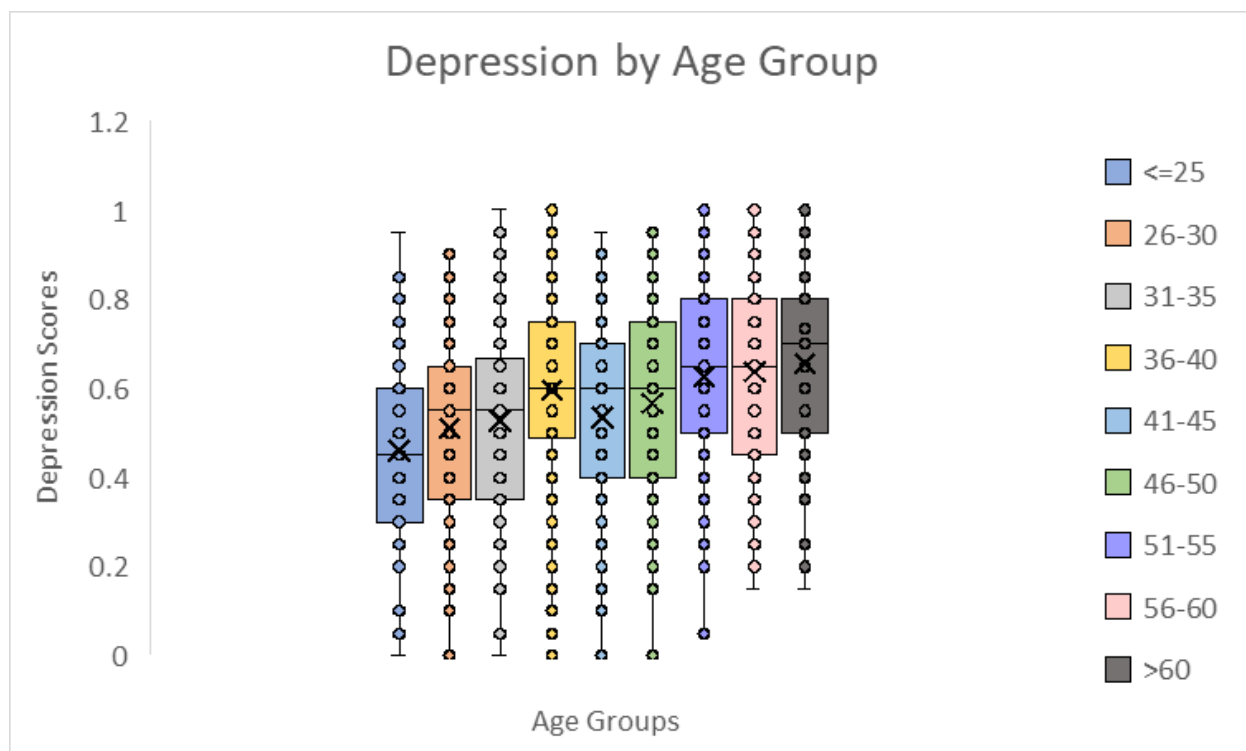


**Figure A5.** Boxplot of 2023 data with jittered dots showing MHI depression scores across age groups.

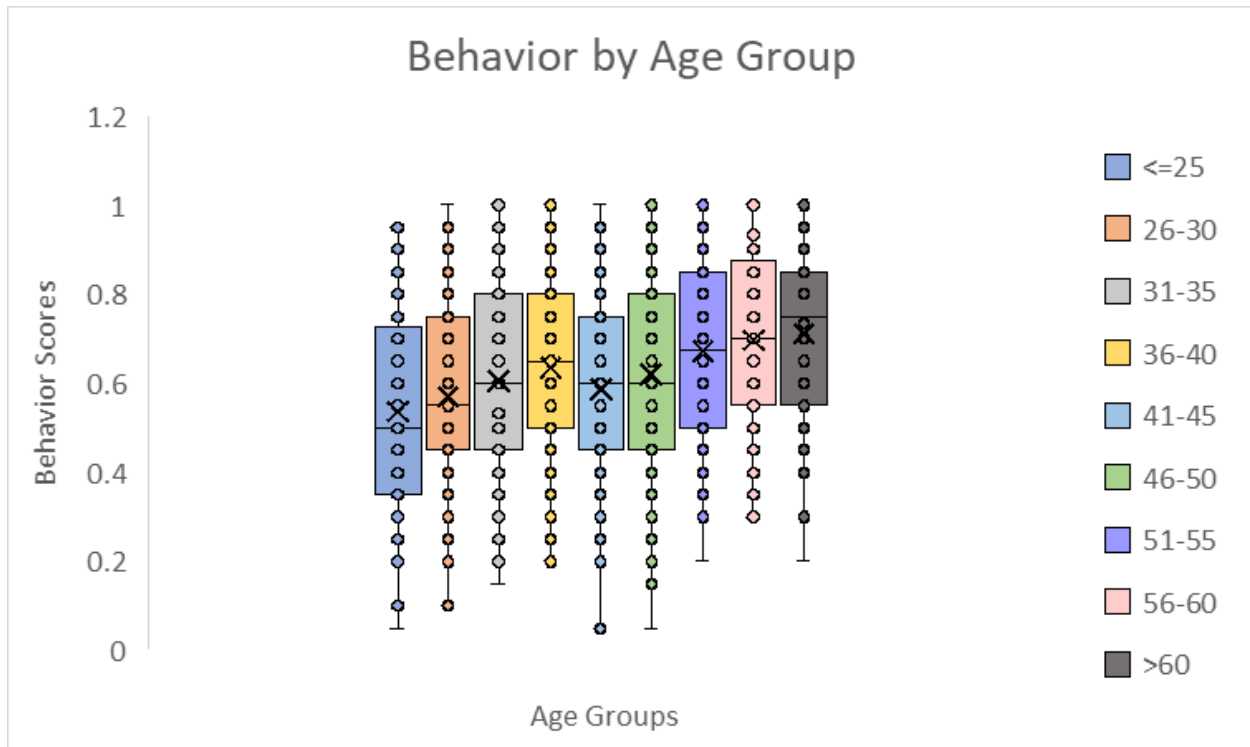


**Figure A6.** Boxplot of 2023 data with jittered dots showing MHI behavior scores across age groups.

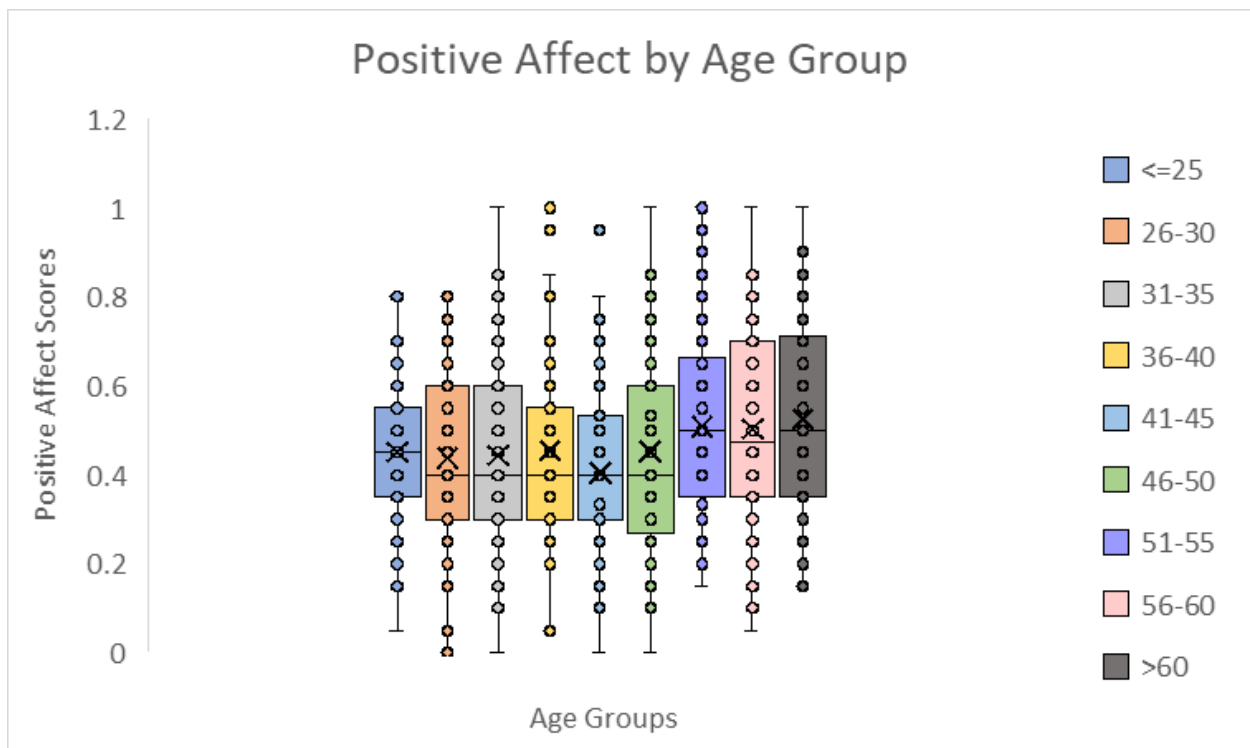


**Figure A7.** Boxplot of 2023 data with jittered dots showing MHI positive affect scores across age groups.

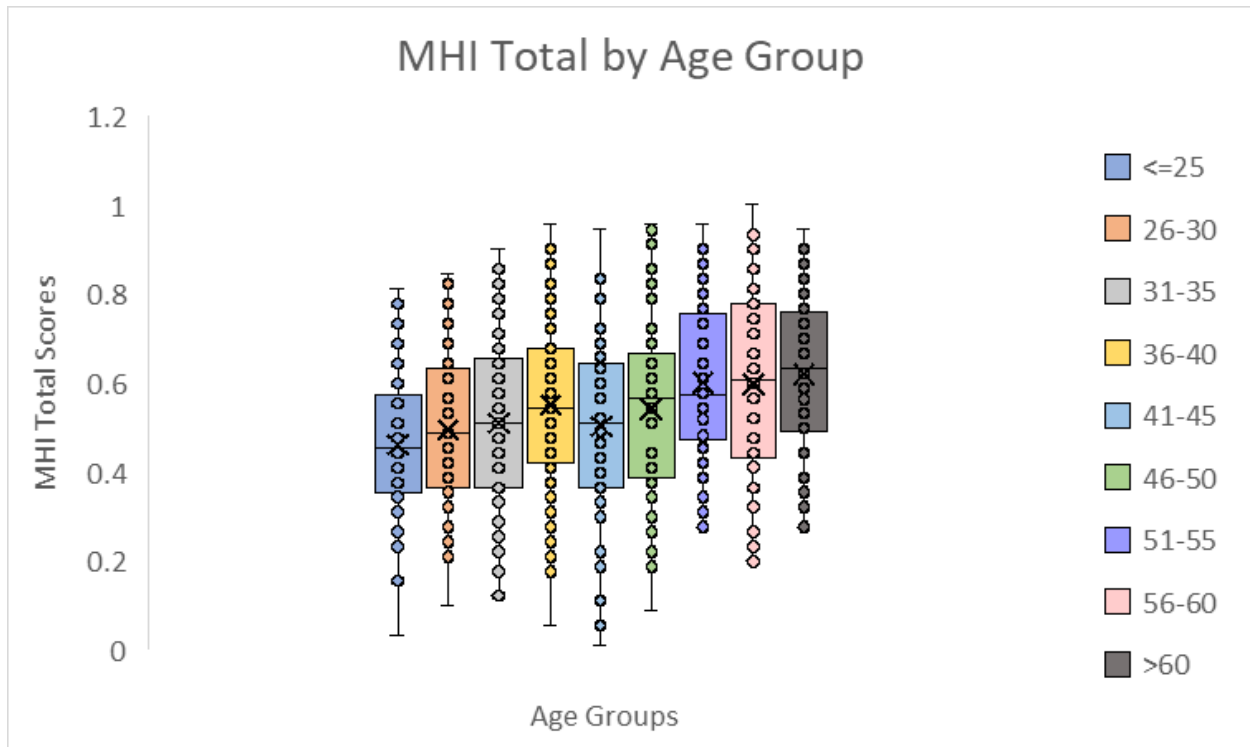


**Figure A8.** Boxplot of 2023 data with jittered dots showing total MHI scores across age groups.

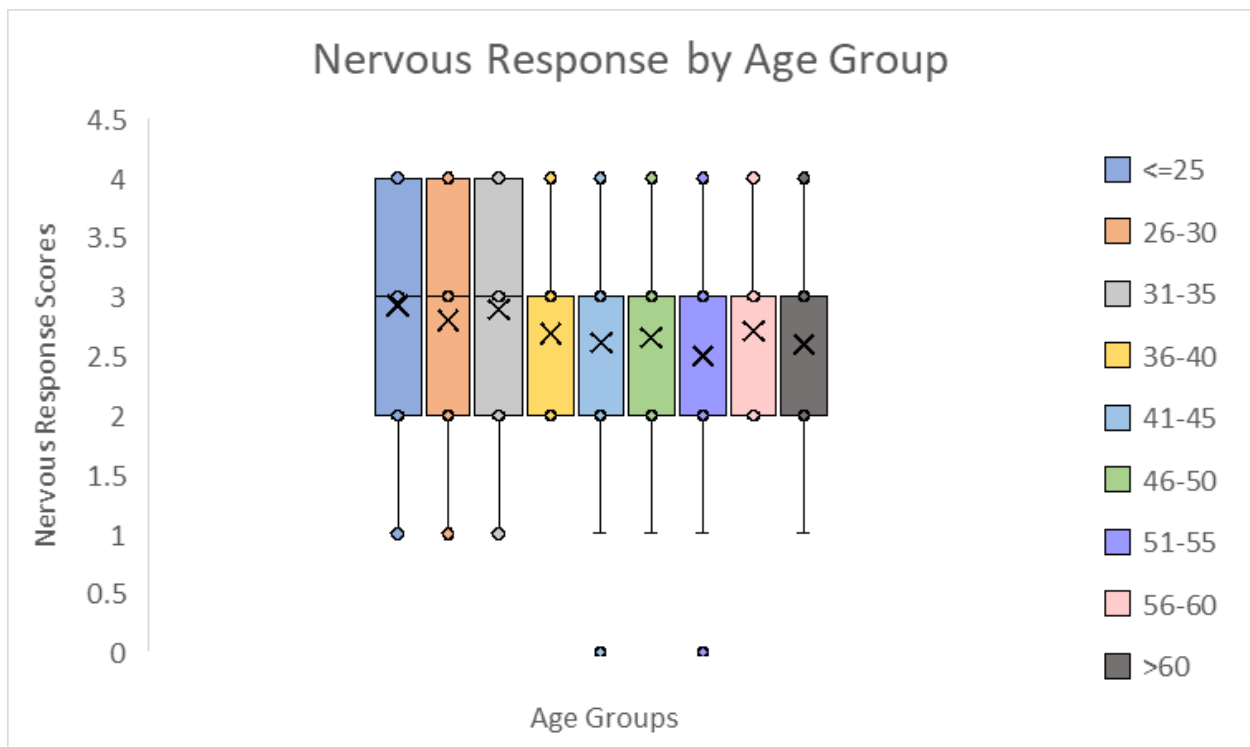


**Figure A9.** Boxplot of 2023 data with jittered dots showing K6 nervous response scores across age group.



**Figure A10.** Boxplot of 2023 data with jittered dots showing K6 hopeless scores across age groups.

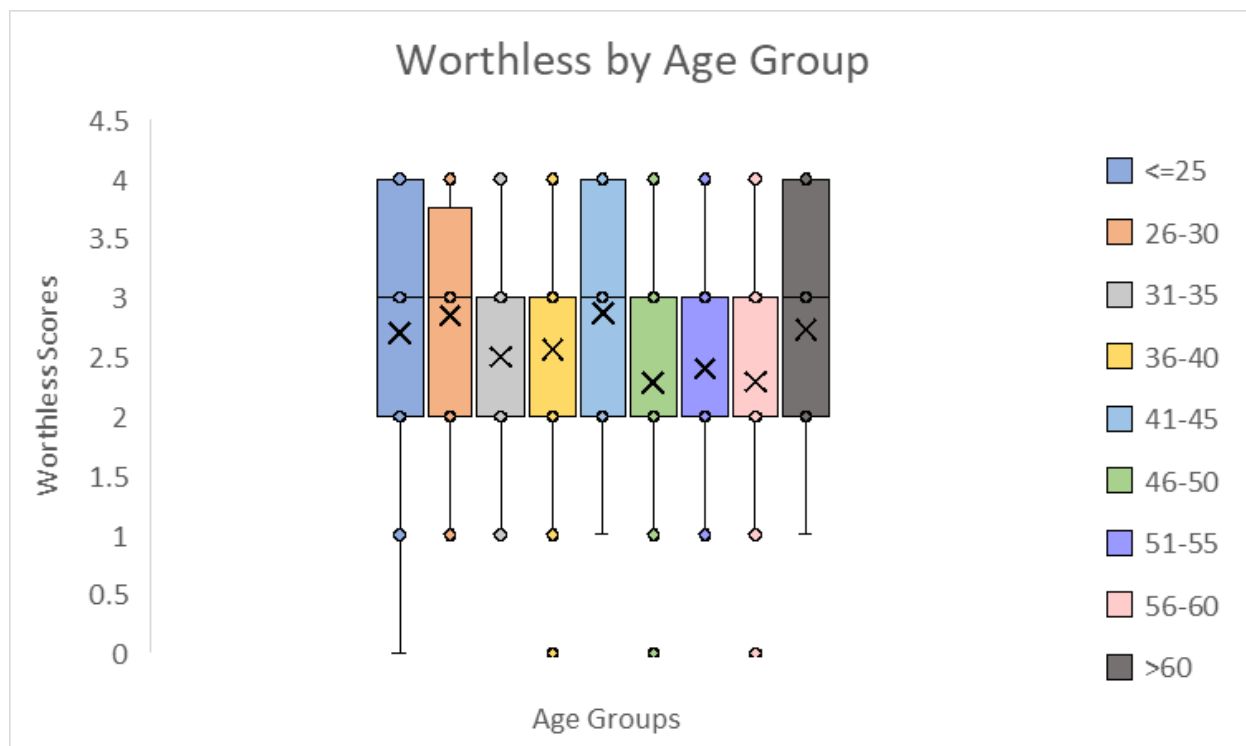


**Figure A11.** Boxplot of 2023 data with jittered dots showing K6 worthlessness scores across age groups.

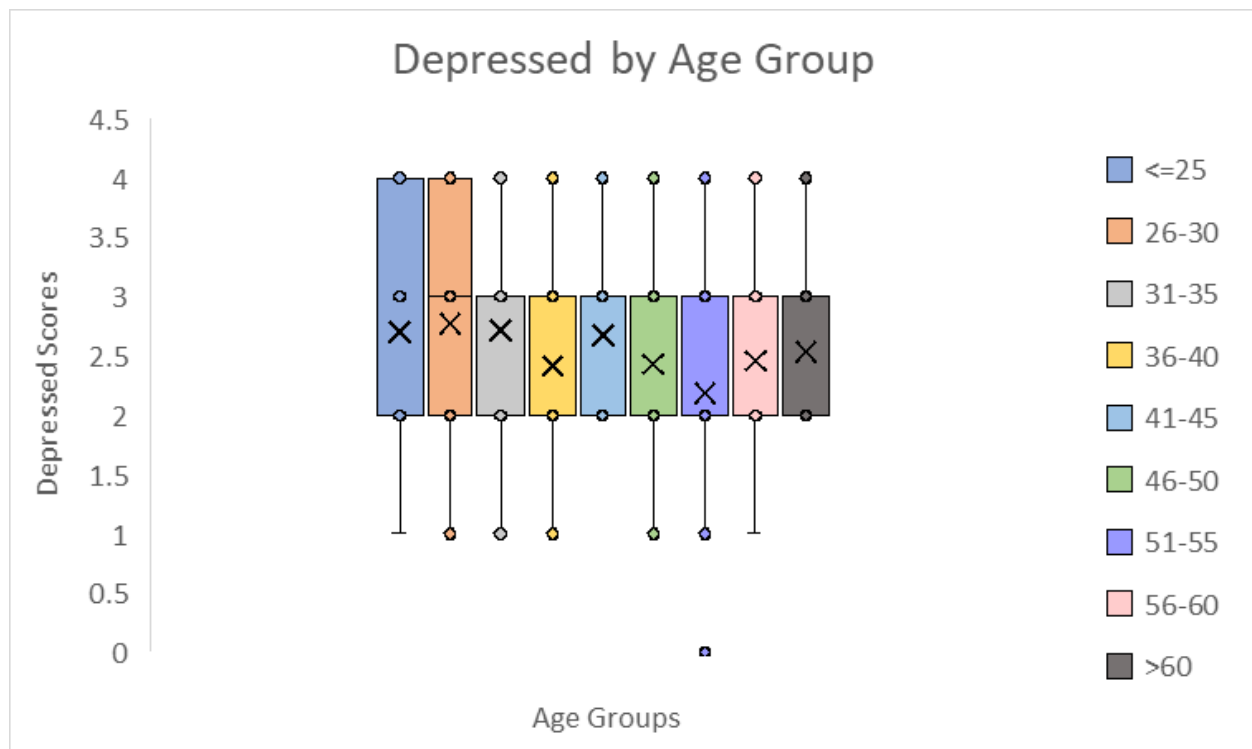


**Figure A12.** Boxplot of 2023 data with jittered dots showing K6 depression scores across age groups.

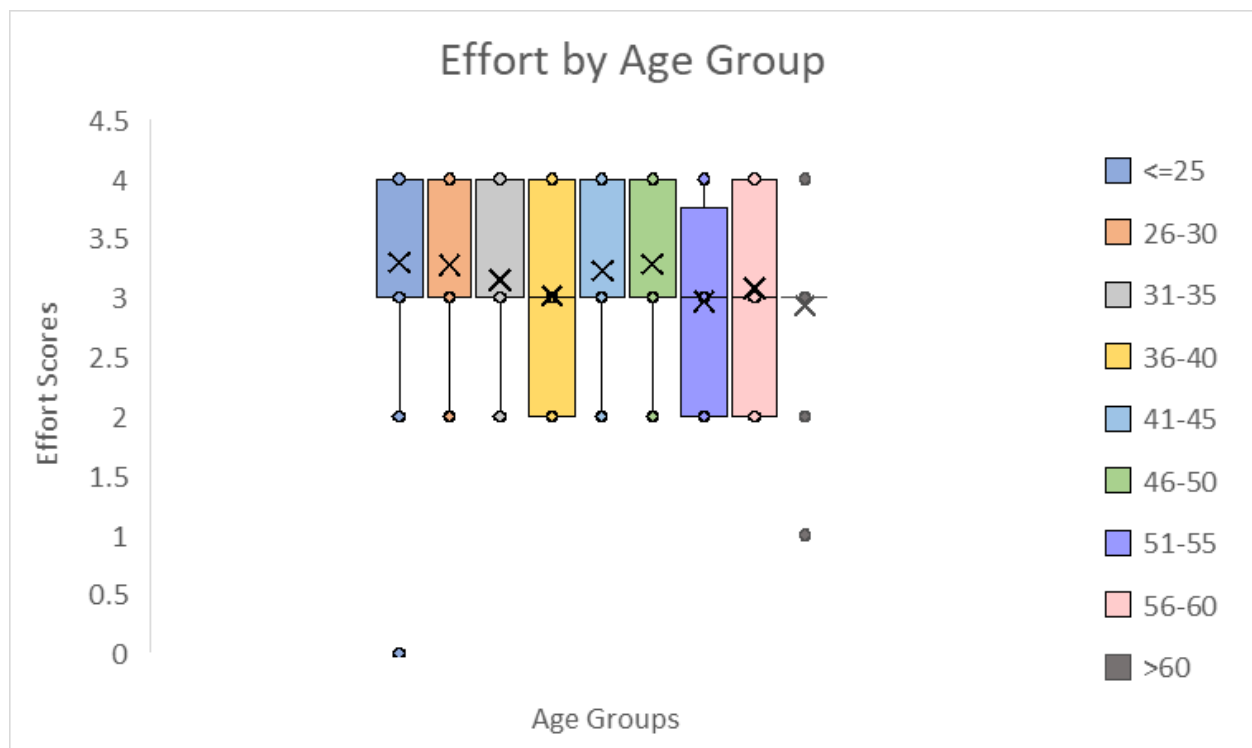


**Figure A13.** Boxplot of 2023 data with jittered dots showing K6 effort scores across age groups.

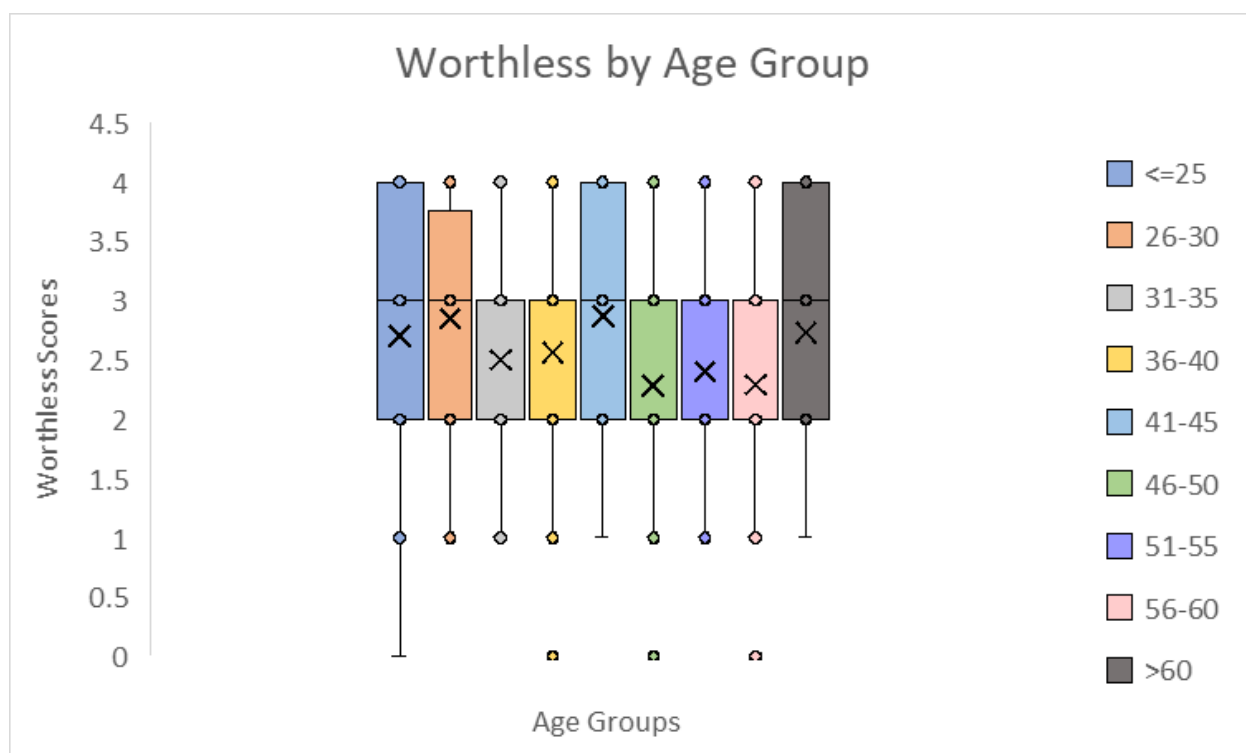


**Figure A14.** Boxplot of 2023 data with jittered dots showing K6 worthlessness scores across age groups.

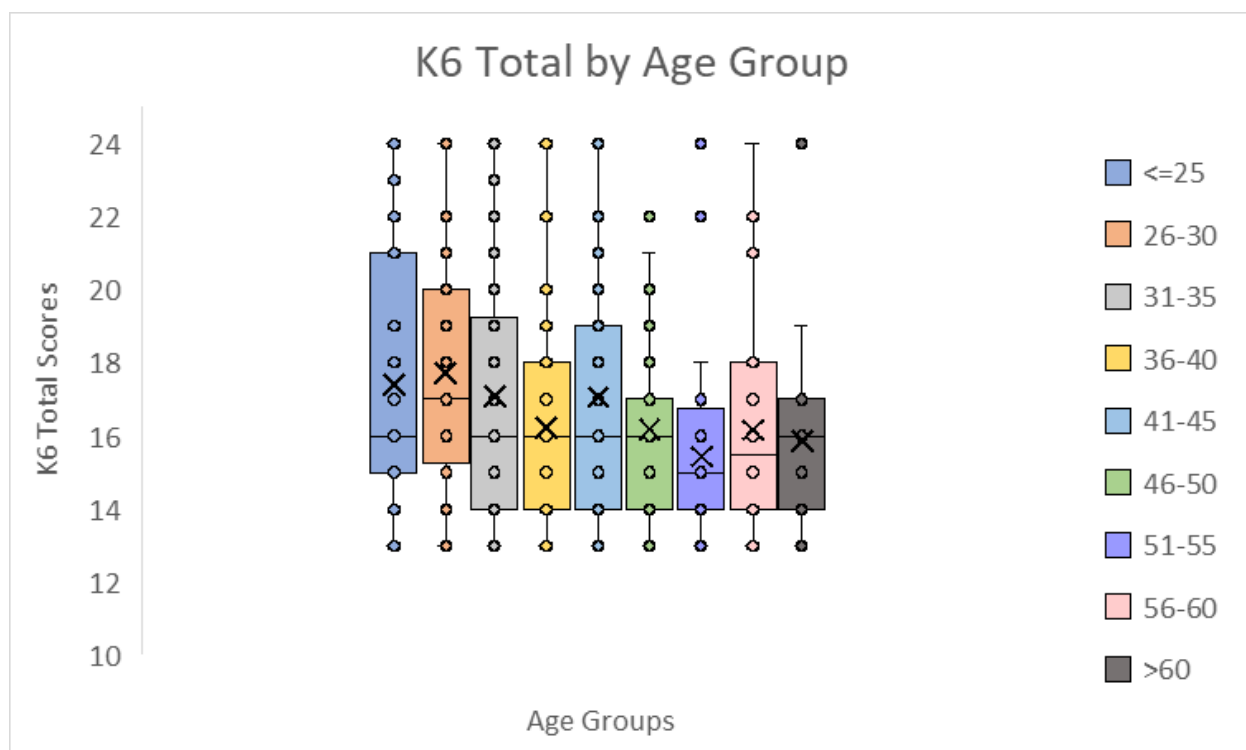


**Figure A15.** Boxplot of 2023 data with jittered dots showing total K6 scores across age groups.

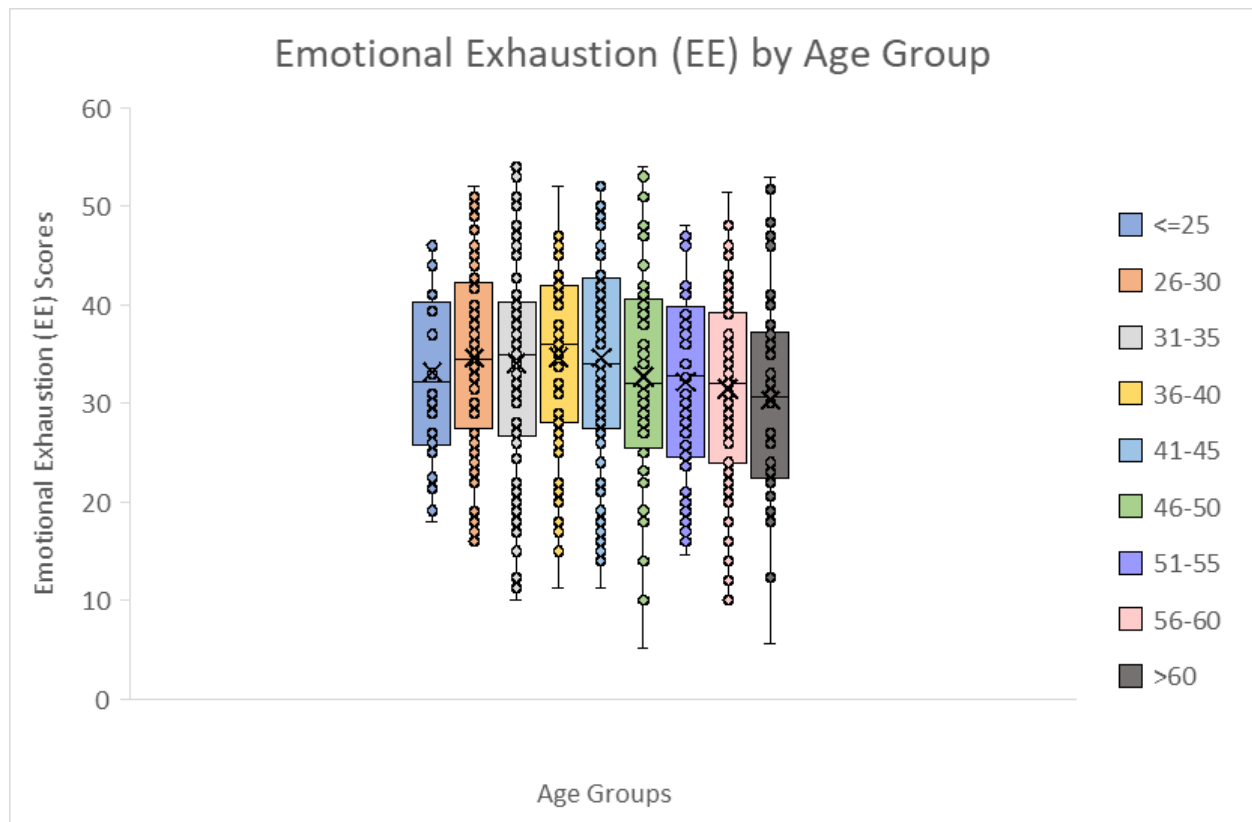


**Figure A16.** Boxplot of 2025 data with jittered dots showing MBI-HSS emotional exhaustion scores across age groups.

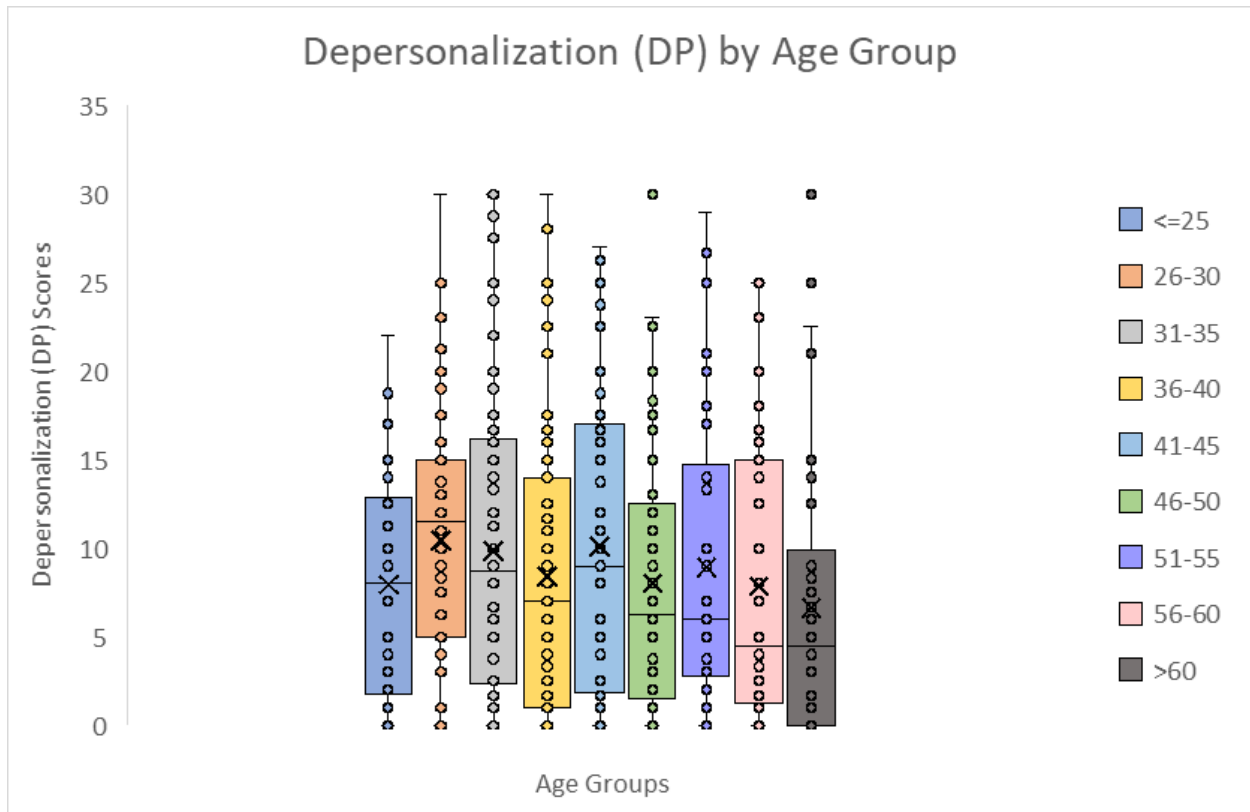


**Figure A17.** Boxplot of 2025 data with jittered dots showing participants' MBI-HSS depersonalization scores across age groups.

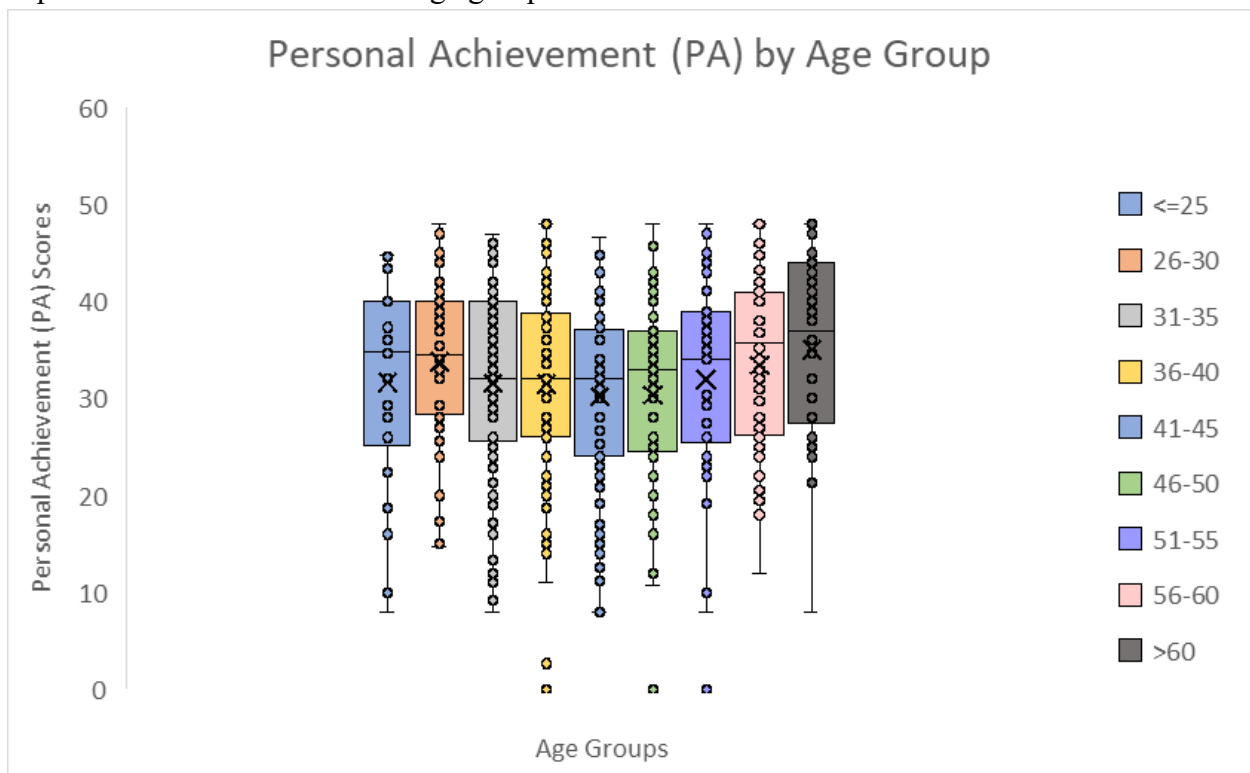


**Figure A18.** Boxplot of 2025 data with jittered dots showing MBI-HSS personal achievement (PA) scores across age groups.

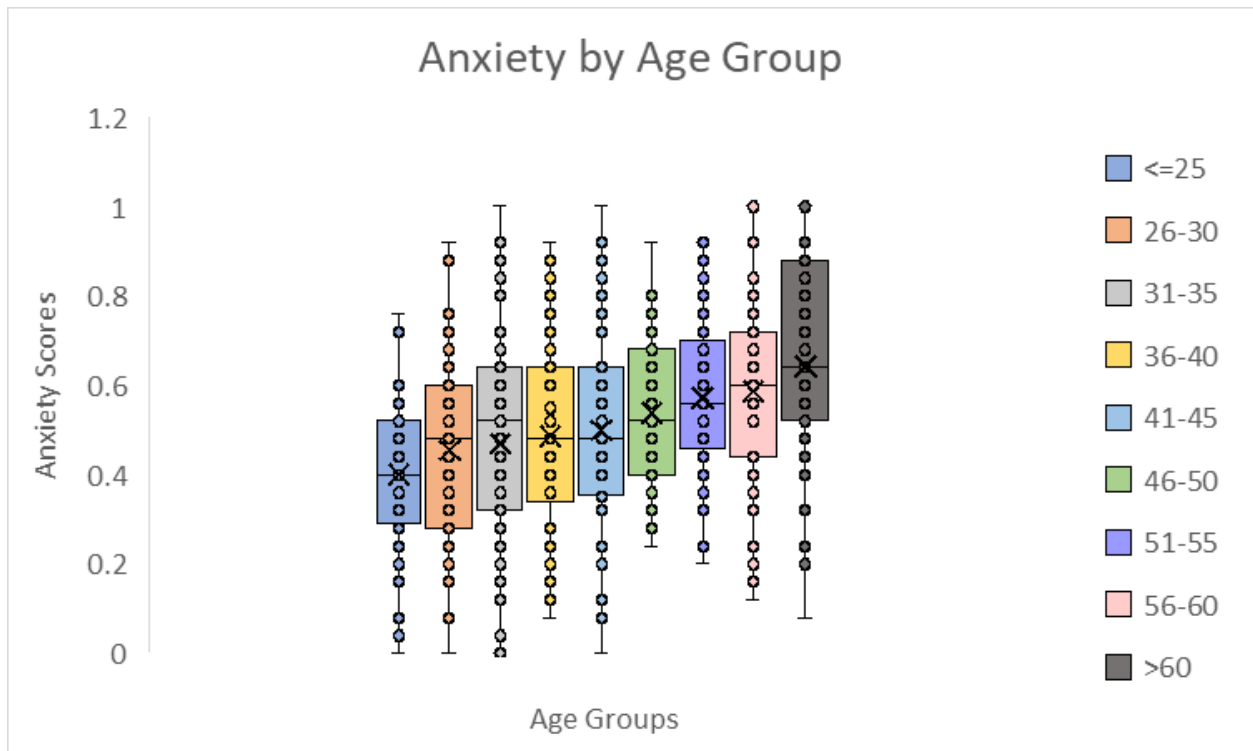


**Figure A19.** Boxplot of 2025 data with jittered dots showing MHI anxiety scores across age groups.

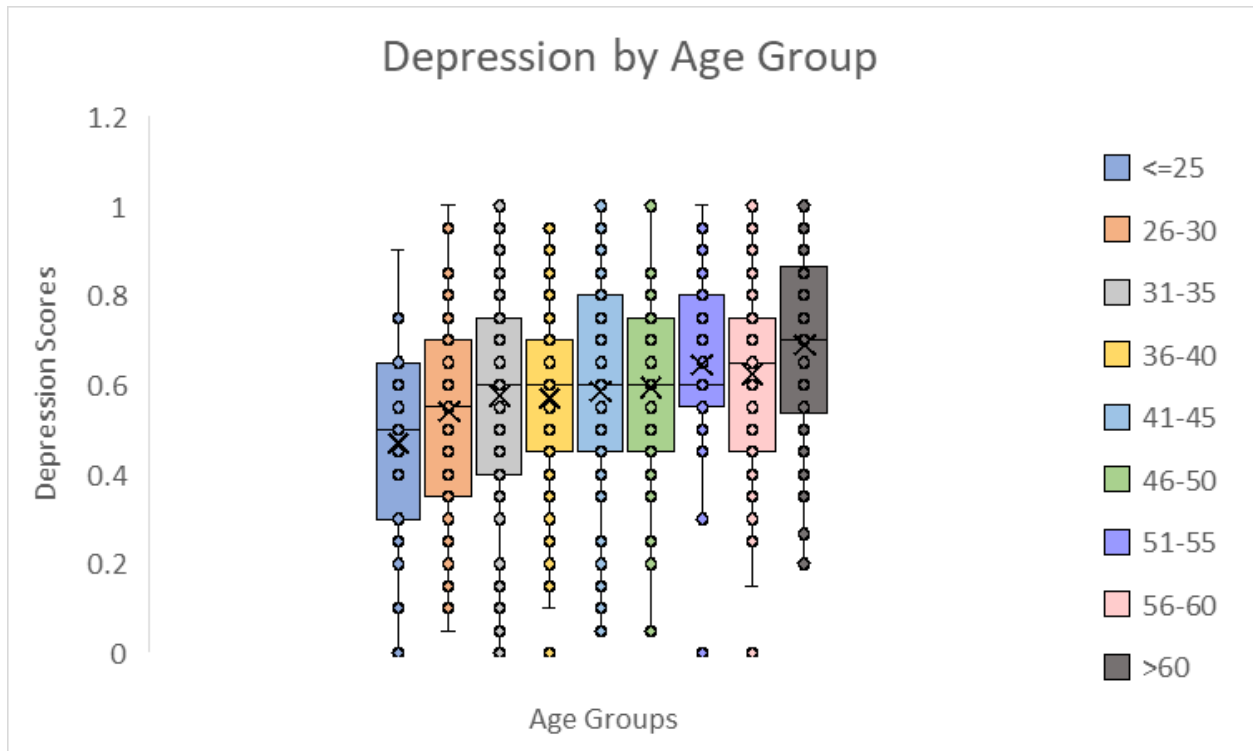


**Figure A20.** Boxplot of 2025 data with jittered dots showing MHI depression scores across age groups.

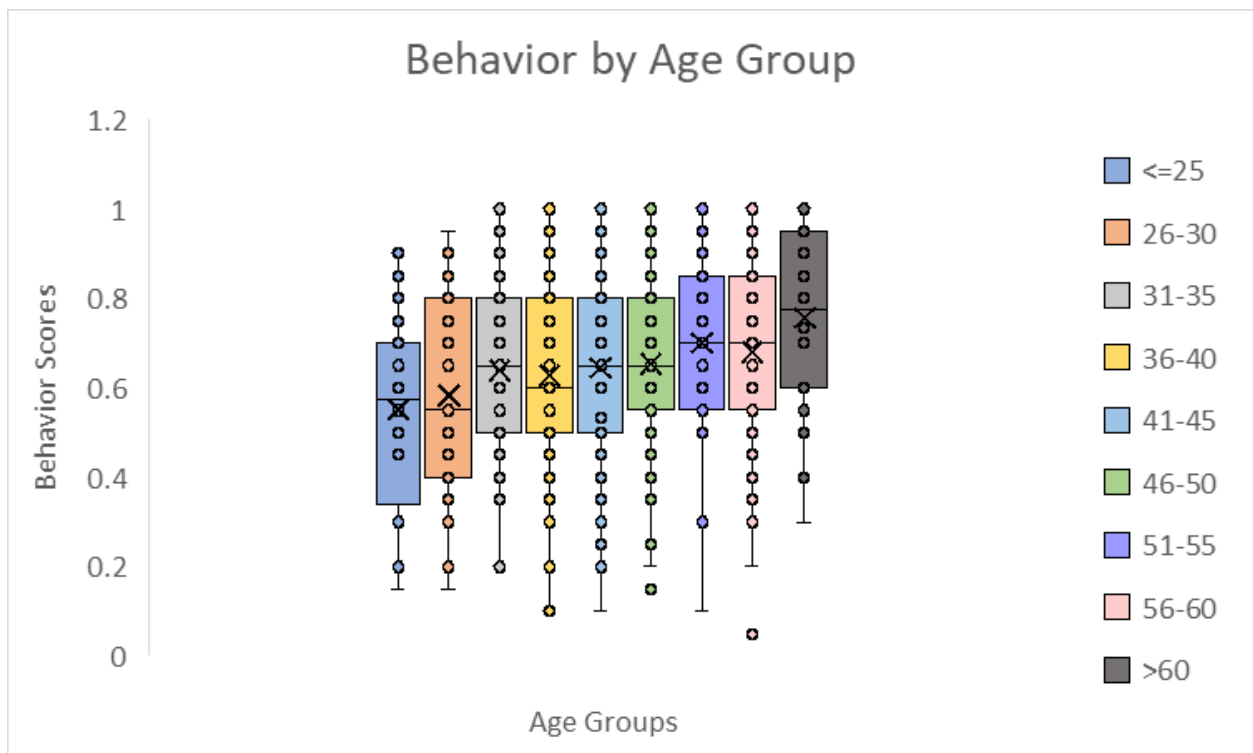


**Figure A21.** Boxplot of 2025 data with jittered dots showing MHI behavior scores across age groups.

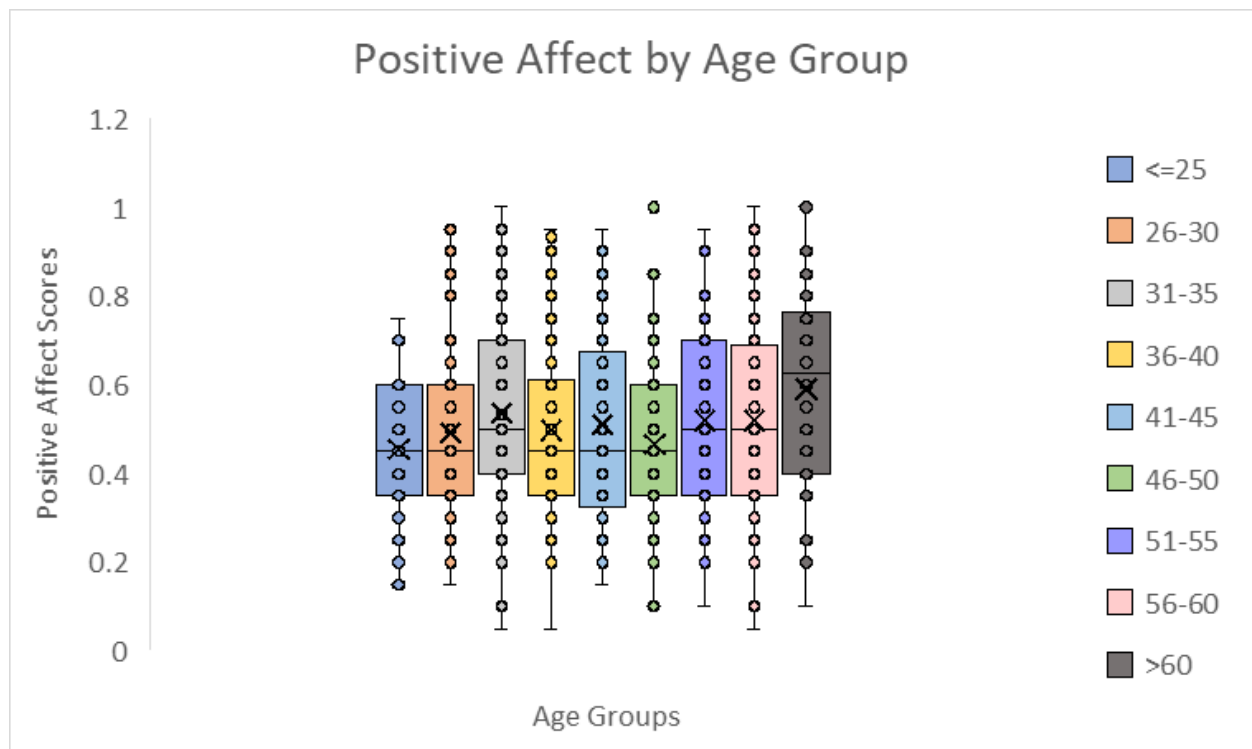


**Figure A22.** Boxplot of 2025 data with jittered dots showing MHI positive affect scores across age groups

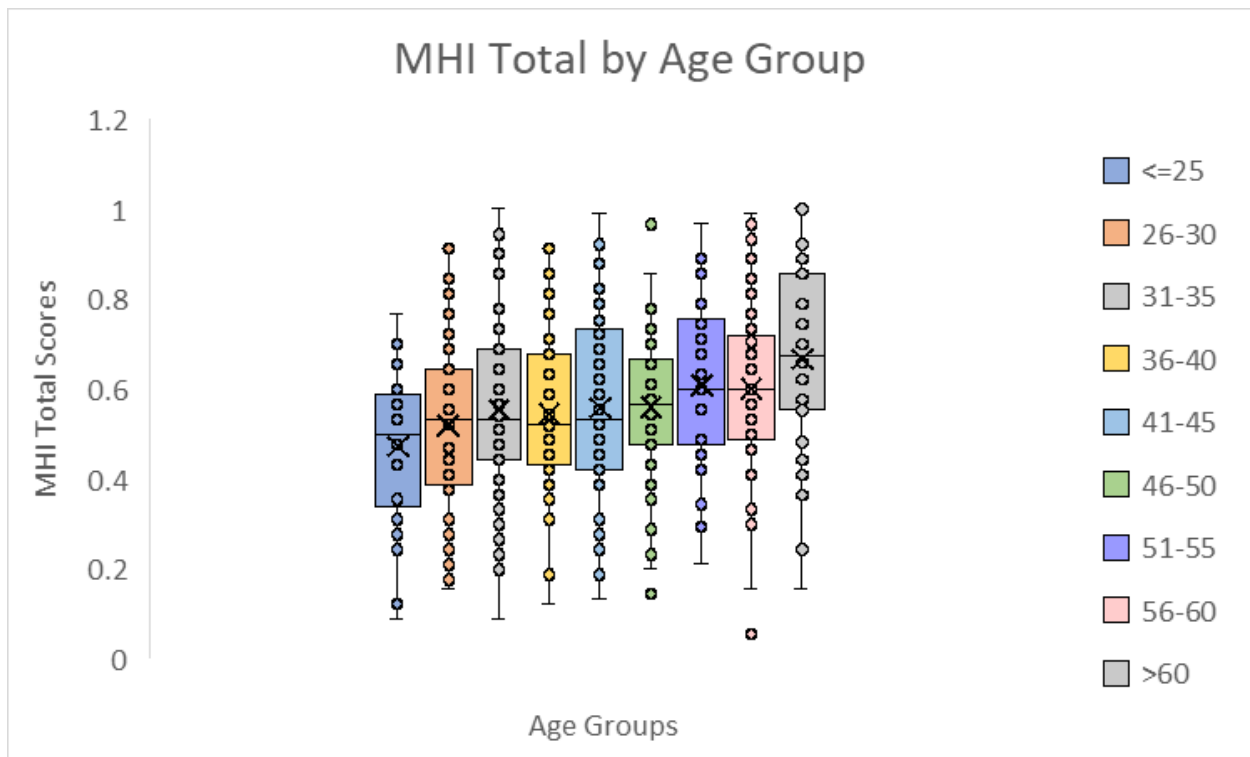


**Figure A23.** Boxplot of 2025 data with jittered dots showing total MHI scores across age groups.

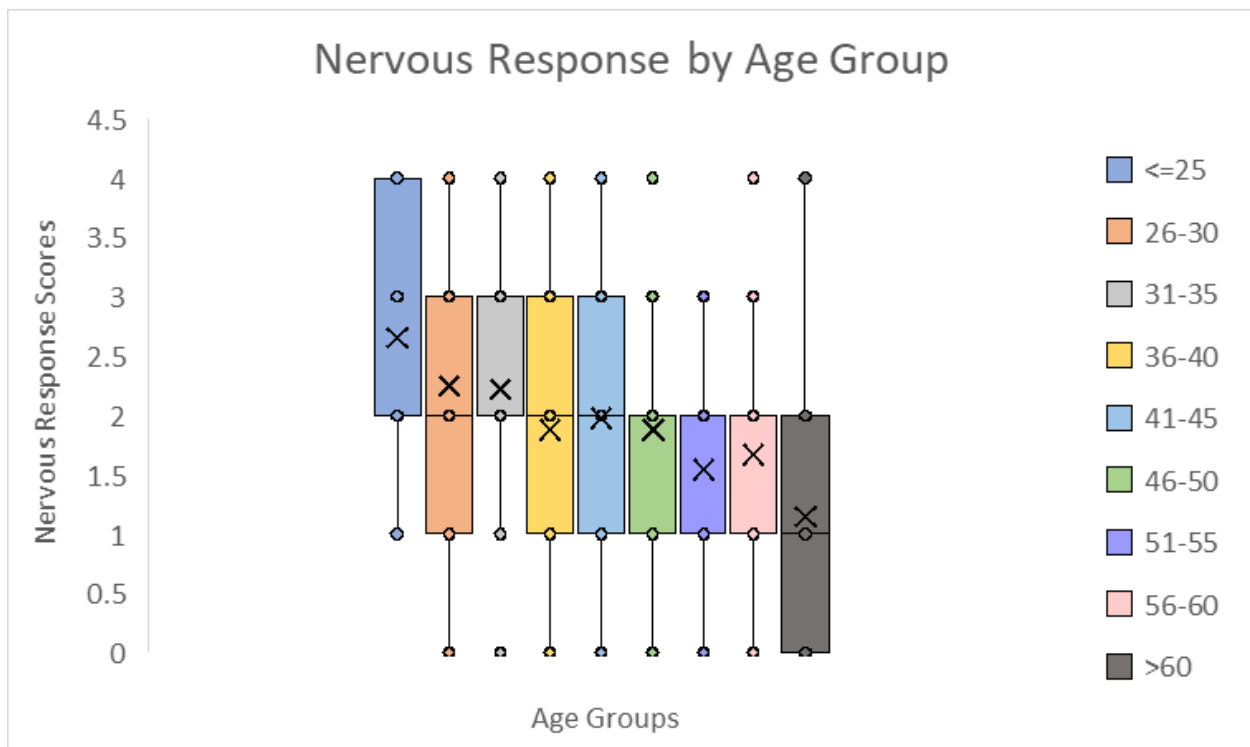


**Figure A24.** Boxplot of 2025 data with jittered dots showing K6 nervous response scores across age groups.

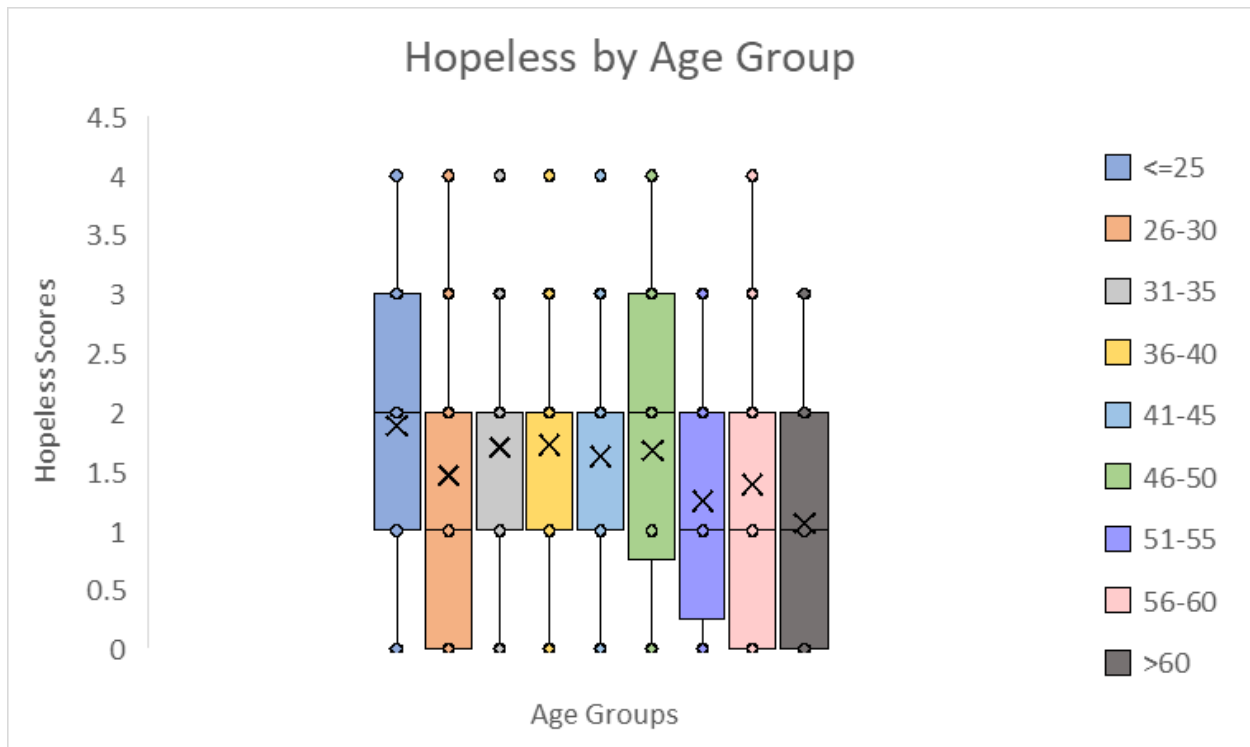


**Figure A25.** Boxplot of 2025 data with jittered dots showing K6 hopeless scores across age groups.

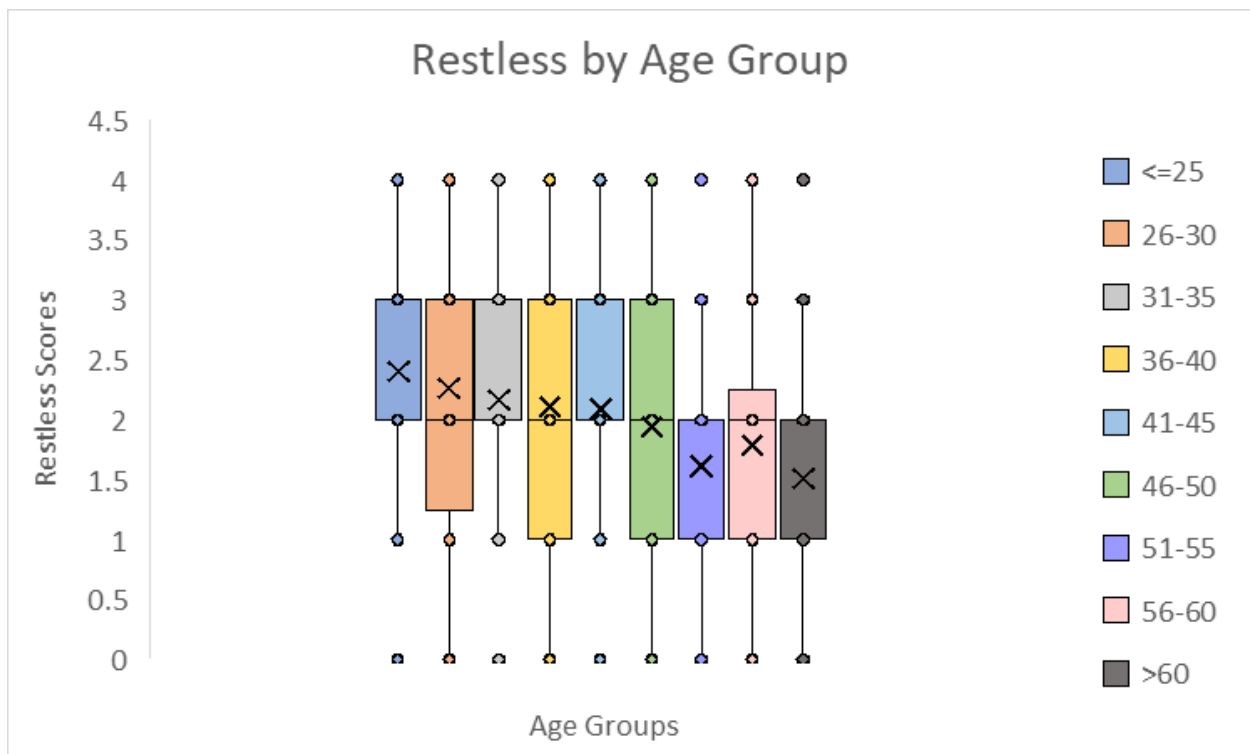


**Figure A26.** Boxplot of 2025 data with jittered dots showing K6 restless scores across age groups.

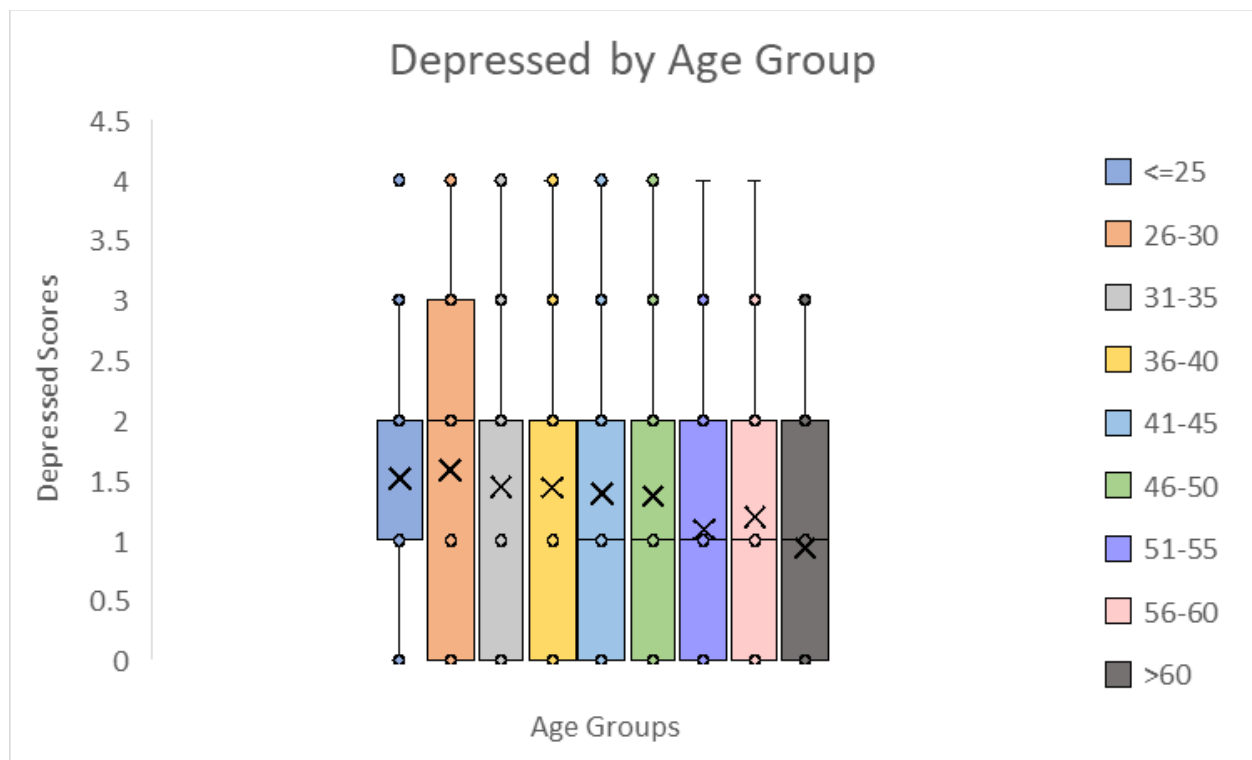


**Figure A27.** Boxplot of 2025 data with jittered dots showing K6 depression scores across age groups.

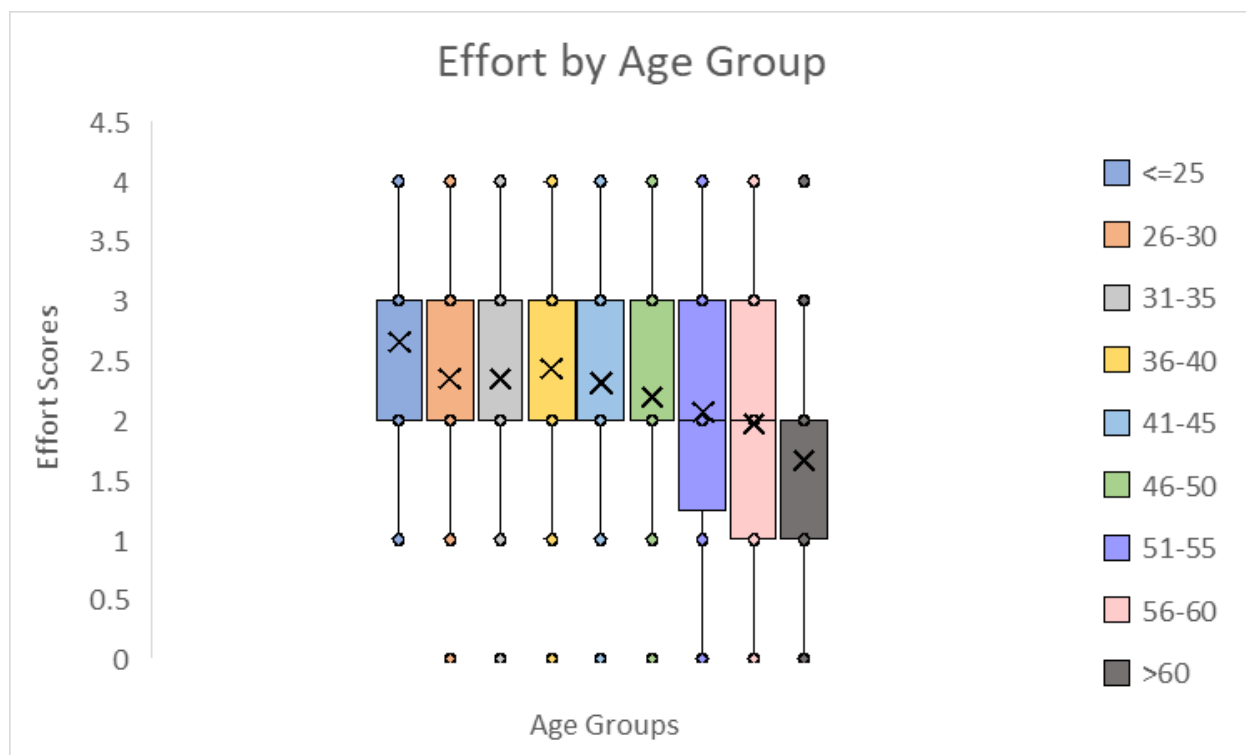


**Figure A28.** Boxplot of 2025 data with jittered dots showing K6 effort scores across age groups.

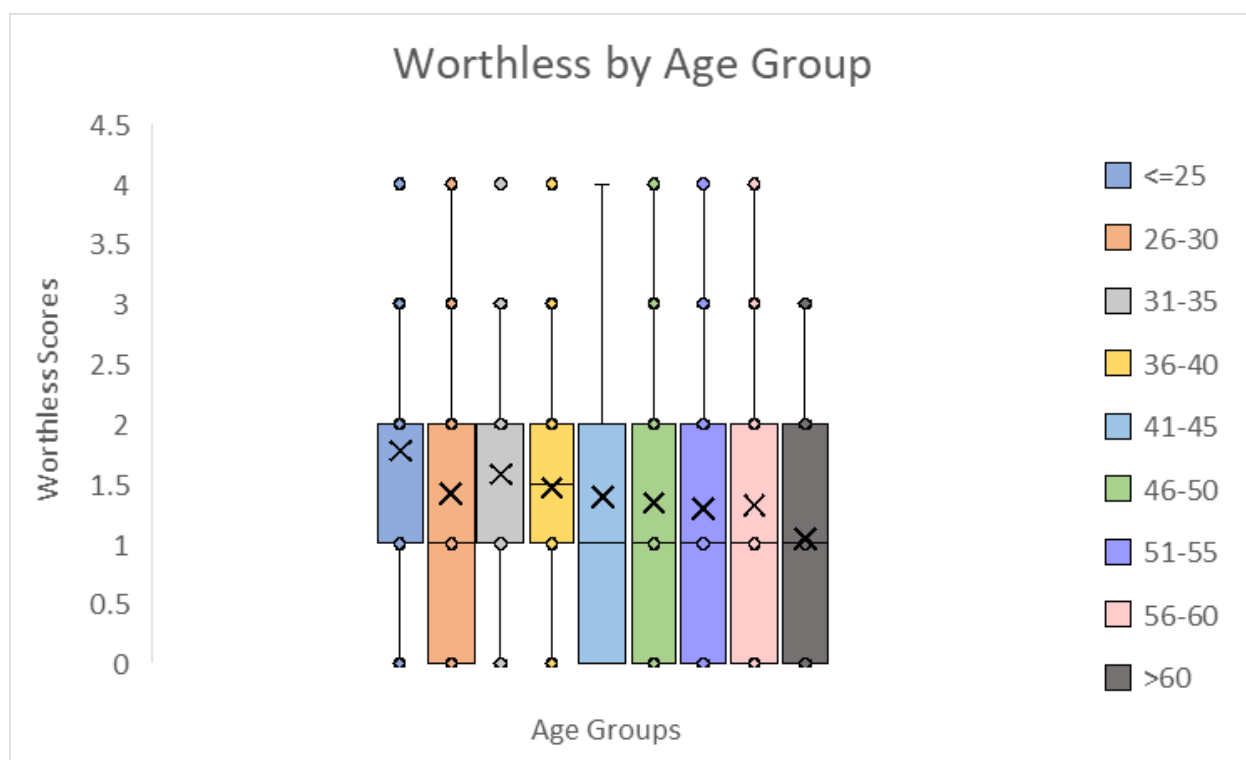


**Figure A29.** Boxplot of 2025 data with jittered dots showing K6 worthlessness scores across age groups.

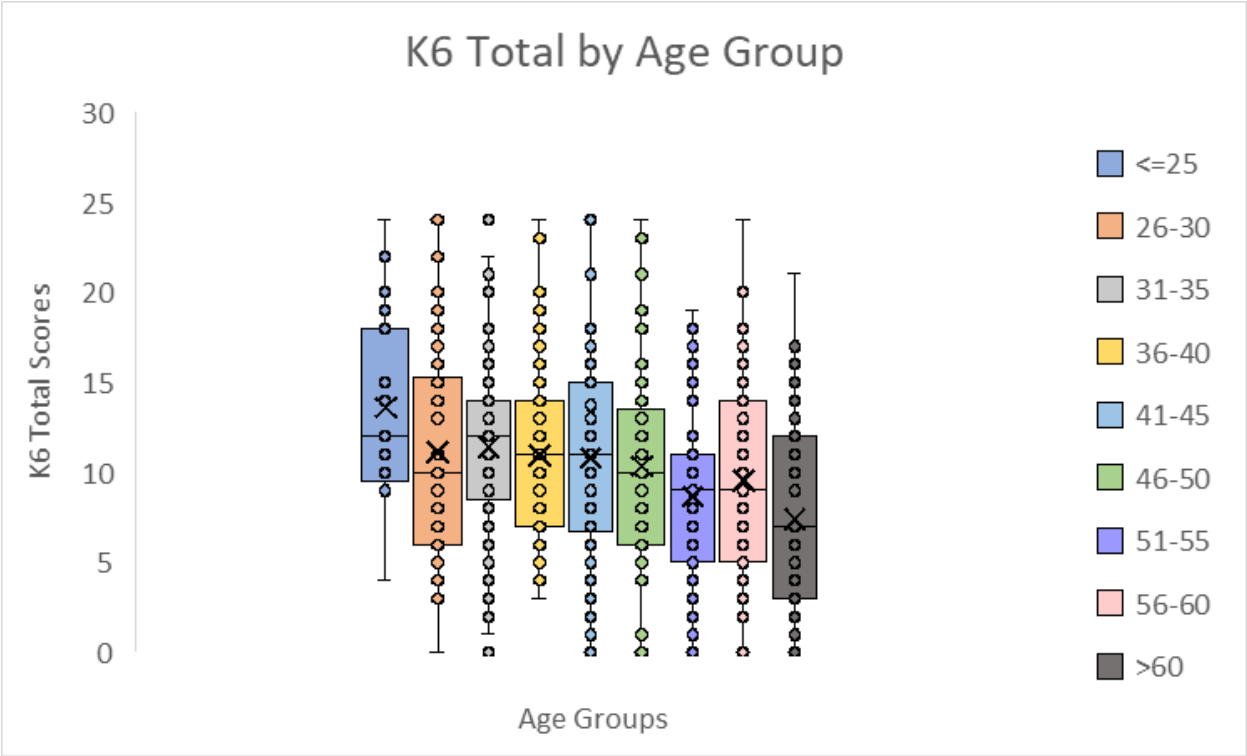


**Figure A30.** Boxplot of 2025 data with jittered dots showing total K6 scores across age groups.

## Appendix B. Inferential Quantitative Analysis

**Table B1.** Descriptive data for 2023 summarizing median MBI-HSS section scores by age group.

| Totals    |     |         | Section Survey Scores       |                          |                             |
|-----------|-----|---------|-----------------------------|--------------------------|-----------------------------|
| Age Group | N   | %       | Median Emotional Exhaustion | Median Depersonalization | Median Personal Achievement |
| ≤25       | 46  | 6.13%   | 36.00                       | 11.00                    | 32.00                       |
| 26–30     | 89  | 11.85%  | 39.00                       | 8.00                     | 31.00                       |
| 31–35     | 101 | 13.45%  | 39.00                       | 9.00                     | 30.00                       |
| 36–40     | 127 | 16.91%  | 36.00                       | 7.00                     | 32.00                       |
| 41–45     | 70  | 9.32%   | 36.00                       | 10.00                    | 31.00                       |
| 46–50     | 85  | 11.32%  | 40.00                       | 10.00                    | 32.00                       |
| 51–55     | 100 | 13.32%  | 37.00                       | 8.00                     | 30.00                       |
| 56–60     | 74  | 9.85%   | 33.31                       | 4.50                     | 33.64                       |
| >60       | 58  | 7.72%   | 28.00                       | 6.00                     | 33.50                       |
| Total     | 751 | 100.00% | 37.00                       | 8.00                     | 32.00                       |

**Table B2.** Summary of 2023 Kruskal–Wallis (KW) analysis results and Dunn’s post hoc test comparisons for MBI-HSS survey sections.

| Survey section            | KW (H statistic, p value) | Group 1 | Group 2 | Z statistic | p value |
|---------------------------|---------------------------|---------|---------|-------------|---------|
| Emotional Exhaustion (EE) | 16.1437 (p=0.040)         | ≤25     | >60     | 2.581       | 0.00986 |
|                           |                           | 26–30   | >60     | 3.216       | 0.00130 |
|                           |                           | 31–35   | >60     | 2.960       | 0.00308 |
|                           |                           | 36–40   | >60     | 2.360       | 0.01826 |
|                           |                           | 41–45   | >60     | 2.319       | 0.02037 |
|                           |                           | 46–50   | >60     | 3.115       | 0.00184 |
|                           |                           | 51–55   | >60     | 2.082       | 0.03732 |
| Depersonalization (DP)    | 21.1332 (p=0.007)         | ≤25     | 56–60   | 3.157       | 0.03732 |
|                           |                           | ≤25     | >60     | 2.998       | 0.00271 |
|                           |                           | 26–30   | 56–60   | 2.974       | 0.00294 |
|                           |                           | 26–30   | >60     | 2.767       | 0.00566 |
|                           |                           | 31–35   | 56–60   | 2.499       | 0.01246 |
|                           |                           | 31–35   | >60     | 2.316       | 0.02057 |
|                           |                           | 36–40   | 56–60   | 2.086       | 0.03698 |
|                           |                           | 41–45   | 56–60   | 2.721       | 0.00651 |

|                           |                    |       |       |       |         |
|---------------------------|--------------------|-------|-------|-------|---------|
|                           |                    | 41–45 | >60   | 2.549 | 0.01079 |
|                           |                    | 46–50 | 56–60 | 2.406 | 0.01615 |
|                           |                    | 46–50 | >60   | 2.241 | 0.02504 |
| Personal Achievement (PA) | 9.48328 (p=0.303)* |       |       |       |         |

\*Result was nonsignificant ( $p>0.05$ ); therefore, Dunn's post hoc test was not performed.

**Table B3.** Descriptive data for 2023 summarizing median MHI section scores by age group.

| Totals     |     |         | Section Survey Scores |                   |                 |                        |              |
|------------|-----|---------|-----------------------|-------------------|-----------------|------------------------|--------------|
| Age Groups | N   | %       | Median Anxiety        | Median Depression | Median Behavior | Median Positive Affect | Median Total |
| ≤25        | 53  | 7.11%   | 36                    | 45                | 50              | 45                     | 46           |
| 26–30      | 87  | 11.68%  | 44                    | 55                | 55              | 40                     | 49           |
| 31–35      | 103 | 13.83%  | 48                    | 55                | 60              | 40                     | 51           |
| 36–40      | 118 | 15.84%  | 56                    | 60                | 65              | 40                     | 54           |
| 41–45      | 71  | 9.53%   | 52                    | 60                | 60              | 40                     | 51           |
| 46–50      | 83  | 11.14%  | 56                    | 60                | 60              | 40                     | 57           |
| 51–55      | 94  | 12.62%  | 60                    | 65                | 68              | 50                     | 57           |
| 56–60      | 70  | 9.40%   | 60                    | 63                | 63              | 43                     | 57           |
| >60        | 66  | 8.86%   | 64                    | 70                | 75              | 50                     | 63           |
| Total      | 745 | 100.00% | 52                    | 60                | 65              | 45                     | 54           |

**Table B4.** Summary of 2023 Kruskal–Wallis (KW) analysis results and Dunn’s post hoc test results for MHI survey sections.

| Survey section | KW (H statistic, p value) | Significant pairwise age group comparisons |         | Dunn’s test (Z statistics and <i>p</i> values) |          |
|----------------|---------------------------|--------------------------------------------|---------|------------------------------------------------|----------|
| Anxiety        | 58.7232 (p=0.000)         | Group 1                                    | Group 2 | Z statistics                                   | P values |
|                |                           | ≤25                                        | 31–35   | 2.135                                          | 0.03279  |
|                |                           | ≤25                                        | 36–40   | 3.855                                          | 0.00012  |
|                |                           | ≤25                                        | 41–45   | 2.880                                          | 0.00398  |
|                |                           | ≤25                                        | 46–50   | 3.590                                          | 0.00033  |
|                |                           | ≤25                                        | 51–55   | 5.523                                          | 0.00000  |
|                |                           | ≤25                                        | 56–60   | 3.971                                          | 0.00007  |
|                |                           | ≤25                                        | >60     | 5.599                                          | 0.00000  |
|                |                           | 26–30                                      | 36–40   | 2.526                                          | 0.01155  |
|                |                           | 26–30                                      | 46–50   | 2.171                                          | 0.02994  |
|                |                           | 26–30                                      | 51–55   | 4.490                                          | 0.00001  |
|                |                           | 26–30                                      | 56–60   | 2.755                                          | 0.00586  |
|                |                           | 26–30                                      | >60     | 4.608                                          | 0.00000  |
|                |                           | 31–35                                      | 36–40   | 2.051                                          | 0.04023  |
|                |                           | 31–35                                      | 51–55   | 4.121                                          | 0.00004  |
|                |                           | 31–35                                      | 56–60   | 2.338                                          | 0.01939  |
|                |                           | 31–35                                      | >60     | 4.261                                          | 0.00002  |
|                |                           | 36–40                                      | >60     | 2.572                                          | 0.01012  |
|                |                           | 41–45                                      | 51–55   | 2.708                                          | 0.00676  |
|                |                           | 41–45                                      | >60     | 2.983                                          | 0.00286  |
|                |                           | 46–50                                      | 51–55   | 2.879                                          | 0.00398  |

|            |                      |       |       |       |         |
|------------|----------------------|-------|-------|-------|---------|
|            |                      | 46–50 | >60   | 3.133 | 0.00173 |
| Depression | 43.8273<br>(p=0.000) | ≤25   | 31–35 | 1.658 | 0.09735 |
|            |                      | ≤25   | 36–40 | 3.512 | 0.00045 |
|            |                      | ≤25   | 46–50 | 2.691 | 0.00713 |
|            |                      | ≤25   | 51–55 | 4.120 | 0.00004 |
|            |                      | ≤25   | 56–60 | 4.056 | 0.00005 |
|            |                      | ≤25   | >60   | 4.518 | 0.00001 |
|            |                      | 26–30 | 36–40 | 2.704 | 0.00685 |
|            |                      | 26–30 | 51–55 | 3.423 | 0.00062 |
|            |                      | 26–30 | 56–60 | 3.363 | 0.00077 |
|            |                      | 26–30 | >60   | 3.889 | 0.00010 |
|            |                      | 31–35 | 36–40 | 2.228 | 0.02589 |
|            |                      | 31–35 | 51–55 | 2.997 | 0.00272 |
|            |                      | 31–35 | 56–60 | 2.959 | 0.00309 |
|            |                      | 31–35 | >60   | 3.508 | 0.00045 |
|            |                      | 41–45 | 51–55 | 2.491 | 0.01273 |
|            |                      | 41–45 | 56–60 | 2.508 | 0.01214 |
|            |                      | 41–45 | >60   | 3.025 | 0.00248 |
|            |                      | 46–50 | >60   | 2.184 | 0.02895 |
| Behavior   | 39.1624<br>(p=0.000) | ≤25   | 36–40 | 2.656 | 0.00791 |
|            |                      | ≤25   | 46–50 | 2.234 | 0.02549 |
|            |                      | ≤25   | 51–55 | 3.502 | 0.00046 |
|            |                      | ≤25   | 56–60 | 3.997 | 0.00006 |
|            |                      | ≤25   | >60   | 4.354 | 0.00001 |
|            |                      | 26–30 | 36–40 | 2.122 | 0.03384 |

|                 |                      |       |       |       |         |
|-----------------|----------------------|-------|-------|-------|---------|
|                 |                      | 26–30 | 51–55 | 3.107 | 0.00189 |
|                 |                      | 26–30 | 56–60 | 3.665 | 0.00025 |
|                 |                      | 26–30 | >60   | 4.067 | 0.00005 |
|                 |                      | 31–35 | 51–55 | 2.081 | 0.03748 |
|                 |                      | 31–35 | 56–60 | 2.731 | 0.00631 |
|                 |                      | 31–35 | >60   | 3.161 | 0.00157 |
|                 |                      | 36–40 | >60   | 2.368 | 0.01788 |
|                 |                      | 41–45 | 51–55 | 2.303 | 0.02129 |
|                 |                      | 41–45 | 56–60 | 2.899 | 0.00374 |
|                 |                      | 41–45 | >60   | 3.297 | 0.00098 |
|                 |                      | 46–50 | 56–60 | 2.065 | 0.03896 |
|                 |                      | 46–50 | >60   | 2.488 | 0.01284 |
| Positive Affect | 20.1172<br>(p=0.010) | 26–30 | >60   | 2.254 | 0.02419 |
|                 |                      | 31–35 | 51–55 | 2.143 | 0.03211 |
|                 |                      | 31–35 | 56–60 | 1.978 | 0.04792 |
|                 |                      | 31–35 | >60   | 2.462 | 0.01381 |
|                 |                      | 36–40 | >60   | 2.152 | 0.03136 |
|                 |                      | 41–45 | 51–55 | 3.097 | 0.00196 |
|                 |                      | 41–45 | 56–60 | 2.895 | 0.00379 |
|                 |                      | 41–45 | >60   | 3.330 | 0.00087 |
|                 |                      | 46–50 | >60   | 2.173 | 0.02974 |
| Total           | 42.226<br>(p=0.000)  | ≤25   | 46–50 | 2.425 | 0.01530 |
|                 |                      | ≤25   | 51–55 | 4.163 | 0.00003 |
|                 |                      | ≤25   | 56–60 | 3.805 | 0.00014 |
|                 |                      | ≤25   | >60   | 4.441 | 0.00001 |

|  |  |       |       |       |         |
|--|--|-------|-------|-------|---------|
|  |  | 26–30 | 51–55 | 3.523 | 0.00043 |
|  |  | 26–30 | 56–60 | 3.126 | 0.00177 |
|  |  | 26–30 | >60   | 3.848 | 0.00012 |
|  |  | 31–35 | 51–55 | 3.111 | 0.00186 |
|  |  | 31–35 | 56–60 | 2.721 | 0.00650 |
|  |  | 31–35 | >60   | 3.474 | 0.00051 |
|  |  | 36–40 | >60   | 2.331 | 0.01973 |
|  |  | 41–45 | 51–55 | 2.958 | 0.00310 |
|  |  | 41–45 | 56–60 | 2.629 | 0.00857 |
|  |  | 41–45 | >60   | 3.328 | 0.00087 |
|  |  | 46–50 | >60   | 2.381 | 0.01728 |
|  |  |       |       |       |         |

**Table B5.** Descriptive data for 2023 summarizing median K6 section scores by age group.

| Totals    |     |         | Section Survey Scores   |                     |                     |                   |               |                      |              |
|-----------|-----|---------|-------------------------|---------------------|---------------------|-------------------|---------------|----------------------|--------------|
| Age Group | N   | %       | Median Nervous Response | Median Hopelessness | Median Restlessness | Median Depression | Median Effort | Median Worthlessness | Median Total |
| ≤25       | 27  | 8.85%   | 3                       | 3                   | 3                   | 2                 | 3             | 3                    | 16           |
| 26–30     | 40  | 13.11%  | 3                       | 3                   | 3                   | 3                 | 3             | 3                    | 17           |
| 31–35     | 46  | 15.08%  | 3                       | 3                   | 3*                  | 3                 | 3             | 2                    | 16           |
| 36–40     | 55  | 18.03%  | 3                       | 3                   | 3                   | 2                 | 3             | 2                    | 16           |
| 41–45     | 31  | 10.16%  | 3                       | 3                   | 3                   | 3                 | 3             | 3                    | 16           |
| 46–50     | 35  | 11.48%  | 3                       | 3                   | 3                   | 2                 | 3             | 2                    | 16           |
| 51–55     | 32  | 10.49%  | 3                       | 3                   | 3                   | 2                 | 3             | 2                    | 15           |
| 56–60     | 24  | 7.87%   | 3                       | 3                   | 3                   | 2                 | 3             | 2                    | 15.5         |
| >60       | 15  | 4.92%   | 3                       | 2                   | 3                   | 2                 | 3             | 3                    | 16           |
| Total     | 305 | 100.00% | 3                       | 3                   | 3                   | 2                 | 3             | 2                    | 16           |

\* The total number of respondents for the K6 section scores was one fewer because one participant did not complete this section of the survey.

**Table B6.** Summary of 2023 Kruskal–Wallis (KW) analysis results for K6 survey sections.

| Survey section   | KW (H statistic, p value) |
|------------------|---------------------------|
| Nervous Response | 6.2396 (p=0.620)*         |
| Hopeless         | 10.0457 (p=0.262)*        |
| Restless         | 6.40922 (p=0.601)*        |
| Depression       | 11.8776 (p=0.157)*        |
| Effort           | 8.46574 (p=0.389)*        |
| Worthlessness    | 12.5196 (p=0.129)*        |
| Total            | 14.2283 (p=0.076)*        |

\*Results were nonsignificant ( $p > 0.05$ ); therefore, Dunn’s post hoc test was not performed.

**Table B7.** Descriptive data for 2025 summarizing median MBI-HSS section scores by age group.

| Total     |     |         | Section Survey Scores       |                          |                             |
|-----------|-----|---------|-----------------------------|--------------------------|-----------------------------|
| Age Group | N   | %       | Median Emotional Exhaustion | Median Depersonalization | Median Personal Achievement |
| ≤25       | 26  | 4.98%   | 32.25                       | 8.00                     | 34.83                       |
| 26–30     | 56  | 10.73%  | 34.50                       | 11.50                    | 34.48                       |
| 31–35     | 86  | 16.48%  | 35.00                       | 8.67                     | 32.00                       |
| 36–40     | 75  | 14.37%  | 36.00                       | 7.00                     | 32.00                       |
| 41–45     | 77  | 14.75%  | 34.00                       | 9.00                     | 32.00                       |
| 46–50     | 53  | 10.15%  | 32.00                       | 6.25                     | 33.00                       |
| 51–55     | 42  | 8.05%   | 32.81                       | 6.00                     | 34.00                       |
| 56–60     | 65  | 12.45%  | 32.63                       | 5.00                     | 35.43                       |
| >60       | 42  | 8.05%   | 30.62                       | 4.50                     | 37.00                       |
| Total     | 522 | 100.00% | 34.00                       | 7.50                     | 33.33                       |

**Table B8.** Summary of 2025 Kruskal–Wallis (KW) analysis results for MBI-HSS survey sections.

| Survey section            | KW (H statistic, p value) |
|---------------------------|---------------------------|
| Emotional Exhaustion (EE) | 10.4506 (p=0.235)*        |
| Depersonalization (DP)    | 12.9185 (p=0.115)*        |
| Personal Achievement (PA) | 11.9351 (p=0.154)*        |

\*Results were nonsignificant ( $p>0.05$ ); therefore, Dunn’s post hoc test was not performed.

**Table B9.** Descriptive data for 2025 summarizing median MHI section scores by age group.

| Total     |     |         | Section Survey Scores |                   |                 |                        |              |
|-----------|-----|---------|-----------------------|-------------------|-----------------|------------------------|--------------|
| Age Group | N   | %       | Median Anxiety        | Median Depression | Median Behavior | Median Positive Affect | Median Total |
| ≤25       | 32  | 6.31%   | 40                    | 50                | 58              | 45                     | 50           |
| 26–30     | 55  | 10.85%  | 48                    | 55                | 55              | 45                     | 53           |
| 31–35     | 87  | 17.16%  | 52                    | 60                | 65              | 50                     | 53           |
| 36–40     | 74  | 14.60%  | 48                    | 60                | 60              | 45                     | 52           |
| 41–45     | 73  | 14.40%  | 48                    | 60                | 65              | 45                     | 53           |
| 46–50     | 47  | 9.27%   | 52                    | 60                | 65              | 45                     | 57           |
| 51–55     | 41  | 8.09%   | 56                    | 60                | 70              | 50                     | 60           |
| 56–60     | 56  | 11.05%  | 60                    | 65                | 70              | 50                     | 60           |
| >60       | 42  | 8.28%   | 64                    | 70                | 78              | 63                     | 67           |
| Total     | 507 | 100.00% | 52                    | 60                | 65              | 50                     | 56           |

**Table B10.** Summary of 2025 Kruskal–Wallis (KW) analysis results and Dunn’s post hoc test comparisons for MHI survey sections.

| Survey section | KW (H statistic, p value) | Significant pairwise age group comparisons |         | Dunn’s Test (Z statistics and p values) |          |
|----------------|---------------------------|--------------------------------------------|---------|-----------------------------------------|----------|
| Anxiety        | 41.617<br>(p=0.000)       | Group 1                                    | Group 2 | Z statistics                            | P values |
|                |                           | ≤25                                        | 41–45   | 2.122                                   | 0.03381  |
|                |                           | ≤25                                        | 46–50   | 2.772                                   | 0.00557  |
|                |                           | ≤25                                        | 51–55   | 3.356                                   | 0.00079  |
|                |                           | ≤25                                        | 56–60   | 3.975                                   | 0.00007  |
|                |                           | ≤25                                        | >60     | 4.723                                   | 0.00000  |
|                |                           | 26–30                                      | 56–60   | 3.228                                   | 0.00124  |
|                |                           | 26–30                                      | >60     | 4.100                                   | 0.00004  |
|                |                           | 31–35                                      | 56–60   | 3.120                                   | 0.00181  |
|                |                           | 31–35                                      | >60     | 4.055                                   | 0.00005  |
|                |                           | 36–40                                      | 51–55   | 2.036                                   | 0.04177  |
|                |                           | 36–40                                      | 56–60   | 2.741                                   | 0.00613  |
|                |                           | 36–40                                      | >60     | 3.690                                   | 0.00022  |
|                |                           | 41–45                                      | 56–60   | 2.426                                   | 0.01529  |
|                |                           | 41–45                                      | >60     | 3.399                                   | 0.00068  |

|            |                      |       |       |       |         |
|------------|----------------------|-------|-------|-------|---------|
|            |                      | 46–50 | >60   | 2.227 | 0.02597 |
| Depression | 21.6164<br>(p=0.006) | ≤25   | 41–45 | 2.265 | 0.02351 |
|            |                      | ≤25   | 46–50 | 2.163 | 0.03052 |
|            |                      | ≤25   | 51–55 | 2.915 | 0.00355 |
|            |                      | ≤25   | 56–60 | 2.808 | 0.00499 |
|            |                      | ≤25   | >60   | 3.834 | 0.00013 |
|            |                      | 26–30 | 51–55 | 2.041 | 0.04129 |
|            |                      | 26–30 | >60   | 3.090 | 0.00200 |
|            |                      | 31–35 | >60   | 2.675 | 0.00748 |
|            |                      | 36–40 | >60   | 2.795 | 0.00519 |
|            |                      | 41–45 | >60   | 2.166 | 0.03031 |
| Behavior   | 26.7742<br>(p=0.001) | ≤25   | 51–55 | 2.903 | 0.00370 |
|            |                      | ≤25   | 56–60 | 2.700 | 0.00694 |
|            |                      | ≤25   | >60   | 3.921 | 0.00009 |
|            |                      | 26–30 | 51–55 | 2.711 | 0.00671 |
|            |                      | 26–30 | 56–60 | 2.491 | 0.01273 |
|            |                      | 26–30 | >60   | 3.878 | 0.00011 |
|            |                      | 31–35 | >60   | 2.994 | 0.00276 |

|                 |                       |       |       |       |         |
|-----------------|-----------------------|-------|-------|-------|---------|
|                 |                       | 36–40 | >60   | 3.180 | 0.00147 |
|                 |                       | 41–45 | >60   | 2.656 | 0.00791 |
|                 |                       | 46–50 | >60   | 2.231 | 0.02567 |
| Positive Affect | 13.3584<br>(p=0.100)* |       |       |       |         |
| Total           | 26.538<br>(p=0.001)   | ≤25   | 46–50 | 1.971 | 0.04875 |
|                 |                       | ≤25   | 51–55 | 2.841 | 0.00450 |
|                 |                       | ≤25   | 56–60 | 2.956 | 0.00312 |
|                 |                       | ≤25   | >60   | 4.092 | 0.00004 |
|                 |                       | 26–30 | 51–55 | 2.148 | 0.03168 |
|                 |                       | 26–30 | 56–60 | 2.256 | 0.02410 |
|                 |                       | 26–30 | >60   | 3.579 | 0.00034 |
|                 |                       | 31–35 | >60   | 3.098 | 0.00195 |
|                 |                       | 36–40 | >60   | 3.374 | 0.00074 |
|                 |                       | 41–45 | >60   | 2.884 | 0.00393 |

\*Results were nonsignificant (p>0.05); therefore, Dunn's post hoc test was not performed.

**Table B11.** Descriptive data for 2025 summarizing median K6 section scores by age group.

| Total     |     |          | Section Survey Scores   |                     |                     |                   |               |                      |              |
|-----------|-----|----------|-------------------------|---------------------|---------------------|-------------------|---------------|----------------------|--------------|
| Age Group | N   | %        | Median Nervous Response | Median Hopelessness | Median Restlessness | Median Depression | Median Effort | Median Worthlessness | Median Total |
| ≤25       | 35  | 6.24%    | 2                       | 2                   | 2                   | 1                 | 3             | 2                    | 12           |
| 26–30     | 60  | 10.70%   | 2                       | 1                   | 2                   | 2                 | 2             | 1                    | 10           |
| 31–35     | 98  | 17.47%   | 2                       | 2                   | 2                   | 2                 | 2             | 2                    | 12           |
| 36–40     | 84  | 14.97%   | 2*                      | 2                   | 2                   | 2                 | 2             | 1.5                  | 12           |
| 41–45     | 80  | 14.26%   | 2                       | 2                   | 2                   | 1*                | 2             | 1                    | 11           |
| 46–50     | 51  | 9.09%    | 2                       | 2                   | 2                   | 1                 | 2             | 1*                   | 10           |
| 51–55     | 44  | 7.84%    | 2*                      | 1                   | 2                   | 1                 | 2             | 1                    | 9            |
| 56–60     | 62  | 11.05%   | 2                       | 1                   | 2                   | 1                 | 2*            | 1                    | 9            |
| >60       | 47  | 8.38%    | 1                       | 1                   | 2                   | 1                 | 2             | 1                    | 7            |
| Total     | 561 | 100.00 % | 2                       | 2                   | 2                   | 1                 | 2             | 1                    | 10           |

\*The total number of respondents for the K6 section scores was one fewer because one participant did not complete this section of the survey.

**Table B12.** Summary of 2025 Kruskal–Wallis (KW) analysis results and Dunn’s post hoc test comparisons for K6 survey sections.

| Survey section   | KW (H statistic, p value) | Group 1 | Group 2 | Z statistic | p value |
|------------------|---------------------------|---------|---------|-------------|---------|
| Nervous Response | 53.1426 (p=0.000)         | ≤25     | 36–40   | 3.321       | 0.00090 |
|                  |                           | ≤25     | 41–45   | 3.004       | 0.00266 |
|                  |                           | ≤25     | 46–50   | 3.078       | 0.00209 |
|                  |                           | ≤25     | 51–55   | 4.276       | 0.00002 |
|                  |                           | ≤25     | 56–60   | 4.185       | 0.00003 |
|                  |                           | ≤25     | >60     | 5.983       | 0.00000 |
|                  |                           | 26–30   | 51–55   | 2.997       | 0.00273 |
|                  |                           | 26–30   | 56–60   | 2.826       | 0.00471 |
|                  |                           | 26–30   | >60     | 4.940       | 0.00000 |
|                  |                           | 31–35   | 36–40   | 2.072       | 0.03829 |
|                  |                           | 31–35   | 51–55   | 3.351       | 0.00081 |
|                  |                           | 31–35   | 56–60   | 3.232       | 0.00123 |
|                  |                           | 31–35   | >60     | 5.498       | 0.00000 |
|                  |                           | 36–40   | >60     | 3.651       | 0.00026 |
|                  |                           | 41–45   | >60     | 3.956       | 0.00008 |

|          |                      |       |       |       |         |
|----------|----------------------|-------|-------|-------|---------|
|          |                      | 46–50 | >60   | 3.266 | 0.00109 |
|          |                      | 56–60 | >60   | 2.311 | 0.02086 |
| Hopeless | 19.5272<br>(p=0.012) | ≤25   | 51–55 | 2.419 | 0.01556 |
|          |                      | ≤25   | 56–60 | 2.038 | 0.04154 |
|          |                      | ≤25   | >60   | 3.191 | 0.00142 |
|          |                      | 31–35 | 51–55 | 2.162 | 0.03062 |
|          |                      | 31–35 | >60   | 3.138 | 0.00170 |
|          |                      | 36–40 | 51–55 | 2.213 | 0.02688 |
|          |                      | 36–40 | >60   | 3.164 | 0.00156 |
|          |                      | 41–45 | >60   | 2.601 | 0.00929 |
|          |                      | 46–50 | >60   | 2.575 | 0.01002 |
| Restless | 25.5257<br>(p=0.001) | ≤25   | 51–55 | 3.105 | 0.00190 |
|          |                      | ≤25   | 56–60 | 2.747 | 0.00601 |
|          |                      | ≤25   | >60   | 3.620 | 0.00029 |
|          |                      | 26–30 | 51–55 | 2.768 | 0.00565 |
|          |                      | 26–30 | 56–60 | 2.357 | 0.01842 |
|          |                      | 26–30 | >60   | 3.359 | 0.00078 |
|          |                      | 31–35 | 51–55 | 2.621 | 0.00878 |

|            |                       |       |       |       |         |
|------------|-----------------------|-------|-------|-------|---------|
|            |                       | 31–35 | 56–60 | 2.176 | 0.02957 |
|            |                       | 31–35 | >60   | 3.272 | 0.00107 |
|            |                       | 36–40 | 51–55 | 2.234 | 0.02545 |
|            |                       | 36–40 | >60   | 2.859 | 0.00425 |
|            |                       | 41–45 | 51–55 | 2.343 | 0.01914 |
|            |                       | 41–45 | >60   | 2.964 | 0.00304 |
| Depression | 12.3637<br>(p=0.136)* |       |       |       |         |
| Effort     | 22.0764<br>(p=0.005)  | ≤25   | 51–55 | 2.305 | 0.02118 |
|            |                       | ≤25   | 56–60 | 2.952 | 0.00316 |
|            |                       | ≤25   | >60   | 3.851 | 0.00012 |
|            |                       | 26–30 | >60   | 2.828 | 0.00468 |
|            |                       | 31–35 | 56–60 | 2.071 | 0.03839 |
|            |                       | 31–35 | >60   | 3.221 | 0.00128 |
|            |                       | 36–40 | 56–60 | 2.385 | 0.01708 |
|            |                       | 36–40 | >60   | 3.486 | 0.00049 |
|            |                       | 41–45 | >60   | 3.016 | 0.00256 |
|            |                       | 46–50 | >60   | 2.186 | 0.02880 |

|               |                       |       |       |       |         |
|---------------|-----------------------|-------|-------|-------|---------|
| Worthlessness | 10.2927<br>(p=0.245)* |       |       |       |         |
| Total         | 31.8285<br>(p=0.000)  | ≤25   | 26–30 | 2.183 | 0.02905 |
|               |                       | ≤25   | 36–40 | 2.168 | 0.03013 |
|               |                       | ≤25   | 41–45 | 2.425 | 0.01529 |
|               |                       | ≤25   | 46–50 | 2.518 | 0.01182 |
|               |                       | ≤25   | 51–55 | 3.710 | 0.00021 |
|               |                       | ≤25   | 56–60 | 3.282 | 0.00103 |
|               |                       | ≤25   | >60   | 4.553 | 0.00001 |
|               |                       | 26–30 | >60   | 2.895 | 0.00380 |
|               |                       | 31–35 | 51–55 | 2.779 | 0.00545 |
|               |                       | 31–35 | 56–60 | 2.194 | 0.02825 |
|               |                       | 31–35 | >60   | 3.876 | 0.00011 |
|               |                       | 36–40 | 51–55 | 2.194 | 0.02823 |
|               |                       | 36–40 | >60   | 3.241 | 0.00119 |
|               |                       | 41–45 | >60   | 2.882 | 0.00395 |
|               |                       | 46–50 | >60   | 2.319 | 0.02038 |

\*Results were nonsignificant ( $p>0.05$ ); therefore, Dunn's post hoc test was not performed.