Examining the Mental Health Status of D.D.S. Students at UNMC College of Dentistry

As part of a collaboration between Carson Trego, Anna Campbell, and Shayla Meyer

5/5/2025

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Anna Campbell and Shayla Meyer are both dental students
working on a research project as part of a requirement for the
completion of their dental program.

The project includes data collection, a poster presentation, and
a written report.

Campbell and Meyer had decided to base their project on
another group's project last year, which had compared the
mental health of 4 dental school grades using three mental
health metrics.

In the 2023–2024 academic year, do dental school grades show significant differences from each other in the three mental health measures?

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Several QR code posters were placed around the UNMC Dental
College.

Students responding to the survey would answer a set of
mental health questions from three questionnaires.

The project used data from last year and this year. Identifiable
information was not stored, which means that if a student had
taken the survey this year and last year, there is no way to tell.

Metrics

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- Patient Health Questionnaire 9 (PHQ-9): 9-question survey designed to quickly assess a respondent's risk of depression. 0 to 3 integer scale for each question.

- Burnout Mini-Z 1.0 Q3: Single question asking survey respondents to report how burned out they feel. 0 to 4 integer scale.

- Generalized Anxiety Disorder 7 (GAD-7): 7-question survey designed to quickly assess a respondent's risk of generalized anxiety disorder. 0 to 3 integer scale for each question.

All of these scores are designed to be easily graded using a point system, where the points from each question are added together to get a total value.

D1, D2, D3, D4: Codes indicating what year in dental school a student is, similar to words like "Freshman" and "Senior".

(2023–2024) / (2024–2025): Which academic year the survey was taken.

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Client Goals:

- Analysis should be valid and reasonable (as always).
- No expectation of any specific result; client just needed to perform a research project.
- No issue with complex methods, but would like to take time to understand the methods used.
- The results should be prepared for a presentation.

Actions:

- Be careful and transparent about validity conditions and choices.
- Prefer robust methods when possible.
- If equally valid, prefer the less complex method.
- Provide mini-lessons to explain methods.
- Summarize choices in short sentences for presentation.

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- In the 2024–2025 academic year, do any dental school grades show significant differences from each other across the three mental health measures? For example, is the average senior different from the average freshman?

- In terms of the three mental health metrics, is the average dental school student of a given grade different this year from last year? Are freshman this year less or more anxious on average?

Respondents

All groups received at least 22 responses, except D4 in the 2023–2024 academic year, which was excluded due to small sample size.

	D1	D2	D3	D4	Total
2023-2024	25	29	22	12	88
2024-2025	35	23	32	26	116

Data Modification

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The DEs supplied two datasets, with surveys from both years.

The two files had to be converted to the same format, then compiled into one CSV file.

Timestamp	Year	Gender	PHQ-9 Q1
12/9/2024 11:47:52	D3	Female	Not at all
12/9/2024 11:58:13	D3	Female	More than half the days
12/9/2024 14:52:43	D1	Female	More than half the days
12/9/2024 14:52:45	D1	Female	Several days
1/7/2024 12:08:50	D4	Male	1
1/8/2024 14:33:15	D2	Male	0
1/8/2024 14:33:59	D3	Female	3
1/8/2024 14:34:58	D2	Female	1

Table: Combined survey table, with the PHQ-9 responses encoded in both numeric values (last year's data) and direct words selected (this year's data)

Isolating Years

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Six contrasts of interest:

- PHQ-9 Score: (D1 2025–2024) - (D1 2023–2025), (D3 2025–2024) - (D3 2023–2025)
- Burnout Score: (D1 2025–2024) - (D1 2023–2025), (D3 2025–2024) - (D3 2023–2025)
- GAD-7 Score: (D1 2025–2024) - (D1 2023–2025), (D3 2025–2024) - (D3 2023–2025)

Missing Question and Reporting

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One PHQ-9 question was missing, making it essentially PHQ-8.

> **9.** Thoughts that you would be better off dead
> or of hurting yourself in some way

I assumed due to ethical concerns, but made sure to let the DEs know that the change was made and recommended that they report this alteration.

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Our metrics are calculated by adding multiple responses. Although the researchers are interested in a pre-existing metric rather than summing several variables to make their own, it couldn't hurt to check the loadings on the variables.

Metric	Cronbach's Alpha
PHQ-9	0.85
BURN	Not Applicable
GAD-7	0.90

PHQ	MR1 Loading
1	0.739
2	0.768
3	0.515
4	0.723
5	0.624
6	0.764
7	0.664
8	0.419

GAD	MR1 Loading
1	0.826
2	0.849
3	0.909
4	0.823
5	0.572
6	0.605
7	0.678

Alpha 0.70
Load 0.40

- PHQ-9: 0–3 each, 0–24 total
- Burnout Mini Z: 0–4 each, 0–4 total
- GAD-7: 0–3 each, 0–21 total
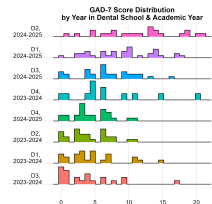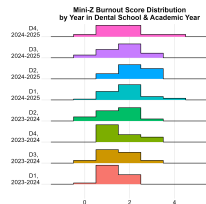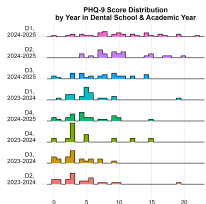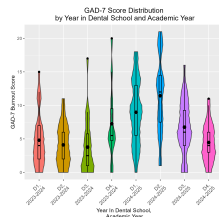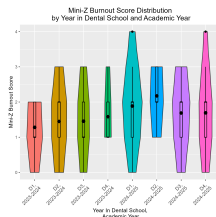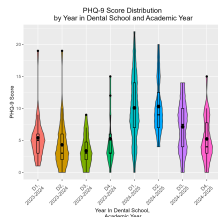
Assumption Checks

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	Levene	Shapiro	QQ
PHQ-9	0.04*	0.00*	Questionable
BURN	0.51	0.02*	Fine
GAD-7	0.04*	0.03*	Questionable

DENTALYR_NESTED	phq_mean	phq_median	phq_skew	phq_kurt	phq_var
D1.2024	5.4	5	2.31	9.99	12.42
D1.2025	10.09	10	0.24	2.49	27.61
D2.2024	4.31	3	1.97	8.19	15.01
D2.2025	10.30	9	0.66	2.61	18.86
D3.2024	3.36	3	0.55	2.61	6.59
D3.2025	7.13	7.5	0.02	2.08	16.31
D4.2024	5.25	3	1.13	3.10	19.84
D4.2025	5.23	4	0.77	3.36	12.66

DENTALYR_NESTED	burn_mean	burn_median	burn_skew	burn_var
D1.2024	1.28	1	0.14	0.29
D1.2025	1.89	2	0.50	0.75
D2.2024	1.45	2	-0.22	0.68
D2.2025	2.17	2	-0.25	0.51
D3.2024	1.45	1	0.15	0.64
D3.2025	1.69	2	-0.28	0.74
D4.2024	1.58	1	0.86	0.63
D4.2025	1.69	2	0.64	1.02

DENTALYR_NESTED	gad_mean	gad_median	gad_skew	gad_kurt	gad_var
D1.2024	4.8	4	0.93	3.18	16
D1.2025	8.97	9	0.09	2.11	22.56
D2.2024	4.10	4	0.45	2.37	9.91
D2.2025	11.43	12	-0.03	2.10	32.62
D3.2024	3.77	2.5	1.55	5.48	17.52
D3.2025	6.75	6	0.09	2.58	16.06
D4.2024	7.25	5	0.96	3.21	32.75
D4.2025	4.46	4	0.43	2.64	8.18

- Diagnostic plots are somewhat subjective.
- Tests that produce a numeric result are still somewhat subjective, as the tests of normality (Shapiro-Wilk) and unequal variances (Levene's test) are sometimes considered overly-conservative depending on the sample size.

Ultimately, I made the decision to NOT assume normality or equality of variance within groups.

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- Originally, Kruskal Wallis and Dunns test were considered.
- This would substantially change the hypothesis we are interested in.
- Many non-parametric tests like KW are sensitive to distributional differences that are not the location, which causes further issues for the hypothesis.
- To stay consistent with the client's hypothesis, a different method would be required.

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- Bootstrapping was chosen as a non-parametric alternative that preserves the main idea the client is interested in testing.
- To reduce the family-wise error rate, a Bonferroni adjustment was used.
- The choice of bootstrap and the importance of adjusting the p-values was communicated to the client.

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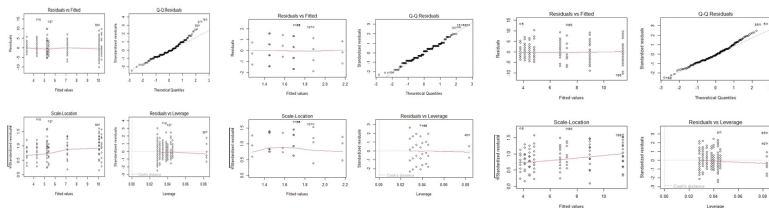| PHQ-9		
	Estimate	Adjusted P Value
D1(2023–2024) – D1(2024–2025)	-4.69	$< 0.001^{***}$
D3(2023–2024) – D3(2024–2025)	-3.75	$< 0.001^{***}$
Burnout Mini Z		
	Estimate	Adjusted P Value
D1(2023–2024) – D1(2024–2025)	-0.61	0.004^{**}
D3(2023–2024) – D3(2024–2025)	-0.23	1.00
GAD-7		
	Estimate	Adjusted P Value
D1(2023–2024) – D1(2024–2025)	-4.17	$< 0.001^{***}$
D3(2023–2024) – D3(2024–2025)	-2.98	0.048^{*}

Table: Between-Year Differences for PHQ-9, Burnout, and GAD-7

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	Estimate	Adjusted P Value
D1–D2	-0.29	1.00
D1–D3	2.96	0.05^* (rounded up)
D1–D4	4.85	$< 0.001^{**}$
D2–D3	3.17	0.03^*
D2–D4	5.07	$< 0.001^{***}$
D3–D4	1.89	0.32

Table: Within-2024–2025 PHQ-9 Comparisons Between Grades

Within 2024–2025 Results GAD-7

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	Estimate	Adjusted P Value
D1–D2	-2.46	0.48
D1–D3	2.22	0.21
D1–D4	4.51	$< 0.001^{***}$
D2–D3	4.68	0.003^{**}
D2–D4	6.97	$< 0.001^{**}$
D3–D4	2.29	0.06

Table: Within-2024–2025 GAD-7 Comparisons Between Grades.
Note: no signficant difference was found for the Burnout Mini Z
within the 2024-2025 academic year.

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- PHQ-9: D1 $\neq$ D3, D1 $\neq$ D4, D2 $\neq$ D3, D2 $\neq$ D4
- GAD-7: D1 $\neq$ D4, D2 $\neq$ D3, D2 $\neq$ D4
- PHQ-9: D1(2023-2024) - D1(2024-2025) $\neq$ 0, D3(2023-2024) - D3(2024-2025) $\neq$ 0
- Burnout: PHQ-9: D1(2023-2024) - D1(2024-2025) $\neq$ 0
- GAD-7: PHQ-9: D1(2023-2024) - D1(2024-2025) $\neq$ 0, D3(2023-2024) - D3(2024-2025) $\neq$ 0

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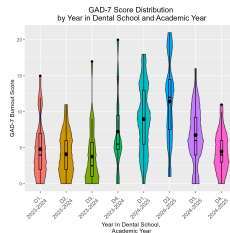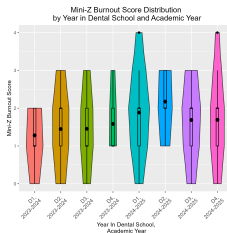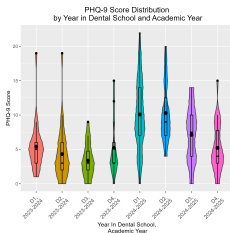
- Client very interested in understanding the methods used.
- Presentation not primarily on statistics, but responses to statistical questions were prepared in advance.
- Went over how to interpret p-values and the results in general.
- Discussed the error with the former poster interpretation (see below).

Conclusions

Our findings suggest that many dental students are feeling some amounts of anxiety, depression, and burnout. Our hypothesis is rejected, as there are no statistical differences in levels of anxiety, depression, and burnout among the 4 years of dental students, but it is still important to keep researching and determining mental health status of dental students.

Reflection on Subjective Choices

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- In hindsight, the assumption checking was a bit overconservative, particularly with the normality assumption. A simple Welch test would probably have been appropriate.
- Both clients seemed happy with the results and their presentation.
- In a good way, we over-prepared a bit. Statistical questions were apparently not asked during the presentation, and while the project did not require a reproducible code section, we decided to include it in their report.
- Overall, working with these clients was a positive experience.

Meetings List

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- January 28th - initial meeting
- January 31st - results for abstract
- February 13th - results for analysis
- February 20th - poster check in + prepare responses
- March 27th - discuss final analysis plan