



Data Analysis of the Association between Periodontitis and Hypertension

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Why It Matters

- Periodontal disease is one of the most common chronic inflammatory conditions. And we know inflammation is central in hypertension.
- Hypertension itself is a leading preventable cause of heart attack and stroke
- If the mouth is chronically inflamed, it may raise the risk of elevated blood pressure and related complications.
- It could be valuable to know and explore to what extent periodontitis tracks with a higher blood pressure burden, perhaps dentists can better flag risk and counsel.

Data & Research Questions

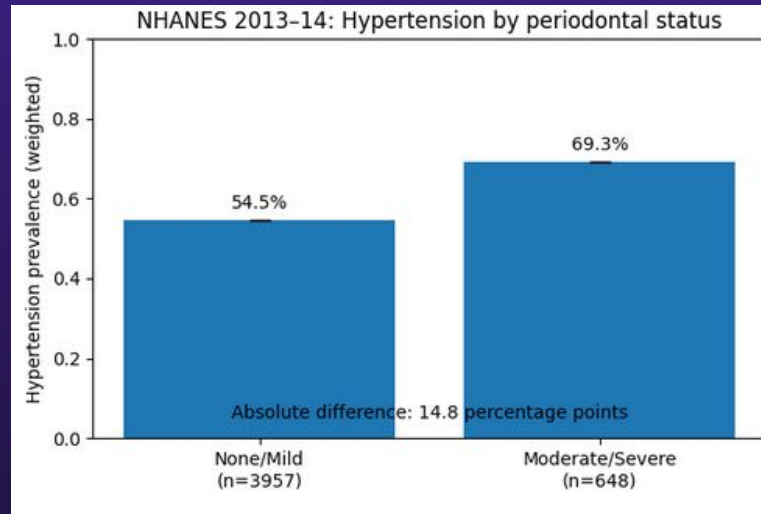
- We used NHANES which is a U.S. representative health survey
- Particularly we focused on adults over 30 years with full periodontal exam
- Primary hypothesis: Adults with moderate/severe periodontitis have higher odds of hypertension than those with none/mild.
- Pattern checks: Does risk climb with severity? Does the gap widen with age?
- Robustness: Do results hold under the classic 140/90 definition?
- Scope guardrail: NHANES is cross-sectional, so we are only reporting and exploring associations, not necessarily causation

How do we define our measurements?

- Gum disease: I group people as none/mild vs moderate/severe based on the dental exam
- High blood pressure: either 130/80 or higher, or a doctor already told them they have it
- We also note things that obviously matter: age, body weight (BMI), smoking, diabetes, sex, race/ethnicity
- Later, I re-check everything using the old-school 140/90 cutoff

Hypertension By Periodontal Status

- None/Mild: 54.5% have high BP (n=3,957)
- Moderate/Severe: 69.3% (n=648)
- About 15 extra people out of 100 in the worse-gums group



Who carries more of this link?

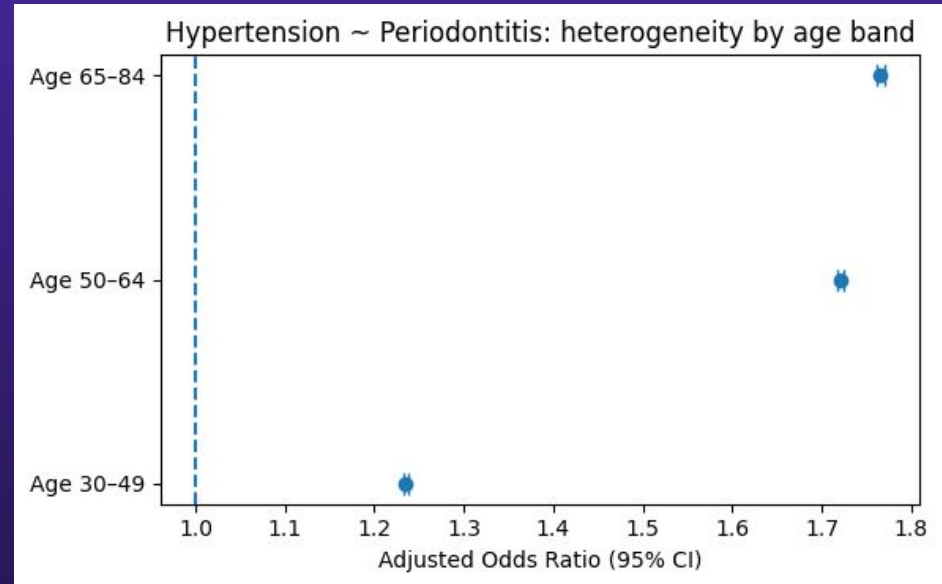
By age (adjusted OR for gum disease → high BP):

- 30–49: 1.235 (n=1,951)
- 50–64: 1.722 (n=1,417)
- 65–84: 1.766 (n=1,233)

By sex:

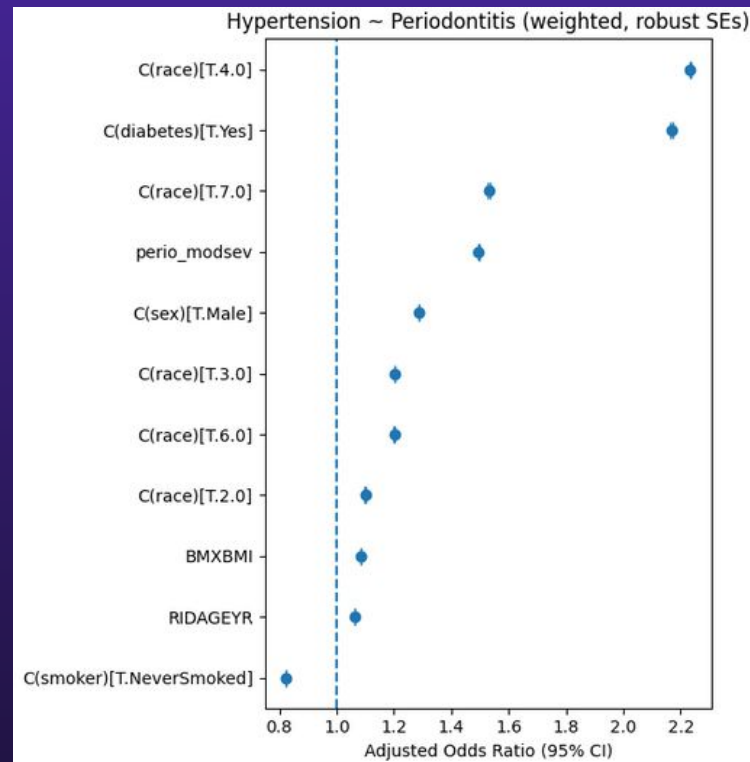
- Women 1.328 (n=2,414)
- Men 1.720 (n=2,187)

Pattern: stronger in older adults and in men



The Gap Survives Adjustment

- Forest plot shows adjusted OR (perio_modsev vs none/mild) = 1.49 (95% CI 1.49–1.50, $p=0.0000$)
- After accounting for **age, BMI, diabetes, smoking, sex, race**, the **periodontitis** marker stays to the right of 1
- Therefore, people with **moderate/severe** disease still have **higher odds** of high BP
- Other signals behave as expected: **older/heavier/diabetes, more** high BP

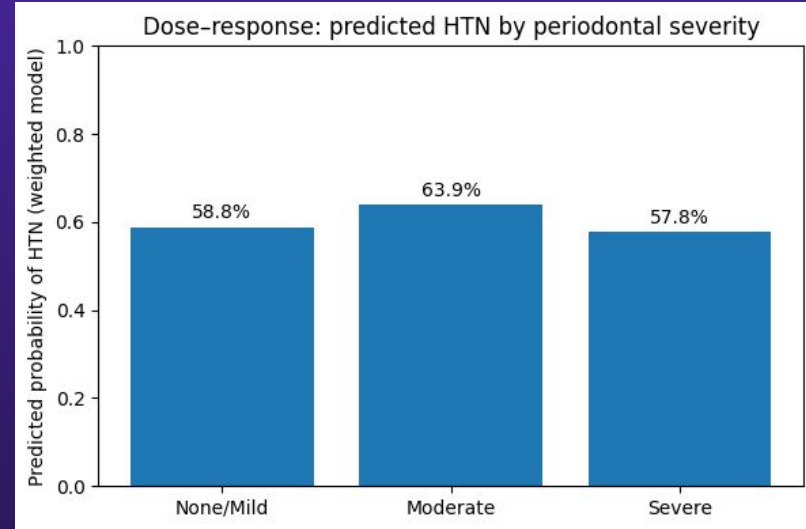


“More disease” isn’t a perfect staircase

Predicted chance of high BP (after adjustments):

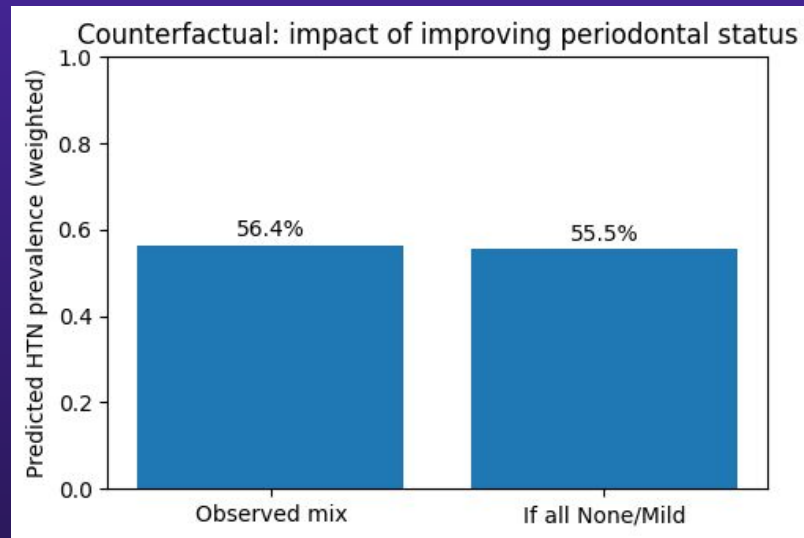
- **None/Mild: 58.8%**
- **Moderate: 63.9%**
- **Severe: 57.8%**

Takeaway: link is **real**, but not a clean “more disease necessarily means more risk” link



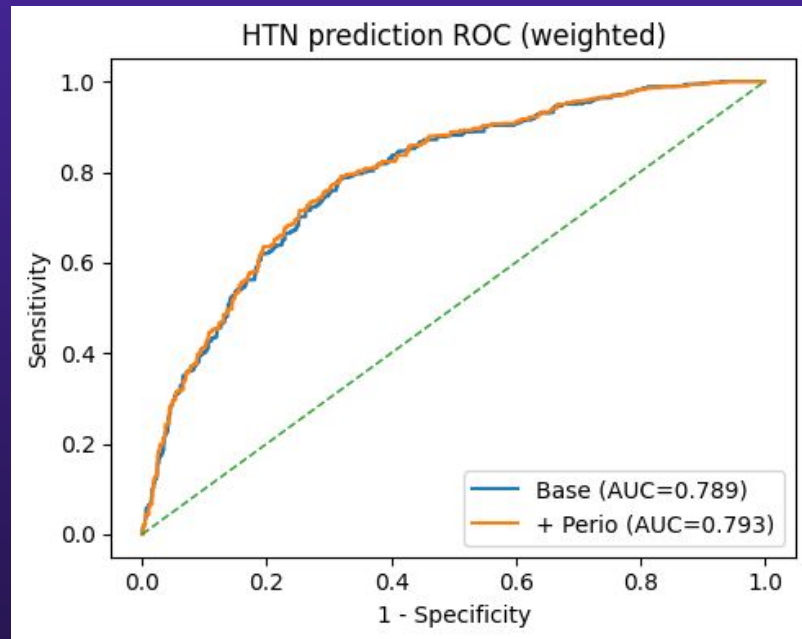
“What if” everyone had healthier gums?

- Two bar counterfactual, if every adult had none/mild periodontitis, how much would high BP drop
- Predicted high-BP rate **now**: **56.4%**
- If everyone were **none/mild** : **55.5%**
- Difference: **−0.9 percentage points** = **9 fewer per 1,000** adults
- About 9 fewer people with high BP per 1,000. Relevant, but not a population game-changer by itself. (surely age, BMI, and diabetes still dominate)



Machine Learning Exploration- Can gum status help PREDICT high BP?

- A baseline model (age, BMI, sex, smoking, diabetes, race) scores AUC = 0.789.
- Add the periodontitis flag and AUC nudges to 0.793. That's a tiny +0.004 bump, and the curves nearly overlap.
- So, gum status is interesting, but definitely not a secret cheat code for classifying hypertension.



Machine Learning Exploration- What matters most?

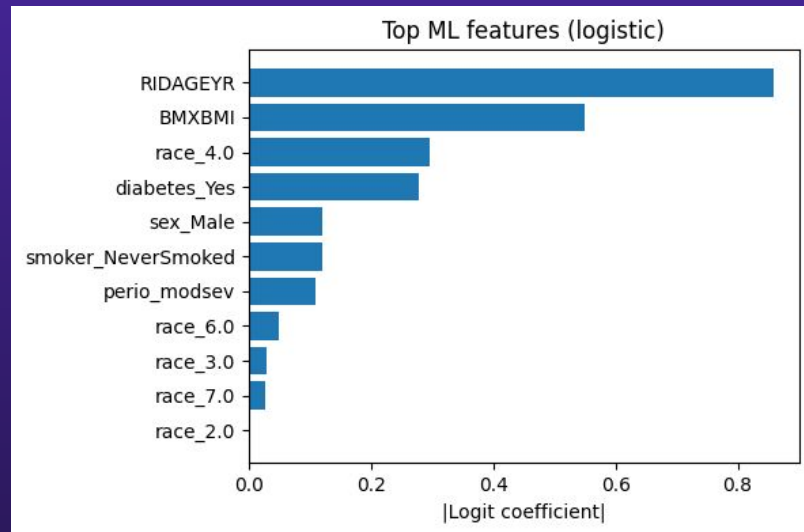
In the logistic model used for prediction, these are the results we get feature-ranking

Age is the heavyweight (coef ≈ 0.858 , OR ≈ 2.36 per SD)

BMI is next (0.550, OR ≈ 1.73), then diabetes (Yes) and male sex

Never-smoker leans protective

Periodontitis adds a modest push (≈ 0.110 , OR ≈ 1.12), real, but small, matching the tiny Δ AUC.



Exploring Periodontitis Associations Further

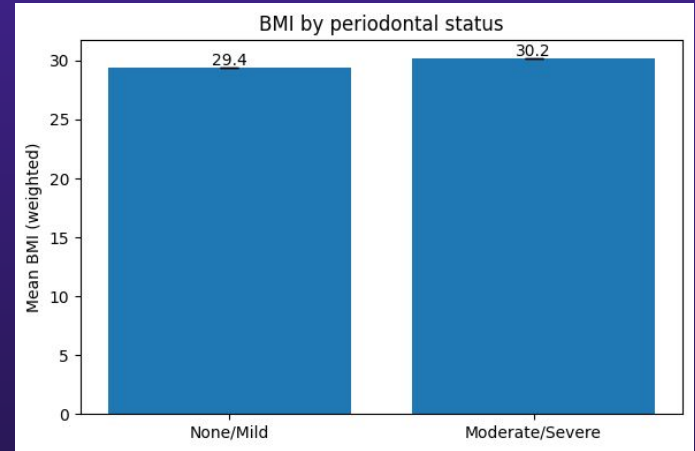
- Because I am interested in the relationship between oral and systemic health, in general, I wanted to briefly take a look at how periodontitis interacts with some other features in the NHANES survey
- Specifically, I chose BMI and diabetes, as I saw them high up on the previous slides feature ranking, and I was just curious if they might associate strongly with periodontitis.

BMI and Periodontal Status

Average BMI: 29.4 (None/Mild) vs 30.2 (Mod/Sev) $\text{kg/m}^2 \rightarrow +0.8$
higher with periodontitis.

After a fair comparison, the difference is $+0.68 \text{ kg/m}^2$ (95% 0.68–0.69).

For the average adult, that's something like 4-5 lbs. We could say this is statistically significant, but not a huge association.



Diabetes and Periodontal Status

Diabetes prevalence: 14.9% (None/Mild) vs 20.6% (Mod/Sev), so 5.7% higher occurrence of moderate/severe periodontitis amongst diabetics. A statistically significant association here as well.

Looking at several moderate/severe periodontitis odds:

- 1.08× higher odds of having +5 BMI (95% 1.08–1.08).
- 1.15× higher odds (95% 1.15–1.15).
- Age nudges up (1.025× per year)
- Male lower (0.683×)
- Never-smoker lower (0.900×).