

THE IMPACT OF GINGIVITIS AND PERIODONTITIS ON COVID-19 OUTCOMES: A CASE-CONTROL STUDY

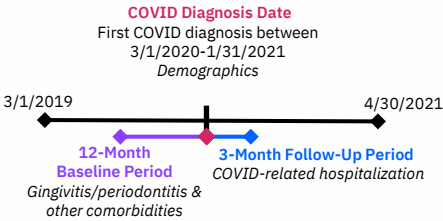
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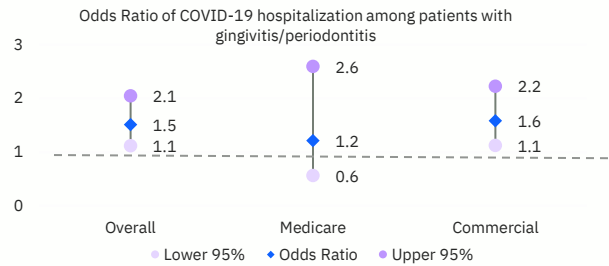
Study Summary

Study Question: Are patients with severe COVID-19 more likely to have periodontal disease?

Study Design



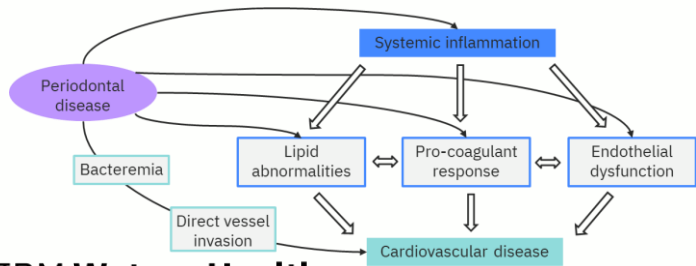
Study Results



Conclusion: Patients with periodontal disease are at higher risk for severe COVID-19 infections. Further research should explore mitigating socio-economic factors and baseline respiratory-related clinical characteristics.

Background

- Periodontal disease (PD) is a group of chronic inflammatory diseases, including gingivitis and periodontitis, which impacts 20-50% of the global population.¹
- Studies demonstrate association between PD and diseases such as diabetes, cardiovascular disease, chronic obstructive pulmonary disease, cancer, liver disease, and rheumatoid arthritis, among others, although underlying mechanism have not been completely established. Shared risk factors between PD and Covid-19 led Pitones-Rubio et al. to hypothesize a connection between periodontal disease and Covid-19 severity early in the pandemic.² That relationship is measured here.
- Possible mechanisms by which PD may interact with the inflammatory pathway to promote diseases, such as cardiovascular disease, is demonstrated by Madore 2009, and depicted below.³



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Objective

- To measure the association between gingivitis or periodontitis and COVID-19-related hospitalization in a large sample of Medicare and commercially insured U.S. patients.

Methods

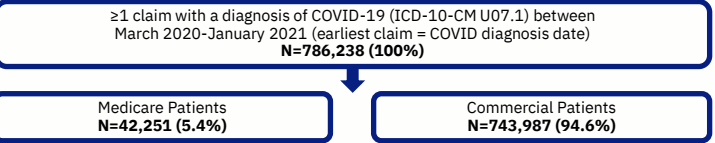
Study Design and Data Source

- This study employed a retrospective observational design using IBM® MarketScan® Medicare and Commercial Claims and Encounters Databases
- Data were analyzed using IBM MarketScan® Treatment Pathways 4.0, an online analytic platform

Outcomes

- Diagnosis of gingivitis or periodontitis (ICD-10-CM K05) in the year prior to Covid-19 diagnosis.
- Additional outcomes were patient demographics and baseline clinical characteristics

Figure 1. Patient Selection



Results

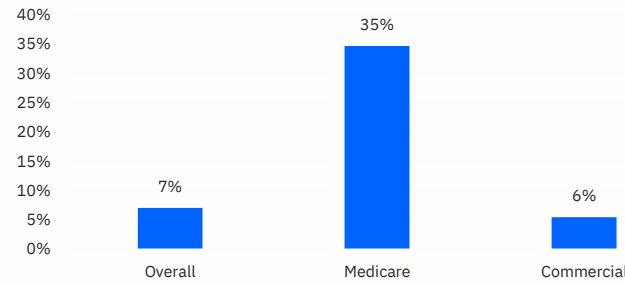
- 786,238 patients (42,251 Medicare and 743,987 Commercial) were diagnosed with COVID-19 during the study period. (Figure 1)
- Overall 46% were male; 90% were above the age of 18, mean age of 40. (Table 1)

Table 1. Demographic Characteristics (on COVID diagnosis date)

	Overall N=786,238	Medicare N=42,251	Commercial N=743,987
Male, N (%)	361,757 (46%)	20,129 (48%)	341,628 (46%)
Age, mean years (SD)	40.4 (17.7)	76.7 (8.5)	38.3 (15.8)
Age, N (%)			
<18	75,612 (10%)	0 (0%)	75,612 (10%)
18-24	99,955 (13%)	0 (0%)	99,955 (13%)
25-34	132,274 (17%)	3 (0%)	132,271 (18%)
35-44	136,695 (17%)	10 (0%)	136,685 (18%)
45-54	157,607 (20%)	71 (0%)	157,536 (21%)
55-64	141,355 (18%)	637 (2%)	140,718 (19%)
65-74	19,640 (2%)	18,500 (44%)	1,140 (0%)
75+	23,100 (3%)	23,030 (54%)	70 (0%)
Health plan type ^a , N (%)			
Comprehensive	25,533 (3%)	9,466 (22%)	16,067 (2%)
EPO	5,757 (1%)	22 (0%)	5,735 (1%)
HMO	100,403 (13%)	7,743 (18%)	92,660 (12%)
POS/POS with capitation	79,669 (10%)	107 (0%)	79,562 (11%)
PPO	364,437 (46%)	24,302 (58%)	340,135 (46%)
CDHP	94,322 (12%)	211 (0%)	94,111 (13%)
HDHP	82,170 (10%)	337 (1%)	81,833 (11%)
Population density ^a , N (%)			
Urban	675,146 (86%)	34,640 (82%)	640,506 (86%)
Rural	110,044 (14%)	7,085 (17%)	102,959 (14%)

^aHealth plan, region, and population density could not be determined for <5% of patients in any cohort. CDHP, consumer-directed health plan; EPO/PPO, exclusive/preferred provider organizations; HDHP, high-deductible health plan; HMO, health maintenance organization; POS, point of service; SD, standard deviation

Figure 2. COVID-19-Related Hospitalization (3 months following COVID)

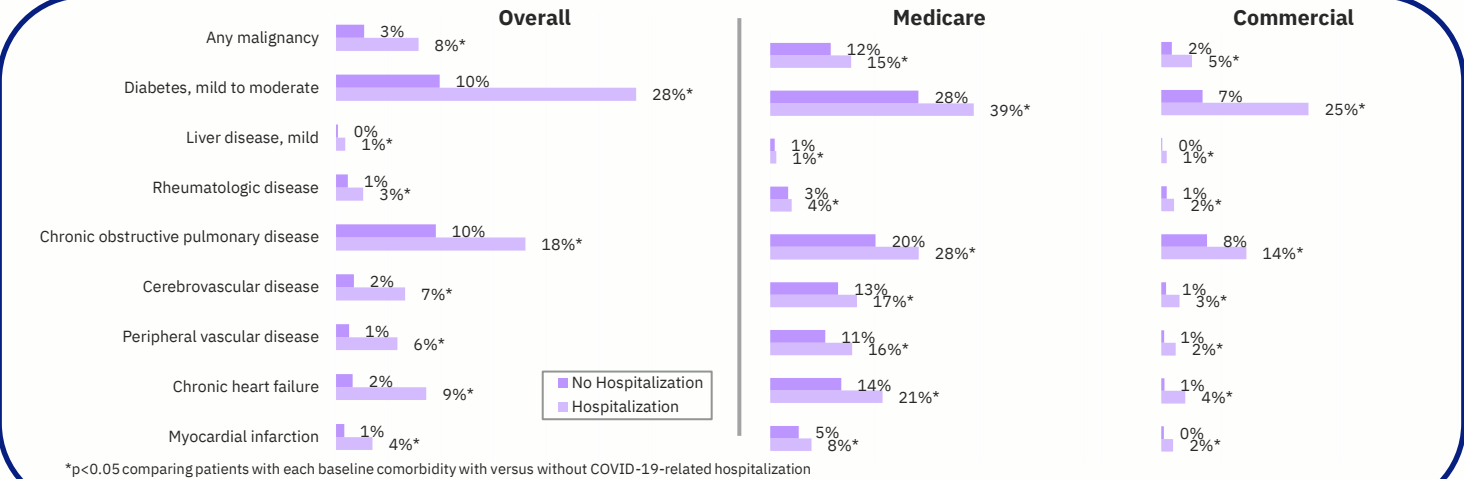


Results, continued

- In the 3 months following COVID diagnosis, 7% of patients had a COVID-19-related hospitalization; 35% among Medicare patients (35%). (Figure 2)
- The proportion of patients with select comorbidities in the 12 months before COVID diagnosis was higher among those with compared to those without a COVID-19-related hospitalization. (Figure 3)
- Overall, the proportion with each baseline disease was more than twice among those with COVID hospitalization (e.g., Diabetes w/hospitalization 28% vs w/out hospitalization 10%). (Figure 3)
- Specifically, among patients with a COVID-19-related hospitalization, overall 47 (<1%) had a gingivitis and/or periodontitis diagnosis.

Gingivitis/periodontitis was associated with COVID-19-related hospitalization for the sample overall, the Medicare subset, and the Commercial subset (odds ratio=1.5, 1.2, and 1.6, respectively).

Figure 3. Baseline Comorbidities (12 months prior to COVID-19 Diagnosis) by COVID-19-Related Hospitalization



*p<0.05 comparing patients with each baseline comorbidity with versus without COVID-19-related hospitalization

Limitations

This analysis has conventional limitations of claims-based analyses:

- This study was based on patients with commercial health coverage, and results may not be generalizable to COVID-19 patients with other types of insurance or without health insurance coverage
- Diagnoses on claims may be mis-coded, thereby potentially underestimating the size of the patient population
- Systematic differences by COVID-related hospitalization or comorbidities such as gingivitis/periodontitis may account for observed differences in study outcomes..

Conclusions

- In an unadjusted case-control study of commercially insured and Medicare patients, an association between PD and severity of COVID-19 was identified.
- This confirms a hypothesized association put forth early in the pandemic and similar relationships found in electronic health record data.⁴
- This study observed a significant difference in other baseline comorbidities by COVID-19 hospitalization, and we would expect in an adjusted analysis, some of these differences may account for COVID-19 severity.
- In addition, health care administrative databases, such as IBM® MarketScan® Research Databases, are rich sources of real-world information containing documentation of diagnoses, treatment, and costs, but lack key clinical factors, which could be important in predicting associations such as this.
- Future analyses of this kind would be strengthened by leveraging linkage other datasets, such as the IBM® MarketScan® Dental Database, which in addition to dental coverage enrollment data, plan types, provider types, and diagnoses, contains tooth-specific services rendered.

References

- Sanz M. European Heart Journal Supplements (2010)
- Pitones-Rubio V et al. Medical Hypothesis (2020)
- Madore F. Kidney International (2009)
- Marouf N et al. J Clin Periodontal (2021)

Disclosure

Cynthia Morrow, Liisa Palmer and Eleanor Gebauer are employees of IBM Watson Health. At the time of this work, Ryan McKenna was also an employee of IBM Watson Health. This study was funded by IBM Watson Health.