



CONNECTING LINKS: STUDYING THE RELATIONSHIP BETWEEN SMOKING AND CARIES

GROUP 1:

- AISHWARYA KUNAM
- SANJANA MADARAPU
- SRINIJA KASARANENI

Background and significance:

Dental caries, commonly known as tooth decay, is a chronic bacterial infection that destroys tooth enamel and dentin, leading to a multitude of oral health problems.

It remains a prevalent oral health issue, is a significant public health concern due to its impact on tooth structure and overall well-being.

Dental caries can range in severity from mild buccal space infections to severe multi-space infections. If left untreated, it can progress to irreversible damage, potentially causing pulp perforation, pulpitis, periapical inflammation, and ultimately tooth loss.

While the prevalence of dental caries has significantly decreased by up to 75% in many high-income countries during the latter half of the 20th century, it remains a persistent global health concern, affecting an estimated 60-90% of schoolchildren and nearly all adults worldwide, regardless of socioeconomic status.

Among the various risk factors that contribute to the onset of dental caries, smoking stands out as a significant and well-established contributor. This prevalent habit not only increases the likelihood of tooth decay but also heightens the risk of gum disease, further exacerbating oral health concerns. (Jiang et al., 2019).

Background and significance contd.

Smoking can reduce the amount of saliva produced making it more difficult for the body to protect teeth from decay.

It can also weaken the immune system, making it more difficult for the body to fight off infections that can lead to decay.

While the existing evidence suggests that smoking is a risk factor for dental caries, more research is needed to understand the exact mechanisms by which smoking contributes to tooth decay. This information could then be used to develop more effective preventive strategies, such as smoking cessation programs and targeted interventions for smokers.





Background and significance Contd...:

Studies have demonstrated that smokers often exhibit unhealthy dietary habits, neglect proper oral hygiene practices, delay seeking professional dental care, and demonstrate poor compliance to treatment recommendations (Wu, J., Li, M., & Huang, R, 2019).

By investigating the nuanced link between smoking habits and various aspects of dental caries, we aspire to contribute valuable insights to the existing body of literature.

Understanding this association can help us implement targeted preventive strategies ultimately improving overall oral health outcomes.

Methods:

Workflow:

Step 1

- Developing a research question

Step 2

- Generating clinical notes

Step 3

- Developing manual review guidelines

Step 4

- Performing annotations on ehost

Step 5

- Generating IAA Report

Step 6

- Reaching a consensus

Methods:

Our approach to data extraction involved a comprehensive analysis of clinical notes, focusing on obtaining vital information related to both dental and smoking statuses. The scope of our investigation encompassed intricate details such as tooth-specific information, diverse decay types, and materials used for fillings. Beyond dental attributes, our study incorporated crucial smoking-related data, particularly smoking status. To ensure a systematic and precise annotation process, we implemented specific manual review guidelines.

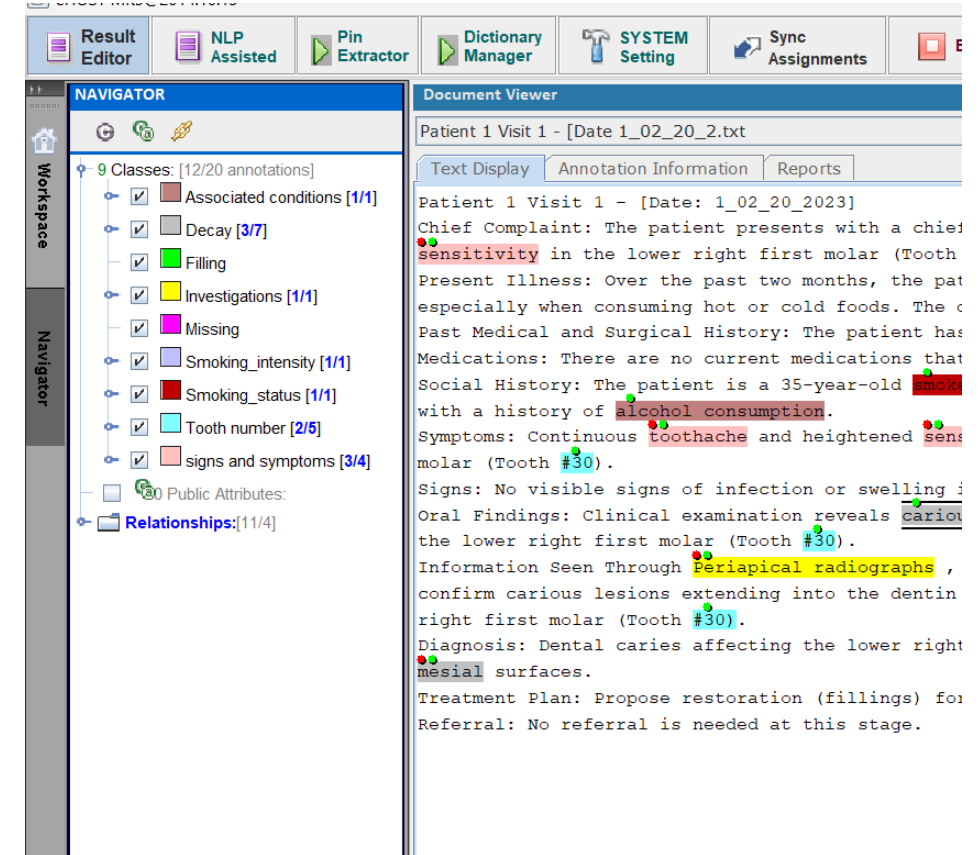
Manual Review Guidelines

To maintain consistency and precision during annotation, we have established specific manual review guidelines. These guidelines provide clear instructions for annotating key elements, including:

- Smoking status: Identification of current, former, and never smokers
- Decay characteristics: Differentiation between caries, erosion, and abrasion
- Tooth numbers: Accurate identification and recording of tooth numbers
- Fillings: Recording types, locations, and materials of fillings

Schema (Before):

- Smoking Status: "Current smoker," "Former smoker," or "Never smoked."
- Smoking Intensity: Categorized based on cigarettes per day.
- Signs and Symptoms: Dental caries-related terms.
- Diagnostic Tests: Procedures identifying dental caries.
- Decay: Types and affected tooth surfaces.
- Tooth Number: Specifics on the location.
- Fillings: Materials used for restoration.
- Missing Teeth: Extracted or congenitally absent.
- Associated Conditions: Alcohol consumption, smokeless tobacco, e-cigarettes.



Schema: (After)

- Smoking Status: "Current smoker," "Former smoker," or "Never smoked."
- Decay: Types and affected tooth surfaces.
- Tooth Number: Specifics on the location.
- Fillings: Materials used for restoration.

The screenshot displays the eHOST MK5@2014.10.15 software interface. The top toolbar includes buttons for 'Result Editor', 'NLP Assisted', 'Pin Extractor', 'Dictionary Manager', and 'SYS Set'. The main interface is divided into three panels: 'Workspace' on the left, 'NAVIGATOR' in the center, and 'Document Viewer' on the right.

The 'NAVIGATOR' panel shows a tree structure with the following items:

- 4 Classes: [6/9 annotations]
 - ☒ Decay [2/3]
 - ☒ Filling [1/1]
 - ☒ Smoking_status [1/2]
 - ☒ Tooth number [2/3]
- ☐ @0 Public Attributes:
- ☐ Relationships: [4/2]

The 'Document Viewer' panel displays the text of 'pt 3 Visit 2 - [Date 2_03_0]'. The text includes fields for 'Chief Complaint', 'Present Illness', 'Past Medical and Surg', 'Medications', 'Social History', 'Symptoms', 'Signs', 'Oral Findings', 'Information Seen Thrc', 'Diagnosis', 'Treatment Plan', and 'Referral'. The word 'Cariou' is highlighted in the 'Oral Findings' field.



Relationships:

Tooth Number -----> Decay

Tooth Number -----> Filling

Exclusion Criteria:

Focus on information directly related to the research question, excluding unrelated medical conditions or events.

Avoid ambiguous or unclear mentions that cannot be definitively classified based on the given attributes and values.

Refrain from creating annotations for attributes or values that are not present in the clinical notes.

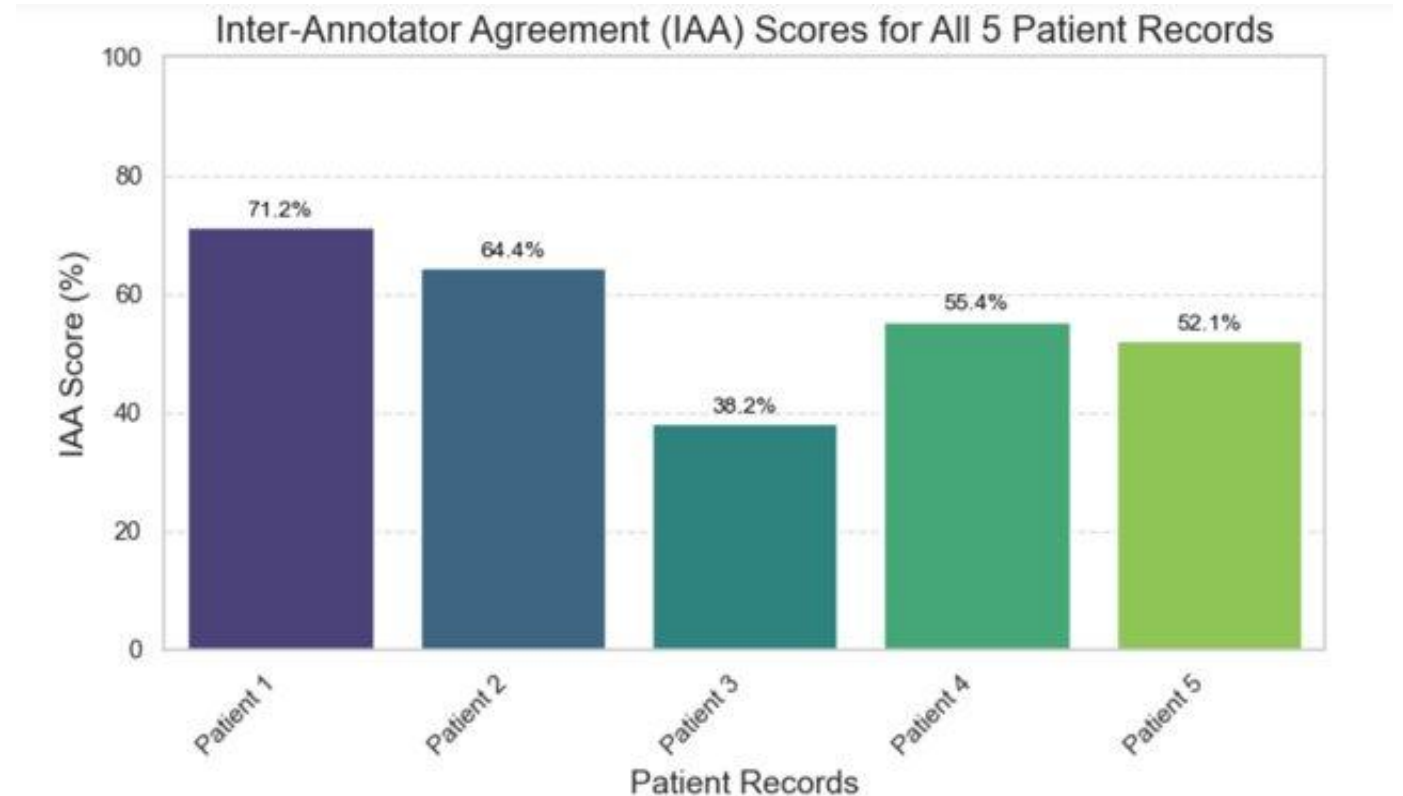
By adhering to these inclusion and exclusion criteria, the extracted information will be accurate and aligned with the study's objective, enabling a thorough analysis of the link between smoking status and dental caries severity in adults.



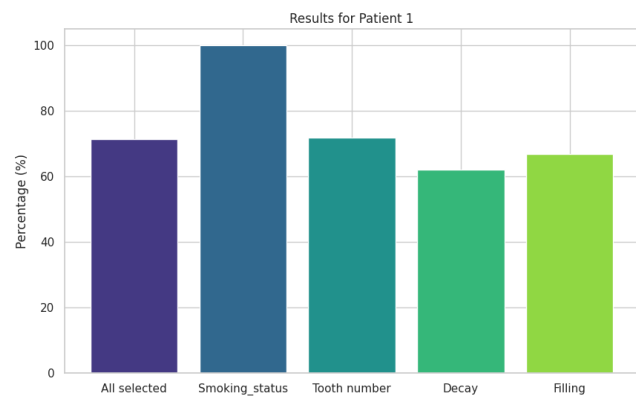
RESULTS

IAA scores

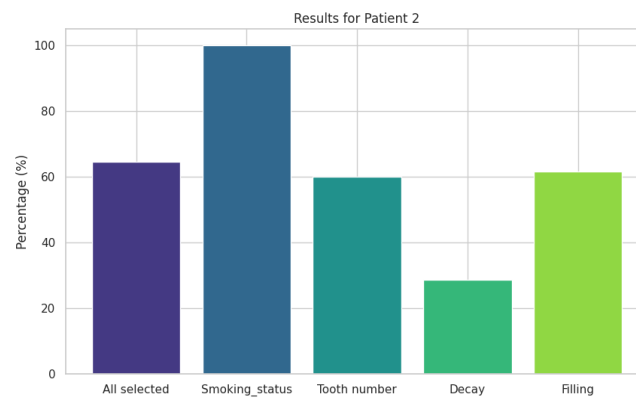
- The IAA scores exhibit variability across patient records, ranging from 38.2% to 71.2%. This suggests differing levels of agreement between annotators, with Patient 1 demonstrating the highest and Patient 3 the lowest agreement.
- Overall, the IAA scores fall within a moderate range except for one patient (patient 3 – 38.2%), indicating a substantial level of agreement between annotators.



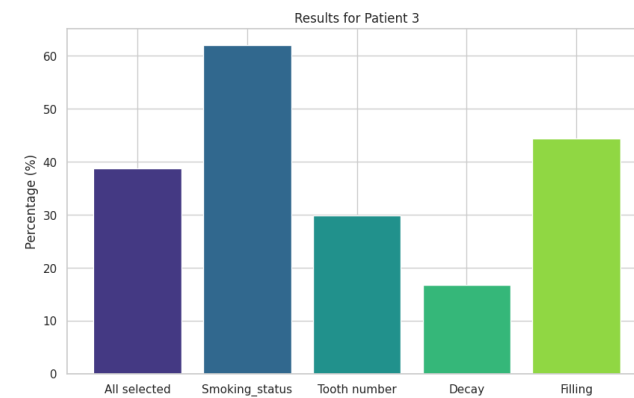
Patient -1



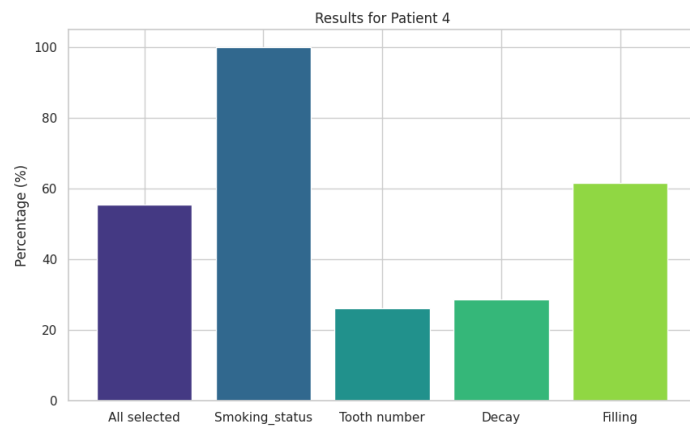
Patient -2



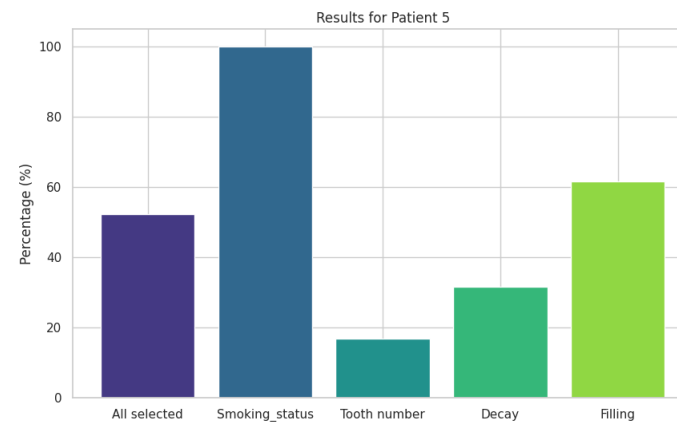
Patient -3

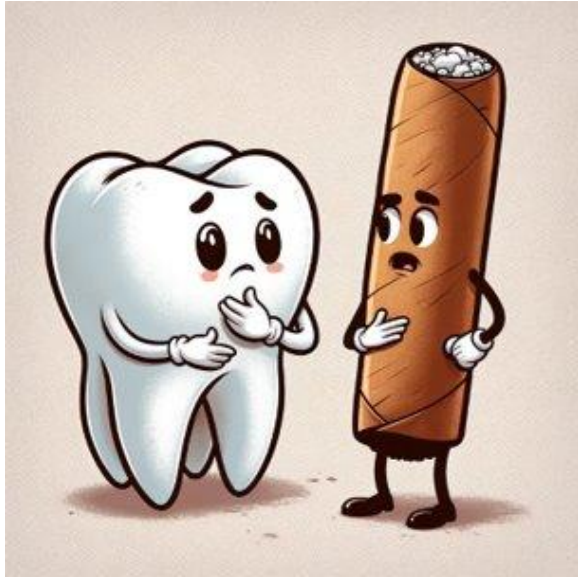


Patient -4



Patient -5





Discussion:

Consistency Range: Fair to moderate across patients.

Highlights:

High Agreement: Consistently observed in Smoking Status across all patients.

Moderate Agreement: Notable in various classes.

Lower Agreement: Classes like Tooth Number, Decay, and Filling showed varying, often lower, agreement levels.

Patient-Specific Insights:

Patients 1, 2, 4: Generally moderate agreement, except for specific classes.

Patients 3, 5: Fair agreement, especially in classes like Filling.

Implications:

Strengths: Strong agreement in Smoking Status.

Areas to Improve: Clearer guidelines needed for classes with lower agreement to enhance consistency.

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Information Reports

ate: 1_02_20_2023]

atient presents with a chief complaint of persi
er right first molar (Tooth #30).

the past two months, the patient has experience
ing hot or cold foods. The discomfort has been
cal History: The patient has no significant pas
no current medications that the patient is tak
tient is a 35-year-old smoker, consuming 10 pac
hol consumption.

oothache and heightened sensitivity to temperat

s of infection or swelling in the oral cavity.
l examination reveals carious lesions on the oc
molar (Tooth #30).

gh Periapical radiographs , Laboratory Results:
s extending into the dentin on the occlusal and
th #30).

es affecting the lower right first molar (Tooth

e restoration (fillings) for the affected surfa
is needed at this stage.

Discussion Contd...

After producing the initial annotation report, we (two annotators (Aishwarya and Sanjana) and moderator (Srinija)), convened for a collaborative review session. The purpose of this session was to address and resolve the annotations marked with dotted lines in the report, enhancing the overall accuracy and consistency of the annotations.

We meticulously examined the instances marked with dotted lines and had a comprehensive discussion based on the previously established manual review guidelines.

Following the discussion, we accepted and rejected some annotations and reached an agreement.

Lessons Learned:

Importance of Clear Guidelines: The development and adherence to clear and specific manual review guidelines proved essential in maintaining precision and consistency during annotation. Establishing criteria for inclusion and exclusion facilitated a focused approach to data extraction.

Collaborative Review: The collaborative review session emphasized the significance of ongoing collaboration between annotators and moderators. This iterative process allowed for the resolution of discrepancies and refinement of annotation practices.

Flexibility in Annotation Criteria: The need for flexibility in annotation criteria became apparent during the review session. Adjustments to criteria, when warranted by the nature of research topic, ensured a context-aware approach to annotation adjustments.

Continuous Improvement: The collaborative review session highlighted the iterative nature of annotation work. Accepting and rejecting annotations based on discussions reflects a commitment to continuous improvement, emphasizing the dynamic and evolving nature of the research process.



In a nutshell...



Generation of Reports



Analysis overview



Inter-Annotator Agreement

Patients assessed: 1 through 5
Annotators: Aishwarya and Sanjana
Moderator: Srinija



Findings Summary:

Consistency varied across patients.
Notable agreement for Smoking Status.
Other classes displayed varying agreement levels.
Ranging from perfect to low agreement.

Contributions:

S No	Name	Role and Responsibilities
1	Srinija	Moderator Developed the research question Worked on the presentation Generated reports
2	Aishwarya	Annotator –1 Refined the research question Worked on the presentation
3	Sanjana	Annotator – 2 Refined the research question Worked on the presentation





■ **Acknowledgements:**

- Dr. Thankam Thyvalikakath
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- Dr. Shuning Li

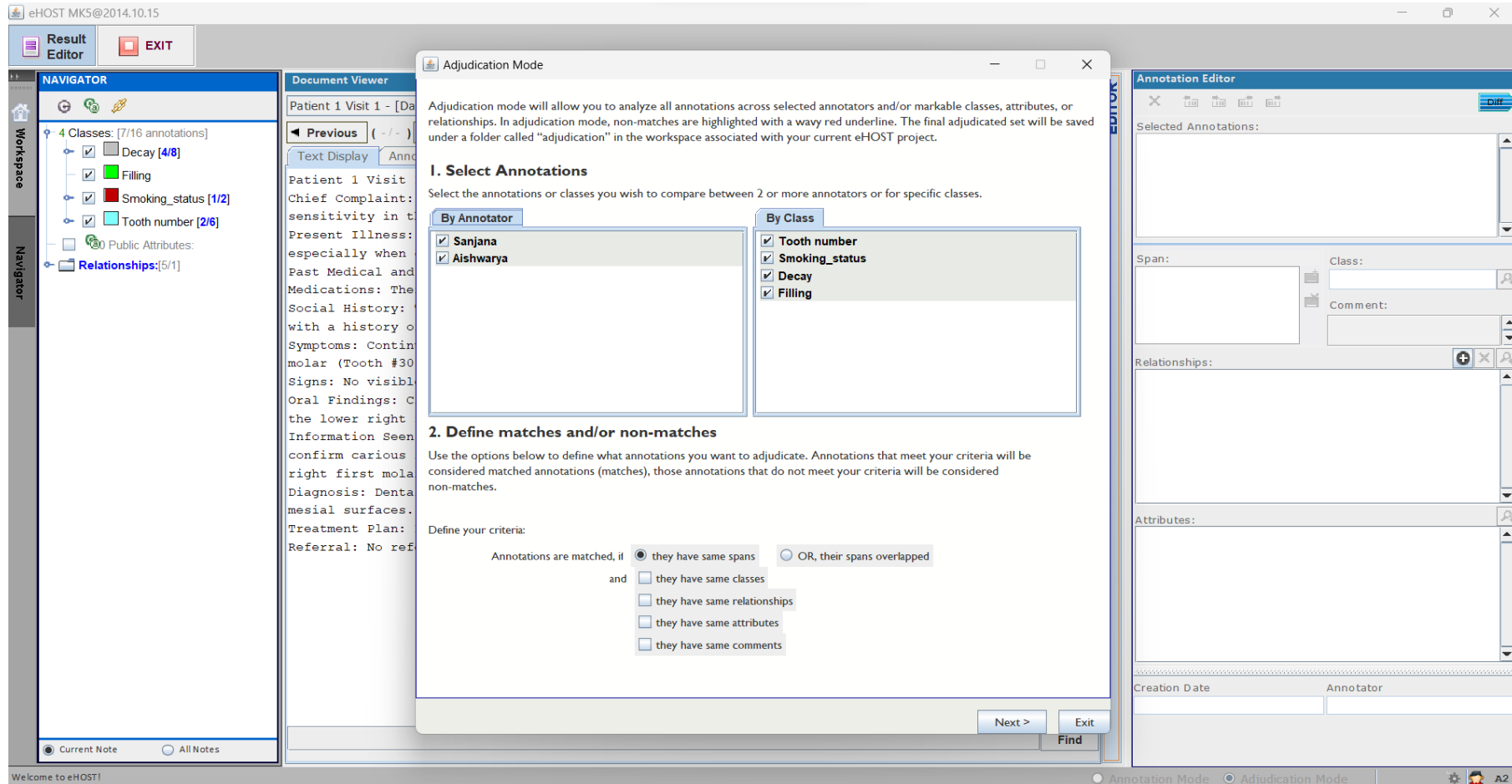


References:

Jiang*, X., Jiang*, X., Wang#, Y., & Huang#, R.. (2019). Correlation between tobacco smoking and dental caries: A systematic review and meta-analysis. *Tobacco Induced Diseases*, 17(April). <https://doi.org/10.18332/tid/106117>

Wu, J., Li, M., & Huang, R. (2019). The effect of smoking on caries-related microorganisms. *Tobacco induced diseases*, 17, 32. <https://doi.org/10.18332/tid/105913>

Appendix:



Appendix: The following are IAA scores for each patient notes

Patient 1

Class and span matcher

Annotations match if they have same or overlapping spans, with same classes.

2-way IAA Results

IAA calculated on 10 documents.

all annotations = matches + non-matches

IAA = matches / all annotations

For annotations between Annotator[Aishwarya] and Annotator[Sanjana]:

Type	IAA	matches	non-matches
All selected classes	71.2%	104	42
Smoking_status	100.0%	20	0
Tooth number	71.8%	28	11
Decay	61.9%	26	16
Filling	66.7%	30	15

Pair-wise agreement

Gold standard set	compared set	true positives	false positives	false negatives	recall	precision	F-measure
Aishwarya	Sanjana	52	41	1	98.1%	55.9%	71.2%
Sanjana	Aishwarya	52	1	41	55.9%	98.1%	71.2%

Precision and recall are given equal weight for the F-score.

Patient 2

IAA Reports

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Class and span matcher

Annotations match if they have same or overlapping spans, with same classes.

2-way IAA Results

IAA calculated on 10 documents.

all annotations = matches + non-matches

IAA = matches / all annotations

For annotations between Annotator[Aishwarya] and Annotator[Sanjana]:

Type	IAA	matches	non-matches
All selected classes	64.4%	58	32
Tooth number	60.0%	18	12
Smoking_status	100.0%	20	0
Decay	28.6%	4	10
Filling	61.5%	16	10

Pair-wise agreement

Gold standard set	compared set	true positives	false positives	false negatives	recall	precision	F-measure
Aishwarya	Sanjana	29	21	11	72.5%	58.0%	64.4%
Sanjana	Aishwarya	29	11	21	58.0%	72.5%	64.4%

Precision and recall are given equal weight for the F-score.

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Patient 3

2-way IAA Results

IAA calculated on 10 documents.

all annotations = matches + non-matches

IAA = matches / all annotations

For annotations between Annotator[Aishwarya] and Annotator[Sanjana]:

Type	IAA	matches	non-matches
All selected classes	38.2%	52	84
Smoking_status	62.1%	18	11
Decay	16.7%	4	20
Tooth number	29.8%	14	33
Filling	44.4%	16	20

Pair-wise agreement

Gold standard set	compared set	true positives	false positives	false negatives	recall	precision	F-measure
Aishwarya	Sanjana	26	71	13	66.7%	26.8%	38.2%
Sanjana	Aishwarya	26	13	71	26.8%	66.7%	38.2%

Precision and recall are given equal weight for the F-score.

Patient 4

Class and span matcher

Annotations match if they have same or overlapping spans, with same classes.

2-way IAA Results

IAA calculated on 10 documents.

all annotations = matches + non-matches

IAA = matches / all annotations

For annotations between Annotator[Aishwarya] and Annotator[Sanjana]:

Type	IAA	matches	non-matches
All selected classes	55.4%	46	37
Smoking_status	100.0%	20	0
Tooth number	26.1%	6	17
Decay	28.6%	4	10
Filling	61.5%	16	10

Pair-wise agreement

Gold standard set	compared set	true positives	false positives	false negatives	recall	precision	F-measure
Aishwarya	Sanjana	23	20	17	57.5%	53.5%	55.4%
Sanjana	Aishwarya	23	17	20	53.5%	57.5%	55.4%

Precision and recall are given equal weight for the F-score.

Patient 5

IAA Reports

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Class and span matcher

Annotations match if they have same or overlapping spans, with same classes.

2-way IAA Results

IAA calculated on 10 documents.

all annotations = matches + non-matches

IAA = matches / all annotations

For annotations between Annotator[Aishwarya] and Annotator[Sanjana]:

Type	IAA	matches	non-matches
All selected classes	52.1%	50	46
Smoking_status	100.0%	20	0
Decay	16.7%	2	10
Tooth number	31.6%	12	26
Filling	61.5%	16	10

Pair-wise agreement

Gold standard set	compared set	true positives	false positives	false negatives	recall	precision	F-measure
Aishwarya	Sanjana	25	33	13	65.8%	43.1%	52.1%
Sanjana	Aishwarya	25	13	33	43.1%	65.8%	52.1%

Precision and recall are given equal weight for the F-score.

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