

**COMPARING SALZMANN INDEX INTER-ARCH DEVIATION AMONG  
MEDICAID PATIENTS SEEKING ORTHODONTIC TREATMENT IN  
PENNSYLVANIA**

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Submitted to  
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by  
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## ABSTRACT

**Introduction:** The Salzmann Evaluation Index (SEI) was chosen by the state of Pennsylvania to evaluate the treatment needs of prospective orthodontic patients and to help determine the allocation of funding for orthodontic treatment, with a score of 25 being the threshold for funding allocation. This study will compare the summed scores of the columns under the inter-arch deviation (IAD) rows, which represent eight types of malocclusion (overjet, overbite, anterior crossbite, anterior openbite, Class II, Class III, posterior crossbite, and posterior openbite) to determine whether there is a difference in the scores of those approved and denied orthodontic insurance coverage.

**Materials and Methods:** 560 Patients with SEI >25, submitted for Medicaid orthodontic insurance approval from Temple University were stratified into “approved” (n=289) and “unapproved” (n=271) for treatment. Their mean IAD column scores (representing the malocclusions listed above) were compared and tested with Wilcoxon test for significance.

**Results:** Anterior crossbite, anterior openbite, posterior crossbite, and posterior openbite were identified as significantly higher scores in the “approved” group compared to the “unapproved” group. Overjet, overbite, Class II, and Class III had no significant differences between approved and unapproved groups.

**Conclusions:** Patients with anterior crossbite, anterior openbite, posterior crossbite, and posterior openbite may be more likely to receive coverage for orthodontic treatment by Medicaid insurance companies in Pennsylvania. Scores denoting presence of overjet, overbite, Class II, and Class III malocclusions were not different in patients approved and denied coverage for orthodontic treatment.

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# CHAPTER 1

## INTRODUCTION

Medicaid in the United States covers medically necessary orthodontic treatment. The definition of “medically necessary” orthodontic treatment, however, is left to be defined by each individual state (American Association of Orthodontists, 2015). The SEI was developed by Joseph Salzman in 1968 with the goal of quantifying and triaging patient’s need for orthodontic treatment based on the severity of their malocclusion. It is one of many indices that have been developed for this purpose (Beglin *et al.*, 2001), despite of the AAO’s opposition of using such indices to determine the treatment needs of patients (Järvinen, 2001). Pennsylvania uses the SEI, along with additional orthodontic records, to determine whether orthodontic treatment is “medically necessary” and thus whether it will be funded by Medicaid insurance.

Medicaid coverage for orthodontic treatment is more nuanced than its coverage of other medical procedures. Malocclusion is different from other pathologies because it usually does not directly cause the patient immediate harm or pain. However, malocclusion can lead to the development of both physical and psychological ailments if maintained (Solow, 1995). Many children that are eligible to receive orthodontic treatment are in a mentally fragile state of development, and highly value social acceptance. Those with appealing dentofacial features have even been found to be more successful than those with severe malocclusions (Littlewood and Mitchell, 2019). Quality of life has become an important consideration in healthcare, and there is no doubt that orthodontic treatment can improve the quality of life of patients with malocclusion by enhancing dental and facial aesthetics and improving masticatory function.

Patients scoring 25 or higher on the SEI completed by the orthodontist are expected to receive insurance funding for their orthodontic treatment. However, this is not always the case. The insurance providers review the records sent by the orthodontist and conduct their own SEI evaluation. The discrepancy in scores between orthodontists and insurance companies could be due to a variety of factors, including non-diagnostic records sent to the insurance company and differences in opinion of the examiners.

The SEI is a series of categorized diagnoses of malocclusions that are each given numeric scores when present (or zero when absent) and summed to produce a single “Grand Total” score. The SEI is divided into “Intra-Arch” and “Inter-Arch” Deviations. The “Intra-Arch Deviations” section of the SEI includes the diagnoses of missing, crowded, rotated, or spacing of the teeth, and is divided into maxillary anterior, maxillary posterior, mandibular anterior, and mandibular posterior segments. The “Inter-Arch Deviation” section is divided into two subsections, the “Anterior Segment” (defined as the permanent central and lateral incisors only) and the “Posterior Segment” (defined as the permanent canines, first and second premolars, and first molars). The “Anterior Segment” diagnoses include overjet, overbite, crossbite, and open bite as vertical columns. The “Posterior Segment” diagnoses include Angle Class II, Angle Class III, crossbite, and open bite in vertical columns evaluating each tooth in the posterior segment (Salzmann, 1968). An example of the SEI form is displayed in the Figure 9.

A previous study conducted by the Temple University orthodontic residency program concluded that SEI scores were statistically significantly higher in patients approved by Medicaid for orthodontic treatment funding compared to those denied



treatment funding. The study further examined the scores of the three sections of the SEI, “Intra-Arch Deviations” (IAD), “Anterior Inter-Arch Deviations” (AIAD), and “Posterior Inter-Arch Deviations” (PIAD). The study found no statistically significant difference in the mean scores of IAD, however it found significantly higher mean scores for approved patients in the AIAD and PIAD sections when compared to unapproved patients. In addition, the study examined the horizontal rows that comprise the IAD, AIAD, and PIAD sections between patients approved and denied coverage by Medicaid insurance. It found no difference in any of the horizontal rows in the IAD section, but mean scores of all horizontal rows of the AIAD and PIAD were significantly higher for approved patients when compared to unapproved patients (Henderson *et al.*, 2023). This study did not examine whether the individual scores of the vertical columns comprising the AIAD and PIAD are different between the approved and unapproved groups. The vertical columns include overjet, overbite, crossbite, and open bite for AIAD and Angle Class II, Angle Class III, crossbite, and open bite for PIAD. The present study will examine these columns in an attempt to pinpoint key differences in scores in these columns between patients accepted and denied Medicaid coverage for orthodontic treatment. Since these columns represent malocclusion patterns, differences in scores can identify specific malocclusion characteristics that influence insurance companies to approve orthodontic treatment.

## CHAPTER 2

### REVIEW OF THE LITERATURE

#### 2.1 Methods of Determining Malocclusion Severity

The term “malocclusion” is defined by the Oxford Dictionary as “imperfect positioning of the teeth when the jaws are closed”. In this sense, in order to assess a malocclusion, one must first define the “perfect positioning” of the teeth and determine the degree to which a patient’s occlusion strays from this “perfect positioning”. In an attempt to define this “perfect positioning” or a normal occlusion, Dr. Lawrence Andrews studied 120 patients who had never received orthodontic treatment and would not benefit from orthodontic treatment. In this study, *The six keys to normal occlusion*, Dr. Andrews defined a normal occlusion as having proper molar relationship, crown angulation (mesiodistal), crown inclination (buccolingual), no rotations present, no spaces present, and an occlusal plane that is flat or has a minor Curve of Spee (Andrews, 1972). The proper molar relationship to which he refers was originally defined by Dr. Edward Angle (Angle, 1899). The Ackerman-Proffit method of malocclusion classification adds other key features to consider in malocclusion diagnosis, including facial esthetics and vertical skeletal and dental relationships (Ackerman and Proffit, 1969). With these principles in mind, an orthodontist can identify variations from ideal occlusion and determine a need for orthodontic treatment.

In orthodontic evaluation, it is critical to classify the degree to which a given malocclusion differs from the ideals defined above. The orthodontist will then create a treatment plan appropriate for the severity of the malocclusion. For example, a patient with a minor degree of dental crowding can typically be treated successfully without the need

for extraction of teeth. However, a patient with severe crowding may require extraction of teeth to align the teeth properly with appropriate inclination and bone support. While both patients differed from the ideal occlusion due to crowding, the severity of their malocclusion drastically changed their ideal orthodontic treatment plan.

Since Medicaid Insurance in the United States only provides orthodontic coverage to patients with malocclusions deemed “medically necessary” to correct, insurance providers must also assess the severity of a patient’s malocclusion to determine whether to allocate funding for orthodontic treatment. Given the subjective nature of malocclusion severity diagnosis, insurance companies must create an index with specific criteria that qualifies a person for insurance coverage to avoid biased decision-making. The World Health Organization defines an ideal index for medical evaluations as “reproducible, simple, accurate, sensitive, and easily administered with minimal judgement.” (Grippaudo *et al.*, 2008). There have been several indices developed for the classification of malocclusion severity, some qualitative and quantitative in nature. Since descriptive terms like “severe” and “extreme” are subjective and subject to a clinician’s opinion, qualitative indices have been shown to exhibit a higher degree of bias compared to quantitative indices (Grippaudo *et al.*, 2008). For this reason, many states, including Pennsylvania, have chosen quantitative indices as integral parts of their fund allocation decision making. Quantitative indices involve patients being allocated a “score” based on the presence of identified characteristics that indicate need for treatment. With numerical scores correlating to the severity of the malocclusion present, an insurance company can set a threshold score needed for allocation of funds, which helps ensure consistency from patient to patient.

An ideal index to assess malocclusions should be immune to examiner biases by being as objective as possible. In this sense, the ideal index should have both intra-examiner and inter-examiner reliability. In addition, it should have high sensitivity and specificity values, so that patients who truly have the most severe needs for orthodontic treatment are identified (Borzabadi-Farahani, 2011). If a quantitative index can meet these criteria, then it can be used by insurance companies to reliably guide decision making for insurance funding allocation for treatment. Quantitative indices used by insurance companies typically have a cut-off score, above which funding is awarded and below which it is not. Since most insurance companies have their own reviewers to examine submitted indices and even score their own indices, inter-examiner reliability is crucial to an index's success, fairness, and utility in insurance fund allocation. This would help clinicians to educate their patients on the likelihood of insurance coverage, and it would help the insurance company to have confidence in their fund allocation decisions.

## **2.2 An Overview of Medicaid Insurance Coverage of Orthodontic Treatment**

Medicaid and the Children's Health Insurance Program (CHIP) offer free or low-cost medical insurance coverage to millions of people in the United States of America. Since individual state funding covers half of the budget for these programs, individual states are given liberty to decide what treatments or procedures should be covered by their state's insurance. In the United States, these programs allocate funding for "medically necessary orthodontic treatment", but as stated above, each state can define what orthodontic treatment is medically necessary in their own way.

Defining what orthodontic treatment is medically necessary is more nuanced than most other medical treatments. Malocclusion is a unique medical condition because it

usually does not directly cause the patient immediate harm or pain. However, malocclusion can lead to the development of both physical and psychological ailments if maintained (Solow, 1995). The World Health Organization (WHO) has included mental health among the most important health problems in the world (Choobineh *et al.*, 2013). The presence of certain malocclusions and their correction has been shown to have a profound effect on patient's mental health (Kiyak, 2008). Many children that are eligible to receive orthodontic treatment are in a critical stage of mental and social development. The social handicaps associated with orthodontic problems can stunt the social development of these children and leave behind lasting emotional scars. Those with appealing dentofacial features have even been found to be more successful than those with severe malocclusions (Littlewood and Mitchell, 2009). Quality of life is a leading driver of healthcare decisions, and there is no doubt that orthodontic treatment can improve the quality of life of patients with malocclusion by enhancing dental and facial esthetics and improving masticatory function (Proffit *et al.*, 2019).

The Salzmann Evaluation Index (SEI) was developed by Joseph Salzmann in 1967 with the goal of quantifying and triaging patient's need for orthodontic treatment based on the severity of their malocclusion. It is one of many indices that have been developed for this purpose (Beglin *et al.*, 2001), despite of the AAO's opposition of using such indices to determine the treatment needs of patients (Järvinen, 2001). Pennsylvania uses the SEI, along with additional orthodontic records, to determine whether orthodontic treatment is "medically necessary" and thus whether it will be funded by Medicaid insurance (Minick *et al.*, 2017).

The SEI is regarded as being a user-friendly malocclusion handicapping index, as it does not require cephalometric measurements and can be efficiently completed with a chairside examination of a patient. The SEI is a quantitative index that gives a score for the presence of the following orthodontic problems: missing, crowded, or rotated teeth, open or closed spaces, overbite, overjet, crossbites, and the Angle classification of each tooth in the posterior segment (Class I, II, or III). The SEI has been shown to have a high level of inter-examiner reliability (Grewe and Hagan, 1972). An additional study showed the SEI to be “highly accurate and reproducible” in handicapping malocclusions and identifying patients with orthodontic treatment needs (Gray and Demirjian, 1977). For these reasons, the SEI can be said to be a reliable method for insurance companies to determine need for orthodontic treatment and make decisions on treatment funding allocation.

### **2.3 Scoring the Salzman Evaluation Index**

To be considered for Medicaid coverage for orthodontic treatment in Pennsylvania, a Salzman Evaluation Index must be completed by an orthodontist, general dentist, or pediatric dentist and submitted to their respective insurance provider. Patients scoring 25 or higher on the SEI completed by the orthodontist traditionally receive insurance funding for their orthodontic treatment. Once the patient is identified as being a candidate for Medicaid coverage by their SEI score, records (including clinical photographs and radiographs) are submitted on the patient’s behalf to their insurance provider for a decision to be rendered. Once received by the company, an employee reviews the records and completes their own SEI to decide whether to allocate funding for treatment. In Pennsylvania, patients need to be under the age of 21 and be in the permanent dentition

phase to be eligible for Medicaid orthodontic coverage. Some exceptions are made, such as for patients with over-retained primary teeth.

The SEI was designed to be completed with a chairside evaluation without the use of radiographic examination. The SEI is a series of categorized diagnoses of malocclusions that are each given numeric scores when present (or zero when absent) and summed to produce a single “Grand Total” score. The SEI is divided into “Intra-Arch” and “Inter-Arch” Deviations. The “Intra-Arch Deviations” section of the SEI includes the diagnoses of missing, crowded, rotated, or spacing of the teeth, and is divided into maxillary anterior, maxillary posterior, mandibular anterior, and mandibular posterior segments. The “Inter-Arch Deviation” section is divided into two subsections, the “Anterior Segment” (defined as the permanent central and lateral incisors only) and the “Posterior Segment” (defined as the permanent canines, first and second premolars, and first molars). The “Anterior Segment” diagnoses include overjet, overbite, crossbite, and open bite as vertical columns. The “Posterior Segment” diagnoses include Angle Class II, Angle Class III, crossbite, and open bite in vertical columns evaluating each tooth in the posterior segment (Salzmann). An example of the SEI form is displayed in Figure 10 below.

The following guidelines for completing the SEI have been outlined by Medicaid insurance companies in Pennsylvania. It is crucial that these guidelines are followed diligently in order to maintain inter-examiner reliability between clinicians and reviewers from the insurance companies, who modified these guidelines from the ones originally set forth by Dr. Joseph Salzmann.

- 1. Intra-Arch Deviations**

- a. General Scoring Principles:

- i. Each affected tooth in this section is awarded one point. The score of the maxillary anterior is multiplied by 2 as an esthetic handicap
- ii. The score for the maxillary and mandibular anterior segments in this section is capped at 5 (10 for maxillary anterior after the 2x multiplier) and 4 for the maxillary and mandibular posterior
- iii. A tooth cannot be scored as both crowded and rotated or crowded and closed spacing, one diagnosis must be chosen

b. Diagnoses:

i. Missing teeth

1. Scored by the number of missing teeth. Retained roots and unerupted teeth are considered missing.

ii. Rotated Teeth

1. Disruption to the continuity of the dental arch resulting in broken or malpositioned proximal contact with sufficient space to address mispositioned crown without movement of other teeth in the dental arch

iii. Crowded Teeth

1. Lack of adequate space for proper alignment of a tooth without moving other teeth.

iv. Spacing

1. Open

- a. Space between teeth allowing for visualization of the interproximal papilla from an occlusal viewpoint



- i. In the anterior segments, each visible papilla is awarded one point
- ii. In the posterior segments, the interproximal papilla on both mesial and distal sides must be visible to be scored

2. Closed

- a. A space is present/interproximal papilla can be seen, however the space is insufficient for the eruption of a tooth when a tooth is missing

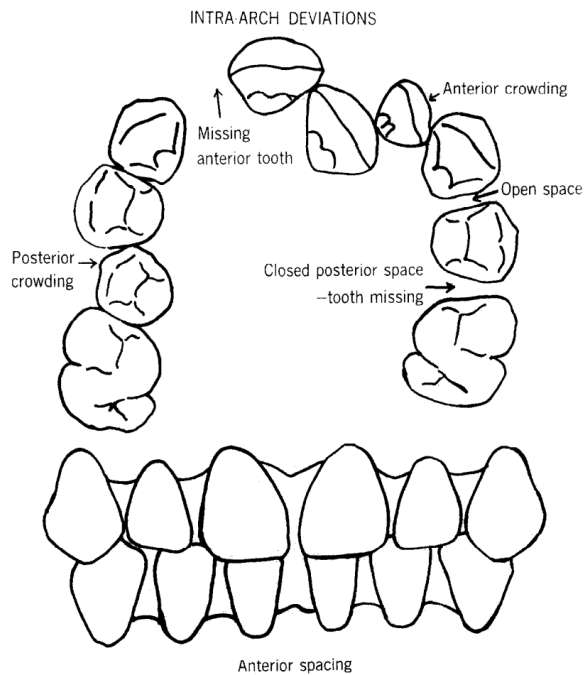


Figure 1. Intra-Arch Deviations. (Salzmann, 1968)

2. **Inter-arch Deviation, Anterior Segment**

- a. Overall Scoring Principle:
  - i. Each affected tooth in this section is awarded one point. The score of the anterior segment is doubled as an esthetic handicap.

b. Diagnoses:

i. Overjet:

1. The horizontal distance measured from the incisal edge of the maxillary incisors to the most labial aspect of the adjacent mandibular incisors when the patient bites in maximum intercuspation. Each tooth with an overjet of 9 mm or above is awarded one point.



Figure 2. Inter-Arch Deviations –Overjet.

ii. Overbite

1. Mandibular incisors occluding on the maxillary palatal mucosa when the patient bites in maximum intercuspation.



Figure 3. Inter-Arch Deviations – Overbite.

iii. Anterior Crossbite

1. When the patient bites in maximum intercuspation, the maxillary incisors are lingual to the mandibular incisors



Figure 4. Inter-Arch Deviations – Anterior Crossbite.

iv. Anterior Openbite

1. Presence of vertical spacing between the maxillary and mandibular incisors when the posterior teeth are in occlusion



Figure 5. Inter-Arch Deviations- Anterior Openbite.

### **3. Inter-arch Deviations, Posterior Segment**

#### **a. Sagittal Discrepancy of Posterior Teeth**

- i. A sagittal discrepancy from the norm is awarded a point for each tooth with a discrepancy of a full cusp in the posterior segment (canine, first and second premolars, and first molars). On the SEI form, the discrepancy is reported as the position of the mandibular teeth relative to the maxillary teeth, *i.e.* “Mesial” being Angle Class III and “Distal” being Angle Class II



Figure 6. Inter-Arch Deviations – Distal Deviation of Posterior Teeth.



Figure 7. Inter-Arch Deviations – Mesial Deviation of Posterior Teeth.

b. Posterior Crossbite



- i. Transverse discrepancy of posterior teeth, where maxillary buccal cusps are palatal to mandibular buccal cusps, or maxillary palatal cusps are buccal to mandibular buccal cusps



Figure 8. Inter-Arch Deviations –Posterior Crossbite.

- c. Posterior Open Bite

- i. Presence of vertical spacing between maxillary and mandibular teeth (Canines, premolars, or first molars) when the remainder of the teeth are in occlusion



Figure 9. Inter-Arch Deviations –Posterior Open Bite.

**ORTHODONTIC SERVICE  
SALZMANN EVALUATION INDEX**

Commonwealth of Pennsylvania  
Department of Public Welfare  
MEDICAL ASSISTANCE PROGRAM

PATIENT'S NAME - LAST, FIRST, MIDDLE INITIAL				County	Record Number	Cat.	Chr. Dig.	Line No.
REFERRING DENTIST								
ORTHODONTIST'S NAME			PROVIDER TYPE	M.A.I.D. NO.	DATE OF ASSESSMENT			

**HANDICAPPING MALOCCLUSION ASSESSMENT RECORD**

**A. Intra - Arch Deviation**

SCORE TEETH AFFECTED ONLY	MISSING	CROWDED	ROTATED	SPACING		NO.	POINT VALUE	SCORE
				Open	Closed			
MAXILLA	ANT.						X2	
	POST.						X1	
MANDIBLE	ANT.						X1	
	POST.						X1	
<b>TOTAL SCORE</b>								

ANT = Anterior Teeth (4 incisors)  
POST = Posterior Teeth (Include canine, premolars and first molars)  
NO. = Number of teeth affected

**B. Inter - Arch Deviation**

**1. Anterior Segment**

SCORE MAXILLARY TEETH AFFECTED ONLY EXCEPT OVERBITE*	OVERJET	OVERBITE	CROSSBITE	OPENBITE	NO.	PT. VALUE	SCORE
						X2	
<b>TOTAL SCORE</b>							

\*Score Maxillary or Mandibular Incisors  
No. = Number of teeth affected

**2. Posterior Segment**

SCORE AFFECTED TEETH ONLY	RELATE MANDIBULAR TO MAXILLARY TEETH				SCORE AFFECTED MAXILLARY TEETH ONLY				NO.	POINT VALUE	SCORE
	DISTAL		MESIAL		CROSSBITE		OPENBITE				
	Right	Left	Right	Left	Right	Left	Right	Left			
CANINE										X1	
1ST PREMOLAR										X1	
2ND PREMOLAR										X1	
1ST MOLAR										X1	
<b>TOTAL SCORE</b>											

<b>GRAND TOTAL</b>	
--------------------	--

Figure 10. The Salzmann Evaluation Index.



After scoring each section of the SEI, the rows are summed horizontally and then multiplied (if a multiplier is present) to produce a score for each horizontal row. These scores are then vertically summed for a “Total Score” in each subsection. The three total scores are then summed to produce the “Grand Total” score, which is the score that is considered by insurance companies in fund allocation decision making. The “Grand Total” score is meant to correlate with the severity of the malocclusion present, with higher scores being associated with more severe malocclusion.

#### **2.4 Past Studies Examining Orthodontic Treatment and Medicaid Funding**

A 2017 study revealed significant regional discrepancies in Medicaid funding for orthodontic treatment throughout the United States (Minick *et al.*, 2017). Since each state has its own guidelines for orthodontic treatment coverage, this should not be considered a surprising finding. However, this study also revealed a decrease over the study’s ten-year period in overall orthodontic treatment coverage by Medicaid insurances. This highlights a lack of access to orthodontic treatment by those who rely on Medicaid coverage.

Another recent study by found that the SEI score was not predictive of Medicaid approval or denial for orthodontic treatment. Even though Medicaid providers in Pennsylvania list an SEI score of 25 being needed for orthodontic treatment funding, only 46.6% of the approved patients had an SEI score of 25 or greater (Patel *et al.*, 2021).

Another study examined the correlation between SEI score and Medicaid approval. The typical threshold for orthodontic coverage in the state of Pennsylvania is a score of 25 on the SEI. However, this study found that the Medicaid approval rate for patients scoring above 25 on the SEI in their sample was only 52.3% (Moran *et al.*, 2021). The study also examined differences in coverage rates amongst different Pennsylvania Medicaid

providers and found that companies varied from covering 33.3%-69.7% of patients with an SEI score above 25. This not only shows low coverage rates for patients that should theoretically qualify for coverage, but a low level of agreement between companies.

Another study from Temple University took a closer look at the differences in patients who were covered by Medicaid insurance for orthodontic treatment and those who were not who scored above 25 on the SEI. This study found that there was no difference between the scores of these patients in any of the “Intra-Arch Deviation” rows, but that there were significant differences in the scores of these patients in all of the “Inter-Arch Deviation” rows (Henderson *et al.*, 2023). This may suggest that there are certain characteristics that may make a patient more likely to be covered by Medicaid insurance, or that Medicaid insurance providers value certain types of malocclusions more than others. This is the basis of the present study, as it will examine the diagnoses that may influence Medicaid providers to fund orthodontic treatment.

## CHAPTER 3

### AIMS OF THE INVESTIGATION

Purpose: This study aims to examine discrepancies in Salzman Evaluation Index “Inter-Arch Deviation” scores between patients approved and unapproved for orthodontic treatment by Medicaid insurances. This study aims to identify diagnoses that distinguish scores and influence Medicaid approval or denial for orthodontic treatment.

Specific Aim:

1. Identify differences between SEI “Inter-Arch Deviation” subsection scores for patients who have an overall SEI score  $\geq 25$  and are approved or unapproved by Medicaid insurance for orthodontic treatment.

Hypothesis: This Study Investigates the following hypothesis:

1. There is a statistical difference in the average score per “Inter-Arch Deviation” subsection between patients approved or unapproved for orthodontic treatment by Medicaid insurance.

The aim of this study is to identify if certain diagnoses on the SEI lead to a higher probability of insurance coverage for orthodontic treatment. Since “Inter-Arch Deviation” scores have been found to be higher in patients receiving Medicaid orthodontic coverage (Henderson *et al.*, 2023), this study will aim to further specify if any of the scores that comprise the “Inter-Arch Deviation” categories are different between the approved and unapproved groups. Identification of these differences will help orthodontists to understand insurance providers’ evaluation of the SEI and improve orthodontic education on evaluating malocclusion.

## CHAPTER 4

### MATERIALS AND METHODS

The patients in this study will be chosen from the patients at the Temple University Orthodontic Residency Program screening clinic. Each Medicaid patient at the screening clinic has a SEI completed by an orthodontic resident and submitted to their Medicaid Insurance company. In addition to the SEI, clinical records are taken and submitted to be reviewed by the insurance company. These clinical records include the SEI, a Treatment Plan Form, intraoral and extraoral photographs, a Panoramic radiograph, and a Cephalometric radiograph. In addition, some insurance providers require digital models produced by intraoral scans to be submitted, including a posterior view of the occlusion to visualize palatal impinging deep bites. The inclusion and exclusion criteria from this study are described below.

Inclusion Criteria: Patients under the age of 21, who have a Medicaid insurance provider and had a SEI scored by a Temple Orthodontic Resident from the years 2020 and 2021. Only scores above 25 will be analyzed for the purpose of this study.

Exclusion Criteria: Any patient who is over the age of 21, has either private or no insurance, an SEI scored by a Temple Orthodontic Resident that is below 25, or no SEI completed due to being in the mixed dentition phase or other reason.

This study had 560 patients meet the above inclusion criteria. The information compiled about these patients includes the patient's age at time of submission, gender, Salzmann Score, Insurance provider and their response (approval or denial), and the scored Salzmann Evaluation Index. The patients have been de-identified and given a unique study

ID. Throughout the study, the examiners will be blinded to each patient's identity, and will only refer to the patients by the unique study ID.

**Description of Measures/Outcomes:**

The sample of patients selected were stratified into two groups: those who were approved for orthodontic treatment funding by their Medicaid provider ("Approved") and those who were not ("Unapproved"). Mean and median scores and standard deviations from the eight "Inter-Arch Deviation" diagnoses on the SEI, including the four anterior and four posterior segment diagnoses were calculated for each group. The anterior diagnoses include overjet, overbite, crossbite, and openbite. The posterior segment diagnoses include Angle Class II, Angle Class III, crossbite, and openbite. The scores derived from these eight categories were compared between the group of patients approved and patients denied Medicaid coverage for orthodontic treatment.

**Statistical data collection, management, and analysis:**

A Shapiro-Wilk test for normality was run to determine the normality of the data. Mean and median scores and standard deviations for each diagnosis were calculated from the SEI scores for each of the approved and unapproved groups. Based on the results of the normality test, each category was analyzed using a Wilcoxon test for a significant difference between the approved and unapproved groups, with  $\alpha < 0.05$  being considered significant. This analysis was used to identify if there are any diagnoses with higher scores in the approved group compared to the unapproved group, which may identify certain diagnoses that lead to higher chances of Medicaid insurance approval for orthodontic treatment.

## CHAPTER 5

### RESULTS

The Temple University Department of Orthodontics screened 1,293 patients with Medicaid insurance between January 1, 2020 and December 31, 2021. The total sample of patients that satisfied the inclusion criteria was 560 patients. This sample included 289 patients (51.6%) that were approved for Medicaid funding for treatment and 271 patients (48.4%) that were denied funding for treatment. The sample included 314 female (56.1%) and 246 male (43.9%) patients. The distribution of Medicaid approval status by age and sex are listed below in Table 1.

Table 1. *Age and sex distribution of patients by treatment approval status*

	<b>Age</b>	<b>Female (n=314)</b>	<b>Male (n=246)</b>
<b>Approved</b>	14.3±2.83	155	134
<b>Unapproved</b>	14.6±2.84	159	112

The mean overall SEI score for patients that were approved by Medicaid for orthodontic treatment funding was 3 points higher than the mean score for those who were denied funding by Medicaid. This was a highly statistically significant difference between SEI scores of the two groups. A histogram of all of the scores in the sample is given below. SEI scores of 25 are the lowest included in this sample, per the inclusion criteria and

Pennsylvania Medicaid threshold for orthodontic treatment coverage. As SEI scores increase, their frequency decreases, as scores above 40 are rare, and most scores included in this sample were clustered between 25 and 30.

Table 2. *Mean SEI scores and standard deviations between Approved and Unapproved groups*

	<b>SEI Score</b>
<b>Approved</b>	32.8 ± 5.71
<b>Unapproved</b>	29.8 ± 4.82
<b>p-value</b>	8.82x10 <sup>-12</sup>

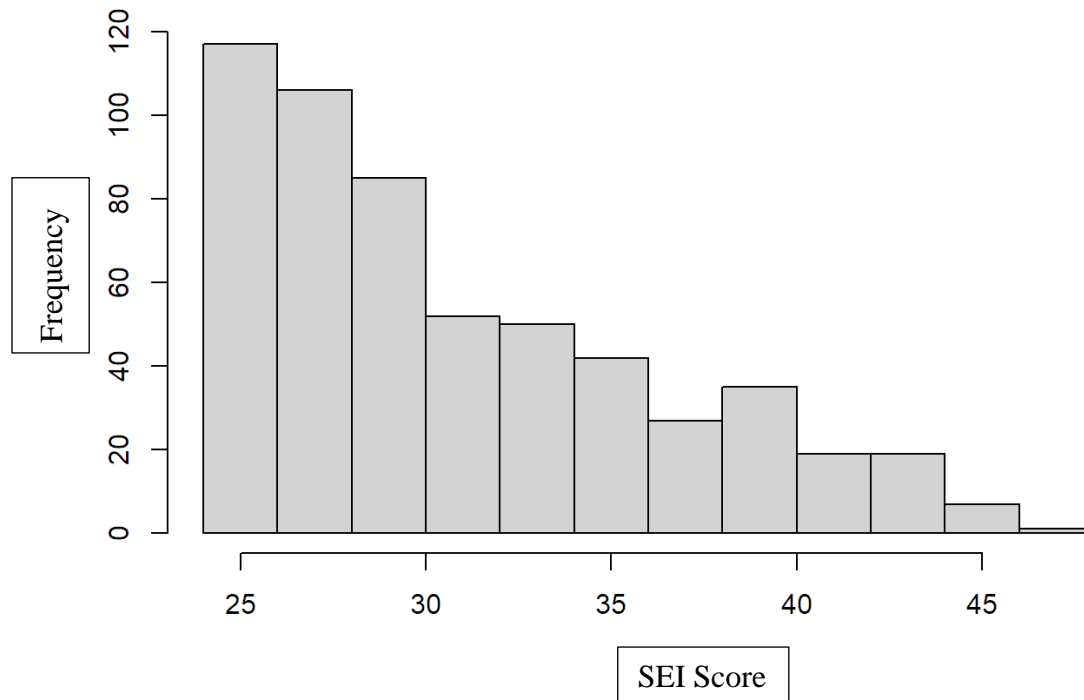


Figure 11. Histogram of SEI scores of the sample.

A Shapiro-Wilk test was run to determine whether the data for both the approved and unapproved groups was normally distributed. Neither the approved nor unapproved group was normally distributed. Thus, the Wilcoxon test for significance was chosen to compare the scores of each of the IAD diagnoses.

The hypothesis to be tested by this study was to determine whether there is a variance of scores received for each subsection of the SEI between patients that are approved or unapproved by a Medicaid Insurance. The median scores of each of the subsection categories for the Inter-arch deviation sections (Overjet, Overbite, Anterior crossbite, Anterior openbite, Class II, Class III, Posterior crossbite, and Posterior openbite) were calculated. The Wilcoxon test for significance was used to identify differences between the approved and unapproved groups for each of the subsection scores. Anterior crossbite, anterior openbite, posterior crossbite, and posterior openbite were identified as significantly higher scores in the approved group compared to the unapproved group.



Overjet, overbite, Class II, and Class III had no significant differences between approved and unapproved groups. The average scores per section for the approved and unapproved groups are listed in Table 3 below.

Table 3. *Mean values of IAD scores between approved and unapproved for orthodontic treatment groups*

	<b>Overjet</b>	<b>Overbite</b>	<b>Anterior Crossbite</b>	<b>Anterior Openbite</b>	<b>Class II</b>	<b>Class III</b>	<b>Posterior Crossbite</b>	<b>Posterior Openbite</b>
<b>Approved</b>	2.38	2.34	1.76	2.21	2.90	2.36	1.09	0.48
<b>Unapproved</b>	2.58	2.27	0.84	1.13	2.64	1.97	0.61	0.28
<b>p-value</b>	0.236	0.969	$9.69 \times 10^{-4}$	$7.38 \times 10^{-5}$	0.431	0.380	$4.86 \times 10^{-3}$	0.0188

## **CHAPTER 6**

### **DISCUSSION**

The Salzmann Evaluation Index is a tool that is vitally important for orthodontic practitioners, orthodontic Medicaid insurance providers, and orthodontic patients. Each day, the SEI is used to determine whether thousands of Medicaid recipients in Pennsylvania and several other states will have the financial ability to receive orthodontic care. A shared belief among all parties involved in this process is that the allocation of Medicaid funding for orthodontic treatment should be fair, transparent, and consistent. Any biases or inconsistencies on the part of the insurance providers needs to be identified so that the limited funding for orthodontic treatment available for Medicaid recipients is given to the patients who would benefit most profoundly from orthodontic treatment.

The orthodontic department at Temple University has the distinct privilege of serving a high volume of orthodontic Medicaid patients, giving them a unique opportunity to study trends in orthodontic Medicaid funding. A previous master's thesis from the department showed significant differences in mean scores from the Anterior Inter-arch Deviation and Posterior Inter-Arch Deviation sections between patients approved and unapproved by Medicaid insurance for orthodontic treatment (Henderson *et al.*, 2023). This study aimed to evaluate the subsections that comprise the Anterior Inter-arch Deviation (Overjet, Overbite, Anterior crossbite, and Anterior openbite) and Posterior Inter-arch Deviation sections (Class II, Class III, Posterior crossbite, and Posterior openbite) to determine whether there was a difference in the scores of the subsections when comparing approved and unapproved groups. The study did identify four of the subsections (Anterior crossbite, Anterior openbite, Posterior crossbite, and Posterior openbite) had significantly

higher scores ( $p < 0.05$ ) in the approved group compared to the unapproved group. This may indicate a higher probability of insurance coverage for orthodontic treatment for patients that have the presence of one or more of these diagnoses. It could also indicate a bias by the insurance companies toward funding treatment to patients with these diagnoses more frequently than those who do not.

A possible explanation for the difference in the subsection scores may be explained by the nature of the way that the SEI is scored. In order to score a tooth-antagonist relationship as having Overjet, for example, requires that there is at least 9 millimeters of overjet measured between the maxillary incisor tooth and its antagonist. While this may seem objective, the insurance reviewer is not able to clinically measure the overjet, so there may be differences between the insurance reviewer and clinician's scores. Similarly, in order to score a tooth-antagonist relationship as Class II or Class III, the tooth-antagonist relationship must be at least a "full-cusp" Class II or Class III. This is also subject to the insurance examiner and clinician's definition of what is a true "full-cusp" relationship. Finally, in order to score a tooth-antagonist relationship as having Overbite, the lower teeth must be contacting the palate when the posterior teeth are in occlusion. It is sometimes difficult for the clinician to provide evidence of palatal impingement of the lower incisors with the records provided to the insurance companies, so there can be differences in Overbite scoring between insurance providers and clinicians. If there is not agreement between the clinician and the insurance reviewer, the scores provided by the clinician will not be predictive of insurance approval, and thus will not be different between the approved and unapproved groups.

The scoring of the subsection scores that were found to be statistically significantly different between approved and unapproved groups is seemingly less subjective than those that were not different. The posterior and anterior openbite sections may be scored if the tooth and its antagonist do not vertically overlap when the patient bites in maximum intercuspation position. This is an objective observation, and it is easily seen in the records provided to the insurance companies. Similarly, anterior crossbite can be scored when the maxillary incisors are lingually positioned compared to the mandibular incisors when the patient occludes. This is also objective, and it is easily observed in the records provided to the insurance companies. Posterior crossbite is scored when the buccal cusps of a posterior tooth are either lingual to the buccal cusps of its mandibular antagonist or the lingual cusps of a posterior tooth are buccal to the buccal cusps of its mandibular antagonist when the patient occludes. This is usually objective and clearly demonstrated by the records submitted for insurance review. When there is high agreeability between the clinician and insurance reviewer's scores, higher scores by each will be present in patients that are given insurance approval for orthodontic treatment.

The data collected from each of the eight subsections was inherently not normally distributed. For the Anterior Inter-Arch Deviation (AIAD) subsections (Overjet, Overbite, Anterior crossbite, and Anterior openbite), there are only five possible scores for each. Each incisor-antagonist tooth relationship with one of the conditions listed is given two points for that subsection. Therefore, the only possible scores for these four subsections are 0, 2, 4, 6, or 8. The most likely scores for each subsection are 0 and 8, because skeletal discrepancies will cause all incisor-antagonist relationships to have a type of malocclusion when present. For example, a Class III Hyperdivergent skeletal pattern will most likely

cause all four incisor-antagonist relationships to have Anterior crossbite and Openbite, which would award 8 points to each of those respective subsections. Each of these subsections also has a paired subsection for which an incisor-antagonist pair cannot be scored as having both. For example, an incisor-antagonist pair cannot simultaneously have both overjet and an anterior crossbite, and similarly, cannot have both overbite and openbite. Taking these limitations into account, the maximum possible score for the AIAD section is 16, and an odd score is not possible.

The Posterior Inter-Arch Deviation (PIAD) section is more continuous in nature because each tooth-antagonist relationship with presence of a given malocclusion is awarded one point. Each subsection of the PIAD section can have nine possible scores, ranging the integers from 0 to 8. As is the case with the AIAD section, there are two subsections for which a tooth-antagonist relationship cannot be mutually scored, as a tooth-antagonist cannot be simultaneously Class II and Class III. Additionally, scores of 0 and 8 are the most common for each subsection, as skeletal discrepancies can make it more likely that all tooth-antagonist relationships have the same sagittal, transverse, and vertical diagnoses.

Since 2015, the AAO has pushed to establish universal diagnoses that, when present, entitle the patient to Medicaid coverage for orthodontic care called automatic qualifiers (American Association of Orthodontists, 2015). Many of the subsections studied are now considered automatic qualifiers. Some of the automatic qualifiers, as listed by one of the insurance companies studied, include the following:

Given these automatic qualifiers, a score of 2 on the Overjet section, a score of 6 on the Overbite section, a score of 4 on the Anterior crossbite section, or a score of 4 on the Anterior openbite section should individually automatically qualify a patient for Medicaid funding for orthodontic treatment. Similarly, a score of 4 on either the Class II, Class III, or Posterior crossbite sections should also automatically qualify a patient for orthodontic coverage. Only 51.6% of the patients included in this study were approved for orthodontic treatment, even though all have SEI scores above 25 and many have conditions that would be considered automatic qualifiers.

A limitation of this study is the variability in scoring of the SEI between different residents. Each year, there are 12 residents within the Temple University Department of Orthodontics that are responsible for screening new patients and completing SEI forms when applicable. While each resident completes an SEI calibration annually, and the SEI has been shown to have high levels of reproducibility and repeatability (Beglin, 2001) (Järvinen, 2001), there is still some inherent differences in the interpretation of clinical findings and thus the scoring of the SEI.

Another limitation of the study is that all patients examined were patients with Medicaid insurance screened by the Temple University department of Orthodontics in North Philadelphia. These patients may have unique malocclusion characteristics, and may not be an accurate representation of the entire state of Pennsylvania. Although there may be differences in the study population compared with the state's population, the study's large sample size may limit the effect of these differences.

As stated above, the AAO has recently pushed for the approval of orthodontic treatment for patients with presence of automatic qualifiers. These patients can receive

orthodontic treatment funding with an SEI score below 25. This study has shown that the presence of automatic qualifiers may not guarantee patients orthodontic treatment funding from Medicaid insurances in Pennsylvania. Further research is needed to examine whether these patients are awarded orthodontic treatment funding when automatic qualifying malocclusions are present.

## **CHAPTER 7**

### **CONCLUSIONS**

Patients with anterior crossbite, anterior openbite, posterior crossbite, and posterior openbite may be more likely to receive coverage for orthodontic treatment by Medicaid insurance companies in Pennsylvania. Scores denoting presence of overjet, overbite, Class II, and Class III malocclusions were not different in patients approved and denied coverage for orthodontic treatment. It is possible that insurance providers prioritize transverse and vertical malocclusions more than sagittal malocclusions. In addition, the presence of the prioritized malocclusions may be less susceptible to inter-rater bias since they are more easily diagnosed and obvious when present, and not subject to evaluation of their severity.



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## APPENDIX A

# INSTITUTIONAL REVIEW BOARD APPROVAL AND HIPAA WAIVER



Research Integrity & Compliance  
Student Faculty Center  
3340 N. Broad Street, Suite 304  
Philadelphia PA 19140

Institutional Review Board  
Phone: (215) 707-3390  
Fax: (215) 204-4609  
e-mail: [irb@temple.edu](mailto:irb@temple.edu)



Approval for a Project Involving Human Subjects Research that is Approved as Exempt

Date: 08-May-2023

Protocol Number: 30458

PI: JEFFREY H. GODEL

Review Type: EXEMPT

Approved On: 08-May-2023

Risk: Minimal risk

Committee: A2

Sponsor: NO EXTERNAL SPONSOR

Project Title: "Comparing Salzmann Index Inter-arch deviation among Medicaid Patients seeking orthodontic treatment in Pennsylvania"

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The IRB approved the protocol 30458.

The study was approved under Exempt review. The IRB determined that the research **does not require a continuing review**, consequently there is not an IRB approval period.

As this research was approved as Exempt, the IRB will not stamp the consent or assent form(s).

**Note that all applicable Institutional approvals must also be secured before study implementation.** These approvals include, but are not limited to, Medical Radiation Committee ("MRC"); Radiation Safety Committee ("RSC"); Institutional Biosafety Committee ("IBC"); and Temple University Survey Coordinating Committee ("TUSCC"). Please visit these Committees' websites for further information.

**Finally, in conducting this research, you are obligated to submit the following:**

- **Amendments - Any changes to the research that may change the Exempt status of this study must be reviewed and approved by the IRB prior to implementation.** Examples of such changes are: including new, sensitive questions to a survey or interview, changing data collection such that de-identified data will now be identifiable, including an intervention in the methods, changing variables to be collected from medical charts, decreasing confidentiality measures, including minors or adults lacking capacity to consent as subjects when previously only adults with capacity to consent were to be enrolled, no longer collecting signed HIPAA Authorization, etc. Please reach out to the IRB Staff with any questions about if a change to the study warrants an Amendment.
- **Reportable New Information** - Using the Reportable New Information e-form, report new information items such as those described in HRP-071 Policy - Prompt Reporting Requirements to the IRB **within 5 days**.
- **Closure report** - Using a closure e-form, submit when the study is permanently closed to enrollment; all subjects have completed all protocol related interventions and interactions; collection of private identifiable information is complete; and analysis of private identifiable information is complete.

**For the complete list of investigator responsibilities, please see the HRP-070 Policy – Investigator Obligations, the Investigator Manual (HRP-910), and other Policies and Procedures** found on the Temple University IRB website: <https://research.temple.edu/irb-forms-standard-operating-procedures>.

Please contact the IRB at (215) 707-3390 if you have any questions.



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Approval of the waiver of HIPAA authorization

Date: 08-May-2023

Protocol Number: 30458  
PI: JEFFREY H. GODEL  
Committee: A2  
Project Title: "Comparing Salzman Index Inter-arch deviation among Medicaid Patients seeking orthodontic treatment in Pennsylvania"

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On 08-May-2023, the Temple IRB approved the waiver or alteration of HIPAA authorization for the protocol approved with submission # **30458-0002**. The waiver or alteration was reviewed and approved under expedited review procedures.

If this is an alteration of HIPAA authorization, additional information regarding the alteration will be provided below or in a separate manual letter.

The IRB has determined that all the specified criteria for a waiver of HIPAA authorization were met:

The description of the Protected Health Information (PHI), for which use or access is being requested, is included in the protocol summary or a separate data collection document and is necessary for the research.

The use or disclosure of protected health information involves no more than a minimal risk to the privacy of individuals, based on, at least, the presence of the following elements: an adequate plan to protect the identifiers from improper use and disclosure; an adequate plan to destroy the identifiers at the earliest opportunity consistent with conduct of the research, unless there is a health or research justification for retaining the identifiers or such retention is otherwise required by law; and adequate written assurances that the protected health information will not be reused or disclosed to any other person or entity, except as required by law, for authorized oversight of the research study, or for other research for which the use or disclosure of protected health information for which an authorization or opportunity to agree or object is not required by 45 CFR 164.512.

The research could not practicably be conducted without the waiver or alteration.

The research could not practicably be conducted without access to and use of the protected health information.

Please contact the IRB at (215) 707-3390 if you have any questions.

*Sudeep Abraham Pakyanadhan*  
05/08/2023

## APPENDIX B

### STUDY DATA SHEET – DEMOGRAPHICS

Random Identifier	Sex	Age at Screening Records	Treatment Date	Insurance Company	Approval Status	Overall Salzman Score
1400	M	12	3/25/2021	Avesis	0	37
1401	F	19	10/21/2020	KMHP	0	31
1402	M	11	11/5/2020	Avesis	0	27
1403	M	13	4/21/2021	KMHP	0	36
1404	M	19	2/19/2020	KMHP	0	25
1405	M	12	1/15/2020	Avesis	0	35
1406	F	19	5/19/2021	KMHP	0	44
1407	F	15	4/21/2021	Avesis	0	29
1408	M	20	11/3/2020	Avesis	0	44
1409	M	16	1/24/2020	Avesis	0	41
1410	F	16	12/3/2020	Avesis	0	35
1411	M	15	9/8/2021	Avesis	0	37
1412	F	14	1/24/2020	KMHP	0	33
1413	F	10	2/10/2020	Avesis	0	35
1414	F	17	3/31/2021	Avesis	0	30
1415	F	10	6/25/2020	Avesis	0	43
1416	F	12	1/24/2020	Avesis	0	37
1417	M	13	3/24/2021	KMHP	0	33
1418	F	15	2/26/2020	KMHP	0	46
1419	F	11	4/26/2021	KMHP	0	26
1420	M	18	6/9/2021	KMHP	0	44
1421	M	12	10/22/2020	Avesis	0	39
1422	F	17	9/2/2020	Avesis	0	33
1423	M	12	9/24/2020	Avesis	0	33
1424	F	12	3/16/2020	KMHP	0	41
1425	F	20	7/8/2021	Avesis	0	26
1426	F	13	2/11/2021	Avesis	0	29
1427	M	14	11/5/2020	Avesis	0	33
1428	M	11	4/29/2021	Avesis	0	35
1429	M	11	2/10/2020	Avesis	0	26
1430	M	15	1/25/2021	Avesis	0	42
1431	M	17	9/2/2021	KMHP	0	29

1432	M	16	3/12/2020	Avesis	0	30
1433	M	11	3/16/2021	Avesis	0	28
1434	M	18	1/21/2021	Avesis	0	26
1435	F	11	8/14/2020	Avesis	0	36
1436	M	14	4/21/2021	Avesis	0	30
1437	F	14	2/13/2020	Avesis	0	43
1438	F	14	3/22/2021	Avesis	0	25
1439	M	19	2/20/2020	Avesis	0	30
1440	F	17	1/18/2021	KMHP	0	26
1441	F	15	12/1/2020	KMHP	0	35
1442	M	16	1/25/2021	KMHP	0	33
1443	M	11	10/15/2021	KMHP	0	28
1444	M	15	9/23/2021	Avesis	0	31
1445	F	14	2/26/2020	KMHP	0	27
1446	F	11	7/23/2020	KMHP	0	45
1447	F	15	11/9/2020	KMHP	0	28
1448	F	13	8/4/2020	KMHP	0	26
1449	M	15	2/4/2021	Avesis	0	33
1450	F	13	2/9/2021	KMHP	0	27
1451	M	18	12/9/2021	Avesis	0	25
1452	F	20	2/13/2020	Avesis	0	34
1453	M	17	1/7/2020	Avesis	0	34
1454	F	17	3/24/2021	Avesis	0	29
1455	F	13	7/23/2020	KMHP	0	29
1456	M	12	6/9/2020	Avesis	0	42
1457	F	12	8/13/2021	KMHP	0	30
1458	M	14	1/23/2020	Avesis	0	29
1459	F	14	10/22/2020	KMHP	0	26
1460	F	14	3/11/2020	Avesis	0	39
1461	M	13	5/5/2021	Avesis	0	25
1462	F	11	5/5/2021	Avesis	0	40
1463	F	15	6/25/2020	Avesis	0	35
1464	F	12	6/17/2020	KMHP	0	36
1465	M	11	6/5/2020	Avesis	0	31
1466	M	13	11/17/2021	Avesis	0	46
1467	M	12	12/16/2021	KMHP	0	34
1468	F	11	3/12/2020	KMHP	0	39
1469	M	11	3/15/2021	KMHP	0	33
1470	M	12	2/11/2020	KMHP	0	31

1471	M	13	9/21/2020	KMHP	0	25
1472	F	10	4/30/2021	KMHP	0	28
1473	M	10	2/11/2021	KMHP	0	27
1474	M	11	9/16/2021	Avesis	0	39
1475	M	14	8/19/2020	Avesis	0	29
1476	M	13	2/25/2021	Avesis	0	39
1477	F	15	9/21/2020	KMHP	0	32
1478	F	17	7/29/2020	Avesis	0	38
1479	F	20	2/3/2020	KMHP	0	34
1480	F	11	6/23/2020	KMHP	0	29
1481	F	12	1/24/2020	KMHP	0	27
1482	M	14	1/2/2020	KMHP	0	27
1483	M	13	1/2/2020	Avesis	0	44
1484	F	16	1/8/2020	Avesis	0	40
1485	M	11	1/8/2020	KMHP	0	32
1486	F	13	1/8/2020	KMHP	0	26
1487	F	18	7/24/2020	KMHP	0	35
1488	M	12	1/9/2020	Avesis	0	26
1489	F	14	4/29/2021	KMHP	0	29
1490	F	13	1/15/2020	Avesis	0	45
1491	M	11	1/15/2020	KMHP	0	32
1492	M	13	1/15/2020	Avesis	0	36
1493	F	13	1/16/2020	Avesis	0	32
1494	F	13	2/10/2021	KMHP	0	45
1495	F	12	2/5/2020	Avesis	0	26
1496	M	13	1/23/2020	Avesis	0	43
1497	F	12	1/23/2020	Avesis	0	42
1498	M	17	1/23/2020	KMHP	0	27
1499	F	18	1/23/2020	KMHP	0	31
1500	M	14	1/29/2020	Avesis	0	40
1501	F	12	1/29/2020	KMHP	0	37
1502	F	15	1/29/2020	KMHP	0	38
1503	M	13	1/29/2020	Avesis	0	27
1504	M	17	2/6/2020	KMHP	0	35
1505	F	20	1/30/2020	Avesis	0	29
1506	M	13	2/5/2020	KMHP	0	37
1507	F	18	2/5/2020	Avesis	0	25
1508	M	19	2/6/2020	KMHP	0	33
1509	F	19	2/6/2020	Avesis	0	42

1510	F	10	9/8/2021	KMHP	0	30
1511	M	15	2/6/2020	Avesis	0	40
1512	M	13	2/6/2020	KMHP	0	29
1513	F	14	2/19/2020	KMHP	0	37
1514	F	19	2/13/2020	Avesis	0	27
1515	M	15	9/2/2021	KMHP	0	29
1516	F	20	4/29/2021	Avesis	0	26
1517	F	12	7/30/2020	KMHP	0	27
1518	M	16	2/19/2020	Avesis	0	26
1519	M	19	2/20/2020	KMHP	0	29
1520	F	11	2/20/2020	KMHP	0	27
1521	M	14	2/27/2020	KMHP	0	40
1522	M	12	6/9/2020	Avesis	0	27
1523	M	11	3/11/2020	Avesis	0	39
1524	F	14	3/11/2020	KMHP	0	25
1525	F	14	3/12/2020	Avesis	0	44
1526	F	11	6/17/2020	KMHP	0	31
1527	M	20	6/24/2020	Avesis	0	37
1528	F	18	6/25/2020	Avesis	0	30
1529	M	20	6/25/2020	KMHP	0	31
1530	F	20	7/1/2020	Avesis	0	39
1531	F	16	7/22/2020	KMHP	0	31
1532	F	20	7/22/2020	Avesis	0	27
1533	F	13	7/23/2020	KMHP	0	25
1534	M	15	1/6/2021	KMHP	0	27
1535	F	13	4/28/2021	KMHP	0	32
1536	F	10	8/3/2020	KMHP	0	28
1537	M	20	7/23/2020	KMHP	0	35
1538	F	11	12/15/2021	Avesis	0	36
1539	F	17	7/31/2020	Avesis	0	27
1540	M	14	11/25/2020	Avesis	0	32
1541	F	19	8/3/2020	KMHP	0	27
1542	M	12	9/17/2020	Avesis	0	29
1543	M	11	8/20/2020	KMHP	0	40
1544	F	14	8/20/2020	Avesis	0	30
1545	F	17	9/9/2020	Avesis	0	35
1546	F	12	8/21/2020	Avesis	0	28
1547	M	19	8/21/2020	Avesis	0	25
1548	F	15	8/6/2020	KMHP	0	26



1549	M	13	11/5/2020	Avesis	0	39
1550	F	15	9/22/2020	KMHP	0	27
1551	F	18	9/24/2020	Avesis	0	36
1552	M	14	10/1/2020	KMHP	0	36
1553	F	17	10/7/2020	KMHP	0	34
1554	M	13	10/7/2020	Avesis	0	31
1555	F	13	10/14/2020	Avesis	0	41
1556	F	17	10/14/2020	Avesis	0	44
1557	M	13	12/3/2020	KMHP	0	28
1558	F	10	10/21/2020	Avesis	0	39
1559	F	11	11/12/2020	KMHP	0	43
1560	M	16	10/22/2020	KMHP	0	39
1561	M	17	3/11/2021	Avesis	0	40
1562	M	16	1/27/2021	KMHP	0	37
1563	M	19	6/16/2021	KMHP	0	27
1564	F	11	11/5/2020	KMHP	0	34
1565	M	18	11/12/2020	Avesis	0	30
1566	F	14	11/12/2020	Avesis	0	34
1567	F	11	11/13/2020	Avesis	0	36
1568	F	15	11/18/2020	Avesis	0	30
1569	M	13	11/18/2020	KMHP	0	29
1570	M	12	6/10/2021	KMHP	0	34
1571	F	16	12/2/2020	Avesis	0	28
1572	M	15	12/3/2020	Avesis	0	29
1573	M	10	12/9/2020	Avesis	0	25
1574	M	18	12/10/2020	KMHP	0	30
1575	F	13	12/10/2020	Avesis	0	33
1576	M	15	1/6/2021	Avesis	0	27
1577	F	12	1/29/2021	KMHP	0	27
1578	F	19	1/19/2021	KMHP	0	28
1579	F	13	10/21/2021	KMHP	0	39
1580	F	17	1/21/2021	KMHP	0	26
1581	M	15	1/21/2021	KMHP	0	27
1582	M	16	2/25/2021	KMHP	0	36
1583	M	10	3/3/2021	Avesis	0	27
1584	F	11	1/27/2021	Avesis	0	26
1585	M	20	1/28/2021	KMHP	0	37
1586	F	15	2/5/2021	KMHP	0	25
1587	M	17	3/11/2021	Avesis	0	37

1588	M	15	3/9/2021	KMHP	0	43
1589	F	13	2/10/2021	KMHP	0	40
1590	F	16	4/21/2021	Avesis	0	30
1591	F	12	2/17/2021	KMHP	0	39
1592	M	13	9/10/2021	Avesis	0	28
1593	M	18	2/25/2021	Avesis	0	34
1594	F	15	3/18/2021	KMHP	0	31
1595	F	11	3/18/2021	KMHP	0	30
1596	M	16	3/11/2021	KMHP	0	34
1597	M	13	3/17/2021	Avesis	0	30
1598	F	14	3/17/2021	Avesis	0	32
1599	F	19	3/19/2021	Avesis	0	26
1600	M	12	3/19/2021	KMHP	0	32
1601	F	10	3/23/2021	Avesis	0	26
1602	F	17	3/24/2021	KMHP	0	36
1603	M	18	3/24/2021	KMHP	0	39
1604	F	19	3/24/2021	KMHP	0	34
1605	F	15	3/24/2021	Avesis	0	33
1606	M	13	3/24/2021	KMHP	0	25
1607	M	11	4/8/2021	Avesis	0	32
1608	F	14	4/1/2021	KMHP	0	48
1609	F	10	4/23/2021	KMHP	0	34
1610	M	14	4/5/2021	Avesis	0	28
1611	F	18	4/14/2021	Avesis	0	30
1612	M	20	4/14/2021	KMHP	0	28
1613	F	15	4/15/2021	Avesis	0	30
1614	M	15	4/21/2021	Avesis	0	30
1615	F	18	4/21/2021	Avesis	0	44
1616	F	13	4/22/2021	KMHP	0	35
1617	M	14	4/22/2021	KMHP	0	36
1618	F	11	5/7/2021	KMHP	0	29
1619	M	12	4/28/2021	Avesis	0	44
1620	M	13	4/29/2021	KMHP	0	27
1621	M	10	8/6/2021	KMHP	0	28
1622	F	13	5/5/2021	KMHP	0	30
1623	F	17	6/7/2021	Avesis	0	26
1624	M	15	5/12/2021	Avesis	0	29
1625	F	12	7/7/2021	KMHP	0	44
1626	M	11	5/13/2021	Avesis	0	36

1627	M	17	5/19/2021	KMHP	0	37
1628	M	15	9/29/2021	Avesis	0	29
1629	M	10	5/26/2021	Avesis	0	38
1630	M	13	5/27/2021	KMHP	0	29
1631	F	10	6/10/2021	Avesis	0	30
1632	F	18	6/9/2021	Avesis	0	26
1633	F	15	6/10/2021	Avesis	0	28
1634	M	12	7/7/2021	Avesis	0	40
1635	M	18	6/16/2021	Avesis	0	42
1636	M	15	6/17/2021	KMHP	0	28
1637	M	11	6/17/2021	KMHP	0	34
1638	F	18	7/7/2021	KMHP	0	42
1639	M	10	7/8/2021	Avesis	0	42
1640	M	11	8/4/2021	Avesis	0	39
1641	F	12	7/14/2021	KMHP	0	34
1642	F	17	9/2/2021	Avesis	0	28
1643	F	12	7/14/2021	KMHP	0	43
1644	M	12	7/15/2021	KMHP	0	42
1645	F	19	9/30/2021	KMHP	0	34
1646	M	18	8/5/2021	Avesis	0	28
1647	F	12	8/19/2021	KMHP	0	31
1648	F	14	8/11/2021	KMHP	0	32
1649	F	14	8/11/2021	KMHP	0	38
1650	F	10	8/18/2021	KMHP	0	29
1651	F	17	9/8/2021	KMHP	0	26
1652	F	15	8/26/2021	Avesis	0	34
1653	M	13	8/26/2021	KMHP	0	37
1654	F	13	9/1/2021	KMHP	0	34
1655	M	12	9/1/2021	KMHP	0	36
1656	F	14	9/1/2021	KMHP	0	29
1657	F	12	9/8/2021	KMHP	0	44
1658	F	15	9/8/2021	KMHP	0	35
1659	M	17	9/9/2021	Avesis	0	40
1660	F	15	9/16/2021	KMHP	0	29
1661	F	18	9/29/2021	Avesis	0	25
1662	M	17	10/7/2021	Avesis	0	42
1663	M	16	9/30/2021	KMHP	0	38
1664	F	12	9/30/2021	Avesis	0	30
1665	F	12	10/6/2021	KMHP	0	30

1666	M	18	10/13/2021	KMHP	0	28
1667	M	13	10/7/2021	Avesis	0	34
1668	F	11	10/14/2021	KMHP	0	25
1669	M	18	10/27/2021	KMHP	0	35
1670	F	14	10/20/2021	Avesis	0	37
1671	M	14	10/21/2021	Avesis	0	42
1672	M	11	10/21/2021	KMHP	0	25
1673	F	12	10/28/2021	Avesis	0	25
1674	M	14	10/28/2021	Avesis	0	29
1675	F	12	11/10/2021	KMHP	0	30
1676	M	15	11/11/2021	Avesis	0	28
1677	F	10	11/11/2021	Avesis	0	33
1678	F	11	11/11/2021	Avesis	0	33
1679	F	20	12/16/2021	Avesis	0	28
1680	F	13	11/18/2021	Avesis	0	27
1681	M	13	12/2/2021	Avesis	0	28
1682	F	10	12/8/2021	Avesis	0	29
1683	F	11	12/8/2021	Avesis	0	36
1684	F	12	12/15/2021	Avesis	0	30
1685	M	12	12/15/2021	KMHP	0	30
1686	F	12	12/16/2021	KMHP	0	35
1687	F	17	12/16/2021	Avesis	0	32
1688	F	14	1/24/2020	KMHP	0	30
24001	M	17	6/11/2020	Avesis	1	29
24002	F	16	2/12/2020	Avesis	1	29
24003	M	20	9/30/2021	KMHP	1	28
24004	F	13	6/9/2021	KMHP	1	28
24005	F	12	5/14/2021	Avesis	1	28
24006	M	17	2/25/2020	Avesis	1	25
24007	M	13	2/17/2021	Avesis	1	34
24008	M	14	2/10/2021	KMHP	1	30
24009	M	11	7/7/2021	Avesis	1	37
24010	M	13	12/16/2020	Avesis	1	31
24011	M	11	2/4/2021	Avesis	1	26
24012	F	11	6/14/2021	Avesis	1	26
24013	M	17	11/10/2021	Avesis	1	26
24014	M	11	5/12/2021	Avesis	1	40
24015	F	12	10/28/2021	Avesis	1	28
24016	F	19	1/30/2020	Avesis	1	34

24017	M	11	10/7/2021	KMHP	1	41
24018	F	16	1/30/2020	KMHP	1	27
24019	F	14	8/21/2021	Avesis	1	37
24020	F	20	2/26/2020	KMHP	1	25
24021	F	11	11/11/2020	KMHP	1	31
24022	F	14	1/14/2020	Avesis	1	27
24023	M	13	2/11/2021	KMHP	1	26
24024	F	19	10/6/2021	Avesis	1	25
24025	M	17	12/9/2020	KMHP	1	27
24026	M	16	6/3/2021	Avesis	1	25
24027	F	18	1/28/2021	KMHP	1	25
24028	M	15	2/10/2021	KMHP	1	27
24029	F	11	3/16/2021	Avesis	1	39
24030	M	20	5/26/2021	Avesis	1	29
24031	M	10	1/29/2021	KMHP	1	25
24032	M	17	9/2/2021	Avesis	1	34
24033	F	15	1/21/2021	Avesis	1	25
24034	M	12	5/13/2021	KMHP	1	32
24035	F	12	10/7/2021	Avesis	1	29
24036	M	13	1/25/2021	KMHP	1	26
24037	F	14	6/17/2020	KMHP	1	35
24038	M	15	9/18/2020	Avesis	1	26
24039	M	13	2/27/2020	KMHP	1	27
24040	M	13	3/24/2021	Avesis	1	32
24041	F	15	10/7/2021	KMHP	1	30
24042	F	15	2/8/2021	Avesis	1	25
24043	M	14	3/10/2021	KMHP	1	25
24044	M	13	10/7/2020	Avesis	1	29
24045	F	18	8/20/2020	Avesis	1	28
24046	F	17	4/14/2021	Avesis	1	30
24047	M	12	7/22/2021	KMHP	1	27
24048	F	17	2/6/2020	Avesis	1	29
24049	F	14	3/17/2021	Avesis	1	33
24050	M	16	7/16/2020	Avesis	1	27
24051	F	12	4/15/2021	Avesis	1	30
24052	F	14	3/25/2021	Avesis	1	26
24053	M	20	3/12/2020	KMHP	1	25
24054	F	12	4/6/2021	KMHP	1	26
24055	F	11	1/18/2021	Avesis	1	30

24056	F	13	10/14/2021	Avesis	1	36
24057	F	18	2/6/2020	Avesis	1	25
24058	M	14	4/28/2021	Avesis	1	25
24059	M	14	12/2/2021	KMHP	1	32
24060	F	20	5/13/2021	Avesis	1	27
24061	M	14	2/17/2021	Avesis	1	26
24062	F	13	3/12/2020	Avesis	1	25
24063	F	10	2/12/2021	Avesis	1	27
24064	F	15	2/27/2020	Avesis	1	30
24065	M	16	6/3/2021	Avesis	1	27
24066	F	11	1/9/2020	Avesis	1	27
24067	F	14	1/8/2020	Avesis	1	25
24068	M	11	7/9/2020	Avesis	1	34
24069	F	12	1/15/2021	Avesis	1	45
24070	M	12	1/20/2020	Avesis	1	38
24071	M	16	7/8/2021	KMHP	1	32
24072	F	14	9/9/2020	Avesis	1	25
24073	M	12	1/29/2021	KMHP	1	25
24074	M	16	1/28/2021	KMHP	1	25
24075	F	13	5/6/2021	Avesis	1	27
24076	M	12	10/27/2020	KMHP	1	30
24077	F	15	1/7/2021	Avesis	1	33
24078	F	12	6/17/2020	KMHP	1	38
24079	M	11	3/31/2021	Avesis	1	26
24080	F	18	4/8/2021	Avesis	1	28
24081	M	16	5/3/2021	Avesis	1	25
24082	M	15	4/28/2021	Avesis	1	30
24083	M	17	1/20/2021	Avesis	1	40
24084	F	10	2/16/2021	Avesis	1	35
24085	F	15	6/3/2021	Avesis	1	28
24086	F	14	1/28/2020	Avesis	1	29
24087	F	11	2/17/2021	KMHP	1	26
24088	M	10	2/12/2021	KMHP	1	25
24089	M	11	8/6/2021	KMHP	1	25
24090	F	19	5/27/2021	KMHP	1	25
24091	M	20	4/22/2021	Avesis	1	29
24092	F	12	12/2/2020	KMHP	1	28
24093	F	11	11/4/2020	KMHP	1	32
24094	F	17	2/12/2020	Avesis	1	27

24095	M	17	1/29/2020	Avesis	1	27
24096	F	15	7/15/2020	KMHP	1	32
24097	F	16	9/9/2021	KMHP	1	40
24098	F	16	3/25/2021	KMHP	1	29
24099	M	15	11/10/2021	Avesis	1	39
24100	F	10	1/2/2020	KMHP	1	27
24101	M	19	1/2/2020	Avesis	1	25
24102	F	10	2/20/2020	Avesis	1	31
24103	F	19	1/9/2020	Avesis	1	33
24104	M	18	1/9/2020	Avesis	1	28
24105	F	13	1/22/2020	KMHP	1	25
24106	M	16	1/16/2020	Avesis	1	25
24107	M	14	1/22/2020	Avesis	1	32
24108	M	14	1/22/2020	KMHP	1	25
24109	F	20	1/23/2020	KMHP	1	33
24110	M	14	2/19/2020	Avesis	1	28
24111	F	11	1/29/2020	Avesis	1	36
24112	M	11	1/30/2020	KMHP	1	27
24113	F	16	2/12/2020	KMHP	1	37
24114	F	16	2/5/2020	Avesis	1	25
24115	F	16	2/12/2020	Avesis	1	36
24116	F	14	2/12/2020	KMHP	1	36
24117	F	13	2/13/2020	Avesis	1	28
24118	M	16	2/26/2020	Avesis	1	34
24119	M	12	2/19/2020	KMHP	1	31
24120	M	19	2/20/2020	KMHP	1	35
24121	M	14	11/10/2021	Avesis	1	27
24122	M	14	11/10/2021	Avesis	1	30
24123	F	18	9/9/2020	KMHP	1	27
24124	M	18	3/11/2020	Avesis	1	27
24125	M	16	3/11/2020	Avesis	1	26
24126	M	12	3/12/2020	Avesis	1	28
24127	F	10	9/9/2021	Avesis	1	31
24128	M	16	3/12/2020	Avesis	1	26
24129	M	14	6/30/2020	Avesis	1	25
24130	F	19	6/17/2020	KMHP	1	34
24131	F	18	8/20/2020	Avesis	1	27
24132	F	16	7/9/2020	KMHP	1	31
24133	F	13	8/20/2020	Avesis	1	25

24134	F	19	7/9/2020	Avesis	1	26
24135	M	17	7/15/2020	Avesis	1	27
24136	F	12	5/19/2021	KMHP	1	36
24137	F	13	8/3/2020	Avesis	1	30
24138	M	15	8/25/2020	Avesis	1	38
24139	M	16	8/19/2020	Avesis	1	34
24140	F	19	8/27/2020	Avesis	1	28
24141	M	11	3/25/2021	Avesis	1	46
24142	F	18	9/10/2020	Avesis	1	27
24143	F	12	9/17/2020	KMHP	1	25
24144	F	10	9/17/2020	KMHP	1	26
24145	M	20	9/17/2020	Avesis	1	32
24146	F	20	9/21/2020	KMHP	1	25
24147	F	16	9/22/2020	KMHP	1	25
24148	M	14	9/22/2020	KMHP	1	27
24149	F	15	11/4/2020	KMHP	1	26
24150	F	19	9/24/2020	Avesis	1	40
24151	F	13	9/25/2020	Avesis	1	25
24152	F	12	7/21/2021	Avesis	1	31
24153	F	10	4/21/2021	Avesis	1	26
24154	F	19	10/1/2020	Avesis	1	44
24155	F	20	10/5/2020	Avesis	1	25
24156	F	16	10/29/2020	KMHP	1	27
24157	F	13	10/8/2020	Avesis	1	28
24158	F	18	10/8/2020	Avesis	1	27
24159	M	10	10/8/2020	KMHP	1	29
24160	M	16	10/15/2020	Avesis	1	42
24161	F	13	11/6/2020	Avesis	1	25
24162	M	11	10/22/2020	KMHP	1	28
24163	F	15	10/28/2020	KMHP	1	29
24164	F	17	10/28/2020	Avesis	1	39
24165	F	14	11/19/2020	Avesis	1	31
24166	F	12	11/11/2020	KMHP	1	32
24167	F	15	11/18/2020	Avesis	1	25
24168	F	16	11/19/2020	KMHP	1	28
24169	F	10	12/3/2020	Avesis	1	28
24170	F	19	12/10/2020	KMHP	1	32
24171	F	16	2/17/2021	KMHP	1	30
24172	F	19	1/6/2021	Avesis	1	29



24173	F	13	1/28/2021	Avesis	1	29
24174	F	13	1/7/2021	Avesis	1	29
24175	F	16	2/4/2021	Avesis	1	31
24176	F	12	1/20/2021	Avesis	1	26
24177	M	15	1/20/2021	KMHP	1	36
24178	F	11	1/20/2021	Avesis	1	25
24179	F	11	1/21/2021	Avesis	1	37
24180	F	13	1/21/2021	Avesis	1	25
24181	F	16	1/21/2021	KMHP	1	27
24182	F	13	1/27/2021	Avesis	1	39
24183	F	15	1/28/2021	KMHP	1	29
24184	F	13	1/28/2021	Avesis	1	26
24185	M	18	2/11/2021	Avesis	1	41
24186	M	14	2/17/2021	Avesis	1	29
24187	F	13	2/24/2021	KMHP	1	25
24188	M	15	2/24/2021	Avesis	1	25
24189	M	12	3/11/2021	Avesis	1	42
24190	M	11	3/24/2021	Avesis	1	33
24191	M	13	4/15/2021	Avesis	1	39
24192	F	13	3/17/2021	KMHP	1	28
24193	F	11	3/10/2021	Avesis	1	31
24194	M	17	3/10/2021	KMHP	1	34
24195	F	14	3/10/2021	Avesis	1	25
24196	F	16	3/11/2021	Avesis	1	32
24197	M	18	10/27/2021	Avesis	1	32
24198	F	14	4/1/2021	KMHP	1	28
24199	F	11	3/19/2021	KMHP	1	27
24200	F	12	4/1/2021	Avesis	1	25
24201	F	12	4/1/2021	KMHP	1	36
24202	M	16	4/16/2021	Avesis	1	25
24203	F	12	4/7/2021	Avesis	1	25
24204	M	17	4/8/2021	KMHP	1	35
24205	M	20	4/21/2021	Avesis	1	35
24206	M	16	4/22/2021	Avesis	1	33
24207	M	14	4/28/2021	Avesis	1	25
24208	M	11	4/28/2021	Avesis	1	26
24209	F	11	4/29/2021	Avesis	1	31
24210	F	15	4/29/2021	Avesis	1	38
24211	M	13	4/30/2021	KMHP	1	27

24212	M	15	7/23/2021	KMHP	1	27
24213	M	11	5/19/2021	Avesis	1	27
24214	F	20	5/6/2021	Avesis	1	25
24215	M	19	5/6/2021	KMHP	1	26
24216	F	18	5/6/2021	Avesis	1	26
24217	M	15	5/6/2021	Avesis	1	27
24218	F	13	5/12/2021	KMHP	1	28
24219	F	13	5/20/2021	KMHP	1	25
24220	M	11	6/2/2021	Avesis	1	31
24221	F	18	8/17/2021	KMHP	1	37
24222	M	13	8/5/2021	Avesis	1	26
24223	F	20	6/3/2021	Avesis	1	34
24224	M	12	6/10/2021	Avesis	1	25
24225	F	19	7/7/2021	Avesis	1	26
24226	M	11	9/29/2021	Avesis	1	35
24227	M	15	7/8/2021	KMHP	1	25
24228	M	19	7/21/2021	Avesis	1	26
24229	M	14	7/22/2021	KMHP	1	40
24230	F	14	7/22/2021	Avesis	1	29
24231	F	17	8/4/2021	Avesis	1	25
24232	F	11	8/11/2021	KMHP	1	33
24233	F	18	8/12/2021	KMHP	1	26
24234	F	13	8/12/2021	KMHP	1	27
24235	M	19	8/18/2021	Avesis	1	33
24236	M	20	9/27/2021	Avesis	1	28
24237	F	15	8/26/2021	Avesis	1	28
24238	F	14	8/26/2021	Avesis	1	29
24239	M	11	9/1/2021	KMHP	1	28
24240	M	15	9/8/2021	Avesis	1	42
24241	M	16	9/9/2021	KMHP	1	32
24242	F	16	9/29/2021	Avesis	1	43
24243	F	12	10/20/2021	Avesis	1	31
24244	F	14	10/27/2021	KMHP	1	25
24245	F	12	9/22/2021	Avesis	1	26
24246	F	13	9/22/2021	Avesis	1	41
24247	F	18	10/6/2021	KMHP	1	29
24248	F	14	9/29/2021	Avesis	1	43
24249	F	14	10/7/2021	Avesis	1	26
24250	M	19	10/7/2021	Avesis	1	32

24251	F	15	10/7/2021	Avesis	1	29
24252	F	12	10/13/2021	Avesis	1	40
24253	F	14	10/13/2021	Avesis	1	28
24254	F	12	10/14/2021	Avesis	1	28
24255	F	18	10/14/2021	Avesis	1	32
24256	F	12	11/10/2021	Avesis	1	27
24257	M	20	10/20/2021	Avesis	1	30
24258	F	14	10/21/2021	Avesis	1	25
24259	F	10	10/27/2021	Avesis	1	36
24260	M	13	11/10/2021	Avesis	1	32
24261	M	16	12/15/2021	Avesis	1	30
24262	F	16	11/18/2021	Avesis	1	33
24263	M	20	11/18/2021	KMHP	1	29
24264	M	18	11/24/2021	KMHP	1	33
24265	F	14	12/1/2021	Avesis	1	31
24266	F	19	12/1/2021	Avesis	1	28
24267	F	12	12/2/2021	KMHP	1	27
24268	F	18	12/2/2021	KMHP	1	25
24269	F	16	12/8/2021	Avesis	1	27
24270	F	12	12/8/2021	Avesis	1	30
24271	M	19	12/8/2021	Avesis	1	25

## APPENDIX C

### STUDY DATA SHEET – INTER-ARCH DEIVATION ANTERIOR

Random Identifier	Inter-Arch Deviation (Anterior)			
	Overjet	Overbite	Crossbite	Openbite
1400	0	0	8	8
1401	0	0	0	8
1402	0	0	0	8
1403	8	8	0	0
1404	0	0	2	2
1405	8	8	0	0
1406	8	8	0	0
1407	2	0	0	0
1408	8	8	0	0
1409	6	6	2	0
1410	0	0	0	4
1411	8	8	0	0
1412	6	0	0	0
1413	8	8	0	0
1414	0	0	0	8
1415	8	8	0	0
1416	8	0	0	8
1417	0	0	0	8
1418	8	8	0	0
1419	0	0	8	0
1420	0	0	8	2
1421	8	8	0	0
1422	0	0	8	0
1423	0	8	0	0
1424	8	8	0	0
1425	0	0	0	0
1426	0	0	0	6
1427	8	8	0	0
1428	8	0	0	0
1429	0	0	2	0
1430	8	8	0	0

1431	0	0	0	8
1432	0	0	0	8
1433	0	0	2	0
1434	0	0	8	0
1435	0	8	0	0
1436	0	0	4	0
1437	0	0	8	8
1438	0	0	2	2
1439	0	8	0	0
1440	0	0	0	8
1441	8	8	0	0
1442	8	8	0	0
1443	0	0	4	0
1444	0	8	0	0
1445	0	0	0	4
1446	8	8	0	0
1447	0	8	0	0
1448	0	0	0	0
1449	0	0	8	0
1450	0	0	8	0
1451	0	0	8	0
1452	0	0	0	8
1453	0	0	0	8
1454	0	0	4	0
1455	2	2	2	0
1456	8	8	0	0
1457	2	4	0	0
1458	0	0	4	6
1459	2	0	4	0
1460	0	0	0	0
1461	0	4	0	0
1462	8	8	0	0
1463	6	6	0	0
1464	0	0	0	8
1465	8	8	0	0
1466	8	8	0	0
1467	2	2	0	0
1468	8	8	0	0
1469	0	0	8	0

1470	6	2	0	0
1471	0	0	4	0
1472	0	0	0	0
1473	8	8	0	0
1474	0	0	6	4
1475	4	4	0	0
1476	0	0	8	0
1477	0	0	0	8
1478	8	4	0	0
1479	8	0	0	8
1480	2	0	0	0
1481	0	2	2	0
1482	0	0	2	0
1483	8	8	0	0
1484	8	0	0	8
1485	6	2	0	0
1486	4	0	0	8
1487	0	0	4	2
1488	4	0	0	4
1489	0	0	0	6
1490	0	0	8	0
1491	4	0	0	8
1492	8	8	0	0
1493	0	0	2	0
1494	8	8	0	0
1495	0	0	2	6
1496	8	8	0	0
1497	0	0	8	8
1498	0	8	0	0
1499	0	0	8	8
1500	0	0	8	0
1501	0	0	4	8
1502	0	0	0	8
1503	0	0	0	0
1504	0	0	0	8
1505	0	0	4	0
1506	8	8	0	0
1507	0	0	0	0
1508	0	0	4	4

1509	0	0	6	8
1510	4	0	0	0
1511	8	8	0	0
1512	0	0	2	0
1513	0	0	4	8
1514	0	0	4	0
1515	0	0	0	8
1516	0	0	4	0
1517	0	0	0	0
1518	0	0	0	0
1519	4	0	0	0
1520	8	0	0	0
1521	8	8	0	0
1522	0	0	2	0
1523	0	0	8	4
1524	0	0	0	8
1525	8	0	0	8
1526	0	0	0	8
1527	8	0	0	0
1528	8	0	0	0
1529	0	0	2	0
1530	0	0	6	0
1531	0	0	0	8
1532	0	0	4	4
1533	0	0	0	0
1534	0	0	0	2
1535	0	0	8	4
1536	4	2	0	0
1537	8	8	0	0
1538	0	8	0	0
1539	0	0	4	0
1540	8	8	0	0
1541	6	0	0	0
1542	0	0	0	0
1543	8	8	0	0
1544	8	0	0	0
1545	0	0	4	4
1546	0	0	0	4
1547	0	2	2	0

1548	0	0	0	8
1549	8	0	0	8
1550	0	0	6	0
1551	0	0	0	8
1552	8	8	0	0
1553	8	0	0	0
1554	0	0	4	0
1555	8	8	0	0
1556	0	0	8	0
1557	0	0	6	0
1558	8	8	0	0
1559	8	8	0	0
1560	8	8	0	0
1561	0	0	2	8
1562	0	0	8	0
1563	0	0	2	0
1564	0	0	8	0
1565	0	8	0	0
1566	0	0	0	8
1567	0	0	0	8
1568	4	0	0	8
1569	0	0	0	2
1570	0	0	0	0
1571	0	0	0	0
1572	0	0	4	6
1573	0	0	0	0
1574	0	0	0	8
1575	0	0	2	2
1576	4	4	0	0
1577	0	0	6	0
1578	0	0	2	0
1579	8	8	0	0
1580	0	2	0	0
1581	0	0	0	4
1582	0	0	0	8
1583	0	8	2	0
1584	4	4	0	0
1585	0	0	6	8
1586	0	0	4	0



1587	0	0	6	8
1588	8	8	0	0
1589	8	0	0	8
1590	8	0	0	0
1591	0	0	0	4
1592	0	4	4	0
1593	0	0	4	8
1594	0	0	2	4
1595	0	0	0	8
1596	4	4	0	0
1597	0	0	8	0
1598	0	0	6	2
1599	0	0	8	0
1600	4	4	0	0
1601	0	0	0	0
1602	0	0	0	8
1603	0	0	0	8
1604	0	0	4	4
1605	0	8	8	0
1606	0	0	0	0
1607	0	0	8	8
1608	0	0	8	8
1609	8	8	0	0
1610	0	0	4	0
1611	0	0	6	2
1612	0	0	0	0
1613	0	8	0	0
1614	0	0	6	0
1615	0	0	8	8
1616	0	0	8	0
1617	8	0	0	0
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1619	8	8	0	0
1620	0	0	0	8
1621	0	0	0	8
1622	0	0	0	4
1623	0	4	0	0
1624	0	8	0	0
1625	8	8	0	0

1626	8	8	0	0
1627	6	0	0	6
1628	0	0	0	0
1629	8	8	0	0
1630	2	2	0	0
1631	4	0	0	0
1632	0	0	0	8
1633	0	0	0	8
1634	0	0	8	0
1635	0	0	4	8
1636	0	0	2	6
1637	4	8	0	0
1638	8	0	0	8
1639	8	8	0	0
1640	8	8	0	0
1641	4	2	0	0
1642	6	6	0	0
1643	8	8	0	0
1644	8	8	0	0
1645	0	8	0	0
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1647	4	4	0	0
1648	2	2	0	0
1649	0	0	0	8
1650	0	0	0	8
1651	0	0	0	0
1652	8	0	0	0
1653	0	4	4	0
1654	0	0	2	2
1655	4	4	0	0
1656	0	0	6	0
1657	0	8	8	0
1658	8	0	0	8
1659	0	0	0	8
1660	0	8	0	0
1661	0	8	0	0
1662	0	0	8	0
1663	8	8	0	0
1664	0	0	2	0

1665	0	0	4	0
1666	0	0	0	0
1667	0	0	0	8
1668	0	0	2	0
1669	0	0	8	0
1670	8	8	0	0
1671	8	8	0	0
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1673	0	8	0	0
1674	0	8	0	0
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1678	4	4	0	0
1679	0	8	0	0
1680	0	0	0	8
1681	0	0	0	8
1682	0	0	4	0
1683	0	0	0	8
1684	0	0	4	4
1685	0	0	0	8
1686	8	8	0	0
1687	0	0	6	0
1688	0	0	6	0
24001	0	0	2	0
24002	0	0	4	2
24003	0	6	0	0
24004	4	4	0	0
24005	4	0	0	4
24006	0	0	0	0
24007	0	0	4	8
24008	0	0	0	0
24009	6	6	0	0
24010	8	8	0	0
24011	0	0	6	0
24012	6	0	0	0
24013	0	0	2	0
24014	8	8	0	0
24015	0	8	0	0

24016	6	0	0	0
24017	8	8	0	0
24018	2	0	0	0
24019	8	8	0	0
24020	4	0	0	0
24021	0	0	4	0
24022	0	0	0	4
24023	0	0	0	4
24024	8	0	0	0
24025	0	0	8	0
24026	0	0	2	2
24027	0	0	0	0
24028	0	8	0	0
24029	8	8	0	0
24030	0	8	0	0
24031	0	0	0	0
24032	0	0	4	0
24033	6	4	0	0
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24038	8	4	0	0
24039	0	0	0	0
24040	4	4	0	0
24041	2	8	2	0
24042	0	0	0	0
24043	0	0	0	0
24044	4	0	0	0
24045	8	0	0	0
24046	2	2	0	0
24047	4	4	0	0
24048	0	0	6	2
24049	0	8	0	0
24050	0	0	0	8
24051	0	8	0	0
24052	0	0	0	0
24053	0	0	2	0
24054	0	0	4	0

24055	2	0	2	0
24056	0	8	0	0
24057	0	0	0	2
24058	0	0	0	0
24059	4	4	0	0
24060	0	0	0	0
24061	0	0	6	0
24062	2	0	2	0
24063	0	0	0	0
24064	0	0	0	8
24065	0	0	2	2
24066	4	4	0	0
24067	0	0	4	2
24068	8	4	0	0
24069	8	0	0	8
24070	8	8	0	0
24071	0	0	0	4
24072	8	8	0	0
24073	0	0	0	0
24074	8	0	0	0
24075	0	0	0	8
24076	4	0	0	0
24077	0	0	2	6
24078	4	4	2	0
24079	8	0	0	0
24080	8	0	0	0
24081	0	0	0	0
24082	0	0	0	4
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24087	0	0	0	0
24088	0	0	4	0
24089	0	4	0	0
24090	0	0	4	2
24091	0	8	0	0
24092	0	0	0	0
24093	0	6	0	0

24094	0	0	2	4
24095	0	0	2	2
24096	0	0	4	0
24097	0	0	0	4
24098	0	8	0	0
24099	2	0	2	8
24100	0	2	4	0
24101	0	0	0	0
24102	0	0	0	0
24103	8	0	0	0
24104	0	8	0	0
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24106	2	0	0	0
24107	8	0	0	0
24108	0	0	0	0
24109	0	0	8	8
24110	0	0	0	0
24111	8	8	0	0
24112	8	8	0	0
24113	0	0	2	6
24114	0	0	4	0
24115	2	8	0	0
24116	6	6	0	0
24117	0	0	4	0
24118	0	0	4	4
24119	0	0	0	0
24120	0	4	2	0
24121	2	0	0	0
24122	4	2	0	0
24123	0	0	4	0
24124	0	0	2	0
24125	0	0	0	0
24126	4	4	0	0
24127	4	4	0	0
24128	0	4	0	0
24129	0	0	0	0
24130	8	8	0	0
24131	0	0	2	0
24132	0	0	4	0

24133	8	0	0	0
24134	0	0	0	0
24135	4	2	0	0
24136	0	0	4	8
24137	0	8	0	0
24138	6	6	0	0
24139	0	0	8	0
24140	8	0	0	8
24141	8	8	0	0
24142	0	0	4	0
24143	0	0	0	0
24144	8	0	0	0
24145	6	6	0	0
24146	0	0	0	0
24147	0	0	2	0
24148	0	0	0	0
24149	0	0	2	0
24150	8	0	0	8
24151	0	0	0	0
24152	4	8	0	0
24153	6	4	0	0
24154	0	0	8	8
24155	4	0	0	0
24156	4	0	0	0
24157	4	4	0	0
24158	4	0	0	0
24159	4	0	0	6
24160	8	8	0	0
24161	4	0	0	0
24162	6	6	0	0
24163	4	8	0	0
24164	8	0	0	8
24165	0	4	0	0
24166	8	0	0	0
24167	0	0	0	0
24168	0	0	4	0
24169	0	0	0	8
24170	0	0	0	4
24171	0	0	0	8

24172	0	0	0	0
24173	4	0	0	0
24174	0	0	2	0
24175	2	2	2	0
24176	0	0	0	0
24177	8	0	0	0
24178	0	0	6	0
24179	8	8	0	0
24180	0	4	0	0
24181	0	0	0	6
24182	8	8	0	0
24183	0	0	0	0
24184	0	0	2	4
24185	8	8	0	0
24186	2	8	0	0
24187	0	6	0	0
24188	0	0	0	0
24189	8	8	0	0
24190	0	4	0	8
24191	8	8	0	0
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24194	0	0	4	0
24195	0	0	2	0
24196	0	0	2	4
24197	0	0	0	8
24198	8	0	0	0
24199	0	0	0	8
24200	0	0	2	0
24201	8	0	0	0
24202	0	0	2	0
24203	0	2	0	0
24204	0	0	8	0
24205	0	0	0	8
24206	4	4	0	0
24207	4	2	0	0
24208	0	0	0	0
24209	8	8	0	0
24210	0	0	0	8



24211	0	0	0	4
24212	0	0	4	0
24213	0	0	0	0
24214	0	0	0	8
24215	0	0	0	8
24216	0	0	2	0
24217	8	8	0	0
24218	0	8	0	0
24219	0	0	0	0
24220	0	0	2	0
24221	8	0	0	0
24222	0	8	0	0
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24231	0	0	0	0
24232	8	8	0	0
24233	6	6	0	0
24234	0	0	2	4
24235	0	8	2	0
24236	2	2	2	0
24237	0	0	0	8
24238	0	0	8	0
24239	4	8	0	0
24240	6	6	0	0
24241	0	0	4	4
24242	8	8	0	0
24243	8	0	0	0
24244	0	0	0	4
24245	0	8	0	0
24246	8	0	0	0
24247	6	6	0	0
24248	8	8	0	0
24249	0	0	2	0

24250	0	0	2	4
24251	4	0	0	6
24252	8	8	0	0
24253	2	2	0	0
24254	8	0	0	0
24255	0	8	0	0
24256	8	0	0	0
24257	0	0	0	4
24258	8	0	0	0
24259	6	6	0	0
24260	2	2	0	0
24261	8	0	0	0
24262	0	8	0	0
24263	4	4	0	0
24264	8	8	0	0
24265	6	0	0	0
24266	4	0	0	0
24267	0	8	0	0
24268	0	0	0	0
24269	0	0	0	0
24270	8	0	0	0
24271	0	0	0	0

## APPENDIX D

### STUDY DATA SHEET – INTER-ARCH DEVIATION POSTERIOR

Random Identifier	Inter-arch Deviation (Posterior)			
	Distal	Mesial	Crossbite	Openbite
1400	0	4	1	0
1401	0	3	3	0
1402	2	0	0	0
1403	0	0	0	0
1404	0	3	1	0
1405	4	0	0	0
1406	8	0	0	0
1407	8	0	0	0
1408	8	0	2	0
1409	0	2	1	2
1410	4	0	4	0
1411	1	0	1	0
1412	8	0	0	0
1413	5	0	0	0
1414	1	0	1	0
1415	8	0	0	0
1416	4	0	0	0
1417	5	0	0	0
1418	8	0	1	0
1419	0	4	0	1
1420	0	6	0	6
1421	0	7	0	0
1422	0	2	5	0
1423	1	4	0	0
1424	8	0	2	0
1425	4	0	2	0
1426	5	0	1	0
1427	3	0	1	0
1428	4	0	0	0
1429	0	4	0	0
1430	0	6	0	0

1431	0	8	0	4
1432	0	8	0	2
1433	4	0	2	0
1434	0	8	0	1
1435	8	0	0	0
1436	0	0	6	0
1437	0	8	0	0
1438	1	0	0	0
1439	3	0	0	1
1440	0	8	0	2
1441	0	6	0	0
1442	0	7	0	0
1443	2	0	0	4
1444	4	3	0	0
1445	0	4	0	3
1446	7	0	0	0
1447	0	0	0	0
1448	1	2	0	0
1449	0	8	2	0
1450	3	2	0	0
1451	0	1	0	0
1452	1	3	0	2
1453	0	2	1	2
1454	3	2	1	0
1455	4	0	1	0
1456	8	0	2	0
1457	0	6	0	0
1458	0	5	0	0
1459	0	4	0	0
1460	0	8	7	0
1461	0	8	0	0
1462	8	0	0	0
1463	3	0	1	0
1464	3	3	4	0
1465	8	0	0	0
1466	7	0	3	0
1467	4	2	4	0
1468	7	0	0	0
1469	0	7	0	0

1470	8	0	0	0
1471	0	2	0	0
1472	6	0	0	2
1473	0	4	0	0
1474	0	8	1	0
1475	3	0	0	0
1476	0	8	5	0
1477	8	0	0	0
1478	8	0	0	0
1479	1	0	3	0
1480	4	2	0	0
1481	2	0	0	0
1482	8	0	3	0
1483	6	0	1	0
1484	6	0	2	0
1485	7	0	0	0
1486	8	0	0	0
1487	6	0	2	1
1488	6	0	0	0
1489	8	0	0	0
1490	0	8	7	0
1491	0	0	0	0
1492	2	0	0	0
1493	4	0	4	0
1494	4	4	1	0
1495	0	1	0	0
1496	8	0	0	0
1497	0	8	5	0
1498	0	0	0	0
1499	0	4	0	0
1500	0	8	8	0
1501	0	8	2	2
1502	0	8	4	4
1503	0	5	3	0
1504	0	8	4	0
1505	2	0	0	0
1506	2	0	0	0
1507	0	3	2	0
1508	0	7	2	0

1509	0	7	3	0
1510	6	0	0	0
1511	8	0	0	0
1512	4	0	1	2
1513	0	8	2	4
1514	2	2	1	0
1515	0	8	2	0
1516	0	0	0	0
1517	0	4	0	0
1518	4	2	0	0
1519	6	0	0	0
1520	7	0	0	0
1521	8	0	0	0
1522	3	1	0	0
1523	0	6	1	0
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1527	4	3	2	0
1528	8	0	1	0
1529	7	0	0	0
1530	4	0	5	2
1531	1	0	1	0
1532	0	8	0	0
1533	8	0	0	0
1534	4	0	2	0
1535	0	0	0	0
1536	2	0	1	0
1537	0	1	0	0
1538	5	0	0	3
1539	0	2	1	0
1540	4	0	0	0
1541	4	1	0	0
1542	8	0	1	0
1543	3	0	0	3
1544	8	0	0	0
1545	0	8	1	0
1546	1	1	1	1
1547	3	0	0	0

1548	2	0	0	0
1549	4	0	1	0
1550	0	4	1	0
1551	0	8	0	0
1552	8	0	0	0
1553	8	0	0	0
1554	0	5	1	1
1555	5	0	0	0
1556	0	7	7	0
1557	3	0	0	0
1558	8	0	0	0
1559	8	0	0	1
1560	4	0	0	0
1561	0	4	4	2
1562	0	8	5	0
1563	5	0	1	0
1564	0	8	0	0
1565	0	4	0	0
1566	8	0	0	2
1567	0	8	0	8
1568	6	0	0	0
1569	8	0	0	0
1570	8	0	2	0
1571	4	4	0	0
1572	0	0	0	1
1573	2	1	1	1
1574	1	1	0	0
1575	6	0	2	2
1576	0	0	1	0
1577	4	0	0	1
1578	4	0	0	0
1579	4	0	0	0
1580	8	0	0	0
1581	0	8	0	1
1582	0	8	0	0
1583	0	2	0	2
1584	4	0	0	1
1585	0	2	2	0
1586	0	8	1	0

1587	0	0	1	0
1588	8	0	2	0
1589	5	0	0	0
1590	0	6	0	0
1591	1	6	4	4
1592	2	1	0	1
1593	0	8	0	0
1594	0	6	2	4
1595	0	0	0	2
1596	6	0	2	0
1597	4	0	0	0
1598	6	0	0	0
1599	0	3	3	0
1600	2	0	0	2
1601	8	0	0	0
1602	0	8	2	0
1603	0	8	1	2
1604	0	8	0	2
1605	0	0	1	0
1606	2	2	3	2
1607	0	2	0	0
1608	0	8	4	0
1609	0	0	2	0
1610	0	0	4	0
1611	0	2	2	0
1612	6	0	0	2
1613	0	2	0	0
1614	0	6	1	0
1615	4	0	7	0
1616	0	8	6	0
1617	2	2	4	1
1618	8	0	0	2
1619	8	0	0	0
1620	0	4	3	1
1621	5	0	4	0
1622	8	0	0	0
1623	3	0	0	0
1624	2	0	0	0
1625	5	1	2	0



1626	0	4	0	0
1627	6	0	2	0
1628	8	0	0	1
1629	8	0	0	0
1630	0	6	0	0
1631	6	0	0	0
1632	8	0	0	0
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1646	0	8	2	0
1647	5	0	0	0
1648	0	4	2	4
1649	5	0	0	6
1650	3	0	0	0
1651	1	4	1	0
1652	8	0	2	0
1653	6	0	6	0
1654	0	8	4	0
1655	5	0	0	3
1656	1	0	0	2
1657	0	8	2	0
1658	4	0	0	0
1659	0	8	0	4
1660	0	5	0	0
1661	5	0	0	0
1662	0	8	6	0
1663	8	0	0	0
1664	0	5	7	0

1665	0	6	0	0
1666	2	6	0	0
1667	0	6	0	0
1668	1	2	1	3
1669	0	6	4	0
1670	4	0	1	0
1671	7	0	0	0
1672	4	0	3	1
1673	0	3	1	0
1674	0	0	2	0
1675	0	7	0	0
1676	1	2	3	2
1677	0	8	0	0
1678	6	0	0	0
1679	2	0	0	0
1680	0	8	0	0
1681	0	7	0	3
1682	3	0	7	0
1683	8	0	0	0
1684	0	5	0	6
1685	0	8	2	0
1686	2	0	1	0
1687	0	8	1	0
1688	0	0	2	0
24001	4	0	3	0
24002	5	0	0	0
24003	2	1	0	0
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24008	7	0	2	1
24009	8	0	1	0
24010	5	0	0	0
24011	0	8	0	1
24012	0	2	0	0
24013	4	0	0	0
24014	8	0	0	0
24015	2	1	0	0

24016	7	0	0	0
24017	6	0	1	0
24018	6	0	0	0
24019	4	0	0	0
24020	2	0	0	0
24021	0	8	0	0
24022	4	0	0	0
24023	0	4	1	1
24024	0	0	0	0
24025	4	4	1	0
24026	1	1	4	0
24027	7	0	1	0
24028	0	4	0	0
24029	4	0	1	0
24030	1	0	0	0
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24036	0	4	0	0
24037	7	0	0	0
24038	0	0	0	0
24039	5	0	0	2
24040	6	0	0	0
24041	1	2	1	0
24042	8	0	1	0
24043	1	4	1	0
24044	6	0	3	0
24045	0	0	0	0
24046	5	0	1	0
24047	6	0	0	0
24048	1	4	1	0
24049	4	1	0	0
24050	0	0	0	0
24051	0	8	0	0
24052	8	0	0	0
24053	1	4	0	0
24054	0	0	0	2

24055	0	6	1	0
24056	4	4	0	1
24057	3	0	0	0
24058	4	0	1	0
24059	4	0	1	0
24060	7	0	0	0
24061	0	0	0	0
24062	4	0	1	0
24063	0	8	2	0
24064	0	0	0	3
24065	1	5	5	0
24066	5	0	0	0
24067	0	1	0	1
24068	5	0	0	0
24069	4	4	2	2
24070	4	0	0	0
24071	3	2	0	3
24072	0	0	0	1
24073	0	3	2	0
24074	0	0	0	0
24075	2	0	0	0
24076	8	0	1	0
24077	0	6	0	0
24078	4	2	0	0
24079	0	0	0	0
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24081	0	5	0	0
24082	0	8	0	0
24083	0	3	2	0
24084	7	0	0	6
24085	4	0	1	0
24086	3	0	0	0
24087	8	0	0	0
24088	1	0	0	0
24089	0	8	0	0
24090	0	1	2	0
24091	8	0	1	0
24092	1	3	3	1
24093	6	0	0	0

24094	0	4	0	0
24095	0	0	1	4
24096	0	8	2	0
24097	2	5	1	8
24098	0	4	0	1
24099	0	7	0	5
24100	4	0	0	0
24101	0	4	0	0
24102	6	1	1	3
24103	4	0	1	0
24104	2	3	1	0
24105	0	2	0	0
24106	0	8	0	0
24107	0	2	1	0
24108	2	1	0	0
24109	0	0	2	0
24110	8	0	0	0
24111	4	0	0	0
24112	0	0	0	0
24113	0	8	3	0
24114	0	1	0	0
24115	6	0	0	0
24116	0	6	0	0
24117	0	4	0	0
24118	0	5	3	0
24119	0	8	1	0
24120	1	6	4	0
24121	7	0	0	0
24122	6	0	0	1
24123	2	1	0	0
24124	0	8	0	0
24125	0	6	0	2
24126	0	0	2	0
24127	8	0	0	0
24128	0	2	1	0
24129	6	0	0	0
24130	0	1	0	0
24131	5	0	0	0
24132	1	4	2	0

24133	0	0	0	0
24134	1	1	3	0
24135	1	1	0	0
24136	2	0	4	0
24137	3	3	1	0
24138	3	0	2	1
24139	0	8	0	0
24140	0	0	2	3
24141	8	0	2	0
24142	0	8	2	0
24143	2	0	1	2
24144	2	0	0	0
24145	8	0	0	0
24146	2	3	1	0
24147	3	2	0	0
24148	0	6	0	1
24149	0	4	0	0
24150	4	0	0	0
24151	5	0	0	0
24152	7	0	0	0
24153	0	0	0	0
24154	0	8	4	0
24155	4	0	0	0
24156	4	1	1	0
24157	1	4	0	0
24158	8	0	0	0
24159	0	2	0	1
24160	4	0	1	0
24161	4	0	0	0
24162	2	0	0	0
24163	0	2	0	0
24164	8	0	1	0
24165	4	0	0	4
24166	8	0	0	0
24167	4	0	1	1
24168	0	8	0	0
24169	4	0	0	0
24170	0	8	0	0
24171	2	0	0	0

24172	0	6	0	0
24173	3	1	2	0
24174	0	6	0	2
24175	0	4	1	0
24176	8	0	0	0
24177	8	0	0	0
24178	3	1	1	0
24179	8	0	0	0
24180	0	2	0	0
24181	0	8	0	1
24182	0	3	0	0
24183	0	8	1	0
24184	2	0	0	2
24185	3	0	0	0
24186	1	1	0	0
24187	2	0	0	0
24188	8	0	0	0
24189	8	0	0	0
24190	0	6	0	0
24191	8	0	0	0
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24193	8	0	1	0
24194	0	6	5	0
24195	3	5	1	0
24196	0	2	2	2
24197	4	0	0	0
24198	0	0	0	0
24199	0	0	0	0
24200	3	0	0	0
24201	0	8	0	0
24202	0	2	1	0
24203	3	0	0	0
24204	0	8	6	0
24205	0	8	1	0
24206	8	0	1	0
24207	0	0	0	0
24208	0	5	0	1
24209	4	0	0	0
24210	0	7	3	0

24211	0	3	0	2
24212	0	1	0	0
24213	7	0	0	0
24214	7	0	0	0
24215	0	0	0	0
24216	0	8	1	0
24217	0	0	0	0
24218	4	0	0	0
24219	0	7	0	0
24220	0	6	3	0
24221	8	0	1	0
24222	0	0	0	0
24223	8	0	0	0
24224	0	0	1	0
24225	8	0	1	0
24226	0	0	0	0
24227	1	4	2	0
24228	1	1	2	0
24229	4	0	0	0
24230	1	2	0	0
24231	7	0	0	0
24232	8	0	2	0
24233	0	0	0	0
24234	2	0	0	1
24235	0	7	3	0
24236	3	0	0	0
24237	1	6	0	2
24238	0	0	1	0
24239	2	0	0	0
24240	8	0	2	0
24241	8	0	0	0
24242	4	3	0	0
24243	8	0	2	0
24244	4	0	0	0
24245	0	3	2	0
24246	8	0	1	0
24247	0	0	0	0
24248	0	8	0	0
24249	0	4	0	0



24250	0	7	0	0
24251	0	2	1	0
24252	4	0	0	0
24253	4	2	3	0
24254	8	0	0	0
24255	0	5	0	0
24256	6	0	0	2
24257	2	4	0	0
24258	0	1	1	0
24259	5	1	1	0
24260	8	0	0	0
24261	0	2	0	0
24262	8	0	0	0
24263	0	1	0	0
24264	0	4	0	0
24265	2	0	3	0
24266	3	1	0	0
24267	0	3	1	0
24268	6	0	0	0
24269	7	0	0	0
24270	0	2	0	0
24271	0	6	0	0