

# Utilization of Amalgam or Resin Composite in Pediatric Dental Restorations

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## BACKGROUND

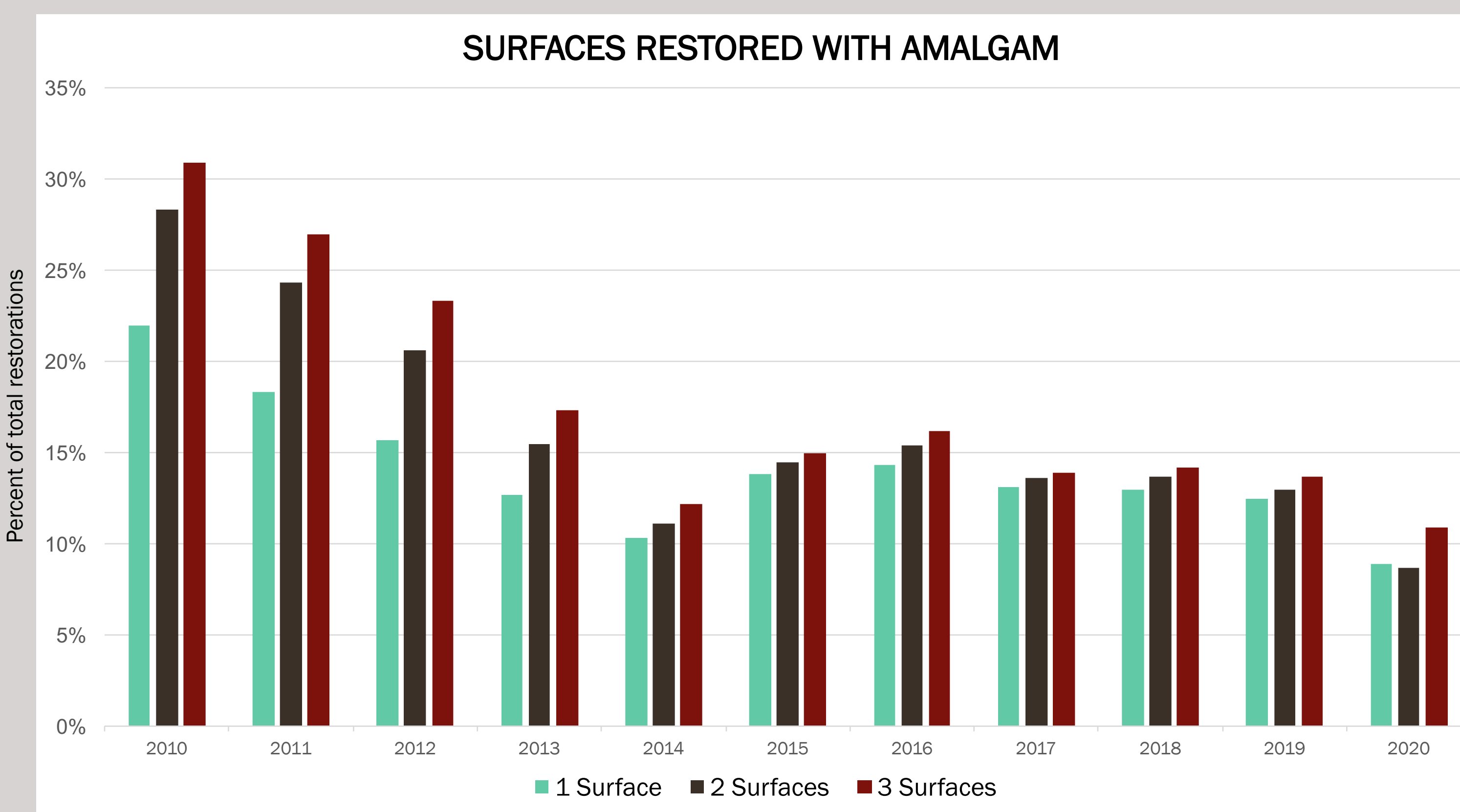
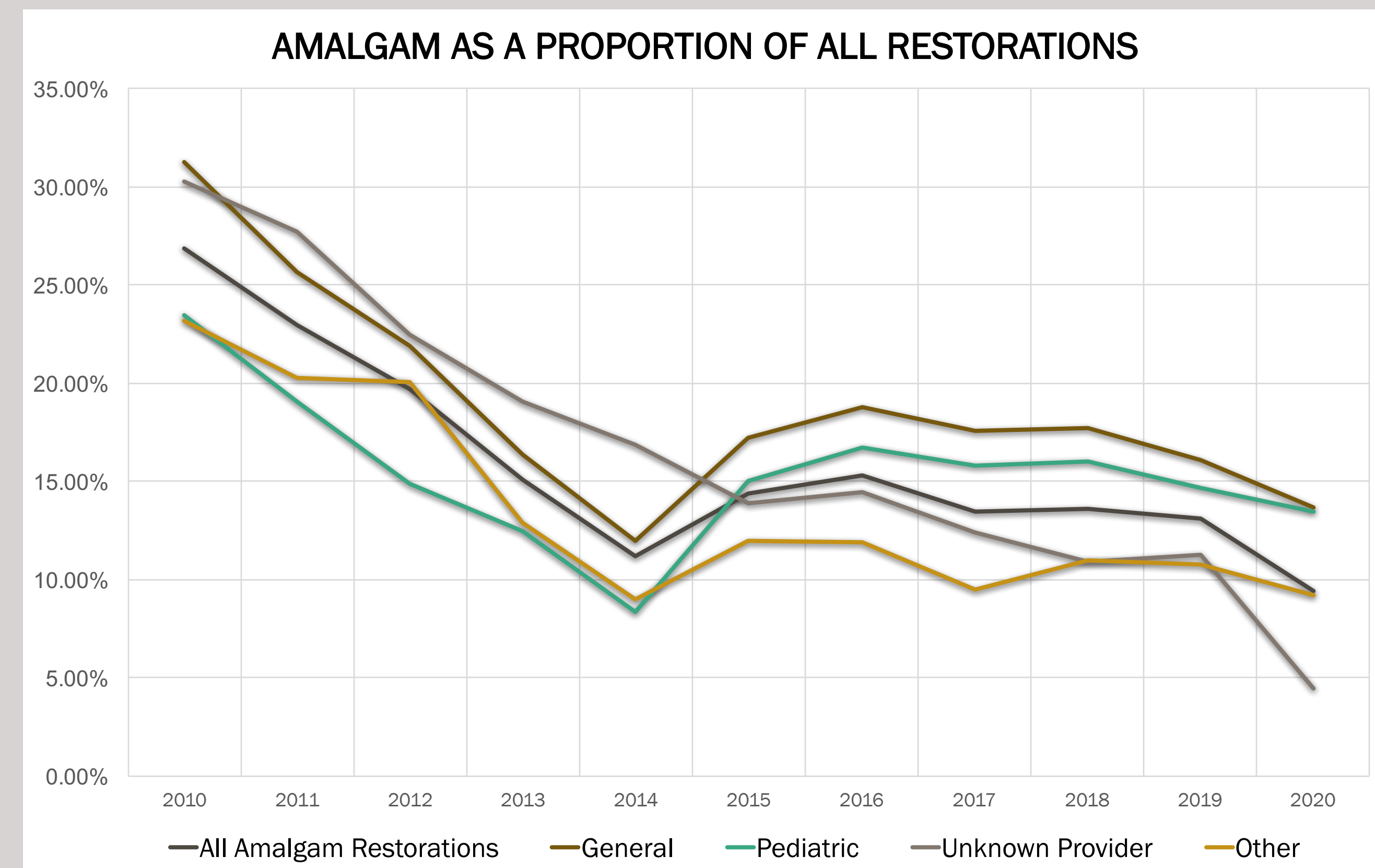
Amalgam has been a gold standard in restorative dentistry since it was introduced over 150 years ago. In 2012 the inclusion of dental amalgam in the United Nations Environmental Program Mercury Treaty brought further controversy and awareness to the risks of dental amalgam use.<sup>6</sup> The Children's Amalgam Trials affirmed in the dental community that mercury exposures in amalgam restorations are minute enough to be transient and without deleterious effects to the overall health of the patient, and were frequently cited by the FDA and ADA who advocated the use of dental amalgam.<sup>7,8</sup> However, recent reanalysis of these studies report that there may indeed be an affect, particularly on young boys with a genetic predisposition which makes them susceptible to mercury intoxication.<sup>10</sup> With the signing of the Minamata Treaty, countries such as Sweden and Norway have completely banned the use of dental amalgam, and Ireland, Finland, and Slovakia have implemented phase outs that will eliminate the use of amalgam in dental surgeries over the next few years.<sup>9</sup> Japan, where the Minamata Treaty was signed, has effectively banned amalgam by making it essentially impossible to dispose of in a way that does not violate mercury discharge restrictions. Our aim in this study was to evaluate the effect that these global changes have had on the use of dental amalgam in the United States, and to determine if there is a statistically significant difference in the use of dental amalgam in high and low SES populations, which may indicate a potentially disparate effect of a ban.

## METHODS

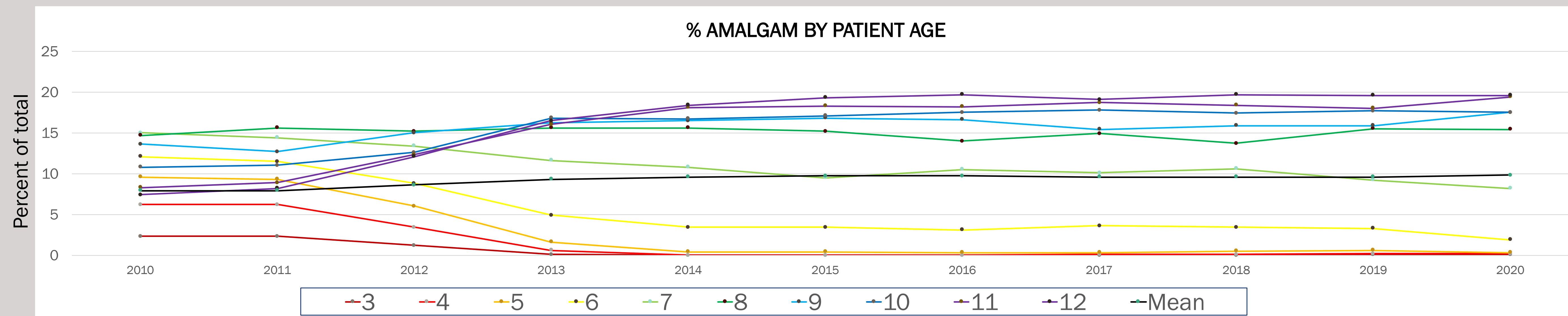
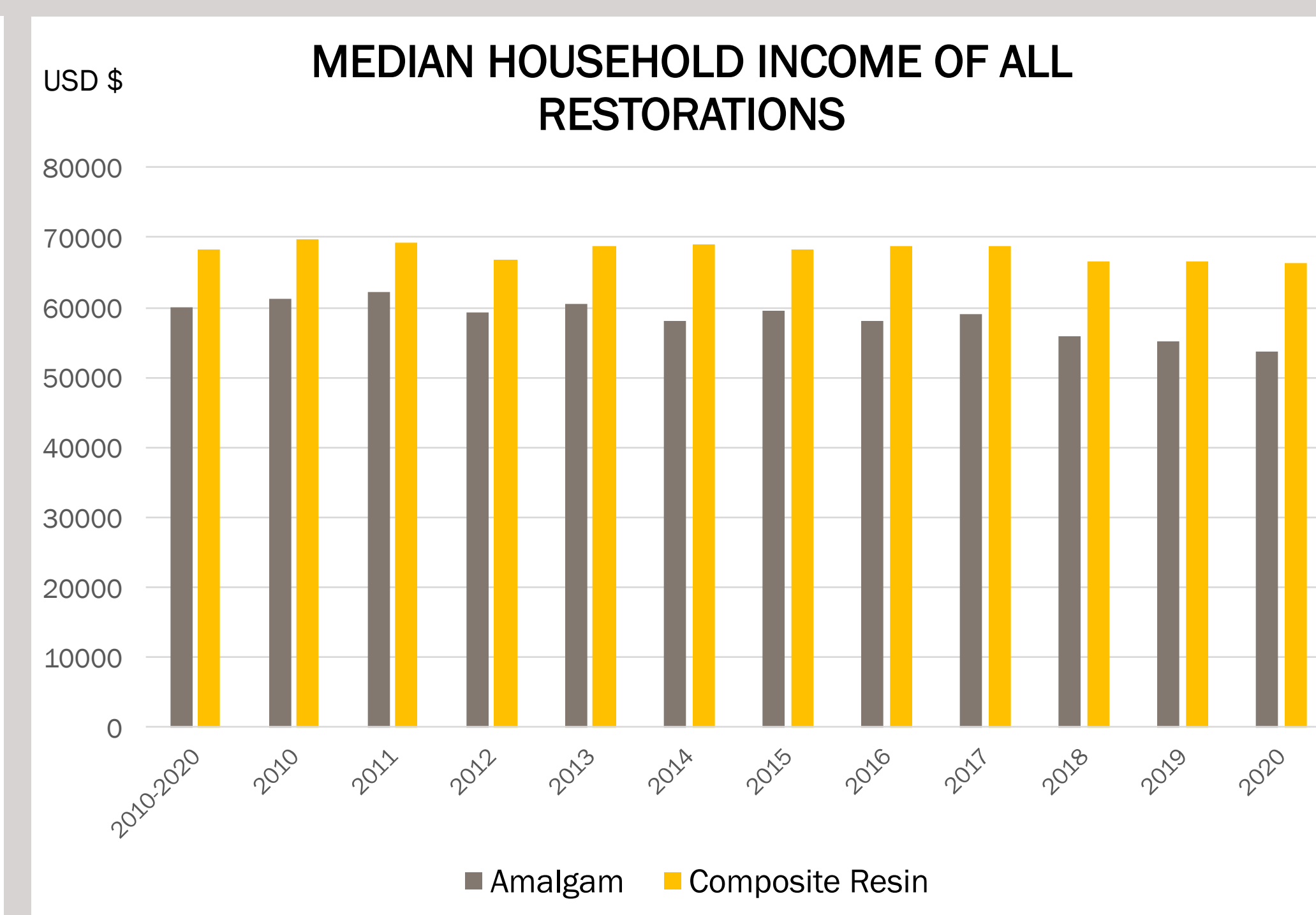
- Paid dental claims collected nationwide from January 2010 up to March 2020 was included for analysis. De-identified data for children 3 to 12 years old was used.
- Dental procedures were selected based on Current Dental Terminology (CDT) codes for 1, 2, and 3-surface restorations, including both amalgam (D2140, D2150, and D2160) and resin composite (D2391, D2392, D2393).
- Associations of service year, patient age, patient gender, provider specialty, number of surfaces in the restoration, and median household income for the patient's ZIP code with restoration type (amalgam or resin composite) analyzed using generalized estimating equation (GEE) models applied to logistic regression
- GEE models account for the clustering/correlation of restorations placed by the same provider.
- Provider specialties other than general practice (GP) and pediatric dentist (PD) were combined into 'other' (OT)
- Zip code-based median household incomes were obtained from the US government Census Bureau website for 5-year estimates from 2019 data. Median household income for the patient's ZIP code was only available for about half of the restorations. Analyses examining the relationship with median household income with amalgam restorations were restricted to this subset of the data.
- A separate analysis that did not include median household income based on ZIP code in the model was used to evaluate the relationships of the other factors with amalgam restorations. GEE models include main effects for each of the factors and interactions of service year with patient age, provider specialty, and number of surfaces in the restoration. A two-sided 5% significance level was used for all tests. Analyses were performed using SAS version 9.4 (SAS Institute, Inc., Cary, NC, USA).

## DISCUSSION

- General trend away from amalgam over the last decade, and a shift in 2020 away from placing them in younger patients below the age of 6 may correspond with the FDA recommendation to avoid placement of amalgam in high risk populations<sup>1</sup>
- Females were less likely to receive amalgam, which may be related to esthetic concerns of parents<sup>2</sup>, though the 1.2% difference may not be of much clinical significance
- Patients who live in ZIP codes with higher median household incomes were less likely to have amalgam utilized as a restorative material
- Pediatric dentists were less likely to utilize amalgam as a restorative material than general practitioners, which varies in consistency with previous research<sup>2,3</sup>.
- Utilization of amalgam increased in restorations with additional surfaces involved, which may be related to perceived higher rates of success/longevity for amalgams in such restorations<sup>4</sup>, particularly by general practitioners.
- These findings may be used to inform public policy decisions regarding amalgam in dental restorations, which is increasingly under public scrutiny following the Minamata Treaty (2013) and its ban/restrictions in several European countries<sup>5</sup>



	Patient Gender			Provider Specialty					Restoration Surfaces		
Service Year	F	M	Unk	All	GP	PD	OT	Unk	1	2	3
2010-2020	16.60%	17.80%	12.20%		18.40%	15.10%	13.00%	15.30%	13.70%	15.50%	17.00%
2010				26.90%	31.30%	23.50%	23.20%	30.30%	22.00%	28.30%	30.90%
2011				23.00%	25.70%	19.10%	20.30%	27.70%	18.30%	24.30%	27.00%
2012				19.70%	21.90%	14.90%	20.10%	22.50%	15.70%	20.60%	23.30%
2013				15.10%	16.40%	12.50%	12.90%	19.10%	12.70%	15.50%	17.30%
2014				11.20%	12.00%	8.40%	9.00%	16.90%	10.30%	11.10%	12.20%
2015				14.40%	17.20%	15.00%	12.00%	13.90%	13.80%	14.50%	15.00%
2016				15.30%	18.80%	16.70%	11.90%	14.50%	14.30%	15.40%	16.20%
2017				13.50%	17.60%	15.80%	9.50%	12.40%	13.10%	13.60%	13.90%
2018				13.60%	17.70%	16.00%	11.00%	10.90%	13.00%	13.70%	14.20%
2019				13.10%	16.10%	14.70%	10.80%	11.30%	12.50%	13.00%	13.70%
2020				9.40%	13.70%	13.50%	9.20%	4.50%	8.90%	8.70%	10.90%



## CONCLUSIONS

The use of dental amalgam has been consistently trending downward, with the sharpest rate of decline noted in 2014 shortly after the Minamata Treaty. Pediatric dentists were less likely to utilize amalgam as a restorative material vs general dentists. Females and patients with higher SES were less likely to have an amalgam restoration placed. These findings may inform public policy in the future with mounting pressure to ban the use of dental amalgam for toxicity or environmental concerns.

## REFERENCES

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