



G47 Dental Age Estimation: Appropriate Censoring of Stage H

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The goal of this presentation is to draw attention to a widespread error in the process of age estimation at the 18-year threshold.

This presentation will impact the forensic science community by showing attendees how to appropriately censor Stage H.

Attendees will learn how to censor Stage H of 3rd molars and will become aware of the errors resulting from no-censoring of Stage H of third molars. Attendees will also learn that failure to censor stage H leads to unrealistic overestimates of the mean Age at Attainment (AaA) for Stage H of 3rd Molars.

Introduction: Since the publication of the probability thresholds in the American Board of Forensic Odontology study of third molar development, the process of age assessment for emerging adults has been simplified.¹ This seminal paper did not take account of “censoring” the AaA of Stage H.² This has resulted in datasets for Stage H being top-heavy. The consequence of this is that the mean AaA is erroneously elevated.

Materials and Methods: A review of the literature revealed 14 studies that used the eight Tooth Development Stages described in 1973.² The mean AaA designated as x-tds and the Standard Deviation designated as sd-tds for stage H were extracted from the data.

Uncensored and Censored* Data for Stage H — males						
Year	Ethnicity	x-tds (years)	sd — tds (years)	Minus 3 sd (years)	Plus 3 sd (years)	Range (years)
2003	Spanish	19.45	1.15	16.00	22.90	6.90
2005	Spanish	19.74	1.09	16.47	23.01	6.54
2014	United Kingdom Caucasian	19.98	2.09	13.71	26.25	12.54
2008	Italy Caucasian	20.02	1.46	15.64	24.40	8.76
2002	Hispanics United States	20.10	2.60	12.30	27.90	15.60
2007	Turkish	20.10	1.80	14.70	25.50	10.80
2009	Korean	21.10	1.20	17.50	24.70	7.20
2004	Spanish	21.86	2.47	14.45	29.27	14.82
2012	Northeast Malaysian	22.37	1.98	16.43	28.31	11.88
2004	German Caucasian	22.50	1.70	17.40	27.60	10.20
2004	Japanese	22.50	1.80	17.10	27.90	10.80
2004	South African	22.60	1.90	16.19	28.30	12.11
2010	South China (Han)	22.72	2.27	15.91	29.53	13.62
2010	First Nations (Canada)	23.20	2.80	14.80	31.60	16.80

The Table is ordered by the AaA (x-tds), smallest to largest. It is clear that some of the AaA values are far too high. The assessment is that this cut-off starts at 21 years — the Korean data.



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From this AaA value, there are increasing AaA which reaches 23.20 years for the First Nations of Canada. The consequences of these elevated AaA values for the First Nations study can be seen in the Minus 3sd and Plus 3sd columns where, for example, the lowest value is 14.80 years and the highest value is 31.60 years. This is clearly not tenable. This problem can be overcome by censoring the data.³ There are three possible methods for this: (1) sort the ages for TDSs with the accompanying TDS so when stage G no longer appears, the censor point can be identified; (2) create a small graph with the Cumulative Probability — this enables identification of the censor point; and, (3) create a data set censored at the upper stage by the largest value of Stage G — beyond that point all the ages are for Stage H only. The data is delimited to +/- 3sd. This is achieved by using a simple calculation within a worksheet and then to extract only the data that lies between these lower and upper values with a spreadsheet with calculated values, viz.: =IF(AND(A5>=D\$5,A5<=D\$6),A5,""). This will limit the data set to +/- 3 sd values. This incorporates 99.7% of the population data and censors the data appropriately. This results in realistic values for the AaA of Stage H.

References:

1. Mincer HH, Harris EH, Berryman HE, The ABFO study of third molar development and its use as an estimator of chronological age. *J For Sci.* 1993; 38(2): 379-390.
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3. Boonpitaksathit T, Hunt N, Roberts GJ, Petrie A, Lucas VS. Dental age assessment of adolescents and emerging adults in UK Caucasians using censored data for stage H of third molar roots. *European Journal of Orthodontics.* 2011; 33(5): 503 – 508.

Age Estimation, Censoring Stage H, Age at Attainment (AaA)