Dental Radiographs for Age Estimation in US Asylum Seekers: Methodological, Ethical, and Health Issues

Unaccompanied migrant children seeking asylum status in the United States are often forced to undergo dental radiographs, or x-rays, to verify that they are younger than 18 years.

The application of third molar dental radiographs is methodologically flawed and should not be employed as a determinant of chronological age. Furthermore, the use of such tests without obtaining informed consent from either the youth or an objective advocate is unethical.

Finally, the legal and health consequences of these inappropriately applied tests are severe and jeopardize the safety and security of these vulnerable minors. (*Am J Public Health*. 2020; 110:1786–1789. https://doi.org/10.2105/AJPH.2020.305918)

Farzana Kapadia, PhD, MPH, Jacqueline Stevens, PhD, and Diana Silver, PhD, MPH

Unaccompanied migrant minors seek asylum status in the United States because they are forcibly displaced from their home countries as a result of fear of torture or persecution. To prevent trafficking of minors, the 2008 Trafficking Victims Protection Reauthorization Act (TVPRA)[1] requires the secretary of health and human services, in consultation with the secretary of homeland security, to develop age determination procedures that "at a minimum . . . take into account multiple forms of evidence." Nonetheless, the Office of Refugee Resettlement (ORR), which is mandated to house unaccompanied minors in shelters separate from adults, often relies on dental radiographs as the primary and even exclusive means of age verification, despite the technique's well-established methodological, legal, and ethical flaws.

Unaccompanied migrant minors to the United States are defined by statute as children younger than 18 years who lack lawful immigration status in the country, and who are either without a parent or legal guardian in the United States or without a parent or legal guardian in the country who is available to provide care and physical custody (https://fas.org/sgp/crs/homesec/R43599.pdf). The consequences of misclassifying children as adults are dire. Unaccompanied minors deemed 18 years old or older via radiograph are transferred from ORR youth shelters to Immigration and Custom Enforcement (ICE)-operated jails and housed with adults while awaiting court hearings, which can expose them to physical harm and mental distress, including anxiety, depression, suicidal ideation, and posttraumatic stress disorder. A memorandum of age determination, submitted during court hearings, will reference dental radiograph findings to allege that unaccompanied minors have purposefully lied about their age, thus substantially jeopardizing the credibility of their asylum claims. These allegations extend immigration proceedings for additional months or years, during which time the minors remain in ICE jails. Adverse asylum determinations based on these flawed findings result in deportation, retraumatization, and the potential for further physical and mental harms upon return to their home country.

A recent court order during this period of the SARS-CoV-2 (COVID-19) pandemic should raise concern among health care professionals taking part in this flawed age determination process. Specifically, on June 26, 2020, Judge Dolly Gee of the US District Court for the Central District of California noted concerns about reports of COVID-19 transmission in ORR shelters and ordered ICE to transfer juveniles from shelters to "non-congregate settings," to parents or guardians, or to sponsors approved by their parents or guardians; these transfers were to take place no later than July 17, 2020.[2] Despite this ruling, individuals targeted for age estimation protocols will not be released, but placed in ICE custody, thus increasing the risk for COVID-19 acquisition and transmission in these settings. Here, we summarize dental radiograph-based age estimation, its methodological flaws, and the legal, ethical, and public health harms inflicted by the inappropriate testing.

ABOUT THE AUTHORS

Farzana Kapadia, Deputy Editor at AJPH, *is with the Department of Epidemiology, School of Global Public Health, New York University, New York, NY. Jacqueline Stevens is with the Department of Political Science and the Deportation Research Clinic, Northwestern University, Evanston, IL. Diana Silver is with the School of Global Public Health, New York University.*

Correspondence should be sent to Farzana Kapadia, PhD, MPH, Associate Professor of Global Public Health & Population Health, New York University–School of Global Public Health, 715-719 Broadway, Room 1006, New York, NY 10003 (e-mail: farzana.kapadia@nyu.edu). Reprints can be ordered at http://www.ajph.org by clicking the "Reprints" link.

This article was accepted August 9, 2020.

https://doi.org/10.2105/AJPH.2020.305918

THIRD MOLAR DEVELOPMENT AND DENTAL AGE

Third molar developmental stage can be described using radiographs (x-rays). Third molar crowns have been seen on radiographs between ages 6 to 19 years, roots from 11 to 24 years old, and fully mature teeth as early as 16 years old.[3] The American Dental Association recommends that third molar staging be used only for identifying normal versus abnormal development or dental disease in living humans. In forensics, dental radiography is used to identify a likely dental age range of skeletal remains when recorded historical information is unavailable. Employing third molar staging to determine the age of living adolescents is subject to substantial inaccuracy given the wide variation in timing of third molar development. Despite this, ORR, the Department of Homeland Security (DHS), and ICE contract with dentists to create dental radiographs and estimate age probabilities based on a staging system described in a 1973 study of French Canadians aged 2 to 20 years,[4] with further statistical data derived only from a handful of studies of US and Japanese adolescents.[5–8]

METHODOLOGICAL CONCERNS

US asylum seekers come from countries across Africa, Asia, Europe, Latin America and the Caribbean, and the Middle East,[9] where patterns of third molar maturation may differ[10] from those described in the currently used staging systems. Although Liversidge demonstrated differences in the timing of third molar formation in several ethnic groups,[11] it is well recognized that applying these group-based age estimates to individuals yields inaccurate inferences because of the large standard deviations around any given age in the reference data. Thus, dental radiographs are simply not evidence of precise chronological age.

For example, stages G and H are the last two stages of third molar development. Although they are likely to be observed during late adolescence, there is overlap in the ages at which they can occur. Specifically, stage G has a mean age of 17.5 years (95% confidence interval [CI] = ±2.8 years) but can present as late as age 23 years, whereas stage H has an older mean age but can present as early as age 15 years.[12] On the basis of the 95% CI, an individual may be aged anywhere from 14.7 years to 20.3 years and have evidence of stage G development. Statistically, we can accept that a 95% CI provides a range for an estimated population parameter. However, in the current application, a one- to two-unit range in years can result in classifying a minor as an adult. Thus, the imprecision and false adult-age inferences from these staging categories should preclude their use in determining ages of living adolescents, especially given the harms caused by these procedures.[13]

In summary, studies purporting to assess chronological age by using dental radiographs provide, at best, only weak correlations between dental age and exact chronological age.[5–8] Because of the high rate of misclassification of minors as adults based on third molar radiographs, Cole advises that the "use of developmental markers, be they skeletal, dental or other, for age assessment purposes, is imperfect and where they are used the quality of their evidence should be challenged."[10(p387)]

ETHICAL CONCERNS

To ensure their safety, unaccompanied migrant children in US government custody are mandated to be transported and held separately from adults.[14] In implementing this mandate, immigration officers may invoke the vague standard, "if a reasonable person would conclude that an individual is an adult," thereby disregarding a minor's stated age, instead of relying on procedures as stated in the TVPRA. In doing so, officials "may require an individual to submit to a medical or dental examination conducted by a medical professional or other appropriate procedures to verify his or her age"[15] to reassess a minor's age. Public comments on this rule (http://www.regulations.gov; see ICEB-2018-0002) raised several objections exposing the ethical, practical, and legal challenges in the implementation and associated outcomes of TVPRA's age estimation requirement.

First, the language of the TVPRA "requires the age determination procedures, at a minimum, to take into account multiple forms of evidence." Accordingly, under these procedures, each case must be evaluated carefully on the basis of the totality of all available evidence, including the statement of the individual in question. As clearly stated in the statute, reliance on any one method—especially one that is not intended to be used for age determinations in living humans—violates the TVPRA.

Second, employees of DHS, ORR, or the private shelters contracted by ORR are most likely to be the ones to question a minor's age claim, but they are neither medical professionals nor neutral "reasonable persons." DHS and ORR are charged with acting on behalf of the "best interest" of unaccompanied minors, but they violate their mandate by requiring the use of dental radiograph procedures for age assessments. When a dental age assessment suggests that a minor may be aged 18 years or older, that individual is transferred from a facility designed for housing and educating children to an ICE detention facility, and ORR is no longer obligated to provide care. The health and medical failures of migrant shelters are well documented, not just for unnecessary dental age estimation procedures, but also in their refusal to provide appropriate and necessary medical care and for forcibly providing unnecessary and inappropriate care such as psychotropic medication to exert behavioral control (https://reut.rs/2M1YAUi).

Third, ORR's exercise of custodial authority to order age determination tests depends on the very results of these tests to establish if the unaccompanied migrant is indeed a minor (https://bit.ly/2zwwFJo). ORR's custodial authority over unaccompanied minors means the agency is not obligated to obtain informed consent or assent for subjecting minors to dental radiograph age estimation procedures. However, those whose ages are in question are typically in later adolescence—ages when minors are able, at a minimum, to provide or withhold consent for medical treatment. For example, in most states, adolescents, typically older than 15 years, are legally able to provide their own consent for health care, including treatment of reproductive and sexual health care, substance abuse treatment, and mental health care.[16] Despite the fact that there are well-established

guidelines for obtaining informed consent for health care from minors in the United States, ORR does not use such guidelines for unaccompanied minors in their custody who are between 15 and 17 years old. Such protocols are especially important for a population whose parents or relatives willing to act as guardians may fear deportation and thus not present at ORR facilities to assist minors as they navigate through these complex processes.

Fourth, even Trump-era regulatory guidance does not allow an agency to require participation in an investigative procedure that poses a health risk and whose stated objective is to create legal burdens for the person tested (https://bit.ly/2zwwFJo). Subjecting children to any level of radiation for a nonmedical purpose exposes them to a risk of harm that provides no known health benefit.[17] As clearly stated in the Nuremberg Code, "The degree of risk to be taken should never exceed that determined by the humanitarian importance of the problem to be solved" (https://history.nih.gov/display/history/Nuremburg+Code). Thus, health care professionals participating in these procedures may be in violation of the Nuremberg Code.

Finally, it is well established by researchers that dental radiographs only provide an estimated dental age range for third molar dentition. Again, a 95% CI in statistics provides a degree of uncertainty around a point estimate. Here, this degree of uncertainty is being used to suggest that minors are lying about their ages. Those interpreting test results may be ignoring the inherent lack of precision in these results, and their consequences. Because a single dental age estimation result does not meet the threshold of totality of evidence and is inherently an invalid measurement of chronological age, there is simply no credible appeals process for challenging incorrect age determinations based on dental radiographs.

LEGAL IMPLICATIONS

If unaccompanied individuals subjected to these tests are indeed minors, then ORR's routine policy of ordering tests that require nontherapeutic exposure to radiation violates ORR's obligation to "ensur[e] that the interests of the child are considered in decisions and actions relating to [their] care and custody."[18] Relying on a flawed test to transfer individuals misclassified as adults to ICE facilities violates ORR's obligation to ensure that unaccompanied minors reside "in the least restrictive setting that is in the best interest of the child,"[19] as well as the Flores Settlement Agreement, which prohibits housing minors in ICE-operated jails with adults (https://www.loc.gov/item/usrep507292).

Furthermore, radiograph results cannot be used for an age redetermination without other evidence of adult status, such as a birth certificate. In federal lawsuits since 2016, the courts have found ORR in violation of this policy. In October 2018, the federal district court of Arizona noted:

> There is no apparent plausible construction of the TVPRA, or the ORR Guide, under which an ORR official's nonspecific, unsubstantiated speculation of what they perceive to be adult behavior suffices as "evidence" that may be considered and relied upon in making an age determination. Indeed, ORR does not include appearance or behavior as criteria for evaluating whether an individual is an adult or juvenile, but instead lists those factors as a challenge to the age determination process.[20]

In October 2019, a federal court sitting in California ordered that the petitioning minor be returned to the custody of the respondent, in this instance ORR, as he had

> carried his burden of establishing a strong likelihood that Respondents impermissibly determined that he is not a minor given the totality of the evidence presented by [the petitioner]. Not only did Respondents represent to [the petitioner's] counsel that their age determination was based solely on a dental radiograph in violation of the TVPRA, see Pet. Ex. 12, but Respondents' post hoc justifications on alternative bases for their age determination are contrary to the law and fail properly to consider the totality of other evidence probative of [the petitioner's] minority, including his . . . birth certificate and government-issued student identification card. . . . The Court must agree with [the petitioner] that "the idea that the government can prejudge an entire country's documents as inauthentic ab initio is preposterous—it is pernicious discrimination based on a suspect classification of national origin and alienage."[21]

Despite these legal victories, application of dental radiographs as the sole means of making age determinations persists. Moreover, the vast majority of unaccompanied minors who are wrongfully forced to comply with radiograph age assessment lack the legal representation to challenge an incorrect test result. Thus, for many, the implications of an inaccurate test result end in deportation.

PUBLIC HEALTH IMPLICATIONS

The long-term health impacts of mislabeling minors as adults are substantial.[22] Increased anxiety, depression, and trauma while awaiting test results; fear of coercion or reprisal for not participating in assessments; harms from exposures to radiation including repeat dental radiographs; physical and mental safety risks from being confined with adults; and wrongful return to conditions of persecution or torture are all real threats to the short- and long-term well-being and safety of unaccompanied minors seeking asylum. We cannot let misapplication of medical procedures based on imprecise methodologies undermine the special rights of children—particularly those most vulnerable to harm and danger—to safety and protection. The principles of autonomy, nonmaleficence, beneficence, and justice must be our guiding principles.

Presently, minors are not provided information on the purpose, procedures, risks and benefits, or legal implications vis-à-vis detention and deportation. At a minimum, age-, language-, and cognition-appropriate information about the risks and benefits of age assessment radiographs should be distributed to everyone in ORR custody or those who claim to be minors, as well as access to a legal advocate or guardian who can advise unaccompanied minors on this testing and its purpose. A Child Advocate Program was established as part of TVPRA and allows DHS to "appoint independent child advocates for child trafficking victims and other vulnerable unaccompanied alien children"[1]; however, the Child Advocate Program is woefully underutilized, and in many ORR facilities completely ignored.[23]

As per the United Nations Convention on the Rights of the Child,[24] care of unaccompanied migrant minors must be held to

the highest ethical and medical standards as guaranteed by state and federal law. Even though the United States is the only country in the world not to ratify this convention, protection of unaccompanied migrant children, particularly during a highly vulnerable and traumatic time, must be guided by these principles. We therefore call on health professionals to do the following:

1. Refuse to take part in these testing programs that employ radiation without any medical benefit.
2. Campaign for the expansion of the advocate programs in their states and mandate appointment of an advocate to provide unbiased support that is in the best interests of all unaccompanied minors in immigration detention.
3. Reach out to their local and state leaders to support funding for advocate programs.
4. Lend their expertise to advocate programs and become child advocates themselves.
5. Urge their professional associations to pass resolutions prohibiting use of dental radiograph for age determination because of its methodological inadequacy and the ensuing ethical and legal harms of its misapplication to unaccompanied minors seeking asylum. AJPH

CONTRIBUTORS

All authors contributed equally to this article.

CONFLICTS OF INTEREST

The authors have no disclosures or conflicts of interest.

REFERENCES

1. HR7311, William Wilberforce Trafficking Victims Protection Reauthorization Act of 2008, Pub L 110-457.

2. Case 2:85-cv-04544-DMG-AGR, June 26, 2020, p. 3–4.

3. Levesque GY, Demirjian A, Tanguay R. Sexual dimorphism in the development, emergence, and agenesis of the mandibular third molar. *J Dent Res*. 1981; 60(10):1735–1741. https://doi.org/10.1177/00220345810600100201

4. Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. *Hum Biol*. 1973;45(2):211–227.

5. Mincer HH, Harris EF, Berryman HE. The ABFO study of third molar development and its use as an estimator of chronological age. *J Forensic Sci*. 1993; 38(2):379–390. https://doi.org/10.1520/JFS13418J

6. Arany S, Iino M, Yoshioka N. Radiographic survey of third molar development in relation to chronological age among Japanese juveniles. *J Forensic Sci*. 2004;49(3):JFS2003372–5. https://doi.org/10.1520/JFS2003372

7. Kasper KA, Austin D, Kvanli AH, Rios TR, Senn DR. Reliability of third molar development for age estimation in a Texas Hispanic population: a comparison study. *J Forensic Sci*. 2009; 54(3):651–657. https://doi.org/10.1111/j.1556-4029.2009.01031.x

8. Blankenship JA, Mincer HH, Anderson KM, Woods MA, Burton EL. Third molar development in the estimation of chronologic age in American blacks as compared with whites. *J Forensic Sci*. 2007;52(2):428–433. https://doi.org/10.1111/j.1556-4029.2006.00356.x

9. Refugee Processing Center. Arrivals by region as of September 30, 2019. Available at: https://www.wrapsnet.org/admissions-and-arrivals. Accessed October 1, 2019.

10. Cole TJ. The evidential value of developmental age imaging for assessing age of majority. *Ann Hum Biol*. 2015;42(4): 379–388. https://doi.org/10.3109/03014460.2015.1031826

11. Liversidge HM. Timing of human mandibular third molar formation. *Ann Hum Biol*. 2008;35(3):294–321. https://doi.org/10.1080/03014460801971445

12. Cole TJ. Hot potato topic. *Br Dent J*. 2008;205(11):581–582. https://doi.org/10.1038/sj.bdj.2008.1030

13. Child Rights Advocacy UNICEF. & Education Section–PFP Geneva, Identification of Unaccompanied and Separated Children: Exploring Age Assessment Challenges. Background and Discussion Paper for the Expert Seminar on Unaccompanied Minors, Children Crossing the External Borders of EU in Search of Protection Organized by the Belgian Presidency of the European Union, 2010, p. 3.

14. 6 CFR §115.14, juvenile and family detainees.

15. 8 CFR §236.3(c)(2).

16. English A, Bass L, Boyle AD, Eshragh F. State minor consent laws: a summary. 3rd ed. January 2010. Center for Adolescent Health & the Law. Available at: https://www.freelists.org/archives/hilac/02-2014/pdftRo8tw89mb.pdf. Accessed May 20, 2020.

17. Hwang SY, Choi ES, Kim YS, Gim BE, Ha M, Kim HY. Health effects from exposure to dental diagnostic x-ray. *Environ Health Toxicol*. 2018;33(4):e2018017. https://doi.org/10.5620/eht.e2018017

18. 6 USC §279(b)(1)(B)

19. 8 USC §1232(c)(2)(A)

20. L.B. v Charles Keeton et al, 2:18-cv-03435-JJT—MHB, Doc. 12, p. 10.

21. N.B. v Barr, case no. 19-CV-1536 JLS (LL), 2019.

22. Aynsley-Green A, Cole TJ, Crawley H, Lessof N, Boag LR, Wallace RM. Medical, statistical, ethical and human rights considerations in the assessment of age in children and young people subject to immigration control. *Br Med Bull*. 2012; 102(1):17–42. https://doi.org/10.1093/bmb/lds014

23. US Government Accountability Office. Unaccompanied children: HHS can take further actions to monitor their care. February 2016. Available at: https://www.gao.gov/assets/680/675001.pdf. Accessed May 1, 2020.

24. UN Committee on the Rights of the Child (CRC). CRC general comment no. 6 (2005): treatment of unaccompanied and separated children outside their country of origin. September 1, 2005. CRC/GC/2005/6. Available at: https://www.refworld.org/docid/42dd174b4.html. Accessed May 1, 2020.