

THE UNIVERSITY OF HONG KONG**IMPACT CASE HISTORY****Title of case study:****Dental development: An Aid to Give Identities and to Inform General Health****1. Summary**

Dr Hai Ming Wong and a team of PhD and BDS students in the Faculty of Dentistry have applied dental age assessment to address the social issue of unregistered births in the region. The lack of a registered identity can make it difficult for children to get an education and medical treatment and may leave them vulnerable to abuse. The team has brought dental age assessment and oral health education programmes to two villages in India, where nearly 60 per cent of births are unregistered. Their public awareness programme has reached about 500 families in rural areas of India, and about 150 undocumented children in rural welfare homes had their age estimated through their efforts. They have established a charity, the D.O.B. (Date of Birth) Foundation, the first of its kind in the world to promote accurate birth records. In addition, about 200 dentists and forensic practitioners in India and Hong Kong have been trained in dental age assessment. They have also transferred knowledge of dental development and oral health care to teachers of primary schools and orphanages in rural areas of Guangxi, China. The team was awarded the inaugural Knowledge Exchange (KE) Excellence Award of HKU this year.

2. Underpinning research

The timing of all stages of tooth development follows a sequential and organised pattern, so the developing dentition can be used as a maturity indicator. Dental age relates more closely to chronological age than other physical or psychological attributes, so an individual's age can be assessed from dental development more accurately. For example, variation of estimated age from skeletal tissues is around 1 to 2 years, whereas age estimated from dental maturity can be accurate with a range of only 6 months. Dr Hai Ming Wong of the Faculty of Dentistry has conducted research to identify factors that affect dental development to further improve the accuracy of the method for age estimation.

While there has been much research on tooth development among Western populations, this has been lacking for Chinese populations. Dr Wong led a research project to establish a reference data set (RDS) for a southern Chinese population for the age range from 3 to 22 years based on the defined developmental stages of each permanent tooth using dental panoramic tomographs collected in Hong Kong, and to validate the established southern Chinese RDS and the age estimation method internally using the two-fold cross-validation technique, and externally with a southern Chinese sample. The research team further investigated the applicability of the established southern Chinese RDS and the age estimation method to a northern Chinese sample. The established dataset is the world's first dental age assessment dataset for southern Chinese. This realistic, valid and reliable method of age estimation that was developed based on clearly defined criteria of tooth development stages and mathematical techniques can be used by any researchers and related authorities in civil, legal, criminal and forensic applications around the world to estimate age accurately. This information, for example, can help to identify children in natural disasters such as earthquakes, or help orphans.

Dr Wong's current research focuses on the applicability of the southern Chinese RDS and the age estimation method to the southeast Asian population groups such as Vietnam, Thailand, Cambodia, and the Philippines.

3. References to the research

Key peer-reviewed publications:

Jayaraman J., Wong H.M., King N.M., Roberts G.J.; Development of a Reference Data Set (RDS) for dental age estimation (DAE) and testing of this with a separate Validation Set (VS) in a southern Chinese population. *Journal of Forensic and Legal Medicine*, 2016, Jul 12, 43: 26-33.

Jayaraman J., Roberts G.J., Wong H.M., McDonald F., King N.M.; Ages of legal importance: Implications in relation to birth registration and age assessment practices. *Medicine, Science and the Law*, 2016, 56(1), 77-82.

Wong H.M., Peng S.M., Wen Y.F., McGrath C.P.; A population survey of early factors associated with permanent tooth emergence: findings from a prospective cohort study. *Community Dentistry and Oral Epidemiology*, 2016, doi: 10.1111/cdoe.12236.

Jayaraman J., Wong H.M., King N.M., Roberts G.J.; Secular trends in the maturation of permanent teeth in five-year-old children. *American Journal of Human Biology*, 2013, 25, 329-334.

Jayaraman J., Roberts G.J., King N.M. and Wong H.M.; Dental age assessment of southern Chinese using the United Kingdom Caucasian reference dataset. *Forensic Science International*, 2012, 216, 68-72.

Jayaraman J., Roberts G.J., King N.M. and Wong H.M.; Dental age assessment: are Demirjian's standards appropriate for southern Chinese children? *Journal of Forensic Odontostomatology*, 2011, 29(2), 22-28.

Selected external grant funding:

Dental age assessment in Southeast Asians: Is the reference data set of southern Chinese applicable? (17126115)

Funding Scheme: General Research Fund

Principal Investigator: Dr Hai Ming WONG

Period of the Grant: January 1, 2016 – December 31, 2018

Amount Awarded: HK\$656,166

Dental age assessment: Development and validation of a reference data set for the southern Chinese and its application to the northern Chinese (17122914)

Funding Scheme: General Research Fund

Principal Investigator: Dr Hai Ming WONG

Period of the Grant: January 1, 2015 – June 30, 2017

Amount Awarded: HK\$470,700

Child risk factors for delayed eruption of permanent teeth (HKU 781112M)

Funding Scheme: General Research Fund

Principal Investigator: Dr Hai Ming WONG

Period of the Grant: January 1, 2013 – December 31, 2015

Amount Awarded: HK\$524,356

4. Details of the impact or benefit

About one-third of births in the world are unregistered, according to UNICEF. In India, nearly 60% of the births are unregistered. Official statistics are unavailable for China. According to a report by UNICEF, in 19 countries including China, 26% to 60% of children, less than 5 years old, were not registered. In a world where governments and other providers of public services increasingly demand proof of identity, the lack of a registered identity can make it difficult for children to get an education and medical treatment and may leave them vulnerable to abuse.

Dr Wong led a team of PhD and BDS students in the Faculty of Dentistry to conduct a series of knowledge exchange (KE) programmes to apply dental age assessment to address the social issue of unregistered births in the region. With the help of NGOs in India and Mainland China, they used multiple methods to achieve the project aims, through dental age assessment, oral examinations/anthropometric assessments and follow-ups, in-depth consultations, and personalized oral and general health instructions.

Dr Wong's team brought dental age assessment and oral health education programmes to two villages in India. Their public awareness campaigns on the importance of birth registration have reached 500 families. They used different languages, for example, Tamil, a language used in South India, in their educational materials. Oral health information and oral health education was provided to 200 less privileged children in Chennai, India. About 150 undocumented children in rural welfare homes had their age estimated through their efforts and got their age certificates.

Students also visited an orphanage in Mainland China to conduct programmes on age estimation and oral health education. Knowledge of dental development and oral health care has been transferred to teachers of primary schools and orphanages in rural areas inhabited by minorities to benefit more children.

In addition, the team wanted to train the trainers in order to sustain the project efforts. They provided training in dental age assessment to about 200 dentists and forensic practitioners in India and Hong Kong.

The team has established a charity, the D.O.B. (Date of Birth) Foundation, the first of its kind in the world, to promote accurate birth records. They have also advocated to the United Nations Framework Convention on Climate Change to tackle the global issue concerning climate change displaced people, especially the small islanders, using dental age assessment.

Their KE work has also enabled them to join forces and build capacity with dental organisations and relief agencies in India, Mainland China and Hong Kong.

5. References to the corroboration of impact or benefit

- The project was extensively covered by the media in India as well as newspapers in Hong Kong, for example:

‘Dental test can give near precise estimate – Expert’ – Med India Network for Health
www.medindia.net/health-press-release/Dental-Test-Can-Give-Near-Precise-Birth-Date-Expert-209073-1.htm

‘Teenage Woes? No more lying through the teeth’ – The Times of India
www.timesofindia.indiatimes.com/city/chennai/Teenage-woes-No-more-lying-through-the-teeth/articleshow/36409816.cms

‘Dental Age Assessment for Delhi Gang Rape Suspect’ – Indian Television interview
www.youtube.com/watch?v=4toI5XiKVB4

- Establishment of the world’s first charity to promote accurate birth records, D.O.B. (Date of Birth) Foundation: www.dob-foundation.org/