Age determination in Children

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For many people from developing countries, an accurate age is not known. Assessment of age is complex as most of the physical and developmental parameters used for medical and legal purposes have been developed from research in particular climates, ethnicities and environments where there is good health and nutrition.

There are many reasons for a discrepancy between the date of birth on a person's visa and the true date of birth.
This may include:

- the significance of birthdates tends to be a cultural phenomenon and many may know the year of birth without having noted the day and month.
- the banning of calendars (eg in Afghanistan),
- the chaotic circumstances surrounding the time of birth (eg during flight),
- the child may have spent considerable time separated from the parents,
- the child is the child of only one parent (eg one wife may come with the children of other wives),
- the child may be adopted from another family,
- the visa authorities made an inappropriate estimate of the child's age
- many other systemic or administrative errors or mishaps.

For those families who have no records of a child's date of birth, the authorities will often arbitrarily record a birth date of 1st January without taking the time to find out when the child was born. It is hence quite common for children who are born in the middle of the year to be given a birth date that is 18 months different to their true date of birth.

In the absence of a known date of birth, any assessment of age will be laden with difficulty. Even in circumstances of good health, adequate nutrition and a stable environment, behavioural, social and physical milestones vary within a wide range of normality. In circumstances of illness, undernutrition, extreme stress and disrupted socialization, any tools used to assess age are likely to be even less reliable.

The Royal College of Paediatrics and Child Health in the United Kingdom acknowledges that age determination is an inexact science and the margin of error can sometimes be as much as 5 years either side, especially around the time of puberty [4]. The College made the following statement in November 2007.
'We accept the need for some form of age assessment in some circumstances, but there is no single reliable method for making precise

estimates. The most appropriate approach is to use a holistic evaluation, incorporating narrative accounts, physical assessment of puberty and growth, and cognitive, behavioural and emotional assessments. Such assessments will provide the most useful information on which to plan appropriate management.'[5]

Dental age looking at the emergence and development of the primary and secondary teeth is often cited as the most reliable assessment of age and has a mean accuracy of +/- 2.15 years [4, 6]. However there are inter-ethnic differences in the rate of dental maturation [6]. A proper Demirjian's evaluation of dental maturity involves dental panoramic X-rays and a complex assessment based on calcification stages for the seven left permanent mandibular teeth [6]. This method is inappropriate to predict age with any accuracy after the age of 18 [6]. In children who have been malnourished or who have never had any dental hygiene or care, teeth may be in a very poor condition and unable to be assessed clinically. Factors such as nutrition, stress, temperature and humidity may affect the maturation of teeth [6]. The added risks of radiation exposure should be weighed against any perceived benefits of this procedure.

X-ray of the wrist is a controversial means of assessing age because of the exposure to ionizing radiation for non-clinical purposes [5]. Mineralization of the carpal bones begins at birth and lasts until approximately 13 years for girls and 15 for boys and for the epiphyses of the ulna and radius, mineralization lasts until age 16-17 years [7]. Age estimation after the adolescent period is more difficult as the changes in the carpals are not clear after age 14-16 years [7].

The atlas method according to Greulich and Pyle is the most common method for determination of skeletal maturity. The standards were developed from 1931-1942 using X-rays of the hands and wrist of 1000 Americans of northern European descent and upper socioeconomic class. They were last reviewed in 1988 using 100 X-rays [8]. It has been argued that these standards are not applicable in 2008 or for other geographical locations, climates, ethnicities or socioeconomic groups [8-10]. Skeletal maturation is significantly affected by puberty and sexual maturity should be taken into account when assessing X-rays.

A study in the USA showed significant discrepancies between ethnic groups (such as African and Asian) of up to 11 months between bone and chronological age, especially in late childhood and adolescence [9]. Other studies show an even greater discrepancy in bone age when the country of residence as well as ethnicity, is taken into account [8]. This may be due to factors such as antenatal causes, general health, nutrition, climate or Vitamin D and calcium levels. Socio-economic status, illness, malnutrition and poor hygiene significantly affect the rate of ossification of bones with those people of lower socio-economic status having a slower rate of bone maturation [8].

The grading system of Tanner utilizes assessments of the pattern of development of pubic hair in children, of breast development in girls and

penile and testicular size in boys to assess the stage of sexual development. It was originally based on Scottish children with low socio-economic status in the 1950s. Values showed a wide range of individual variability of up to 6 years age difference across different ethnicities [10]. It would not be considered appropriate in most cultures to examine the breast development or penile or testicular size as part of a screening assessment.

A model is suggested based on that of the Royal College of Paediatrics and Child Health in London using basic demographics and a narrative account from the parent [4].

Given that the 'science' of age assessment is inexact, it is important that the narrative account, the parent's story of the time and circumstance of the child's birth and developmental milestones, is clearly documented as this is the most likely means of properly assessing the age. The parent's narrative account will include observations such as: where the family was at time of birth; the time of year of birth (winter, summer, wet, dry); when the child first walked (approx one year), when the child was dry in the day (approx 3 years) and their age in relationship to other children.

Recording an accurate narrative account requires time and patience, a good interpreter and a non-judgemental approach.

Conclusion

Assessment of age is extremely important but very difficult because of differences in ethnicity, health and socio-demographic background from the recognized standards usually used. Narrative history used in conjunction with other observations such as developmental milestones, height, weight, social maturity and sexual maturity (when appropriate).

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*** Questions which may be useful in helping parents remember the child's date of birth:**

- **Are there any other records which may show child's age – immunisation/ health records?**
- **Where the family was at the time of birth.**
- **Time of year of birth (winter, summer, wet, dry).**
- **Walking (approx one year) – how long ago?**
- **Toilet trained i.e. dry in the day (approx 3 years) – how long ago?**
- **Age in relationship to other children in the family.**

Age Assessment Guide:

Questions / Observations:		**Assessed age**
Date of Birth on visa:		
Child's age according to other documentation e.g. early child hood immunisation records, passport.		
Parents initial estimate of age:		
Weight : plot on 50th percentile and find age to match		
Height : plot on 50th percentile and find age to match		
Assessment of child's date of birth according to parent's story*		
Assessment of child's current developmental stage: http://www.health.qld.gov.au/child&youth/factsheets/		
Puberty (if appropriate and with consent) : Girls - periods commenced (usually around age 11-13 yrs) Boys - noted voice change (usually around age 13-15 yrs)		 <11 or >13 <13 or >15
Health or educational professional's estimate of age on the basis of		

maturity and relationships with other people.	
X-ray left wrist:	
According to the MHS Clinical procedure for Age Assessment - which includes the above criteria, the clients age is assessed as:	
Comments:	