



Responses from SBU's Enquiry Service present conclusions solely as interpreted by the authors of the individual studies included. SBU's Enquiry Service makes no attempt to combine or interpret the body of evidence, as there has been no formal quality control by SBU nor statistical processing to weight and synthesize the data provided.

Non-radiological¹ Methods for Age Assessment

When a person lacking legal documentation indicating their age applies for asylum in Sweden, age determination may be used to verify or refute the age-statement made by the asylum-seeker. According to the United Nations Convention on the Rights of the Child, everyone under the age of eighteen has extended rights to social services and protection, including a right to good quality health care, and the right to primary education [1]. In addition, unaccompanied minors seeking asylum in the EU have the right to a legal guardian, cannot be detained unless it is for their own safety, and cannot be deported to their country of origin unless it is deemed to be in the best interest of the child and a safe reintegration process is in place [2] (ref - see note). Thus an asylum-seekers status as a minor may have a significant impact on their application for asylum in Sweden.

Question:

What is the scientific evidence regarding the reliability of non-radiological age assessment techniques?

Summary:

SBU's Enquiry service was unable to find any systematic reviews or primary studies that reliably address the accuracy of non-radiological age assessment techniques. In general, the literature indicates that the variation between individuals is too large to allow an individual's age to be estimated based on physical traits (i.e. height or stage of puberty). Neither were any studies identified that assessed psychosocial methods for assessing an individual's age.

SBU has taken no position in this issue. We present only the conclusions as interpreted by the authors of the individual studies included.

¹ All methods that do not include a radiological examination, e.g. examining physical features such as height and puberty, psychosocial methods etc



Background

The Swedish Migration Agency currently has the responsibility to conduct an initial age assessments when a person lacking legal documentation indicating their age applies for asylum in Sweden. The case officer may alter an applicant's age in the Swedish Migration Agency database if he or she does not accept the applicant's age-claim. The applicant may then choose to have a medical age assessment. The Swedish Migration Agency can change an age assessment if presented with approved documentation of age [3].

Medical age assessments are usually based on a thorough analysis of the individual's medical history combined with height and weight measurements, and an assessment of maturity based on a physical examination. These measurements may be supplemented with radiological exams that estimate the degree of maturity of a person's bones or teeth [4,5]. Medical age assessment is regarded as controversial and ethically unacceptable by some medical professionals [6,7].

SBU's Enquiry Service has only focused on non-radiological methods for age assessment in its Response.

Methods

We searched PubMed, SocIndex, PsycInfo, Scopus, ProQuest (Social Services Abstracts, Sociological Abstracts, ERIC) as well as Campbell Collaboration.

The search strategy was done in two steps. First we conducted a broad search for systematic reviews assessing any kind of age assessment technique (Search I). Subsequently, the search was altered to include any study type, but narrowed to exclude radiological methods (Search II). The complete search strategy is presented in the section "Literature search."

Identified abstracts and articles were largely read by only one person. No attempt was made to assess the quality of the identified articles.



Results

The search strategy identified 16,234 records (15,347 from Search I, and 887 from Search II) (See Figures 1 and 2). The abstracts of all of the articles identified by the literature search were read. Of these, 73 articles (32 from Search I, and 41 from search II) were judged to be potentially assessing the accuracy of non-radiological age assessment methods, and were read in full text.

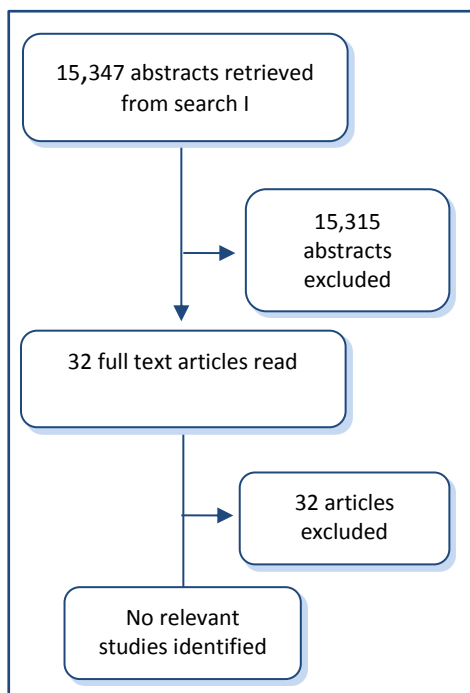


Figure 1. Schematic representation of search I, which was designed to identify systematic reviews assessing any age assessment method.

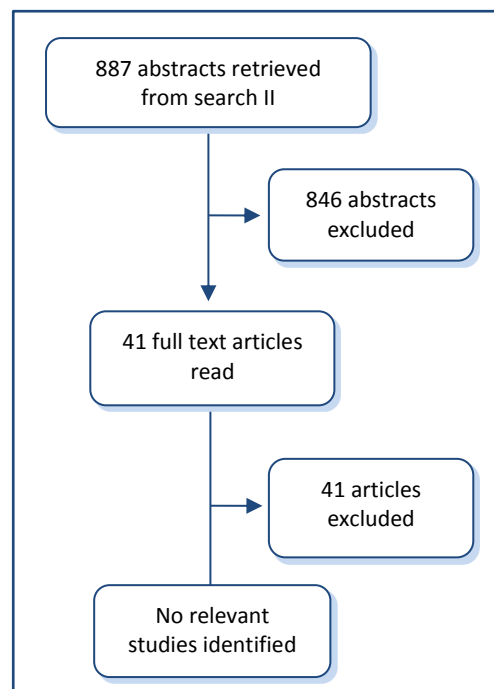


Figure 2. Schematic representation of search II, which was designed to identify studies of any study design, assessing non-radiological age assessment methods.

Identified studies

After all of the potentially relevant studies were read, no systematic reviews or scientific studies were identified that assessed the accuracy of non-radiological age assessment techniques. Only studies that discussed or described certain aspects of non-radiological age assessments such as height or puberty status were identified.

Neither were any scientific studies identified that assessed any psychosocial method for assessing the age of refugees.



Additional observations

According to UNICEF, physical examinations are conducted in conjunction with the age assessment process in some countries [8]. These methods rely on measures of physical appearance (i.e. height and weight) and measures of physiological maturity (i.e. puberty rating) to estimate an individual's age. However, these methods are widely criticized, because they do not take into account the variation that naturally exists between individuals due to ethnicity, nutritional intake or socio-economic background. In addition to being imprecise, these methods have elicited several ethical concerns.

According to the Tanner scale, puberty can be rated based on external primary and secondary sex characteristics, including the size of the genitals and the development of pubic hair [9,10]. For girls, the timing of menarche (their first menstrual bleeding) may also be considered. These scales are based on studies from Great Britain published several decades ago, and are based on a study population that may not be representative for those seeking asylum in Sweden today. The usefulness of the Tanner scale is further limited because the sex characteristics vary widely between individuals, as a result of genetic predisposition or cultural influences [11].

The study of Garamendi et al. examined the validity of the Tanner scale for estimating the chronological age of individuals around the age of 18. The study included 87 people from Morocco, however the authors reveal that they are unsure of the actual age of the study's participants, making it difficult to draw any conclusions from the study [12].

Using a person's height to estimate their age also has inherent reliability issues, in part because height measurements need to be taken at several time points to reveal any correlation with age [13]. In addition, it is important that the reference growth curve is based on a population representative of the individual that is being assessed.

While assessing an individual's physiological and psychosocial condition is an important tool for identifying factors which may have influenced their growth or development, it has been claimed that attempting to assess a person's age solely based on physical characteristics is not reliable [8,11-15].

SBU was unable to identify any scientific literature addressing psychosocial or holistic² methods for age assessment. However, in October, 2015, the English

² Holistic assessment approaches take a broad range of factors into account, ranging from their developmental, physiological, and psychosocial status to their cultural and socio-economic situation.



Association of Directors of Children's Services published a practice guidance that provides social workers and their managers with thorough step-by-step guidelines for conducting holistic age assessments from the planning stages through its completion [15]. According to these guidelines, social workers are by nature of their education, experience and specialist skills in working with and interviewing vulnerable children and young people, uniquely positioned to undertake holistic assessments. As a result of these guidelines, social workers are currently responsible for conducting age assessments on unaccompanied young people seeking asylum in England, so as to ensure that these children and young people are provided for in a way that is appropriate to their age and their needs. The guidelines stress that it is important to engage with any professionals who may already be involved with these asylum-seekers, and that the views of teachers, psychologists, police officers, paediatricians or other relevant professionals should always be considered when available [16].

Project members

This response from SBU's Enquiry Service was formulated by Jessica Dagerhamn, Laura Lintamo och Jan Liliemark, SBU. This response was translated by Rebecca Silverstein, SBU.



Literature search

Search I: A broad search for systematic reviews assessing any method for age assessment.

PubMed via NLM 2015-11-30

Title: Systematic reviews assessing age assessment

Search terms	Items found
1. ((age assessment*[TiAb] OR assessing age[TiAb] OR assessing chronological age[TiAb] OR age determin*[TiAb] OR determin* age[TiAb] OR age diagnos*[TiAb] OR age estimat*[TiAb] OR estimat* age[TiAb] OR age verification*[TiAb] OR verifying age[TiAb] OR age measur*[TiAb] OR measuring age[TiAb]))	
2. systematic[sb]	
3. S1 AND S2	9032

The search result, usually found at the end of the documentation, forms the list of abstracts.

[TiAb] = Title or abstract

Systematic[SB] = Filter for retrieving systematic reviews

* = Truncation

Campbell Collaboration 2015-11-30

Title: Systematic reviews assessing age assessment

Search terms	Items found
1. age assessment* in all text or assessing age in all text or assessing chronological age in all text or age determin* in all text or determin* age in all text or age diagnos* in all text or age estimat* in all text or estimat* age in all text or age verification* in all text or verifying age in all text or age measur* in all text or measur* age in all text and document type is protocol, review	194

The search result, usually found at the end of the documentation, forms the list of abstracts



PsycInfo via Ebsco 2015-11-30

Title: Systematic reviews assessing age assessment

Search terms	Items found
1. TX age assessment* OR assessing age OR assessing chronological age OR age determin* OR determin* age OR age diagnos* OR age estimat* OR estimat* age OR age verification* OR verifying age OR age measur* OR measuring age	30 414
2. TX psychosocial OR psycholog* OR psychiatr* OR social work* OR interview* OR observation*	2 501 762
3. DE "Psychiatric Evaluation" OR DE "Psychiatry" OR DE "Adolescent Psychiatry" OR DE "Biological Psychiatry" OR DE "Child Psychiatry" OR DE "Community Psychiatry" OR DE "Consultation Liaison Psychiatry" OR DE "Forensic Psychiatry" OR DE "Geriatric Psychiatry" OR DE "Neuropsychiatry" OR DE "Orthopsychiatry" OR DE "Social Psychiatry" OR DE "Transcultural Psychiatry"	43 311
4. DE "Psychology" OR DE "Abnormal Psychology" OR DE "Applied Psychology" OR DE "Clinical Psychology" OR DE "Cognitive Psychology" OR DE "Comparative Psychology" OR DE "Cross Cultural Psychology" OR DE "Depth Psychology" OR DE "Developmental Psychology" OR DE "Ecological Psychology" OR DE "Evolutionary Psychology" OR DE "Experimental Psychology" OR DE "Feminist Psychology" OR DE "Folk Psychology" OR DE "Forensic Psychology" OR DE "Geropsychology" OR DE "Humanistic Psychology" OR DE "International Psychology" OR DE "Mathematical Psychology" OR DE "Metapsychology" OR DE "Neuroeconomics" OR DE "Physiological Psychology" OR DE "Positive Psychology" OR DE "Psychology of Women" OR DE "Self Psychology"	77 213
5. DE "Social Casework" OR DE "Social Group Work"	15 209
6. DE "Psychodiagnostic Interview" OR DE "Diagnostic Interview Schedule" OR DE "Structured Clinical Interview"	2 652
7. DE "Empirical Methods" OR DE "Experimental Methods" OR DE "Observation Methods"	16 834
8. DE "Social Services" OR DE "Community Services" OR DE "Outreach Programs" OR DE "Protective Services"	23 784
9. S3 OR S4 OR S5 OR S6 OR S7 OR S8	151 041
10. S2 OR S9	2 507 540
11. DE "Literature Review" OR (TX "literature review" OR "systematic review" OR review)	495 285
12. S1 AND S10 AND S11	1 442



SocIndex via Ebsco 2015-11-30

Title: Systematic reviews assessing age assessment

Search terms	Items found
1. TX age assessment* OR assessing age OR assessing chronological age OR age determin* OR determin* age OR age diagnos* OR age estimat* OR estimat* age OR age verification* OR verifying age OR age measur* OR measuring age	8,495
2. TX review OR "literature review" OR "systematic review"	1,015,003
3. S1 AND S2	4,259

ProQuest (Social Services Abstracts, Sociological Abstracts – 2015-11-30)

Title: Systematic reviews assessing age assessment

Search terms	Items found
1. ab(age assessment* OR assessing age OR assessing chronological age OR age determine* OR determine* age OR age diagnose* OR age estimate* OR estimate* age OR age verification* OR verifying age OR age measure* OR measure* age)	
2. (SU.EXACT("Literature Reviews") OR SU.EXACT("Review/Reviews"))	
3. S1 AND S2	344

Scopus 2015-11-30

Title: Systematic reviews assessing age assessment

Search terms	Items found
1. age assessment* OR assessing age OR assessing chronological age OR age determin* OR determin* age OR age diagnos* OR age estimat* OR estimat* age OR age verification* OR verifying age OR age measur* OR measuring age	73



Search II: The search for studies assessing non-radiological methods for age assessment.

PubMed via NLM 2016-02-12

Title: Age assessment of child refugees

Search terms	Items found
Age	
1. (personality assessment[MeSH Terms] OR psychology[MeSH Terms] OR psychiatry[MeSH Terms] OR social work[MeSH Terms] OR interview, psychological[MeSH Terms] OR behavior observation techniques[MeSH Terms] OR observation[MeSH Terms] OR forensic medicine[MeSH Terms]) OR (assess*[TiAb] OR estimat*[TiAb] OR measur*[TiAb] OR inspect*[TiAb] OR examin*[TiAb] OR determ*[TiAb] OR recogni*[TiAb] OR diagnos*[TiAb] OR verif*[TiAb] OR observ*[TiAb] OR interview*[TiAb] OR test[TiAb] OR tests[TiAb] OR testing[TiAb])	
2. age[Title] OR ages[Title] OR legally relevant age[Title] OR legal age[Title] OR chronological age[Title] OR sexual age[Title] OR sexual maturation[MeSH Terms] OR sexual maturation[Title] OR sex characteristic[Title] OR sex characteristics[Title] OR puberty[Title] OR biological age[Title] OR maturity[Title] OR maturation[Title] OR maturity indicator[Title] OR maturity indicators[Title] OR body measure[Title] OR body measures[Title] OR body measurement[Title] OR body measurements[Title] OR somatic maturity[Title] OR somatic maturation[Title] OR height[Title] OR weight[Title] OR bmi[Title] OR body mass index[Title]	
Child	
3. Child"[Mesh] OR "Adolescent"[Mesh] OR "Minors"[Mesh] OR "Adult Children"[Mesh] OR child*[TiAb] OR young[TiAb] OR youth[TiAb] OR adolescen*[TiAb] OR minor*[TiAb] OR teen*[TiAb]	
Refugee	
4. Unaccompanied[TiAb]	
5. "Emigrants and Immigrants"[Mesh] OR immigrant*[TiAb]	
6. Asylum[TiAb]	
7. Refugees"[Mesh] OR Refuge*[TiAb]	
8. Undocumented Immigrants"[Mesh]	
Combinations:	
9. 3 AND 4	
10. 3 AND 5	
11. 3 AND 6	
12. 3 AND 7	
13. 3 AND 8	
14. 9 OR 10 OR 11 OR 12 OR 13	
15. 1 AND 2 AND 14	274

The search result, usually found at the end of the documentation, forms the list of abstracts.

[MeSH] = Term from the Medline controlled vocabulary, including terms found below this term in the MeSH hierarchy

[TiAb] = Title or abstract

[T] = Title

* = Truncation



PsycInfo via Ebsco 2016-02-12
Title: Age assessment of child refugees

Search terms		Items found
Assessment		
1.	DE "Personality Measures" OR DE "Psychology" OR DE "Forensic Psychology" AND DE "Psychiatry" OR DE "Forensic Psychiatry" OR DE "Social Casework" OR DE "Interviews"	69 054
2.	TX assess* OR estimat* OR measur* OR inspect* OR examin* OR determ* OR recogni* OR diagnos* OR verif* OR observ* OR interview* OR test OR tests OR testing	2 496 321
3.	1 OR 2	2 523 015
Age		
4.	TI age OR ages OR "legally relevant age" OR "legal age" OR "chronological age" OR "sexual age" OR "sexual maturation" OR "sexual maturity" OR "sex characteristic" OR "sex characteristics" OR puberty OR "biological age" OR maturity OR maturation OR "maturity indicator" OR "maturity indicators" OR "body measure" OR "body measures" OR "body measurement" OR "body measurements" OR "somatic maturity" OR "somatic maturation" OR height OR weight OR bmi OR "body mass index"	64 999
5.	DE "Chronological Age" OR DE "Physical Maturity" OR DE "Emotional Maturity"	1 648
6.	4 OR 5	65 931
Child		
7.	TX child* OR young OR youth OR adolescen* OR minor* OR teen*	1 355 176
Refugee		
8.	TX Unaccompanied	624
9.	DE "Refugees" OR TX refugee*	6 438
10.	DE "Immigration" OR TX immigration OR TX immigrant*	26 860
11.	DE "Political Asylum" OR DE "Asylum Seeking" OR TX asylum	3 205
Combinations:		
12.	7 AND 8	370
13.	7 AND 9	3263
14.	7 AND 10	1 5107
15.	7 AND 11	920
16.	12 OR 13 OR 14 OR 15	17 939
17.	3 AND 6 AND 16	205

The search result, usually found at the end of the documentation, forms the list of abstracts.

[DE] = Term from the PsycInfo

[TI] = Title

[TX] = Text word

* = Truncation



SocIndex via Ebsco 2016-02-12
Title: Age assessment of child refugees

Search terms		Items found
Assessment		
1.	DE "PERSONALITY assessment" OR DE "PSYCHOLOGY" OR DE "FORENSIC psychiatry" OR DE "FORENSIC sociology" OR DE "INTERVIEWING" OR DE "SOCIAL services"	83 265
2.	TX (assess* OR estimat* OR measur* OR inspect* OR examin* OR determ* OR recogni* OR diagnos* OR verif* OR observ* OR interview* OR test OR tests OR testing)	1 132 664
Combined		
3.	1 OR 2	1 142 561
Age		
4.	TI (age OR ages OR "legally relevant age" OR "legal age" OR "chronological age" OR "sexual age" OR "sexual maturation" OR "sexual maturity" OR "sex characteristic" OR "sex characteristics" OR puberty OR "biological age" OR maturity OR maturation OR "maturity indicator" OR "maturity indicators" OR "body measure" OR "body measures" OR "body measurement" OR "body measurements" OR "somatic maturity" OR "somatic maturation" OR height OR weight OR bmi OR "body mass index")	20 811
5.	DE "AGE" OR DE "PUBERTY" OR DE "MATURATION (Psychology)" OR DE "CHILD development" OR DE "CHILD psychology" OR DE "DEVELOPMENTAL psychology" OR DE "ADOLESCENT psychology"	27 757
6.	4 OR 5	46 851
Child		
7.	DE "CHILDREN" OR DE "YOUTH" AND DE "TEENAGERS" OR DE "ADOLESCENCE" OR DE "YOUNG adults"	44 218
8.	TX (child* OR young OR youth OR adolescen* OR minor* OR teen*)	722 552
9.	7 OR 8	722,552
Refugee		
10.	TX Unaccompanied	2 433
11.	DE "REFUGEES" OR TI refugee*	6 756
12.	DE "IMMIGRANTS" OR TI immigration OR TI immigrant*	25 338
13.	DE "POLITICAL refugees" OR TI asylum	1 939
Combinations:		
14.	9 AND 10	2 271
15.	9 AND 11	2 678
16.	9 AND 12	11 975
17.	9 AND 13	764
18.	14 OR 15 OR 16 OR 17	16 288
19.	3 AND 6 AND 18	296

The search result, usually found at the end of the documentation, forms the list of abstracts.

[DE] = Term from the PsycInfo
[TI] = Title
[TX] = Text word
* = Truncation



ProQuest – Social Services Abstracts, Sociological Abstracts, 2016-02-12
Title: Age assessment of child refugees

Search terms	Items found
Assessment	
1. ((SU.EXACT("Personality Measures") OR SU.EXACT("Psychology") OR SU.EXACT("Forensic Psychiatry") OR SU.EXACT("Interviews")) OR ti(assess* OR estimate* OR measure* OR inspect* OR examine* OR deter* OR recognize* OR diagnose* OR verify* OR observe* OR interview* OR test OR tests OR testing))	
Age	
2. ((SU.EXACT("Age") OR SU.EXACT("Puberty") OR SU.EXACT("Psychological Development") OR SU.EXACT("Child Development") OR SU.EXACT("Adolescent Development")) OR ab(age OR ages OR "legally relevant age" OR "legal age" OR "chronological age" OR "sexual age" OR "sexual maturation" OR "sexual maturity" OR "sex characteristic" OR "sex characteristics" OR puberty OR "biological age" OR maturity OR maturation OR "maturity indicator" OR "maturity indicators" OR "body measure" OR "body measures" OR "body measurement" OR "body measurements" OR "somatic maturity" OR "somatic maturation" OR height OR weight OR bmi OR "body mass index"))	
Barn	
3. (SU.EXACT("Children") OR SU.EXACT("Adolescents") OR SU.EXACT("Young Adults"))	
4. ab(child* OR young OR youth OR adolescent* OR minor* OR teen*) OR	
5. 3 OR 4	
Refugee	
6. ab(Unaccompanied)	2 433
7. SU.EXACT("Refugees") OR ab(refugee*)	6 756
8. SU.EXACT("Immigration") OR SU.EXACT("Immigrants") OR SU.EXACT("Undocumented Immigrants") OR ab(immigrant*) OR ab(immigration)	25 338
9. SU.EXACT("Asylum") OR ab(asylum)	1 939
Combinations:	
10. 5 AND 6	2 271
11. 5 AND 7	2 678
12. 5 AND 8	11 975
13. 5 AND 9	764
14. 10 OR 11 OR 12 OR 13	16 288
Limits: Peer reviewed	
15. 1 AND 2 AND 14	223

The search result, usually found at the end of the documentation, forms the list of abstracts.

[SU.EXACT] = Term from the ProQuest Thesaurus
 [ti] = Title
 [ab] = Text word
 * = Truncation



Referenser

1. Förenta nationerna (FN). Barnkonventionen. FN:s konvention om barnets rättigheter. 1989.
2. European Parliament Resolution. Multi-annual programme 2010-2014 regarding the area of freedom, security and justice (Stockholm programme). Available via European Parliament Resolution. <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P7-TA-2009-0090+0+DOC+XML+V0//EN>
Nedladdad 2016-10-24.
3. Migrationsverket. Assessment of your age as a part of your identity. Last updated: November 11, 2015. Available via: <http://www.migrationsverket.se/English/Private-individuals/Protection-and-asylum-in-Sweden/Children-seeking-asylum/Without-parents/Application-for-asylum/Age-assessment.html>.
4. Hjern A, Ascher A. Svårt att säkert fastställa ålder hos asylsökande barn. Medicinska metoder håller inte måttet – psykosocial bedömning bör prövas. Läkartidningen. 2015;112:DRFZ.
5. Socialstyrelsen. Medicinsk åldersbedömning för barn i övre tonåren. 2012-06-26. Dnr 31156/2011. Artikelnummer: 2012-6-54.
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7. Svenska Läkaresällskapet. I debatten: Åldersbedömning av ensamkommande flyktingbarn. Tillgänglig via: <http://www.sls.se/Aktuellt/Debatt/Aldersbedomning-av-ensamkommande-flyktingbarn/>
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9. Marshall WA, Tanner JM. Variations in pattern of pubertal changes in girls. Arch Dis Child 1969;44:291-303.
10. Marshall WA, Tanner JM. Variations in the pattern of pubertal changes in boys. Arch Dis Child 1970;45:13-23.
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12. Garamendi PM, Landa MI, Ballesteros J, Solano MA. Reliability of the methods applied to assess age minority in living subjects around 18 years old. A survey on a Moroccan origin population. Forensic Sci Int 2005;154:3-12.
13. 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;102:17-42.



14. Santoro V, De Donno A, Marrone M, Campobasso CP, Introna F. Forensic age estimation of living individuals: a retrospective analysis. *Forensic Sci Int* 2009;193:129.e1-4.
15. Australian Human Rights Commission. An age of uncertainty. Inquiry into the treatment of individuals suspected of people smuggling offences who say that they are children (2012).
16. Association of Directors of Children's Services (ADCS). Age assessment guidance. Guidance to assist social workers and their managers in undertaking age assessments in England. October 2015.



Appendix 1 – Studies excluded after review of the full text article.

Search I: The broad search for systematic reviews assessing any method for age assessment

Excluded studies	Reason for exclusion
Association of Directors of Children's Services (ADCS). Age assessment guidance. Guidance to assist social workers and their managers in undertaking age assessments in England. October 2015.	Grey literature (mentioned in the response [15])
Unicef. Age assessment practices: a literature review & annotated bibliography (2011).	Grey literature (mentioned in the response [7])
Australian Human Rights Commission. An age of uncertainty. Inquiry into the treatment of individuals suspected of people smuggling offences who say that they are children (2012).	Grey literature (mentioned in the response [14])
Age assessments of asylum seekers. Children & Young People Now (Haymarket Business Publications Ltd), 2010; 027-27.	News article
Age assessments for those seeking asylum. Children & Young People Now (Haymarket Business Publications Ltd), 2010; 026-27.	News article
Care for unaccompanied asylum-seeking children. Children & Young People Now (Haymarket Business Publications Ltd), 2011; 027-27.	News article
Dispute over the age of an asylum seeker. Children & Young People Now (Haymarket Business Publications Ltd), 2011; 031-31.	News article/case report
Ayiomamitis A. Effects of Age Misstatement. American Journal of Public Health, 1987; 77:1355-56.	Letters to the editor
Bronstein R. Social Work with Unaccompanied Asylum-Seeking Children. Children & Society, 2007; 21 (4): 322-23.	Book Review
Chandiramani R. Ruling will help to safeguard asylum seekers. Children & Young People Now (Haymarket Business Publications Ltd), 2008; 017-17.	News article
Chase E. Agency and Silence: Young People Seeking Asylum Alone in the UK. British Journal of Social Work, 2010; 40 (7): 2050-68.	Study question not addressed
Cooper S. X-rays considered in asylum reforms. Children & Young People Now (Haymarket Business Publications Ltd), 2008; 09-9.	Wrong intervention: radiology
Crawley H. 'Asexual, Apolitical Beings': The Interpretation of Children's Identities and Experiences in the UK Asylum	Study question not addressed



System. Journal of Ethnic & Migration Studies, 2011; 37 (8): 1171-84.	
Dorling K. Age assessment cases: a culture of disbelief? Children & Young People Now (Haymarket Business Publications Ltd), 2011;28-29.	Non-systematic review
Driscoll J. WHEN IS A CHILD NOT A CHILD? ASYLUM, AGE DISPUTES AND THE PROCESS OF AGE ASSESSMENT. Child & Family Law Quarterly, 2008; 20 (1): 125-27.	Book review
Edelbrock C, Costello AJ, Dulcan MK, Kalas R, Conover NC. Age Differences in the Reliability of the Psychiatric Interview of the Child. Child Development, 1985; 56 (1): 265-75.	Study question not addressed
Garamendi PM, Landa MI, Ballesteros J, Solano MA. Reliability of the methods applied to assess age minority in living subjects around 18 years old: A survey on a Moroccan origin population. Forensic Science International, 1543-12.	Wrong intervention: radiology The non-radiological elements are mentioned in the Response [14].
Hunter EJ, Ferguson SH, Newman CA. Listener estimations of talker age: A meta-analysis of the literature. Logoped Phoniatr Vocol, 2015;1-5.	Study question not addressed
Introna F, Campobasso CP. Biological vs legal age of living individuals. Forensic Anthropology and Medicine: Complementary Sciences From Recovery to Cause of Death, 2006; 057-82.	Non-systematic review
Kane S. On New Ground: Supporting Unaccompanied Asylum-seeking Children and Young People. Audio Series 9. Children & Society, 2007; 21 (1): 80-81.	Book review
Kranioti EF, Paine RR. Forensic Anthropology in Europe: An assessment of current status and application. Journal of Anthropological Sciences, 2011; 8971-92.	Study question not addressed
Learner S. Asylum seekers' age under scrutiny. Children & Young People Now (Haymarket Business Publications Ltd), 2008; 014-14.	News article
McCormack H. Social workers could face Children Act conflict over mooted age check. Community Care, 2006; 0 (1617): 6-6.	News article
McCormack H. Campaigners fear desire to control costs will override children's needs. Community Care, 2006; 0 (1618): 18-19.	News article
Mitchell F. The social services response to unaccompanied children in England. Child & Family Social Work, 2003; 8 (3): 179.	Non-systematic review
Moyse E. Age estimation from faces and voices: A review. Psychologica Belgica, 2014; 54 (3): 255-65.	Non-systematic review
Moyse E, Brédart S. An own-age bias in age estimation of faces. European Review of Applied Psychology / Revue Européenne de Psychologie Appliquée S2- Revue de Psychologie Appliquée, 2012; 62 (1): 3-7.	Study question not addressed



Newbigging K, Thomas N. Good Practice in Social Care for Refugee and Asylum-seeking Children. <i>Child Abuse Review</i> , 2011; 20 (5): 374-90.	Study question not addressed
Rhodes MG. Age estimation of faces: A review. <i>Applied Cognitive Psychology S2- Human Learning: Journal of Practical Research & Applications</i> , 2009; 23 (1): 1-12.	Non-systematic review
Stathopulu E, Hulse JA, Canning D. Difficulties with Age Estimation of Internet Images of South-East Asian Girls. <i>Child Abuse Review</i> , 2003; 12 (1): 46-57.	Study question not addressed
Taylor A. 'Asylum review makes sense'. <i>Community Care</i> , 2006; 0 (1633): 16-16.	News article



Appendix 2 – Studies excluded after review of the full text article.

Search II: The search for studies assessing non-radiological methods for age assessment.

Excluded studies	Reason for exclusion
Directors doubt age judgement accuracy. Community Care, 2003; 0 (1482): 9.	News article
NO WAY TO TREAT CHILDREN. Community Care, 2006; 0 (1617): 5-5.	Editorial
Helping unaccompanied asylum-seeking children. Community Care, 2008; 0 (1718): 24-25.	News article
Age dispute puts asylum seeker on the streets. Community Care, 2009; 0 (1788): 22-23.	Case study – wrong study design
Age assessments of asylum seekers. Children & Young People Now (Haymarket Business Publications Ltd), 2010; 027-27.	News article
Age assessments for those seeking asylum. Children & Young People Now (Haymarket Business Publications Ltd), 2010; 026-27.	News article
Age ruling could hit councils. Community Care, 2010; 0 (1804): 4-4.	News article
LEGAL REPORT ASSESSMENT OF A YOUNG PERSON'S AGE. Children & Young People Now (Haymarket Business Publications Ltd), 2010; 013-13.	Case report – wrong study design
Dispute over the age of an asylum seeker. Children & Young People Now (Haymarket Business Publications Ltd), 2011; 031-31.	News article – case report
Abbing HD. Age determination of unaccompanied asylum seeking minors in the European Union: a health law perspective. Eur J Health Law, 2011; 18 (1): 11-25.	Non-systematic descriptive article
Aynsley-Green A. Unethical age assessment. Br Dent J, 2009; 206 (7): 337.	Letter to the editor
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; 10217-42.	Non-systematic descriptive article (mentioned in Response [12]).
Bassed R, Ranson D. Age determination of asylum seekers and alleged people smugglers. J Law Med, 2012; 20 (2): 261-5.	Editorial
Bassed RB. Advances in forensic age estimation. Forensic Sci Med Pathol, 2012; 8 (2): 194-6.	Editorial



Benson J, Williams J. Age determination in refugee children. <i>Aust Fam Physician</i> , 2008; 37 (10): 821-5.	Case reports
Cemlyn SJ, Nye M. Asylum seeker young people: Social work value conflicts in negotiating age assessment in the UK. <i>International Social Work</i> , 2012; 55 (5): 675-88.	Non-systematic descriptive article
De Donno A, Roca R, Introna F, Santoro V. A case of an adoptive girl with precocious puberty: the problem of age estimation. <i>Forensic Sci Int</i> , 2013; 231 (1): 400.e1-4.	Case report
Dyer C. Judge criticises paediatrician for claiming to know how to assess age of asylum seekers. <i>Bmj</i> , 2011; 342d3816.	News article
Ferrante L, Skrami E, Gesuita R, Cameriere R. Bayesian calibration for forensic age estimation. <i>Stat Med</i> , 2015; 34 (10): 1779-90.	Wrong intervention: radiology
Focardi M, Pinchi V, De Luca F, Norelli GA. Age estimation for forensic purposes in Italy: ethical issues. <i>Int J Legal Med</i> , 2014; 128 (3): 515-22.	Study question not addressed: ethical aspects
Garamendi PM, Landa MI, Ballesteros J, Solano MA. Reliability of the methods applied to assess age minority in living subjects around 18 years old. A survey on a Moroccan origin population. <i>Forensic Sci Int</i> , 2005; 154 (1): 3-12.	Primarily covers radiological methods. The non-radiological elements are mentioned in the Response [14].
Gower S. How old are you? Ethical dilemmas in working with age-disputed young asylum seekers. <i>Practice: Social Work in Action</i> , 2011; 23 (5): 325-39.	Non-systematic descriptive article
Hjern A, Brendler-Lindqvist M, Norredam M. Age assessment of young asylum seekers. <i>Acta Paediatr</i> , 2012; 101 (1): 4-7.	Viewpoint article
Jayaraman J, Roberts GJ, Wong HM, McDonald F, King NM. Ages of legal importance: Implications in relation to birth registration and age assessment practices. <i>Med Sci Law</i> , 2016; 56 (1): 77-82.	Non-systematic descriptive review
Kenny C. Lone asylum children denied full support as disputes over age rise. <i>Community Care</i> , 2004; 0 (1538): 10-10.	News article
Kurtzke JF, Dean G, Botha DP. A method for estimating the age at immigration of white immigrants to South Africa, with an example of its importance. <i>S Afr Med J</i> , 1970; 44 (23): 663-9.	Study question not addressed
Learner S. Asylum seekers' age under scrutiny. <i>Children & Young People Now</i> (Haymarket Business Publications Ltd), 2008; 014-14.	News article
Little M, Axford N, Morpeth L. Children's Services in the UK 1997-2003: Problems, Developments and Challenges for the Future. <i>Children & Society</i> , 2003; 17 (3): 205-14.	Non-systematic descriptive article
Mackay IRA, Flege JE, Imai S. Evaluating the effects of chronological age and sentence duration on degree of perceived foreign accent. <i>Applied Psycholinguistics</i> , 2006; 27 (2): 157-83.	Study question not addressed



Mather M. Determining the age of children: another paediatric point of view. <i>Adoption & Fostering</i> , 2006; 30 (1): 81-83.	Letter
McCormack H. Social workers could face Children Act conflict over mooted age check. <i>Community Care</i> , 2006; 0 (1617): 6-6.	News article
Michie C. Age assessment: time for progress? <i>Archives of Disease in Childhood</i> , 2005; 90 (6): 612-13.	Non-systematic descriptive review
Nuzzolese E, Solarino B, Liuzzi C, Di Vella G. Assessing chronological age of unaccompanied minors in southern Italy. <i>Am J Forensic Med Pathol</i> , 2011; 32 (3): 202-7.	Case report
Pruvost MO, Boraud C, Chariot P. Skeletal age determination in adolescents involved in judicial procedures: from evidence-based principles to medical practice. <i>J Med Ethics</i> , 2010; 36 (2): 71-4.	Wrong intervention: radiology
Rudolf E, Kramer J, Gebauer A, Bednar A, Recsey Z, Zehetmayr J, et al. Standardized medical age assessment of refugees with questionable minority claim-a summary of 591 case studies. <i>Int J Legal Med</i> , 2015; 129 (3): 595-602.	Wrong intervention: radiology
Santoro V, De Donno A, Marrone M, Campobasso CP, Introna F. Forensic age estimation of living individuals: a retrospective analysis. <i>Forensic Sci Int</i> , 2009; 193 (1): 129.e1-4.	Case study, mentioned in this response [13].
Schmeling A, Reisinger W, Geserick G, Olze A. Age estimation of unaccompanied minors. Part I. General considerations. <i>Forensic Sci Int</i> , 2006; 159S61-4.	Non-systematic descriptive review
Schmidt S, Knuferrmann R, Tsokos M, Schmeling A. [Forensic age determination in living individuals at the Institute of Legal Medicine in Berlin (Charite): analysis of the expert reports from 2001 to 2007]. <i>Arch Kriminol</i> , 2009; 224 (5): 168-76.	Language: German
Sironi E, Pinchi V, Taroni F. Probabilistic age classification with Bayesian networks: A study on the ossification status of the medial clavicular epiphysis. <i>Forensic Sci Int</i> , 2016; 25881-7.	Wrong intervention: radiology
Thevissen PW, Kvaal SI, Willems G. Ethics in age estimation of unaccompanied minors. <i>J Forensic Odontostomatol</i> , 2012; 3084-102.	Study question not addressed: ethical aspects
Wallace C. Courts to settle age dispute cases. <i>Children & Young People Now</i> (Haymarket Business Publications Ltd), 2008; 01-1.	News article