2018

REPORT

SYSTEMATIC REVIEW:

Age estimation in adolescents and young adults by psychological assessment of maturity

Table of contents

Key messages

Age estimation of individuals with unknown age has been of considerable interest in forensic practice and research. The assessment of physical developmental stages constitutes the basis for medical age assessments. In addition to the biological changes, psychological development is often associated with chronological age in normal human development. This systematic review aimed to summarize the evidence of using psychological maturity tests for chronological age assessment in adolescents and young adults.

After a systematic literature search, we screened 3325 titles and abstracts. We considered seven references as potentially relevant and read them in full-text. However, none of the references met our inclusion criteria.

Therefore, there appears to be no available research evidence on the application and validity of psychological maturity tests for chronological age assessment in adolescents and young adults.

Executive summary

Introduction

Every year, young asylum seekers come to Norway without legal documentation of their chronological age. To ensure that children receive their entitled rights and that adults are not treated as children, it is necessary to estimate their chronological age. Assessments of hand-wrist and third molar teeth using radiographs have been used for age estimation in Norway for years. We have previously published systematic reviews assessing age distribution using radiographs based on the Greulich & Pyle atlas for hand-wrist skeleton, the Demirjian's stages for the third molar teeth, CT and MRI for medial clavicular, knee and ankle ossification. Here we present a systematic review to evaluate the use of psychological tests for age estimation in adolescents and young adults.

Method

We conducted a search for studies in the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, Embase, Google Scholar, PROSPERO and Epistemonikos in May 2018. All available studies that have assessed the psychological maturity for age estimation in people between 10 and 25 years old could be included, regardless of language and study design. Each reference was screened by two authors independently. Studies that were read in full-text but were excluded are listed in a table with the corresponding reason for exclusion.

Results

We found 3325 titles and abstracts for screening. We considered seven references as potentially relevant and read them in full-text. However, none of the references met our inclusion criteria.

Discussion

Several psychological methods have been found to be researched in connection with chronological age, but we did not find any direct measure of using these methods for age estimation.

Conclusion

We have conducted a systematic review to collect evidence of using psychological tests for chronological age estimation in adolescents and young adults. Our systematic literature search did not find any relevant studies that met the research question and the inclusion criteria. There is a lack of research evidence on the application and validity of using psychological test for chronological age estimation in adolescents and young adults.

Hovedbudskap (norsk)

For å sikre at enslige, unge asylsøkere får de rettigheter de har krav på og at voksne ikke behandles som mindreårige, har aldersestimering av ungdom blitt et viktig felt innen rettsmedisinsk forskning og praksis. Vi har oppsummert forskningsbasert dokumentasjon om estimering av kronologisk alder basert på avbildning av hånd, tann, mediale kragebein, kne og ankel. Kronologisk alder er forbundet både med slik fysisk utvikling, og med psykologisk utvikling. Formålet med denne systematiske oversikten var å oppsummere forskning om bruk av psykologiske modenhetstester for å vurdere kronologisk alder hos ungdom og unge voksne.

Et systematisk litteratursøk identifiserte 3325 abstrakter. Vi identifisert sju referanser som potensielt relevante og leste dem i fulltekst. Imidlertid oppfylte ingen av referansene våre inklusjonskriteriene.

Det mangler vitenskapelig dokumentasjon på bruk av psykologiske modenhetstester for å estimere kronologisk alder hos ungdom og unge voksne.

Sammendrag (norsk)

Innledning

Hvert år kommer unge asylsøkere til Norge uten juridisk dokumentasjon på kronologisk alder. Det er nødvendig å fastsette kronologisk alder for å sikre at barn får de rettighetene de har krav på, og for ikke å behandle voksne som barn. I Norge har alder på asylsøkere blitt estimert ved å evaluere modningen av skjelettet i hånd-håndrot og tannutviklingen. Vi har tidligere publisert systematiske oversikter som vurderte aldersfordelingen av forskjellige utviklingsstadier av hånd, tann, mediale kragebein, kne og ankel. Her presenterer vi en systematisk oversikt for å vurdere bruk av psykologiske modenhetstester for aldersvurdering av ungdom og unge voksne.

Metode

Vi søkte etter studier i Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, Embase, Google Scholar, PROSPERO og Epistemonikos i mai 2018. Alle studier kunne bli inkludert om de hadde vurdert psykologisk modenhet for aldersvurdering hos mennesker mellom 10 og 25 år, uavhengig av språk og studiedesign. To av forfatterne vurderte hver referanse uavhengig av hverandre. Studier som ble lest i fulltekst, men som ble ekskludert, ble oppført i en egen tabell med begrunnelse for ekskludering.

Resultat

Vi fant 3325 referanser i søket. Totalt sju potensielt relevante publikasjoner ble vurdert i fulltekst, men ingen av dem oppfylte våre inkluderingskriterier.

Diskusjon

Det finnes noen psykologiske metoder som har vært knyttet til kronologisk aldersvurdering, men vi fant ingen som faktisk hadde validert disse metodene for aldersvurdering.

Konklusjon

Vi har gjennomført en systematisk oversikt om bruk av psykologiske tester for kronologisk aldersvurdering av ungdom og unge voksne. Et systematisk litteratursøk fant ingen relevante studier som oppfylte inkluderingskriteriene våre. Det mangler forskning om anvendelse og validiteten av psykologiske modenhetstester for kronologisk aldersvurdering av ungdom og unge voksne.

Preface

This systematic review aimed to summarize evidence of using psychological tests for chronological age assessment in adolescents and young adults. We have previously published systematic reviews on age assessment by skeletal hand-wrist maturation using the Greulich & Pyle atlas and wisdom teeth formation using Demirjian's grading. And another two systematic reviews using CT and MRI on clavicle, knee and ankle ossification stages.

In parallel with the studies focusing on biological development, we carried out this systematic review to assess the evidence on psychological test for age estimation. Notably, we have chosen to write these systematic reviews as separate documents, but we use consistent texts throughout the documents where relevant.

This project group consisted of:

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Introduction

Age estimation of individuals with unknown age has been of considerable interest in forensic practice and research in many countries, especially related to the movement of young, unaccompanied asylum-seekers (1). From 1 January 2016, the Division of Forensic Sciences at the Norwegian Institute of Public Health, now at the Oslo University Hospital, received the national assignment to take the scientific responsibility for medical age assessment. It was decided to conduct systematic reviews of various methods used for medical age assessment.

There are a number of biological changes as a person grows and develops. The assessment of specific developmental stages constitutes the basis for medical age assessments. Currently, the most widely used methods (2) are based on evaluation of radiographs of hand-wrist and teeth. We recently reviewed the methods based on the Greulich and Pyle atlas (3) and Demirjian's development stages of third molar tooth (4). In addition, we have summarized evidence of age estimation using medial clavicle and knee and ankle ossification with computed tomography (CT) and magnetic resonance imaging (MRI) (5, 6).

In addition to the physical changes, psychological development is often associated with advancing chronological age in normal human development (7). The United Nations High Commissioner for Refugees (UNHCR) suggested that the process of age estimation should never be imposed and must be in accordance with the individual's cultural background: "…such identification measures include age assessment and should not only take into account the physical appearance of the individual, but also his or her psychological maturity" (8). In accordance, psychological assessment of maturity has been performed on children or young people for whom there may be concerns about the legitimacy of their claims to be of a certain age (9, 10). The Norwegian Organization for Asylum Seekers (NOAS) and Save the Children (11) recommends physical and psychosocial assessments for determining age of young, unaccompanied asylum-seekers. However, the performance of these tests are criticized for inaccuracy and difficulties in implementation (12).

The purpose of this systematic review is to assess the evidence of using various methods for psychological maturity assessment in the context of age assessment, and evaluate the quality of such methods in forensic practice of age estimation.

Method

The current project included a systematic literature search for studies focusing on age estimation using psychological test. This systematic review is conducted following the guideline published by the former Norwegian Knowledge Center (13). We used the following specifications:

Inclusion criteria

Study design:	We will include studies regardless of study design if they have assessed the psychological maturity in people with known chronological age.
Population:	Living persons between the age of 10 and 25 years old
Index test:	Psychological maturity tests
Reference test:	Confirmed chronological age
Outcome:	Chronological age and its association to any measure of psychological age (or stage) individually or pooled.
Language:	No language restrictions in the search

Exclusion criteria:

- Studies without full-text (conference abstracts)
- Studies that did not focus on age estimation

Literature search

Research librarian Gyri Hval Straumann created and conducted the literature searches and Marit Johansen peer-reviewed the search strategies. We searched for studies with no limit on study design, publication time, or language in the following databases:

- MEDLINE
- Embase
- Cochrane Central Register of Controlled Trials (CENTRAL)
- Google scholar

- PROSPERO
- Cochrane Library
- Epistemonikos

The search was carried out on 19 May 2018. The search strategies are presented in Appendix 1.

Article selection and assessment

For the literature search, three review authors (GEV, GHS, and KYD) independently screened abstracts identified by the searches. All abstracts were screened in duplicates via the web-application for systematic review: Rayyan (14).

Articles were excluded if the title and/or abstract did not meet the inclusion criteria. For potentially relevant studies, the full-text articles were obtained and screened by two reviewers independently (GEV and KYD), with discrepancies resolved by consensus of reviewers.

Studies that were considered as relevant to the review topic but did not meet all the inclusion criteria for the review were listed in the 'Characteristics of excluded studies' table, with the reason for their exclusion described. We recorded the selection process in sufficient detail to complete a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram.

Risk of bias and data extraction

To evaluate the risk of bias (methodological quality) of included studies, we planned to use a revised QUADAS-2 checklist that has been described in detail in the previous age estimation projects on hand-wrist (3) and third molar teeth (4).

The following information from articles was supposed to be extracted:
- Where and when the study was carried out (country and year)
- Sample selection method
- Age estimation method
- Scoring method
- Study design
- Age range, sex, and sample size

In addition, we planned to extract all other possible information for age estimation.

Analyses

We would have evaluated the heterogeneity of the included studies by looking at population characteristics and psychological test methods. If it had been possible to conduct meta-analysis, we would have used random effects model to pool the data, and evaluated statistical heterogeneity using chi-squared test, where we consider a significance level of p less than 0.10 to indicate heterogeneity. I^2 would also have been used to evaluate the proportion of variation that was due to heterogeneity rather than sampling error.

For dichotomous outcomes, we would have expressed the results as odds ratio (OR) with 95% confidence interval (CI). For continuous outcomes, we would have used mean difference between the groups (MD) with 95% CI, if necessary converted to standardized mean difference (SMD). If the data format had not allowed any calculation, we would have provided a narrative description of the results. If it had not been possible to pool the data, we would have provided a descriptive analysis with presentation of the studies in the text, and in tables with results and quality assessments. Publication bias would have been assessed with Funnel plots and Egger's regression model. The meta-analysis would have been performed using R software (R Core Team, Vienna, Austria; version 3.3.2; using packages "glm", "lme4" and "metafor").

GRADE framework

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool (15) is often used in systematic reviews to rate the quality and certainty of the included evidence. However, the current systematic review is not a typical diagnostic accuracy assessment study, where one presents positive/negative results with sensitivity and specificity analysis. Therefore, evaluating evidence quality by GRADE could not be conducted in the current systematic review.

Results

Results of literature search

We searched electronic databases and registries in May 2018, and identified 3325 titles and abstracts. Among those publications, we considered seven publications as potentially relevant for age estimation using psychological tests.

However, none of the references met our inclusion criteria after checking full-text. Process in detail is described below in Figure 1.
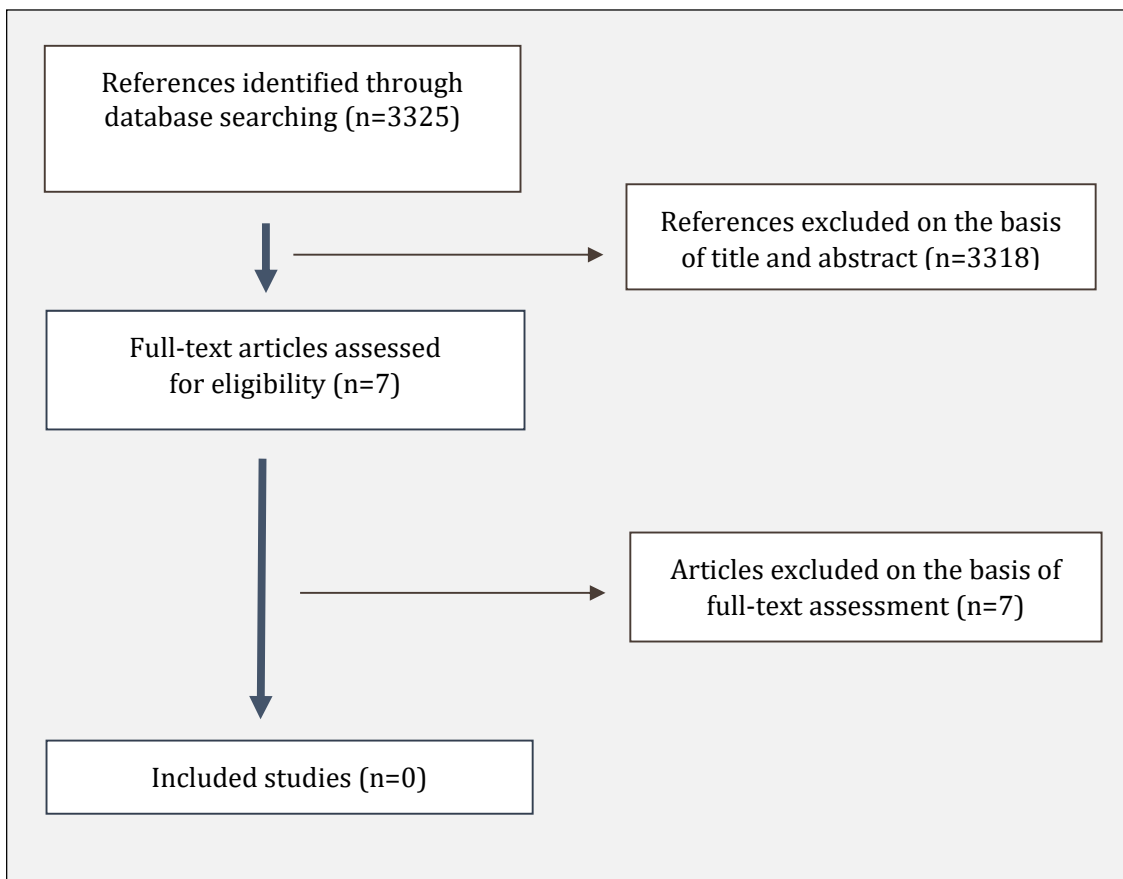

Figure 1*. Flow chart of literature selection*

Excluded studies

Of the seven references obtained in full text, we excluded all of them due to conflicts against the inclusion criteria, or irrelevant psychological methods for age estimation. See the Characteristics of excluded studies table in Appendix 2 for the list of excluded studies with reasons for exclusion.

Discussion

Summary and key findings

We have conducted a systematic review to assess the evidence of using psychological maturity tests for chronological age estimation in adolescents and young adults. After a systematic literature search, we did not find any relevant studies that met the research question and the inclusion criteria. There is a lack of research on the application and validity of using psychological maturity tests for chronological age estimation in adolescents and young adults.

Strengths and limitations

The strength of this systematic review is the systematic and transparent approach that we have used to review the question. We implemented systematic literature searches in many electronic databases, with clear inclusion and exclusion criteria. Two of the authors independently considered each reference according to these criteria. These independent assessments are one of the strengths of this systematic review.

Although we conducted a thorough literature search, we have not searched all databases, and potential relevant studies might not have been identified. A built-in weakness with systematic reviews is that they may become outdated when new studies are published. This systematic review is up-to-date as of May 2018.

Current evidence

Chronological age, biological age and functional age are all considered as aging indicators. Among the studies that we read in full-text, and subsequently excluded, one study focused on biological aging (16), and three studies focused on functional aging (17-19). These studies illustrated various methods or scales of integrating psychological parameters for assessing biological or functional age. Notably, the populations of these studies were mostly adults aged from early 20s to late 70s.

The remaining three studies that we assessed in full-text linked various forms of mental/psychological tests to chronological age. First of all, Juul et al. (20) explored potential association between chronological age and medical knowledge performance using certification and maintenance of certification (MOC) tests, and observed no difference of medical knowledge performance in various age groups. The age range of included population was from 30 – 80 years old. Basic medical knowledge was a prerequisite for such test.

Another study worth to mention is from De Mello et al. (21), published in 1951. The authors used a simplified version of Binet-Simon scale to determine the development of children's intelligence quotient (IQ). Although the study did not show any results that can be utilized, the idea of using IQ test for age estimation is discussed. Mous et al (22) have discussed possible positive association between intelligence and age in young typically developing children (aged from 6-10), but it is not clear if the positive association still exists in late adolescence, which is the relevant age group for the current systematic review, or indeed, if it could be used to guide age assessment. Notably, intelligence is known to be subjective to education, social economic status and maternal intelligence (23). The effects of these factors need to be considered and controlled when assessing individual intelligence.

The last study that we read in full-text aimed to investigate psychological damage caused by natural trauma and human-made disaster in two groups of children and young adults in the US and Germany recently (24). This study did not show any direct measurement on chronological age estimation, but suggested significant stress status in people who suffered from human-made trauma as well as natural disasters. Findings from this study indicated potential psychological struggle among these children and young adults, and highlighted their need for psychological care.

Indeed, immigrant children and adolescents who are investigated are often in an altered psychological state of fear, uncertainty about the future, loss and loneliness (25). Recently, a framework of using psychological test for age estimation in UK has been proposed (9), in which the interviewers ought to assess personal needs, together with cognitive and behavioral development of the respondents. Notably, this suggested framework is only a guideline and needs researching, auditing, validating and standardizing.

Our systematic review confirms the results of a report by the Swedish Agency for Health Technology Assessment and Assessment of Social Services (SBU, 2016) that had a search conducted in 2015 where they searched for all non-radiological methods of age estimation of children and young adults without finding any relevant studies (26).

Conclusion

We conducted a systematic review to assess evidence of using psychological maturity tests for chronological age estimation in adolescents and young adults. After a systematic literature search, we did not find any relevant studies that met the research question and the inclusion criteria. There is lack of research evidence on the application and validity of using psychological tests for chronological age estimation in adolescents and young adults.

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Appendices

Appendix 1. Literature search strategy

Datebase: Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) 1946 to Present
Search date: 2018-05-29
1   ((age adj (determination or estimation or assessment)) and (psych* or test*)).ti. (18)
2   (age adj5 (determinat* or estimat* or assess* or examinat* or verif*)).ti,ab. (46585)
3   Psychological Tests/ (35965)
4   (psych* and (test* or evaluat*)).ti,ab. (197276)
5   3 or 4 (227729)
6   2 and 5 (1319)
7   1 or 6 (1337)

Database: Embase <1974 to 2018 May 25>
Search date: 2018-05-29
1   ((age adj (determination or estimation or assessment)) and (psych* or test*)).ti. (22)
2   age determination/ (5589)
3   (age adj5 (determinat* or estimat* or assess* or examinat* or verif*)).ti,ab. (67109)
4   psychologic test/ (38120)
5   (psych* and (test* or evaluat*)).ti,ab. (297362)
6   2 or 3 (70192)
7   4 or 5 (327424)
8   6 and 7 (2308)
9   1 or 8 (2330)

Database: Cochrane Library
Search date: 2018-29-05
Search result: 650
#1   ((age adj (determination or estimation or assessment)) and (psych* or test*)):ti
#2   (age adj5 (determinat* or estimat* or assess* or examinat* or verif*))
#3   MeSH descriptor: [Psychological Tests] this term only
#4   (psych* and (test* or evaluat*))
#5   #3 or #4
#6   #2 and #5
#7   #1 or #6

Database: Epistemonikos
Search date: 2018-29-05
Search result: 0
((title:("age determination" OR "age estimation" OR "age assessment") OR abstract:("age determination" OR "age estimation" OR "age assessment")) AND (title:("psychological test" OR "psychological tests") OR abstract: ("psychological test" OR "psychological tests")

Database: PROSPERO
Search date: 2018-05-29
age determination: 5
age estimation: 11
age assessment: 12

Database: Google Scholar
Search date:2018-29-05
("age determination" OR "age estimation" OR "age assessment") AND ("psychological test" OR "psychological tests") 165

Appendix 2. Characteristics of excluded studies

Reference	Reason
Anstey KJ, Lord SR, Smith GA. Measuring human functional age: a review of empirical findings. Exp Aging Res. 1996 Jul-Sep;22(3):245-66. Review. PMID: 8872080.	This review summarized evidence of using various parameters (including psychosocial markers) to estimate functional age. But the focus is not chronological age.
De Mello NB. [Abbreviated Binet-Simon scale for the determination of mental age]. Rev Med Mil. 1951 Jul-Dec;40(3-4):243-56. Undetermined Language. PMID: 14921118.	This study used Binet-Simon scale, which is a test for determining the relative development of intelligence, especially for children in different age groups. However, this study did not present any results.
Juul D, Vollmer J, Shen L, Faulkner LR. Comparison of Certification and Recertification Examinee Performance on Multiple-Choice Items in Forensic Psychiatry. J Am Acad Psychiatry Law. 2016 Mar;44(1):91-5. PubMed PMID: 26944748.	This study aimed to find association between age and medical knowledge using certification and maintenance of certification (MOC) tests. However, the participants were from 30 – 80 years old.
Korobeĭnikov HV. [Functional state of the body and mental capability in humans of various ages]. Fiziol Zh. 2001;47(2):87-92. Ukrainian. PMID: 11392121.	This study aimed to examine the difference of functional age, intellectual and cognitive capability among people in five different age groups (13-18, 19-29, 30-39, 40-49, 50-60). There is no data on chronological age estimation.
Kühne KD, Paul W, Köckeritz C, Mikulas J, Schiemann S, Weidinger V. [Determination of biologic aging within the scope of the Halberstadt gerontologic study. 3. Partial Index III (prevailing social area)]. Z Alternsforsch. 1985 Nov-Dec;40(6):351-6. German. PMID: 4082640.	This study was a framework for estimating biological age using Leningrad Assessment Scale. There is no data in the paper. Besides, the focus of this paper is not chronological age.
Myles P, Swenshon S, Haase K, Szeles T, Jung C, Jacobi F, Rath B. A comparative analysis of psychological trauma experienced by children and young adults in two scenarios: evacuation after a natural disaster vs forced migration to escape armed conflict. Public Health. 2018 May;158:163-175. PMID: 29628203.	This study used a standard survey to investigate psychological impact caused by natural trauma and human-made disaster in children and young adults. This study has no data on age estimation.
Ries W, Pöthig D. Chronological and biological age. Exp Gerontol. 1984;19(3):211-6. PubMed PMID: 6479256.	This study suggested a method to estimate people's biological age, using both physical, psychological and social parameters. The age of the population was from early 20s to 70s and above. However, this study did not focus on chronological age.

NIPH