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Kelly K. Anderson

Jordan Edwards

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Age at Migration and the Risk of Psychotic Disorders: A Systematic Review and Meta-Analysis

Kelly K. Anderson[a,b,c] & Jordan Edwards[a,c]

[a] Department of Epidemiology & Biostatistics, Schulich School of Medicine & Dentistry, The University of Western Ontario, London Ontario CANADA
[b] Department of Psychiatry, Schulich School of Medicine & Dentistry, The University of Western Ontario, London Ontario CANADA
[c] Lawson Health Research Institute, London Ontario CANADA

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Correspondence:
Kelly K. Anderson, PhD
Department of Epidemiology & Biostatistics
The University of Western Ontario
1151 Richmond Street, Kresge Building, Room K213
London, ON N6A 5C1
Phone: +1 (519) 661-2111 ext. 81001
Fax: +1 (519) 661-3766
Email: kelly.anderson@schulich.uwo.ca

Abstract

Objective: To conduct a systematic review and meta-analysis of the existing evidence on the association between age at migration and the risk of psychotic disorders.

Methods: Observational studies were eligible for inclusion if they presented data on the association between age at migration and the risk of psychotic disorders among first-generation migrant groups. We used two random effects meta-analyses to pool effect estimates for each stratum of age at migration relative to (i) a native-born reference category; and (ii) the youngest age stratum (0 to 2 years).

Results: Ten studies met inclusion criteria and five were included in the meta-analysis. The risk of psychotic disorder among people who migrate prior to age 18 is nearly twice as high as the native-born population, with no evidence of effect modification by age strata. People who migrate during early adulthood (19 to 29 years) have a similar risk of psychotic disorder as the native-born population (IRR=0.93, 95%CI=0.60,1.44), and a lower risk relative to those who migrate during infancy (0 to 2 years) (IRR=0.58, 95%CI=0.33,1.04).

Conclusions: Migrant status is one of few well-established risk factors for psychotic disorder, yet we have limited understanding of the underlying etiology. The findings of this review advance our understanding of this association, and identify high-risk groups to target for intervention.

PROSPERO Registration: CRD42019121386

Keywords: incidence; psychotic disorders; emigrants and immigrants; refugees

Summations

- We found that people who migrated prior to age 18 had nearly twice the risk of psychotic disorder, relative to the native-born population. This may suggest that exposure to the stressors of international migration have a greater impact during childhood and adolescence; alternatively, this may be due to differential help-seeking behaviours or the cumulative effects of post-migration stressors among those who have resided in the country for longer periods of time.
- We also found that people who migrated during early adulthood were at a lower risk of psychotic disorder, relative to those who migrated during infancy. This could reflect a process of *positive* selective migration, whereby people who migrate during early adulthood are partially or fully through the risk period for illness onset at the time of migration.

Limitations

- Included studies varied greatly in terms of the migrant context, and factors such as local migration policies, types of migrant groups, and migrant acculturation would be expected to differ considerably across the countries and time periods represented in this review.
- The pooled effect estimates have not been adjusted for important confounding factors.
- Data suitable for meta-analysis were not available from all included studies.

Data Availability

Available from the study authors on request.

Background

International migration is a well-established risk factor for psychotic disorders – although only studied in a minority of countries worldwide, evidence from systematic reviews and meta-analyses suggest that some migrant groups have a two- to four-fold greater risk of these conditions, relative to the host population, with the magnitude of risk varying by country of origin and host country.[1–3] However, less is known regarding socio-demographic factors that modify the risk of psychotic disorders within migrant groups. The most consistently studied risk factor is country of origin, with migrants from countries where the population is predominantly Black,[1–3] as well as migrants originating from low- and middle-income countries,[1,3] having markedly higher risk. There is also evidence that migrants who settle in more socio-economically advantaged areas have nearly half the risk of psychotic disorder, relative to those who settle in the most disadvantaged areas,[4] whereas other research suggests that settling in disadvantaged areas with high ethnic density may confer some protection against the development of psychosis.[5] Other studies have highlighted the role of refugee status as a putative factor,[4,6] and emerging evidence suggests sex-specific differences in the effect of family capital during migration on the risk of psychotic disorder.[7] Gaining a greater understanding of these key risk factors for psychotic disorders within migrant groups is crucial for informing prevention and early intervention efforts, as well as gaining a better understanding of the underlying etiology.

Across the total body of literature on the association between migration and psychotic disorders, only a subset of studies have examined the role of age at migration on the risk of developing psychosis, with heterogeneous findings across studies. However, nearly all studies have compared each strata of age at migration to a general population comparison group, with little assessment of whether the risk differs significantly by age within migrant groups. There is reason to believe that age at migration might

be a significant risk factor for psychotic disorders based on studies conducted in other populations. For example, it has been shown that residential mobility during the "sensitive period" of childhood and adolescence is associated with an increased risk for psychotic disorders, with a larger magnitude of effect for moves of longer distance that would likely necessitate a disruption in social networks.[8] Additionally, some studies suggest that younger age at migration is a risk factor for mood disorders, anxiety disorders, substance use disorders, and suicidality among migrant groups.[9] Thus, a more comprehensive assessment of the role of age at migration on the risk of psychotic disorders is warranted.

Aims of the Study

The objective of this study was to: (i) conduct a systematic review of the existing evidence on the association between age at migration and the risk of psychotic disorders among first-generation migrant groups; (ii) compute pooled effect estimates comparing the risk of psychotic disorder for each stratum of age at migration, relative to the native-born population; and (iii) conduct a within-migrant meta-analysis of available estimates to ascertain whether the risk of psychotic disorders varies across the age at migration strata. These meta-analyses will enable us to assess whether the risk of psychotic disorders differs significantly across the strata for age at migration by increasing the available sample for within-migrant analyses, as prior studies were limited in their ability to explore this effect modification. We hypothesized that migration during infancy and early childhood would be associated with the highest risk of psychotic disorder.

Methods

The protocol for this systematic review was pre-registered with PROSPERO (CRD42019121386)[10] after completing study screening but prior to data extraction, and objective ii represents a deviation from the registered protocol. We followed the PRISMA reporting guidelines for systematic reviews and meta-analyses (Online Supplement 1).[11]

We conducted an electronic search of the MEDLINE (1946 to 2019), EMBASE (1947 to 2019), and PsycINFO (1967 to 2019) databases using the OVID platform, and we searched controlled vocabulary and keywords for the following concepts: Psychosis AND Migration/Immigration AND Age (Online Supplement 2). We limited the search to studies published after 1975, as this was the timepoint cited by related reviews when the association between migration and psychosis began to be more rigorously studied.[1] We located additional studies by searching the reference lists of prior systematic reviews on the association between migration and psychotic disorders,[1–3] by searching grey literature in the Dissertations & Theses database, and by conducting forward and backward citation tracing for studies included in the current review. The literature search was conducted in January 2019.

Studies were included in our review if they met the following inclusion criteria: (i) the study focused on first-generation migrant groups; (ii) the study examined the risk of any type of psychotic disorder as a function of the age at migration; and (iii) the study used an observational design and was published after 1975. We excluded non-peer-reviewed articles, book chapters, review articles, and editorials – of exception, dissertations or research letters presenting primary data were included. We did not impose any restrictions on language of publication. Title and abstract screening (level 1) were done by one reviewer and was kept broad and inclusive to avoid errors, and full-text screening (level 2) was conducted by two independent reviewers.

Two independent reviewers also extracted data from included studies using a data extraction form developed and pilot tested *a priori* to record information about the methods and results of each included study. We extracted data on study characteristics, sample characteristics, measurement of the exposure (age at migration) and outcome (psychotic disorder diagnosis) variables, and measures of effect between age at migration and psychosis. One study also included non-psychotic bipolar disorder as part of the case definition,[12] however data were extracted for psychotic disorders only. The two reviewers also assessed the risk of bias using an adapted version of the CLARITY tool,[13] which is a domain-based assessment tool that evaluates the risk of bias for observational studies across seven domains: external validity, selection bias, exposure classification, outcome classification, assessment of confounding, measurement of confounding factors, and missing data (Table 1). Any discrepancies between reviewers in screening, data extraction, or risk of bias assessment were resolved by discussion and consensus.

We synthesized the data descriptively to summarize characteristics of the included studies and key findings. The studies differed in the comparison groups used to compute effect estimates, with some studies using a general population comparison group and others comparing across age strata; therefore, studies were included in the meta-analysis if they presented numerator and denominator data for the native-born population (includes both non-migrants and second-generation migrants), and for each stratum of age at migration, or if these data could be obtained from the corresponding author. The studies additionally differed in the age strata used (Table 2) – in order to obtain consistent age strata across the studies, we assumed that the risk was homogenous within each of the age strata used in the primary studies, and divided the numerator and denominator by the number of years of the stratum. This allowed us reclassify cases and person-time denominators for each year of age at migration to

obtain consistent age strata across the studies. We reclassified the age strata based on the classifications used by Dykxhoorn and colleagues reflecting key developmental periods,[12] including: infancy (0 to 2 years), early childhood (3 to 6 years), middle childhood (7 to 12 years), adolescence (13 to 18 years), and early adulthood (19 to 29 years).

The meta-analyses were conducted using Stata/IC 15.0 (StataCorp LP, College Station, Texas USA). We used the *metan* command to calculate incidence rate ratios (IRR) and 95% confidence intervals (CI) comparing each stratum of age at migration to both the native-born population and to the youngest age stratum (0 to 2 years) – this age stratum was chosen because the upper bound of the age range varied across studies, preventing the use of an older age stratum as the reference category. We used random effects models to compute the pooled estimates due to a high degree of methodological and contextual heterogeneity across the studies.[14] Statistical heterogeneity was explored using the I^2 statistic, and values of 25%, 50%, and 75% suggest low, moderate, and high heterogeneity, respectively.[15] Publication bias was assessed by examining funnel plots generated using the *funnel* command. Finally, we conducted sensitivity analyses using 5-year age strata to examine the impact of the age re-categorization on study findings, as these age categorizations necessitated the least amount of re-classification across the studies.

Results

Our search strategy retrieved 5,885 citations, of which 54 underwent full-text screening and 10 met the inclusion criteria for our review (Figure 1).

Study Characteristics

Of the ten studies included in this review,[4,12,16–23] five were designed with a stated objective of examining the association between age-at-migration and risk of psychotic disorders.[12,18,19,21,22] Most studies were conducted in Europe (n=8), with the remaining studies from Canada (n=1) and Israel (n=1), and the observation periods ranged from 1969 to 2013. Eight studies used population-based registries or health administrative data, one study used a sample from early psychosis intervention services with diagnoses based on chart review,[19] and one study using a sample from outpatient psychiatry with diagnoses assigned based on a standardized intervew.[22] Nearly all studies were restricted to non-affective psychotic disorders, and the proportion of cases of affective psychoses was low (<21%) among the two studies that included these disorders.[12,19]

Most studies had a low risk of bias for the domains of external validity (80%), selection bias (100%), exposure classification (80%), and missing data (80%). Given that most studies used registry or health administrative data, the risk of bias was moderate to high for outcome classification (80%), assessment of confounding (100%), and measurement of confounding factors (100%) (Table 3).

Study Findings

Five studies used a non-migrant reference group in the analysis of the association between age at migration and the risk of psychotic disorders. The studies from Denmark by Cantor-Graae and

colleagues,[17,18] and by Pedersen & Cantor-Graae,[21] found that the risk of psychotic disorder was elevated across all age strata, relative to the general population, both for all migrant groups and for intercountry adoptees specifically. These studies found little evidence of effect modification by age at migration,[17,18,21] and one study found that this elevated risk was no longer evident after adjustment for region of birth.[17] In contrast, Veling and colleagues found that migrants who arrived in the Netherlands during infancy (0 to 4 years) had the highest risk of psychotic disorder, relative to the non-migrant population, with some evidence of a decreasing gradient in risk across increasing age strata.[22] The study by Kirkbride and colleagues from England found an elevated risk only among migrants who arrived during late childhood (5 to 12 years),[19] whereas the study by Dykxhoorn and colleagues from Sweden found an elevated risk across all age strata, relative to the general population, with the highest risk among migrants who arrived during adolescence (13 to 18 years).[12] However, in these three studies the 95% confidence intervals were overlapping across age strata, and none of the studies formally tested whether trends across strata were statistically significant, therefore it is unclear whether the differences in magnitude of effect across the age strata are meaningful.

Five studies restricted the analyses to migrant groups and examined the association between age at migration and the risk of psychotic disorder using a reference group of the youngest age stratum (n=3), or using a continuous measure of age at migration (n=2). The study by Anderson and colleagues from Canada found that people in the two highest age strata (30 to 34 years, 35 to 39 years) had a lower risk of psychotic disorder, relative to those in youngest age stratum (0 to 4 years).[4] The study by Manhica and colleagues found that inter-country adoptees who arrived in Sweden at age 4 to 7 years had a higher risk of psychotic disorder than those who arrived at age 0 to 1 year; however, this association did not hold for those who arrived as refugees.[20] Barghadouch and colleagues found that refugees who arrived

in Denmark between the ages of 12 and 17 had nearly a three times greater risk of psychotic disorder, relative to those who arrived before the age of 5 years.[16] The two studies that used a continuous measure for age at migration had conflicting findings – the study from the Netherlands by Veling and colleagues found a 4% reduction in risk for each year increase in age at migration,[22] whereas the analysis by Pedersen & Cantor-Graae from Demark did not show a significant association.[21] Both studies stratified the analyses by country of origin – Veling and colleagues found evidence of effect modification when comparing Western versus non-Western country of origin, such that younger age at migration increased the risk of psychotic disorders for migrants from non-Western countries only.[22] In contrast, Pedersen & Cantor-Graae continued to find null effects for age at migration when the analyses were stratified by developing versus developed country of origin.[21]

Finally, the study from Weiser and colleagues from Israel stated that there was no association between age at migration and the risk of psychotic disorders, with no further details provided about the magnitude of effect or the type of comparison group used.[23]

Meta-Analyses

Data suitable for meta-analyses were available from 5 of 10 studies included in our review. Three included studies were restricted to selected subgroups of migrants[16,18,20] – specifically refugees and intercountry adoptees – and were therefore excluded from the meta-analysis. Two additional studies did not provide stratified data on the association between age at migration and risk of psychotic disorders and were also excluded from the meta-analysis.[21,23]

The findings from the meta-analysis comparing each stratum of age at migration to a native-born reference group are presented in Figure 2. People who migrate during infancy (age 0 to 2 years, IRR =

1.85, 95%CI = 1.39, 2.47), early childhood (age 3 to 6 years, IRR = 1.85, 95%CI = 1.56, 2.20), middle childhood (age 7 to 12 years, IRR = 1.73, 95%CI = 1.52, 1.98), and adolescence (age 13 to 18 years, IRR = 1.67, 95%CI = 1.17, 2.37) have nearly twice the risk of psychotic disorder, relative to the native-born population. People who migrated during early adulthood (age 19 to 29 years) had rates of psychotic disorder similar to the native-born population (IRR = 0.93, 95%CI = 0.60, 1.44). Statistical heterogeneity was moderate across the early childhood and middle childhood age strata (I^2 = 60% to 64%), and high across the infancy, adolescence, and early adulthood age strata (I^2 = 76% to 98%).

The findings from the within-migrant meta-analysis using migration during infancy (age 0 to 2 years) as the reference category are presented in Figure 3. People who migrated during early adulthood (age 19 to 29 years) had nearly half the risk of psychotic disorder compared with people who migrated during infancy (IRR = 0.58, 95%CI = 0.33, 1.04), although the 95% confidence interval includes the possibility of a null effect. There was no evidence to suggest that migration during early childhood (age 3 to 6 years, IRR = 1.06, 95%CI = 0.93, 1.22), middle childhood (age 7 to 12 years, IRR = 0.99, 95%CI = 0.78, 1.26), or adolescence (age 13 to 18 years, IRR = 1.00, 95%CI = 0.73, 1.36) was associated with an excess risk of psychotic disorder, relative to migration during infancy (age 0 to 2 years). Statistical heterogeneity was low for the early childhood age stratum (I^2 = 0%), moderate for the middle childhood and adolescence age strata (I^2 = 47% to 62%), and high for the early adulthood age stratum (I^2 = 87%).

The results of the sensitivity analyses using the 5-year age categories were largely consistent with the main analyses, but with no evidence of an effect for any age strata under 20 years. (Online Supplement 3). The funnel plot showed some asymmetry (Online Supplement 4), which is suggestive of publication bias, or could also be due to spuriously inflated estimates arising from issues with methodological quality.[24]

Discussion

In this systematic review and meta-analysis, we found that people who migrated prior to age 18 had nearly twice the risk of psychotic disorder, relative to the native-born population. When looking within migrants, we found that people who migrated during early adulthood were at a lower risk of psychotic disorder, relative to those who migrated during infancy. The results of the within-migrant meta-analysis, as well as the meta-analysis using a native-born reference group, show no evidence of effect modification by age at migration prior to age 18.

Negative selective migration is one hypothesis for the higher incidence of psychotic disorder among migrant groups, which posits that people with an elevated risk of psychosis have a differential likelihood of undertaking an international migration, potentially due to early or prodromal symptoms.[25] These findings from our meta-analyses suggest that *negative* selective migration is unlikely to be the mechanism behind the higher rates of psychotic disorder observed among people who migrate prior to age 18, relative to the general population, as migrants who arrive during childhood and adolescence are likely brought by family members and are not migrating under their own initiative. Additionally, previous studies have not found an increased risk of psychotic disorders among the parents of migrants with psychotic disorders, relative to the parents of non-migrants with psychotic disorders,[26,27] suggesting that negative selective migration of the parents is also unlikely to explain the higher risk associated with migration at an early age.

However, our finding of a lower risk of psychotic disorders among those who migrated in early adulthood is consistent with *positive* selective migration. Late adolescence and early adulthood is the period of highest risk for the first onset of psychotic illness;[28,29] therefore, people in the early adulthood age stratum would be partially or fully through the risk period for illness onset at the time of migration,

and may be less likely to be undertaking an international migration if experiencing some of the early signs and symptoms of psychotic disorder. In other words, it is possible that prospective migrants who had an onset of psychotic illness during late adolescence and early adulthood would be unable to complete the migratory process, resulting in an overrepresentation of people at lower risk for psychotic disorders who migrate during early adulthood.

Prior research has suggested that there may be a developmental "sensitive period" during childhood and adolescence whereby exposure to the stressors associated with international migration have a greater impact as compared with other developmental periods.[8,19] Although our findings suggest that migration prior to age 18 nearly doubles the risk of psychotic disorder, we did not find evidence of effect modification by specific developmental periods, aside from the very broad and heterogeneous period of childhood and adolescence. Early life has repeatedly been identified as an important period for exposure to adversities that increase the risk of both psychotic experiences and psychotic disorders,[30–32] demonstrating a dose-response effect for a range of exposures.[33] These consistent effects of early adversities – which include factors such as early parental separation[34] and various forms of childhood bullying, abuse, and neglect[31] – highlight childhood as a key developmental risk period, and these shared effects of early stressors may be suggestive of a common neurodevelopmental mechanism.[33] Exposure to migration and its associated stressors during childhood and adolescence when the brain is still developing may disrupt neurocognitive development, potentially having long-term consequences for the risk of psychotic disorder; however, there is currently insufficient evidence to discern a distinct "sensitive period" prior to age 18 years.

It has also been suggested that the higher risk of psychotic disorder among those who migrate at younger ages may be an artifact of differential help-seeking behaviours and knowledge of the local

health care system among those who have resided in the country for longer periods of time.[22] Thus, people who migrated during childhood will have lived in the host country for a longer duration, and may therefore be more familiar with the health system and available services and more likely to seek help; conversely, more recent migrants may be more likely to seek help from non-medical or alternative healers. Both of these situations would result in differential ascertainment of cases across the age at migration strata. Additionally, one hypothesized mechanism for the association between migration and the risk of psychotic disorders is the detrimental effects of post-migration stressors, including experiences of racism and discrimination, social disadvantage, and lack of social capital.[25] It follows that people who migrate at younger ages have longer cumulative exposures to these post-migration stressors, thereby leading to an increased risk of psychotic disorders. Two included studies explored the role of duration of residence by stratifying the analyses by age at first contact for a psychotic disorder – if the association between age at migration and the risk of psychotic disorder was primarily driven by length of time in the host country, then the magnitude of effect should decrease with increasing age at first diagnosis as people accrue longer duration of residence. However, neither study found evidence to suggest that the observed association could be explained by duration of residence.[19,22] Further research is needed to better ascertain the role of duration of residence in the host country, which may act in conjunction with age at migration to jointly influence psychosis risk, as suggested by others.[19]

Limitations

There are a number of noteworthy limitations to this systematic review and meta-analysis. Firstly, although the statistical heterogeneity was low to moderate across many age strata, the included studies varied greatly in terms of the migrant context. Factors such as local migration policies, observation period, types of migrant groups, and migrant acculturation would be expected to differ considerably across the countries represented in this review. This heterogeneity in exposure should be considered when interpreting the results of our meta-analyses. There was also evidence of asymmetry in the funnel plots, particularly for small studies showing protective effects for older age at migration, which may be suggestive of publication bias.

Secondly, we used crude effect estimates in the meta-analyses, as adjusted estimates were not available in all primary studies, and where available, varied in the factors adjusted for. As such, the pooled estimates that we present have not been adjusted for important confounding factors, such as country of origin and length of time in the host country, which likely interact with age at migration to influence risk. Given that effect estimates for age at migration were attenuated after adjustment for sociodemographic and migration-related factors in some of the included studies,[12,17,20,22] particularly for the older age at migration stratum,[12] we expect that we might see a similar attenuation of effect if we had data available to compute adjusted estimates.

Finally, the number of studies included in this review was small with inconsistent categories used to operationalize age at migration, and data suitable for meta-analysis were not available from two studies meeting our inclusion criteria – notably, these two studies had null effects for age at migration,[21,23] and their exclusion from the meta-analysis may have consequently biased the pooled effect estimates. However, both of these studies only considered migration before mid- to late-

adolescence (age 14 and 17), and would therefore not have contributed to the effect estimates for migration in early adulthood. The inclusion of these estimates may have changed the conclusions drawn for the early childhood and adolescent age strata.

To our knowledge, this is the first systematic review and meta-analysis on the association between age at migration and the risk of psychotic disorders. We compared each stratum of age at migration to the native-born population, and also conducted a within-migrant analysis of the data which enabled us to make meaningful comparisons across the strata of age at migration. Our findings suggest that migration prior to age 18 nearly doubles the risk of psychotic disorder, and people who migrate during early adulthood have a lower risk of psychotic disorder, relative to people who migrate earlier in life. These findings may be indicative of a developmental period in childhood and adolescence during which the impacts of stressful migratory experience may be most pronounced, and may also be explained by positive selection after the period of highest risk. Additional research is needed examining the interplay with other factors – such as country of origin and duration of residence in the host country – to further elucidate the role of age at migration, in order to better understand the underlying etiology and target prevention and early intervention efforts to migrants at greatest risk.

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Figure 1 – Flow diagram showing the study selection process and reasons for exclusion.

Figure 2 – Forest plot of the incidence rate ratio for psychotic disorders for each strata of age at migration, relative to a native-born reference group (includes both non-migrants and second generation migrants).

Figure 3 – Forest plot of the incidence rate ratio for psychotic disorders for each strata of age at migration, relative to migration during infancy (0 to 2 years).

Table 1 – Domain-based criteria used to assess the risk of bias of included studies, based on the CLARITY tool.[13]

1. Is the source population representative of the general population?
Low - Selection of target population from a representative population roster such as a national population registry
Intermediate - Single community-based study
High - Hospital-based patient records, undefined source population, volunteer recruitment
2. Was selection of exposed and non-exposed cohorts drawn from the same population?
Low - Exposed and unexposed drawn from the same administrative database at the same point in time
High - Exposed and unexposed presenting to different points of care over a different time frame
3. Can we be confident in the assessment of exposure?
Low - Secure record (eg. surgical record, pharmacy record), repeated interview or ascertainment of current exposure
Intermediate - Single interview, written self-report, retrospective recall of exposure
High - Uncertain how exposure information obtained
4. Can we be confident in the assessment of the outcome?
Low - Independent blind assessment, record linkage, validated instrument
Intermediate - Instrument with limited validity assessment, self-report
High - Clinical interviews, chart diagnosis, unvalidated or ad-hoc instrument
5. Did the design or analysis account for important confounding factors?
Low - Comprehensive matching or adjustment for all plausible confounding factors
Intermediate - Matching or adjustment for many plausible confounding factors
High - Matching or adjustment for few or no confounding factors, statements of no differences between groups
6. Can we be confident in the assessment of the confounding factors?
Low - Participant interview, self-completed survey, chart review with reproducibility, database with documented accuracy
Intermediate - Chart review without demonstrated reproducibility, database with uncertain accuracy
High - Database with no available information on accuracy of confounding factors
7. Is there little missing data?
Low - High response proportion (eg >75%) with little missing data for variables (eg. <10%)
Intermediate - Moderate response proportions (eg. 50% to 75%) and missing data for variables (eg. <15%)
High - Low response proportion (eg. <50%) and substantial missing data for variables (eg. >15%)

Table 2 – Description of studies included in the systematic review of the association between age at migration and the risk of psychotic disorder (n=10).

Study	Location	Observation Period	Source of Sample	% Non-Affective Psychoses	Migrant Classes Included	Migrant Cases	Migrant Person-Years	Original Age Strata (Years)
*Anderson et al, 2015	Ontario, Canada	1999 - 2009	Registry Data	100%	All	2,233	4,163,062	0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39
Barghadouch et al, 2018	Denmark	1994 - 2012	Registry Data	100%	Refugees	95	NR	0-5, 6-11, 12-17
*Cantor-Graae et al, 2003	Denmark	1970 - 1998	Registry Data	100%	All	201	304,193	0-4, 5-9, 10-14
Cantor-Graae & Pedersen, 2007	Denmark	1986 - 2006	Registry Data	100%	Adoptees	112	108,537	0, 1, 2, 3-6, 7-14
*Dykxhoorn et al, 2019	Sweden	1997 - 2011	Registry Data	79%	All	1,767	1,611,589	0-2, 3-6, 7-12, 13-18, 19-29
*Kirkbride et al, 2017	East Anglia, England	2009 - 2013	Outpatient - Early Intervention Services	83%	All	103	325,045	0-4, 5-12, 13-19, 20-35
Manhica et al, 2016	Sweden	2005 - 2012	Registry Data	100%	Adoptees, Refugees	960	NR	0-1, 2-3, 4-7 (immigrants) 0-6, 7-12, 13-19 (refugees)
Pedersen & Cantor-Graae, 2012	Denmark	1986 - 2010	Registry Data	100%	All	1,057	NR	0-1, 2-3, 4-5, 6-7, 8-9, 10-11, 12-14
*Veling et al, 2011	The Hague, Netherlands	1997 - 2005	Outpatient - Psychiatric Services	NR	All	238	736,235	0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30+
Weiser et al, 2008	Israel	NR	Registry Data	100%	All	284	NR	NR

*NR = Not Reported; *Included in meta-analysis*

Table 3 – Results of the risk of bias assessment for studies included in the systematic review of the association between age at migration and the risk of psychotic disorder (n=10).

Study	1. Is the source population representative of the general population?	2. Was selection of exposed and non-exposed cohorts drawn from the same population?	3. Can we be confident in the assessment of exposure?	4. Can we be confident in the assessment of the outcome?	5. Did the design or analysis account for important confounding factors?	6. Can we be confident in the assessment of the confounding factors?	7. Is there little missing data?
Anderson et al, 2015	—	—	—	+	•	•	—
Barghadouch et al, 2018	—	—	—	+	•	•	—
Cantor-Graae et al, 2003	—	—	—	+	•	•	—
Cantor-Graae & Pedersen, 2007	—	—	—	+	•	•	—
Dykxhoorn et al, 2019	—	—	—	+	•	•	—
Kirkbride et al, 2017	•	—	—	—	•	•	—
Manhica et al, 2016	—	—	—	+	•	•	—
Pedersen & Cantor-Graae, 2012	—	—	NR	+	•	•	NR
Veling et al, 2011	•	—	—	—	•	•	—
Weiser et al, 2008	—	—	NR	+	NR	NR	•

Legend: — low risk, • moderate risk, + high risk, NR not reported