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ORIGINAL PAPER

The associations between migrant status and ethnicity and the identification of individuals at ultra-high risk for psychosis and transition to psychosis: a systematic review

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Abstract

Purpose Migrant and ethnic minority populations exhibit a higher incidence of psychotic disorders. The Ultra-High Risk for psychosis (UHR) paradigm provides an opportunity to explore the stage at which such factors influence the development of psychosis. In this systematic review, we collate and appraise the literature on the association between ethnicity and migrant status and the rate of identification of individuals at UHR, as well as their rate of transition to psychosis.

Methods We conducted a systematic review in the Ovid Medline, PsychINFO, Pubmed, CINAHL and EMBASE databases according to PRISMA guidelines. We included studies written in English that included an UHR cohort, provided a measure of ethnicity or migrant status, and examined the incidence, rate, or risk of UHR identification or transition to psychosis.

Results Of 2182 unique articles identified, seven fulfilled the criteria. One study found overrepresentation of UHR individuals from black ethnic groups, while another found underrepresentation. Two studies found increased rates of transition among certain ethnic groups and a further two found no association. Regarding migrant status, one study found that first-generation migrants were underrepresented in an UHR sample. Lastly, a lower transition rate in migrant populations was identified in one study, while two found no association.

Conclusion Rates of UHR identification and transition according to ethnic and migrant status were inconsistent and insufficient to conclusively explain higher incidences of psychotic disorders among these groups. We discuss the clinical implications and avenues for future research, which is required to clarify the nature of the associations.

Keywords Systematic review · Ultra-high risk for psychosis · Transition to psychosis · Migrants · Ethnicity

Introduction

The incidence of schizophrenia and other psychotic disorders is elevated in migrant and ethnic minority populations [1, 2]. First, second and third-generation migrant status is associated with heightened risk in countries such as Australia, the United States, Canada, England, Netherlands, Sweden, Denmark and France [3–10]. Similarly, belonging to an ethnic minority, such as Black and Asian ethnic groups in the UK, and Moroccan and Surinamese ethnic groups in the Netherlands, is linked to an elevated risk of psychotic disorders [2, 11–15].

Incidence rates differ between migrant subgroups. For example, a meta-analysis of 49 studies estimated a higher incidence of psychosis in first-generation migrants (relative risk RR 2.55) than in second-generation migrants (RR 1.78), compared to that of native-born populations [1].

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Similarly, rates of psychotic disorders can differ among ethnic minority groups in the same region [2, 12, 13, 15, 16]. For example, rates of schizophrenia vary between ethnic minority groups in England, such as Black African (RR 5.72), Black Caribbean (RR 5.20) and South Asian (RR 2.27) populations [2].

Importantly, rates of psychotic disorders in migrant and ethnic minority groups tend to be higher than those found in the countries of origin or heritage. For example, while studies from Africa are limited, data from the Caribbean, India and China indicate lower local incidence rates [17–19]. This suggests that factors intrinsic to the social environment of host countries uniquely interact with ethnicity and migrant status to influence the development of psychotic disorders.

It remains unclear how ethnicity and migrant status contributes to the development of psychosis. To better understand the aetiological processes of social factors, including ethnicity and migrant status, one approach is to focus on the influence exerted at discrete stages in the illness trajectory. One such important stage is the prodrome of psychotic disorders, which can be operationalised by examining the Ultra-High Risk for psychosis (UHR) population.

The UHR population comprises young individuals at increased risk of developing a psychotic disorder compared to the general population. 18% of UHR individuals transition to full-threshold psychotic disorders within 6 months, and 36% after 3 years [20]. To be deemed UHR, an individual must exhibit subthreshold or brief psychotic symptoms, or have a family history and have low functioning. The association between social risk factors, such as migrant status and ethnicity, in those at UHR may thereby provide insights into the development of psychosis.

However, it is yet to be fully elucidated how migrant status and ethnicity influence the prodromal and transition phases of psychosis. Additionally, many existing epidemiological studies have failed to demarcate *migrant status* and *ethnicity*. Therefore, the first objective of this systematic review was to appraise the literature investigating (i) whether there is an association between *ethnicity* and the rate of identification of UHR individuals; and (ii) whether there is an association in UHR cohorts between ethnicity and the risk of transition a full-threshold psychotic disorder. The second objective looked at the same associations for *migrant status*.

Methodology

Protocol and registration

We pre-registered the protocol on PROSPERO (CRD42018091479) and completed the search strategy and selection in accord with PRISMA guidelines.

Data source

We searched Ovid Medline, PsychINFO, Pubmed, CINAHL and EMBASE. References of retrieved articles were reviewed and cross-referenced. Presentation titles and abstracts from the Schizophrenia International Research Society conference (SIRS) and International Conference on Early Intervention in Mental Health (IEPA) were reviewed for unpublished findings. No limit was set on the earliest date of publication. The search strategy was last conducted in March 2020.

Search strategy

We used the following groups of search terms in each database:

1. Keywords: ‘Ethinicity’, ‘Ethnic’, ‘Race’, ‘Racial’. MeSH Term: ‘Ethnic groups’;
2. Keywords: ‘Migrant’, ‘Refugee’, ‘Asylum seeker*’, ‘Immigrant*’,‘Emigrant*’,‘Foreigner’. MeSH Terms: ‘Transients and migrants’, ‘Refugees’, ‘Emigration and Immigration’, ‘Minority health’;
3. Keywords: ‘Ultra high risk’, ‘Ultrahigh risk’, ‘At risk mental state’, ‘Clinical high risk’, ‘High risk’, ‘Familial high risk’, ‘Genetic risk’, ‘Proneness’, ‘Prodrom*’, ‘Vulnerability’, ‘Early’, ‘Subclinical’, ‘Subthreshold’. MeSH Terms: ‘Risk factors’, ‘Risk’, ‘Prodromal symptoms’; and
4. Keywords: ‘Psychosis’, ‘Psychotic’, ‘Schizophreni*’, ‘Schizoaffective’. MeSH Terms: ‘Schizophrenia’, ‘Psychotic disorders’.

Groups (1) and (2) were combined with ‘OR’. This was then combined with both groups (3) and (4) with ‘AND’, such that the search identified articles containing at least one keyword from either (1) or (2), as well as from (3) and (4).

Study selection

Independent reviewers (DM and EC) conducted identical database searches. Search results were first combined, duplicates removed, and titles and abstracts reviewed for

relevance. This process was conducted using Covidence. Reference lists were also reviewed to identify missing articles. Reviewers reached consensus by discussion or, where necessary, consultation with a third independent reviewer (BO'D).

In the final stage, the full text of the remaining studies were assessed against the following inclusion criteria: the study must (a) include a cohort of individuals identified as Ultra-High Risk for psychosis (UHR) or synonymous terms; (b) provide a measure of ethnicity, or synonymous terms OR migrant status, or synonymous terms; (c) statistically evaluate whether incidence, rate or risk of identification of UHR individuals, or transition from UHR to a psychotic disorder, is associated with ethnicity OR migrant status (d) be an original article written in English.

Terminology and definitions

Ultra-high risk for psychosis

Various terms are used to refer to individuals in the putative prodromal phase of a psychotic disorder, including 'Ultra-High Risk for psychosis' (UHR), 'clinical high risk' (CHR) and 'at-risk mental state' (ARMS), all defined as young help-seeking individuals with subthreshold psychotic symptoms who are at increased risk of developing full-threshold psychotic disorders [21, 22]. Identification criteria include the Comprehensive Assessment of At-Risk Mental State (CAARMS), Structured Interview for Psychosis-Risk Syndrome (SIPS) [23] and Basic Symptoms [24]. Here, we used 'Ultra-High Risk for psychosis' (UHR), even if the reviewed articles used differing terminology. The CAARMS criteria are outlined in Online Resource 1. We did not include studies that only identified 'psychotic-like experiences', 'psychotic experiences' or 'psychotic symptoms' without specific at-risk criteria.

Transition to psychosis

We included studies that examined transition to a psychotic disorder (sometimes described as 'conversion), where 'transition' is the point at which an individual proceeds from UHR to a full-threshold psychotic disorder, fulfilling DSM or ICD criteria [25].

Ethnicity

We defined ethnicity as self-ascribed group identification, based on conceptions of cultural, ancestral and social distinctiveness [26, 27]. Thus, we included studies that had a measure of self-reported identification with a census-defined group, and studies that used synonymous terms such as 'ethnic group' and 'race'.

Migrant status

Migrant status was defined as an individual that is foreign-born (first-generation migrant) or has at least one foreign-born parent (second-generation migrant) [28]. We included studies if participants were either first- or second-generation migrants, or both.

Data extraction

Once we deemed a study eligible for inclusion, we extracted relevant data using pre-designed data tables. This included study design and characteristics, as well as study findings relating to ethnic and migrant categories and results of statistical analyses.

Quality assessment

We rated studies according to the quality of their study design, based on a rating system used in McGrath and colleagues' systematic review of the incidence of schizophrenia [29]. As this method was specific to cohort studies, we adapted the criteria for case–control studies from the 'Quality of Assessment of Case–Control Studies' by the National Institute of Health. Studies could score up to 14 points, with higher scores representing higher quality. The quality reporting scale is available in Online Resource 2.

Results

Search results

The initial search yielded 4,697 articles, reduced to 2,182 unique articles after removing duplicates. Following the screening of titles and abstracts, we excluded 2,158 articles. A full-text review was undertaken of 25 articles (including 1 article identified from reference lists), of which seven fulfilled the inclusion criteria [28–34]. A flow chart illustrating this process is presented in Online Resource 3. Table 1 shows the study design and characteristics of eligible studies. Tables 2, 3 show the results of studies pertaining to ethnicity, and Tables 4, 5 summarise studies pertaining to migrant status.

Association between ethnicity and the rate of identification of individuals at Ultra-High Risk for psychosis

Two studies examined the association between ethnicity and rate of UHR identification. Byrne et al. assessed an UHR cohort of 228 young people attending an Early Intervention service in South London, specifically, whether its ethnic

Table 1 Study design and characteristics of all eligible studies [28–34]

Author, year, location	Study variable (s) and outcome(s)	Study setting	Study design	Sample size (*N*)	Data collection methods	Recruitment period	UHR/transition criteria	Age (years; M (SD))	Sex (male%/female%)
Ethnicity									
Byrne et al. England [30]	Identification of UHR and Transition to psychosis	OASIS EI Clinic Single-site, South London	Cohort–P	228	Interview and Medical Records 2011 UK Census	2001–10	UHR: CAARMS Transition: CAARMS	Black: 23.2 (4.8) White British: 22.5 (4.3) White Other: 24.9 (5.0) Other: 23.2 (4.6)	Black: 47/53 White British: 64/36 White Other: 46/54 Other: Male 62/38
Kirkbride et al. England [31]	Identification of UHR	CAMEO EI Clinic Single-site, East London	Case-controlled Cross-Sectional	89	Interview and Medical Records	2010–12	UHR: CAARMS	Median (IQR): UHR: 20.5 (18.9–22.8) Control: 27.0 (23.0–32.0)	UHR group: 50/50 Control group: 46/54
Brucato et al. United States [33]	Transition to Psychosis	COPE EI Clinic Single-site, New York	Cohort–P	200	Interview and Medical Records	2003–15	UHR: SIPS Transition: SIPS	20.0 (3.9)	73/27
Alderman et al. United States [34]	Transition to Psychosis	NAPLS Project 8 research sites, North America	Case-controlled Cohort–P	504	Interview and Medical Records	2000–06	UHR: SIPS Transition: SIPS	Latino UHR: 17.0 (3.6) Non-Latino UHR: 18.5 (4.8) Latino HC: 17.6 (3.4)	Latino UHR: 68/32 Non-Latino UHR: NS Latino HC: 44/56
Migrant status									
Geros et al. Australia [35]	Identification as UHR and Transition to Psychosis	PACE Service, EI Clinic Single-site, Melbourne	Cohort–P	465	Interview and Medical Records 2011 Australian Census	2012–16	UHR: CAARMS Transition: CAARMS	18.7 (2.8)	44/56
O'Donoghue et al. Australia [36]	Migrant Status and Transition to Psychosis	PACE Service, EI Clinic Single-site, Melbourne	Cohort – P	219 Data pertaining to migrant status available for 67.6% ($n = 148$)	Interview and Medical Records	2000–06	UHR: CAARMS Transition: CAARMS	18.8 (3.0)	43/57
Ethnicity and migrant status									
Nelson et al. Australia [32]	Transition to Psychosis	10 International EI Clinics Australia, Asia and Europe	RCT	304 297 included in ethnicity and migrant status analyses	Interview and Medical Records	NS	UHR: CARMS Transition: SCID-IV	NS	NS

BIPS Brief Intermittent Psychotic Syndrome; *Black* Black British, Black African, Black Caribbean; *CAARMS* Comprehensive Assessment of the At-Risk Mental State; *COPE* Centre of Prevention and Evaluation; *EI* Early Intervention; *NAPLS* North American Prodrome Longitudinal Study; *NS* Not Stated; *OASIS* Outreach and Support in South London; *Other*: Asian Oriental, Asian Indian, Middle-East Arab, Mixed; *PACE* Personal Assessment and Crisis Evaluation; *P* Prospective; *R* Retrospective; *RCT* Randomised Control Trial; *SCID-IV* Structured Clinical Interview for DSM-IV-TR Axis I Disorders; *SIPS* Structured Interview for Psychosis-Risk Syndromes; *UHR* Ultra-High Risk for Psychosis; White Other: White Irish, White European, and all other White

distribution differed from comparable UK census data [30]. The proportion of White British, White Other (including White Irish, White European, and White Others), Black, and Other (including Asian, Middle-East Arab and mixed ethnicities) ethnic groups in the UHR cohort differed from that of the background population ($p < 0.001$). Within the UHR cohort, there was a higher proportion of individuals from Black ethnic groups (Absolute Difference AD 14%, 95% CI [7.94, 20.88]), and a lower proportion from White Other (AD -8%, 95% CI [− 12.50, − 3.46]) and Other groups (AD − 7%, 95% CI [− 11.07, − 1.75]).

Kirkbride et al. investigated whether Black and Minority ethnic (BME) or White ethnic group status was associated with UHR identification in a cross-sectional study [31]. A total of 48 UHR individuals attending an Early Intervention service in East London were compared to 41 population-based controls from the service catchment area. The control group was representative of the at-risk population in terms of ethnic group composition, as well as age, sex and socioeconomic status, according to 2011 census data. The adjusted odds of being identified as UHR, relative to controls, was reduced amongst individuals of BME status (aOR 0.19, 95% CI [0.04, 0.97], $p < 0.05$).

Association between ethnicity and transition to a full threshold psychotic disorder

Four studies investigated the association between ethnicity and transition from an UHR state to a full-threshold psychotic disorder [30, 32–34]. In the aforementioned UHR cohort examined by Byrne et al., rates of transition to psychosis over 4 years were prospectively examined for differences according to ethnic group [30]. While 33 UHR individuals transitioned to psychosis, no significant difference between ethnic groups was observed ($p = 0.57$).

Brucato et al. prospectively studied 200 individuals attending an Early Intervention service in New York, who met criteria for the 'Attenuated Positive Symptoms Syndrome' UHR subtype [33]. 30% of the cohort transitioned to psychosis over a mean follow-up time of 13 months and mean time to transition of 11 months. Ethnicity was associated with transition to psychosis, with individuals from Black/African-American and Asian/Pacific Islander ethnic groups, respectively, 2.6 (SE = 0.47, 95% CI [1.1, 6.6], $p = 0.04$) and 4.6 (SE = 0.68, 95% CI [1.21, 17.37], $p = 0.03$) times more likely to transition than those in the Causasian reference group. There was no significant difference in risk of transition according to Hispanic group status.

Alderman et al. examined the association between Latino ethnicity and transition to psychosis in 504 help-seeking young people [34]. They recruited 56 Latino and 314 non-Latino UHR participants, as well as 25 Latino and 134 non-Latino Healthy Controls, from eight research sites across North America for the North American Prodrome Longitudinal Study (NAPLS). No Healthy Control participants transitioned to psychosis, while 35% of the UHR group were known to transition over the 2.5-year follow-up period, with a mean time to transition of 360 days. However, there were no differences in cumulative rates of transition, measured at 6-month intervals over the follow-up period, between the Latino UHR, non-Latino UHR and total UHR groups ($p = 0.10$). It should be noted that there was a higher follow-up rate at the final 2.5-year assessment in the non-Latino UHR group.

Finally, a randomised double-blind controlled trial investigated the effect of omega-3 polyunsaturated fatty acids (in combination with cognitive-based case management) in 304 UHR patients from ten international Early Intervention services in Australia, Europe and Asia [32]. 13% of the cohort transitioned to a psychotic disorder over a median follow-up of 3.3 years. When the association between ethnicity and rate of transition was examined using Cox regression, there was no difference between Caucasian and Non-Caucasian ethnic groups ($\beta = 0.367$, se(β) = 0.381, $p = 0.34$). However, when a stepwise Cox regression was performed to adjust for demographic variables, symptom and functioning measures, and recruitment site, the association between ethnicity and transition was significant, with non-Caucasian individuals at increased risk (HR 4.6, 95% CI [1.8. 12.1], $p = 0.002$).

Association between migrant status and the identification of individuals at Ultra-High Risk for psychosis

Geros et al. examined 467 young people attending an Early Intervention service in Melbourne, Australia to evaluate the UHR identification rate among first-generation migrants [35]. By evaluating cohort demographics against Australian census data on young people living in the corresponding catchment area, first-generation migrants were found to be 2.6-fold *less likely* to be identified as UHR for psychosis than Australian-born participants on crude analysis (IRR 0.39, 95% CI [0.30, 0.51], $p < 0.001$), and when adjusted for age and sex (IRR 0.44, 95% CI [0.34, 0.58], $p < 0.001$). When specific regions of origin were examined, migrants from New Zealand (IRR 0.36, 95% CI [0.13, 0.97], $p = 0.04$), South-East Asia (IRR 0.39, 95% CI [0.24, 0.65], $p < 0.001$), North-East Asia (IRR 0.21, 95% CI [0.09, 0.51], $p = 0.001$) and Southern and Central Asia (IRR 0.40, 95% CI [0.20, 0.77], $p = 0.006$) were less likely to be identified as UHR than Australian-born young people.

Table 2 Findings from eligible studies – ethnicity and rate of identification of UHR [28, 29]

Author, year, location	Ethnic groups *N* (%)	Rate of identification of UHR	Variables controlled For	Author's conclusions	Quality assessment
Byrne et al. England [30]	White British: 91 (40%) Black: 77 (34%) White Other: 28 (12%) Other: 32 (14%)	Difference in distribution of ethnicity between the UHR sample and the background population (adjusted for gender and age): $\chi^2 = 31$, df = 33, $p < .001$ Absolute Difference UHR vs. Background Population [95% CI]: White British: 0 [−6.68, 6.65] Black: 14% [7.94, 20.88] White Other: − 8% [− 12.50, − 3.46] Other: −7% [−11.07, −1.75]	Age and gender	Overrepresentation of black service users among those at UHR compared to the background population	Good
Kirkbride et al. England [31]	UHR group BME: 4 (8%) White British: 44 (92%) Control group BME: 11 (27%) White British: 30 (73%)	aOR (95% CI) of UHR vs. controls BME status vs. White British: 0.19 [0.04, 0.97], $p < .05$	Age, sex, ethnicity and socioeconomic status and median neighbourhood deprivation	Underrepresentation of Black and Minority Ethnic group status individuals among UHR sample	Good

aOR Adjusted Odds Ratio; *Black* Black British, Black African, Black Caribbean; *CI* Confidence Interval; Other: *Asian Oriental* Asian Indian, Middle-East Arab, Mixed; *UHR* Ultra-High Risk for Psychosis; White Other: White Irish, White European, and all other White

Association between migrant status and the risk of transition to a full threshold psychotic disorder

Three studies examined the association between migrant status and risk of transition in UHR cohorts [32, 35, 36]. Geros et al. followed the aforementioned cohort of 467 UHR young people for a median follow-up of 253 days, over which 19% of the participants in total were known to transition to a full-threshold psychotic disorder. Within the migrant group, 21% of individuals transitioned to psychosis, compared to 18% of Australian-born individuals. When controlled for age and sex, there was no difference in transition rates between the migrant and non-migrant group (HR 1.15, 95% CI [0.62, −2.15], $p = 0.65$), or between specific migrant groups according to region of origin [35].

In the aforementioned study by Nelson et al., the association between migrant status and rate of transition in the UHR cohort was also investigated [32]. Like ethnicity, migrant status was not associated with transition to a psychotic disorder when a univariate analysis was performed ($p = 0.16$). However, when adjusted for demographic variables, symptom and functioning measures, and recruiting site, migrant status was associated with a decreased risk of transition (HR 0.3, 95% CI [0.10, 0.91], $p = 0.03$). The authors posited that the association between transition and both ethnicity and migrant status may have been due to the non-Caucasian, non-migrant group, who showed a greater risk of transition than the Caucasian non-migrant (HR 5.98 95% CI [2.08, 16.61]), Caucasian migrant (HR 10.62, 95% CI [2.04, 55.25]), and non-Caucasian migrant (HR 5.08; 95% CI [1.22, 21.19]) groups. This finding was considered to be accounted for by the higher representation of this group in a particular site, which had a higher transition rate overall.

O'Donoghue et al. followed 219 young people identified as UHR over a median follow-up of 5 years [36]. The participants were obtained from the same Early Intervention service in Melbourne, Australia as those that participated in the study by Geros et al. (although there was no overlap of cohorts). 15% of the cohort were known to have transitioned to psychosis. Overall, migrant status was not associated with the risk of transition to a psychotic disorder ($p = 0.65$); even when individually examining first-generation (HR 0.89, $p = 0.89$) and second-generation (HR 1.53, $p = 0.53$) migrants.

Discussion

Summary of findings

The association between ethnicity and the rate of UHR identification was equivocal. Of two identified studies, one

Table 3 Findings from eligible studies–ethnicity and risk of transition to psychosis [28, 30–32]

Author, year, location,	Ethnic groups	Follow-up period	Followed up	Total transitioned	Ethnic group transitioned	Rate of transition	Variables controlled for	Author's conclusions	Quality assessment
Byrne et al. England [30]	White British: 91 (40%) Black: 77 (34%) White Other: 28 (12%) Other: 32 (14%)	4 years	228 (100%)	33 (15%)	White British: 13 (18%) Black: 15 (23%) White Other: 3 (11%) Other: 2 (19%)	HR [95% CI]—'Narrow' Ethnic groups ($p=0.57$): White British: 1 Black: 1.38 [0.65, 2.93] White Other: 0.70 [0.19, 2.50] Other: 0.40 [0.10, 1.78] HR [95% CI]—'Broad' Ethnic groups ($p=0.31$): White British: 1 Black British: 1.24 [0.49, 3.11] Black African: 2.44 [0.96, 6.24] Black Caribbean: 0.42 [0.05, 3.28] White Other: 0.70 [0.20, 2.52] Mixed: 0.38 [0.05, 2.89] Other: 0.43 [0.06, 3.31]	Age and gender	No significant differences in rates of transition to psychosis between ethnic groups However, there was a non-significant trend to suggest an increased rate of transition among black Africans	Good

Table 3 (continued)

Author, year, location,	Ethnic groups	Follow-up period	Followed up	Total transitioned	Ethnic group transitioned	Rate of transition	Variables controlled for	Author's conclusions	Quality assessment
Brucato et al. United States [33]	'Race' Groups: Caucasian: 96 (48%) Black/African American: 44 (22%) Asian/Pacific Island: 15 (8%) Mixed Race: 45 (23%) 'Ethnicity' Groups: Hispanic: 139 (70%) Non-Hispanic: 61 (30%)	2 years Mean follow-up time: 12.7 months ($SD = 12.2$); Range: 1 to 74 months	159 (79%)	60 (30%) Excluding 41 who had not transitioned, but had not yet completed 2-year follow-ups, the rate was 38%	'Race': Caucasian: 18 (30%) Black/African American: 17 (28%) Asian/Pacific Island: 9 (15%) Mixed Race: 16 (27%) 'Ethnicity': Hispanic: 40 (67%) Non-Hispanic: 12 (33%)	Transition vs. non-transition subjects according to 'race': $\chi^2 = 14.438$, $p < 0.01$ OR (SE), [95% CI] Caucasian: ref Black/African American: 2.638 (0.47), [1.05, 6.627], $p = 0.039$ Asian/Pacific Island: 4.590 (0.679), [1.21, 17.37], $p = 0.024$ Mixed Race OR 2.682 (0.518), [0.972, 7.40], $p = 0.057$ Transition vs. non-transition subjects according to 'ethnicity': $\chi^2 = 0.325$, $p > 0.05$ OR (SE), [95% CI] Hispanic 1.041 (0.443), [0.437, 2.483], $p = 0.927$	Age, sex, race, ethnicity, all SIPS Positive symptoms, and totals of Negative, Disorganisation and General symptoms	Asian/Pacific Islander and Black/African-American race associated with increased risk of transition	Good

Table 3 (continued)

Author, year, location,	Ethnic groups	Follow-up period	Followed up	Total transitioned	Ethnic group transitioned	Rate of transition	Variables controlled for	Author's conclusions	Quality assessment
Alderman et al. United States [34]	UHR Group: Latino: 56 (15%) Non-Latino: 314 (85%) Healthy Controls: Latino: 25 (19%) Non-Latino: 109 (81%)	30 months	291 (79%) UHR subjects (incl. 39 Latino UHR) completed follow up	UHR group: 144.3 (39%) HC group: 0	UHR Group Latino: 15 (39%) Non-Latino: 67 (36%) Healthy Controls: Latino HC: 0 Non-Latino HC: 0	Cumulative rates of transition among Latino UHR subjects vs. non-Latino UHR subjects vs. total UHR subjects: $F=3.19$, d.f. $=2$, $p=0.10$ UHR Latino Transition N% (SE): 12.8 (0.05) at 6 months 20.5 (0.07) at 12 months 30.8 (0.08) at 18 months 35.9 (0.09) at 24 months 38.5 (0.10) at 30 months UHR Non-Latino N% (no SE given): 14.7 at 6 months 26.6 at 12 months 31.3 at 18 months 34.4 at 24 months 36.2 at 30 months	Healthy controls matched on ethnicity	There was no significant difference between the cumulative rates of transition among Latino UHR subjects, non-Latino UHR subjects and total UHR subjects	Good

Table 3 (continued)

Author, year, location,	Ethnic groups	Follow-up period	Followed up	Total transitioned	Ethnic group transitioned	Rate of transition	Variables controlled for	Author's conclusions	Quality assessment
Nelson et al. Australia [32]	Caucasian Non-Caucasian (Proportions NS)	12 months	Lost to F/U: Exp. Group: Withdrew $n=14$; unable to contact $n=24$; pregnant $n=1$ Placebo Group: Withdrew $n=18$; Unable to contact $n=22$	40 (13%)	NS	Caucasian vs. Non-Caucasian Unadjusted: $\beta=0.367$, se(β) = 0.381, $p=0.34$ Adjusted HR [95% CI]: 4.6 [1.8–12.1], $p=0.002$ HR [95% CI] for Non-Caucasian, Non-migrants vs.: Caucasian non-migrants: 5.98 [2.08, 16.61] Caucasian migrants: 10.62 [2.04, 55.25] Non-Caucasian migrants: 5.08 [1.22, 21.19]	Demographic variables, symptom and functioning measures, and recruitment site	Ethnicity was associated with transition. High rates of transition amongst the subgroup of non-Caucasian, non-migrant individuals	Good

Black Black British, Black African, Black Caribbean; *CI* Confidence Interval; *HC* Health Controls; *HR* Hazard Ratio; *NS* Not Stated; *Other* Asian Oriental, Asian Indian, Middle-East Arab, Mixed; *OR* Odds Ratio; *SE* Standard Error; *SIPS* Structured Interview for Psychosis-Risk Syndromes; *UHR* Ultra-High Risk for Psychosis; White Other: White Irish, White European, and all other White

Table 4 Findings from eligible studies – migrant status and rate of identification of UHR [33]

Author, year, location	Migrant groups	Rate of identification of UHR	Variables controlled For	Author's conclusions	Quality assessment
Geros et al. Australia [35]	First-generation: 63 (14%) New Zealand: 4 North West Europe: 2 Southern and Eastern Europe: 3 North Africa and Middle East Africa: 9 South-East Asia: 16 North-East Asia: 5 Southern and Central Asia: 9 Americas: 7 Sub-Saharan Africa: 6	IRR [95% CI] First-generation migrants: 0.44 [0.34, 0.58], $p < 0.001$ New Zealand: 0.36 [0.13, 0.97], $p = 0.04$ North West Europe: 0.29 [0.07, 1.16], $p = 0.08$ Southern and Eastern Europe: 0.43 [0.14, 1.34], $p = 0.15$ North Africa and Middle East Africa: 0.53 [0.27, 1.02], $p = 0.06$ South-East Asia: 0.39 [0.24, 0.65], $p < .001$ North-East Asia: 0.21 [0.09, 0.51], $p = 0.001$ Southern and Central Asia: 0.40 [0.20, 0.77], $p = 0.006$ Americas: 1.95 [0.92, 4.12], $p = 0.08$ Sub-Saharan Africa: 0.08 [0.36, 1.80], $p = 0.60$	Age and sex	There was a significantly reduced risk of being identified as UHR for psychosis for first-generation migrants (collectively) aged 15–24 compared to native-born participants The following first-generation migrant subgroups were less likely to be identified as UHR compared to Australian-born young people: New Zealand, South-East Asia, North-East Asia and Southern and Central Asia	Good

CI Confidence Interval; *IRR* Incidence Rate Ratio; *UHR* Ultra-High Risk for Psychosis

Table 5 Findings from eligible studies – migrant status and risk of transition to psychosis [30, 33, 34]

Author, year, location,	Migrant groups	Follow-up period	Followed up	Total transitioned	Migrant group transitioned	Risk of transition	Variables controlled for	Author's conclusions	Quality assessment
Nelson et al. Australia [32]	Migrant (1st and 2nd Generation) Non-Migrant Proportions NS	12 months	Lost to follow-up: Experimental Group Withdrew:14 Unable to contact: 24 Pregnant: 1 Placebo Group: Withdrew:18 Unable to contact: 22	40 (13%)	NS	Migrant vs. non migrant Unadjusted: $\beta = -0.0662$, se(β) = 0479, $p = 0.16$ Adjusted HR [95% CI]: 0.30 [0.10, 0.91], $p = 0.033$ HR [95% CI] for Non-Caucasian, non-migrants vs. Caucasian non-migrants: 5.98 [2.08, 16.61] Caucasian migrants: 10.62 [2.04, 55.25] Non-Caucasian migrants: 5.08 [1.22, 21.19]	Demographic variables, symptom and functioning measures, and recruitment site	Migrant status was associated with transition. However, this seems to be driven by high rates of transition amongst the subgroup of non-Caucasian, non-migrant individuals	Good

Table 5 (continued)

Author, year, location,	Migrant groups	Follow-up period	Followed up	Total transitioned	Migrant group transitioned	Risk of transition	Variables controlled for	Author's conclusions	Quality assessment
Geros et al. Australia [35]	1st generation: 63 (14%) New Zealand: 4 North West Europe: 2 Southern and Eastern Europe: 3 North Africa and Middle East Africa: 9 South-East Asia: 16 North-East Asia: 5 Southern and Central Asia: 9 Americas: 7 Sub-Saharan Africa: 6	Median: 253 days (IQR 139.3–406.8)	NS	87 (19%)	Migrants: 13 (21%) Non-migrants: 74 (18%)	HR [95% CI]: First-generation migrants: 1.15 [0.062, 2.15], $p=0.65$ HR [95% CI] for each region: New Zealand: 0.73 [0.10, 5.40], $p=0.76$ North West Europe: - Southern and Eastern Europe: - North and Middle East Africa: 0.62 [0.15, 2.55] $p=0.51$ South-East Asia: 0.52 [CI 0.18–1.44], $p=0.20$ North-East Asia: - Southern and Central Asia: 0.40 [0.12, 1.27], $p=0.12$ Americas: - Sub-Saharan Africa: 0.84 [0.11, 6.34], $p=0.82$	Age and sex	First-generation migrant status was not associated with an increased risk of transition to psychosis in the UHR cohort as compared to Australian-born UHR individuals	Good

Table 5 (continued)

Author, year, location,	Migrant groups	Follow-up period	Followed up	Total transitioned	Migrant group transitioned	Risk of transition	Variables controlled for	Author's conclusions	Quality assessment
O'Donoghue, Australia [36]	1st generation migrants: 3 (9%) 2nd generation migrants: 62 (42%) Non-migrant: 73 (49%)	Median: 4.8 years	NS	15%	NS	Unadjusted HR [95% CI] 1st Generation: 1.05 [0.23, 4.80], $p = 0.95$ 2nd Generation: 1.29 [0.55, 3.04], $p = 0.46$ Adjusted HR [95% CI] 1st Generation: 1.89 [0.18, 4.50], $p = 0.89$ 2nd Generation: 1.53 [0.56, 4.17], $p = 0.53$	Functioning, BLIPS UHR criteria and baseline year, and duration of symptoms prior to entry	Migrant status not associated with risk of transition in UHR participants	Good

BLIPS Brief Limited Intermittent Psychotic Symptoms; *CI* Confidence Interval; *HR* Hazard Ratio; *NS* Not Stated; *UHR* Ultra-High Risk for Psychosis

found an overrepresentation of young people from black ethnic groups in the UHR sample, while the second found an underrepresentation. The association between ethnicity and rate of transition was similarly equivocal, with two studies finding increased rates among certain ethnic groups and two other studies finding no significant difference between ethnic groups. Meanwhile, only one study assessed migrant status and UHR identification, which indicated underrepresentation of first-generation migrants. Regarding migrant status and transition, one study found a lower rate of transition in migrant populations compared to native-born populations, and two found no association.

Interpretation of findings

Ethnicity

As only one study was found that identified increased UHR identification among certain ethnic minority groups (most notably the Black ethnic group), the reliability of this finding. However, given prior research showing heightened rates of subclinical psychotic symptoms among Black ethnic groups, it is possible that ethnicity plays an early role in the development of psychotic disorders [37]. This coheres with, and may partially explain, findings of elevated rates of psychotic disorders among Black ethnic groups [2, 12, 13].

If this is so, we might interpret the seemingly conflicting finding by Kirkbride et al. (of reduced UHR identification among the BME group compared to the White-British ethnic group) as due to its notably small sample size and study setting, which was rural (rather than urban) and less ethnically diverse. These factors are relevant as rates of psychosis are lower in rural areas and rates of identification of UHR individuals are lower in areas of residence with lower ethnic diversity [31, 38]. In any case, it is worth highlighting that variation in findings should be expected due to differing settings. Social and environmental factors, including access to health services, socioeconomic status, education levels and employment rates, are known to influence help-seeking and duration of untreated psychosis [39–42]. Thus, differences in these factors likely mediate the association between ethnicity (as well as migrant status) and UHR identification across studies.

Turning to the matter of transition, we found evidence suggesting ethnicity may exert its influence early in the psychosis trajectory. Brucato et al. and Nelson et al. demonstrated ethnic variation in rates of transition to psychosis. The validity of their studies is strengthened by moderately large sample sizes and adjustment for clinical and demographic factors, as well as the international multi-site sample employed by Nelson et al., mitigating site-specific effects. Even so, the findings by Nelson et al. may have been driven by higher transition rates in certain sites.

The remaining two studies by Byrne et al. and Alderman et al. that did not find differences were limited by small sample sizes and relatively low overall transition rates, suggesting that true ethnic differences may have been undetected due to limited statistical power. For example, Byrne et al. reported a trend towards increased rate of transition among Black African participants (Hazard Ratio HR 2.44, 95% CI [0.96, 6.24]). Transition rates may also have been affected by variability in interventions received by UHR individuals, given that ethnicity has been shown to influence compliance with and efficacy of certain psychosis interventions, such as antipsychotic therapy and cognitive-behavioural therapy [43, 44].

Migrant status

Studies examining migrant status diverged from those examining ethnicity. Migrant status may actually *lower* rates of UHR identification and transition to psychosis. At first, this finding seems at odds with largely consistent reports of elevated risk of psychotic disorders in migrant populations [1, 4, 28]. But some relevant factors need to be considered. First, migrant status can associated with a longer duration of untreated psychosis and delays to presenting to services for treatment [45, 46]. Potential barriers to accessing health services include cultural, religious, social, geographic, and financial factors [47, 48]. Additionally, linguistic difficulties and poor mental health literacy reduce access to mental health services [49]. This is particularly applicable to recently migrated young people who may be unfamiliar with local healthcare services, particularly culturally appropriate services [50]. Collectively, these factors likely reduce attendance at early intervention clinics where UHR samples are derived. Therefore, migrants may be more likely to present to mental health services *after* full-threshold psychosis has developed.

An alternate explanation for reduced UHR identification rates is that compounding exposures to environmental risk factors may hasten psychosis development among certain migrant groups, thereby reducing opportunities for detection during the UHR stage. For example, certain migrant groups experience a high prevalence of traumatic experiences and socioeconomic disadvantage [51–55]. As these factors increase the risk of psychotic disorder, interaction between multiple risk factors may spur accelerated onset of full-threshold psychosis [56–60].

Moreover, environmental factors may variably apply to different subgroups, and thereby contribute to heterogeneity in rates between migrant subgroups. A recent study in Melbourne, Australia (where the majority of the reviewed migrant studies were performed) found that African migrants had a higher incidence of psychotic disorders compared to Australian-born individuals, while Asian migrants demonstrated a lower incidence [61]. This suggests that assessing migrant status alone may be misleading as it is difficult to establish whether certain migrants are truly at lower risk of qualifying as UHR and transitioning to psychosis, or if there are mediating factors that inhibit their accurate detection. Indeed, the study by Geros et al. included more participants from Asian subgroups than African subgroups, which may have contributed to the lower rates of UHR identification found among the migrant group collectively.

Additionally, it should be noted that the statistical power to accurately detect differences in transition rates according to migrant status may be compromised if the overall number of UHR cases identified is low. This may explain the findings by Geros et al. and O'Donoghue et al. that migrant status and rate of transition were not associated, particularly given their overall rates of transition were also low.

Finally, we suggest that the influence imparted by these factors may be highly stage specific. This has been demonstrated for other social and environmental risk factors associated with increased psychotic disorder incidence, such as cannabis use, urbanicity and socio-economic status, as they do not appear to affect transition from the UHR stage [62, 63]. Likewise, migrant status may solely exert its influence on the development of psychosis at stages prior to transition.

Limitations

We identified only a relatively small number of studies, within which comparison was difficult due to variability in the subcategorisation of ethnicity and migrant groups. Some studies used dichotomous classification (for example, Caucasian/non-Caucasian or migrant/non-migrant), while others used region of origin. Dichotomous categorisation obfuscates the differing mechanisms that are likely to operate in different ethnic minority and migrant groups, as indicated by the heterogeneity in incidence rates of psychotic disorders [2, 61]. However, unless sample sizes are large, there may be insufficient power to detect differences.

Our focus on UHR cohorts was also limiting as recruitment is contingent on individuals attending early intervention services yet help-seeking behaviours vary according to ethnic and migrant group as a result of cultural, educational, social, religious, and economic differences [64–67]. For example, studies conducted in Egypt, Nigeria and Indonesia have demonstrated that up to 78% of patients with schizophrenia first seek treatment from traditional or religious healers. Factors demonstrated to be associated with this preference include perceived stigma, low mental health literacy, and financial hardship [68–70]. Such factors may persist among certain ethnic and migrant groups in developed countries, leading to delayed presentation to health services. In turn, this may reduce the likelihood of detecting patients at the UHR stage.

A related issue is that ethnically derived variations in psychotic symptom expression have been shown in UHR samples, which may hinder the accurate detection of UHR individuals [71]. Thus, the incidence of help-seeking UHR individuals from certain ethnic and migrant groups may not reflect the true incidence in the community.

Comparison between studies examining transition rates is made challenging by heterogeneity in follow-up periods, which ranged between 12 months and 5 years. This could have affected the reliability with which transition to psychosis was detected, as the risk of developing psychosis in the UHR stage appears to increase over time [20].

It is also important to consider trajectories of psychosis development that are not captured by the UHR paradigm. A recent Dutch population-based prospective study of 6,000 participants found that while UHR state conferred a high relative risk for psychosis, the population attributable fraction (PAF) was comparatively low (PAF = 36.9, 95% CI [11.3, 55.1]). Psychotic disorder incidence was, however, notably attributable to preceding diagnoses of mood disorders (PAF = 66.2, 95% CI [33.4, 82.9]), as well as drug use disorders (PAF = 18.7, 95% CI [−0.9, 34.6]) [72]. Similarly, Shah et al. reported that 32% of a first-episode psychosis cohort did not undergo preceding subthreshold psychotic symptoms, but rather depression, anxiety, and functional impairment. Indeed, ethnicity and migrant status may be risk factors for mood and anxiety disorders [73].

Future research

This review highlighted the crucial importance of separating ethnicity and migrant status in future work. These social risk factors have often been conflated in epidemiological research, and yet our review indicates that they have separate and divergent effects.

Future studies should also strive to use larger samples, a variety of settings (including developing countries) and adjust for known confounders. To ascertain the aetiological mechanisms of ethnicity and migrant status, we need more research on the factors mediating their association with UHR identification and transition. Racial discrimination, social defeat and ethnic density in the neighbourhood of residence are some such proposed risk factors for psychosis in ethnic minority and migrant groups [74, 75]. This research would be enhanced by comprehensive comparisons of subpopulations of ethnic and migrant groups, as different exposures may operate within groups.

Lastly, future studies may benefit from a broader identification approach, such as the Clinical High at Risk Mental State (CHARMS) paradigm. This encompasses a broader range of inputs than current UHR criteria, including subthreshold bipolar states, mild to moderate depression, family history of serious mental illness, and functional decline, to more sensitively detect young people at heightened risk of mental illness and overcome the aforementioned limitation of employing narrow UHR criteria [76].

Clinical implications

Associations between ethnicity and migrant status and UHR identification and transition to psychosis have potential implications for the early detection and prevention of psychotic disorders. Treatment delivered at the UHR stage may be key to ameliorating differences in the rates of psychosis between migrant and ethnic groups. Research in this area may guide modifications to the diagnostic process, including UHR criteria, to ensure more sensitive detection of at-risk individuals of certain ethnic and migrant backgrounds. It may also inform how early intervention services can tailor their accessibility and appropriateness to the unique needs of migrant and ethnically diverse groups.

Conclusion

This was the first systematic review to appraise the literature investigating the association between ethnicity and migrant status and the UHR and transition stages of psychotic disorders. The influence of ethnicity and migrant status on these stages was equivocal due to a small number of studies, with methodological limitations and heterogenous results. Local factors likely influence the rate of UHR identification in ethnic minorities and migrants. Findings in relation to rate of transition according to ethnicity and migrant status were inconsistent and insufficient to explain the increased incidence of psychotic disorders in these groups, which may indicate that these groups bypass UHR clinics. Therefore, devising strategies to identify these groups in the prodromal stages of psychotic disorders could improve early intervention.

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Code availability Not applicable.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical statement As this is a systematic review, the manuscript does not contain new patient data.

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