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ORIGINAL PAPER

Cognitive deficits and ethnicity: a cohort study of early psychosis patients in The Netherlands

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Abstract
Purpose Incidence rates of psychotic disorders are higher in immigrant groups compared to native populations. This increased risk may partly be explained by misdiagnosis. Neurocognitive deficits are a core feature of psychotic disorders, but little is known about the relationship between migration and cognition in psychotic disorders. We examined whether immigrant patients have cognitive deficits similar to non-immigrant patients, in order to investigate the plausibility of misdiagnosis as explanation for increased incidence rates.
Methods Patients who made first contact for non-affective psychotic disorder were assessed in the cognitive domains sustained attention, immediate recall and delayed recall. Immigrant patients were compared to Dutch patients on cognitive performance.
Results 407 Patients diagnosed with a non-affective psychotic disorder completed cognitive assessment (157 Dutch, 250 immigrants). Both Dutch and immigrant patients showed large cognitive deficits. Between-subgroup comparisons revealed large cognitive deficits for immigrants compared to Dutch, especially for immigrants from Morocco, Turkey and other non-Western countries.
Conclusions These results indicate that immigrant status is associated with poorer cognitive functioning in early psychosis. The findings argue against diagnostic bias as an explanation for the increased incidence of psychotic disorders in immigrants.

Keywords Schizophrenia · Psychosis · Migration · Ethnicity · Cognition

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Introduction

Various studies demonstrated increased incidence rates of schizophrenia and other psychotic disorders in immigrant groups [1–9]. It has been argued that these high rates were the result of diagnostic bias: experiences and behavior of ethnic minorities may be misinterpreted as positive or negative symptoms of schizophrenia by clinicians who are not familiar with the immigrants' culture [10, 11]. If this kind of diagnostic bias does in fact lead to a larger number of incorrect psychotic diagnoses in immigrant groups compared to non-immigrants, it is likely that average severity of symptoms in clusters other than positive or negative symptoms would be lower in immigrant groups. Studies of ethnic differences in symptom profiles reported contradictory findings [12–14], but were limited to positive, negative and affective symptoms. With regard to the latter, Veling and colleagues [14] found higher levels of depressive or manic symptoms in some, but not all, immigrant groups.

Neurocognitive functioning is another main symptom category in psychotic disorders [15–18]. Three of the most impaired neurocognitive functions in psychotic disorders are sustained attention, immediate recall and delayed recall [19–21]. Cognitive deficits in these areas tend to precede psychotic symptoms [22, 23], to persist after psychotic episodes [24] and are more prominent than in other psychiatric disorders [25, 26]. If the high rates of psychotic

disorders in immigrants are an artifact of misdiagnoses, it is unlikely that we would find large cognitive deficits in immigrant patients, whereas similar or larger cognitive impairments in immigrants compared to non-immigrants would argue against diagnostic bias [11].

Cognitive measures are likely to have ethnic bias in themselves, since cultural and linguistic differences may impact measurement scores considerably [27]. A review showed that immigrants and non-immigrants in the general population of The Netherlands tend to differ on average one standard deviation in cognitive performance tests [28]. This difference was substantially smaller in second-generation immigrants than in first-generation immigrants.

This study examines cognitive differences between immigrants and non-immigrants and between first- and second-generation immigrants with three cognitive measures in a multi-ethnic clinical sample of first episode schizophrenia spectrum patients. We hypothesized that (1) both immigrant patients and non-immigrant patients have cognitive test scores more than one SD below the general Dutch population norm scores, (2) differences in cognitive deficits between immigrant- and non-immigrant patients are smaller than one SD, and (3) differences between second-generation immigrants and non-immigrants will be smaller than those between first-generation immigrants and non-immigrants.

Method

Subjects

All patients who made first contact with mental health services in The Hague between September 1, 2000 until September 1, 2009, who completed our diagnostic protocol, were diagnosed with a non-affective psychotic disorder (DSM IV: schizophrenia, schizophreniform disorder, schizoaffective disorder, brief psychotic disorder, delusional disorder and psychotic disorder NOS) and who also completed neuropsychological assessment were included in this study. The study was approved by the Dutch ethics committee for mental health care. No informed consents were obtained, since all data were collected as part of routine outpatient diagnostic procedures and care over an extended period of time, without premeditation of subsequent data analyses.

Classification of ethnicity

Ethnicity was classified as follows: those patients who are Dutch-born with two Dutch-born parents were categorized as Dutch (DP), those who are Dutch-born and have at least one foreign-born parent were categorized as second-generation immigrant (IP2), and those who are foreign-born were categorized as first-generation immigrant (IP1). The seven ethnic subcategories were: (1) Dutch, (2) Morocco, (5) The Netherlands Antilles, (3) Surinam, (4) Turkey, (6) western(ized) countries (northern, southern or western Europe, the former Yugoslavia, the USA, Canada, Australia, New Zealand, Japan or former Netherlands East Indies), and (7) all other (non-western) countries.

Diagnostic protocol

The patients were interviewed by Dutch residents in psychiatry using two different semi-structured diagnostic interviews: Comprehensive Assessment of Symptoms and History (CASH) [29] (from start study until 30-09-2008) and Schedules for Clinical Assessment in Neuropsychiatry (SCAN) [30] (from 01-10-2008 until end study). Cognitive assessment was performed by clinical psychologists. Relatives were interviewed by trained nurses using the Instrument for the Retrospective Assessment of the Onset of Schizophrenia (IRAOS) [31]. Using information derived for CASH/SCAN, IRAOS, cognitive assessment and the medical file, the residents compiled a narrative history of the patient's illness. For the patients who refused the interviews and/or the cognitive assessment, they constructed a history using information from the responsible physician. On the basis of the narrative history two psychiatrists made a consensus DSM-IV diagnosis during a diagnostic meeting.

Cognitive assessment

The assessment was structured as follows: firstly, date of birth, completed years of education and some other personal characteristics were obtained through a short structured interview. Secondly, the five learning trails of the RAVLT (immediate recall) were conducted (see "Verbal memory"). Thirdly, the patients completed the CPT task (see "Sustained attention") and finally, the RAVLT delayed recall trail (15 min delay) was administered (see "Verbal memory"). Based on demographics-corrected normative data contained within the test manuals [32, 33], raw scores were converted to *Z* scores for all cognitive measures to allow for clinical interpretation. Scores were adjusted so that higher *Z* scores reflected better performance.

Verbal memory

Verbal short-term memory (immediate recall) and verbal declarative memory (delayed recall) were both assessed in all subgroups with the Dutch version of the Rey's Auditory Verbal Learning task (RAVLT) [32, 34]. This task consist of spoken single-syllable words, presented in five identical trials of 15 words with immediate reproduction after every trial and one delayed recall trial after a 15-min delay.

Sustained attention

Sustained attention was assessed in all subgroups with the Continuous Performance Task (CPT, 3-7 version) [33, 35, 36]. During this 10-min test, a string of 600 single digits is sequentially shown on a computer screen. A "hit" is counted when a mouse-click is registered directly after the presentation of first the number three, directly followed by the number seven; 90 targets in total.

Other measures

Education

Completed years of education was ascertained through adding the total number of years completed in primary-, secondary- and tertiary- or higher education.

Global functioning

Global functioning was assessed with the modified Global Assessment of Functioning (GAF) score [37].

Cannabis use

The treating physicians gathered information on current (five times use or more in the last month) and lifetime (five times use or more ever) cannabis use during the psychiatric interview.

Data analysis

The analyses were performed with SPSS version 18 for Windows [38]. Descriptive statistics of all variables involved were first computed. Immediate recall scores (RAVLT) were calculated by adding the scores of the five learning trails. Pearson Chi-squares were calculated to identify group differences in gender- and cannabis use distributions. Between-group differences on all other variables were assessed using Student's *t* tests. Correlations between dependent variables and independent variables were examined to identify covariates. Hierarchical regression models (method enter) were used to assess the predictive quality of cognitive performance on education per ethnic subgroups. The relationship between cognitive performance and education was compared between ethnic groups (ANCOVA) to examine homogeneity of regression slopes and interaction effects. An alpha level of 0.05 was regarded as acceptable for all analyses.

Additional analysis explored the potential cross-cultural measurement bias (CCMB) for the used psychometric tools. A measure may demonstrate CCMB if the regression models that relate the predictor (here: cognitive functioning) to a predicted outcome (e.g., years of education) differ between ethnic groups [39, 40]. Bias is likely if (a) ethnic groups differ in cognitive functioning (regression intercepts) and (b) ethnic groups differ in the associations between cognitive functioning and completed years of education. Education is a useful outcome for this analysis, because it is associated to both immigrant status and cognitive functioning.

Results

Descriptive statistics

Subjects

854 subjects made first contact during this 9-year period, of which 496 completed cognitive assessment (58.1 %). Of the total of 496, 407 subjects (82.1 %; 307 male, 100 female) were diagnosed with a non-affective psychotic disorder (schizophrenia spectrum disorder $N = 319$, brief psychotic disorder $N = 13$, and psychotic disorder NOS $N = 75$). The group of subjects that did not complete cognitive assessment ($N = 358$) contained higher percentages of females ($p \leq 0.05$) and immigrants ($p \leq 0.01$) and a lower percentage of lifetime cannabis users ($p \leq 0.05$) compared to the group that did. No differences were observed on any of the other available variables.

Demographic variables and cognition

Table 1 shows descriptive statistics and frequencies for the study sample, DP, total immigrant subgroup (IPT), IP1, and IP2: sex, age, GAF, education, cannabis use (current and lifetime), immediate recall (RAVLT immediate recall), delayed recall (RAVLT delayed recall) and sustained attention (CPT hit rate). Performance by Dutch patients was −0.45 SD for memory (average over two recall tasks) and −1.14 SD for attention below the norm of the test manuals. Performance by immigrant patients was −0.89 and −2.96 SD, respectively, below these norms. Although first-generation immigrants showed poorer performance compared to second-generation immigrants on all measures, only the difference on sustained attention was significant ($p \leq 0.001$).

Figure 1 shows the standardized cognitive scores for the three cognitive variables per subgroup.

Cannabis use

Post hoc analysis revealed a lower percentage of lifetime cannabis users in IPT ($p \leq 0.01$) and lower percentages of both current ($p \leq 0.05$) and lifetime ($p \leq 0.001$) cannabis users in IP1 compared to DP. No differences in cannabis use were observed between DP and IP2. Cannabis use was unrelated to education and global functioning in all

Table 1 Descriptive statistics and frequencies for the study sample: sex, age, global functioning (GAF), education, cannabis use (current and lifetime), immediate recall (RAVLT immediate recall), delayed recall (RAVLT delayed recall) and sustained attention (CPT hit rate)

	Sample	Dutch	Immigrants		
	Total	Total	Total	2nd generation	1st generation
N	407	157	250	112	138
Sex[a] (male/female)	307/100	115/42	192/58	86/26	106/32
Age	26.90 (7.21)	27.56 (7.66)	26.47 (6.89)	25.11 (7.23)*	27.59 (6.41)
GAF	46.89 (12.63)	48.40 (13.24)	46.00 (12.20)	45.62 (10.89)	46.32 (13.27)
Years of education	11.34 (2.45)	12.06 (2.26)	10.89 (2.46)***	11.34 (2.30)*	10.52 (2.54)***
Cannabis use, current[b]	128 (31.4 %)	53 (33.8 %)	75 (30.0 %)	42 (37.5 %)	33 (23.9 %)
Cannabis use, lifetime[c]	263 (64.6 %)	112 (71.3 %)	151 (60.4 %)	78 (69.6 %)	73 (52.9 %)
RAVLT immediate recall[a]	39.95 (11.36)	43.42 (10.44)	37.61 (11.44)***	38.88 (10.78)**	36.57 (11.91)***
RAVLT delayed recall[d]	8.45 (3.26)	8.94 (2.94)	8.14 (3.42)	8.43 (3.22)	7.89 (3.57)
CPT hit rate[a]	0.808 (0.180)	0.870 (0.126)	0.769 (0.197)***	0.820 (0.161)*	0.729 (0.213)***

Asterisks denote significant differences in comparison with the Dutch subgroup

RAVLT Rey Auditory Verbal Learning Task, *CPT* continuous performance task

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

[a] χ^2 (2) = 0.608, $p = 0.738$

[b] χ^2 (2) = 5.09, $p = 0.078$

[c] χ^2 (2) = 12.82, $p = 0.002$

[d] Differences adjusted for education and cannabis use

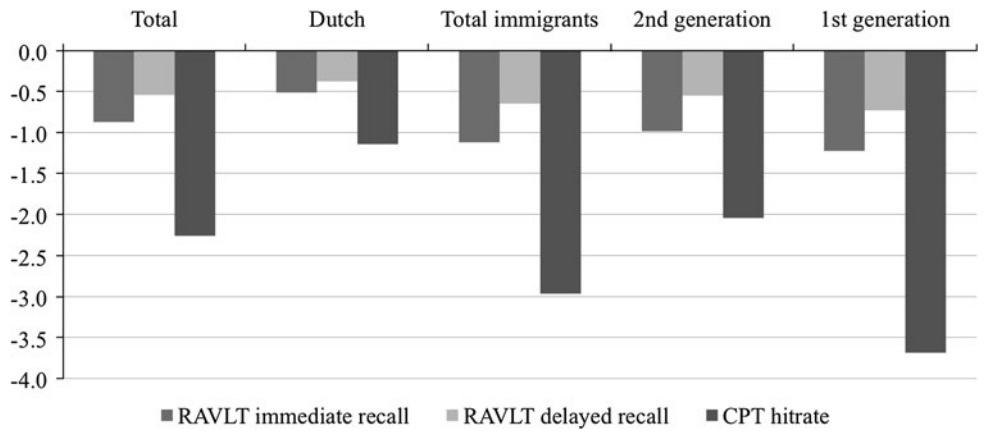

Fig. 1 Standardized cognitive scores for immediate recall (RAVLT IR), delayed recall (RAVLT DR) and sustained attention (CPT) for the study sample and the following subgroups: Dutch, total immigrants, second-generation immigrants and first-generation immigrants. *RAVLT IR* Rey Auditory Verbal Learning Task, immediate recall, *RAVLT DR* Rey Auditory Verbal Learning Task, delayed recall, *CPT* continuous performance task

subgroups, except for lifetime use in DP, where those with lifetime cannabis use had slightly higher GAF scores [$T(154) = 1.49$, $p = 0.14$, ns].

Cognition, education and cannabis

Table 1 and Fig. 1 further show the cognitive measures scores for these groups. All immigrant groups (IP1, IP2 and IPT) had significantly lower scores on all three cognitive measures compared to DP. In addition, current cannabis use was related to smaller deficits on delayed recall ($d = 0.41$) and sustained attention ($d = 0.46$) in IP1 and lifetime cannabis was related to smaller attention deficits in DP ($d = 0.24$). Post hoc tests revealed significant differences between IP1 and IP2 on all cognitive measures ($p \leq 0.01$ for all). Differences between all groups on delayed recall were no longer significant, when controlled for education and cannabis use.

Descriptive statistics: immigrant subgroups

To examine within-ethnic group differences, the IPT subgroup was split into six subgroups based on ethnicity (see "Classification of ethnicity"). Table 2 shows the same means and frequencies for these subgroups as Table 1, adding the

Table 2 Descriptive statistics and frequencies per ethnic subgroup

	Surinam	Antilles	Turkey	Morocco	Non-Western	Western
N	65	16	34	58	58	19
Generation (1st/2nd)[a]	31/34	9/7	15/19	38/20	37/21	8/11
Sex[b] (male/female)	45/20	11/5	23/11	50/8	47/11	16/3
Age	27.25 (7.15)	25.63 (5.54)	26.61 (10.30)	26.50 (5.54)	25.93 (6.28)	25.81 (5.01)
GAF	45.03 (12.47)	43.88 (10.91)	44.42 (10.00)	45.18 (12.18)	49.56 (13.25)	45.59 (12.13)
Years of education	10.74 (2.36)***	11.75 (2.17)	10.80 (2.58)**	10.34 (2.19)***	11.04 (2.78)**	12.11 (2.16)
Cannabis use, current[c]	23 (35.4 %)	4 (25.0 %)	5 (14.7 %)	19 (32.8 %)	19 (32.2 %)	6 (31.6 %)
Cannabis use, lifetime[d]	42 (64.6 %)	9 (56.3 %)	16 (47.1 %)	32 (55.2 %)	38 (64.4 %)	15 (78.9 %)
RAVLT immediate recall[e]	38.91 (10.77)	43.06 (13.25)	34.97 (9.44)**	34.41 (10.69)***	37.09 (12.84)**	44.94 (8.57)
RAVLT delayed recall[e]	8.44 (3.33)	9.67 (3.36)	7.55 (3.26)	7.55 (3.49)	7.89 (3.58)	9.50 (2.90)
CPT hit rate[e]	0.805 (0.178)*	0.779 (0.203)*	0.754 (0.151)***	0.720 (0.235)***	0.757 (0.207)***	0.852 (0.130)

Chi-squares were calculated including the Dutch subgroup, except for the generation distribution for the ethnic subgroups (a). Asterisks denote significant differences in comparison with the Dutch subgroup

RAVLT Rey Auditory Verbal Learning Task, *CPT* continuous performance task, *GAF* global assessment of functioning

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

[a] χ^2 (12) = 317.81, $p = 0.000$

[b] χ^2 (6) = 8.50, $p = 0.204$

[c] χ^2 (6) = 7.16, $p = 0.307$

[d] χ^2 (6) = 14.93, $p = 0.021$

[e] Differences adjusted for education and cannabis use

distribution of first- and second-generation subjects per subgroup. After controlling for education and cannabis use, immigrants from Morocco ($p \leq 0.001$), Turkey ($p \leq 0.01$) and other non-Western countries ($p \leq 0.01$), showed poorer immediate recall compared to DP. Furthermore, the Moroccan ($p \leq 0.001$), Turkish ($p \leq 0.001$), other non-Western countries ($p \leq 0.001$), Surinam ($p \leq 0.05$) and The Netherlands Antillean ($p \leq 0.05$) subgroups demonstrated larger attentional deficits compared to DP.

Figure 2 shows the standardized cognitive scores for the three cognitive variables for the six immigrant subgroups.

Regression models

Cross-cultural measurement bias: regression weights

The regression models for predicting education with cognitive predictors for DP, IP1 and IP2 with gender and age as covariates are displayed in Table 3.

In Fig. 3, the regression models from Table 3 are plotted. As was indicated by Tables 1 and 3, different intercept and slopes are demonstrated between the three subgroups on all three measures (for statistical testing, see "Cross-cultural measurement bias: regression slopes").

Cross-cultural measurement bias: regression slopes

To investigate CCMB for the cognitive measures that were used in this study, the homogeneity of the regression slopes was assessed with ANCOVA analysis. Results are displayed in Table 4, indicating that the ethnicity × cognition interaction (CCMB) was significant only in the DP versus IP2 group comparison. Overall, CCMB explained between 0.0 and 2.2 % of the variance in education in these between-group comparisons, where ethnicity accounted for between 0.1 and 3.5 % of this variance and cognition for 3.0–13.6 %.

Discussion

This study in a sample of first-episode schizophrenia spectrum patients showed substantial cognitive impairment on immediate recall (range −0.55 to −1.45 SD), delayed recall (range−0.13 to −0.85 SD) and sustained attention (range −1.14 to −3.84 SD) in both Dutch and immigrant patients groups. The deficits observed on immediate recall were larger than those observed on delayed recall, even though the latter is generally considered a more strenuous cognitive task. The results revealed significantly larger cognitive deficits in immigrant patients compared to Dutch patients and in first-generation immigrant patients compared to second-generation immigrant patients, controlling for education and use of cannabis. Overall, the Moroccan, Turkish and other Non-Western subgroups demonstrated the largest cognitive deficits.

Reviewing the differences between immigrants and non-immigrants on immediate-and delayed recall we conclude

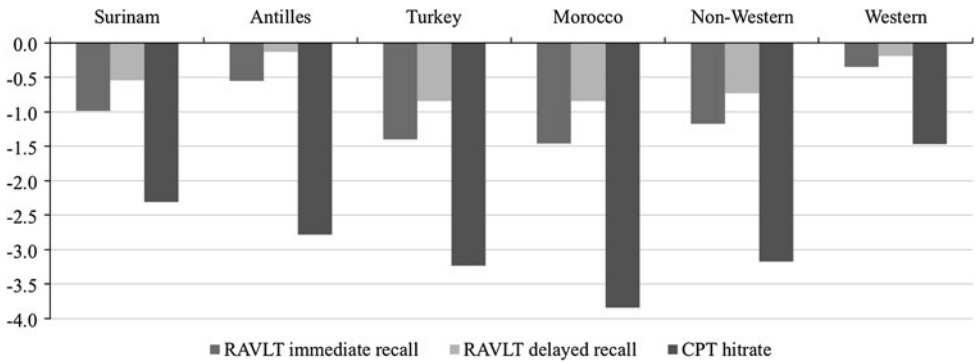

Fig. 2 Standardized cognitive scores for all ethnic subgroups for immediate recall (RAVLT IR), delayed recall (RAVLT DR) and sustained attention (CPT). *RAVLT IR* Rey Auditory Verbal Learning Task, immediate recall, *RAVLT DR* Rey Auditory Verbal Learning Task, delayed recall, *CPT* continuous performance task

Table 3 Hierarchical regression models (method enter) for cognitive predictors of education per ethnic subgroup, adjusted for gender and age

	Model	β	R^2	Δr^2	p value (F)
Dutch ($N = 157$)					
Box 1	Gender + age	−0.004	0.004	–	0.746
		0.061			
Box 2a	Box 1 + RAVLT immediate recall	0.225**	0.054	0.050	0.042
Box 2b	Box 1 + RAVLT delayed recall	0.105	0.015	0.011	0.531
Box 2c	Box 1 + CPT hit rate	0.176*	0.037	0.030	0.135
2nd generation ($N = 112$)					
Box 1	Gender + age	−0.074	0.010	–	0.601
		−0.069			
Box 2a	Box 1 + RAVLT immediate recall	0.485***	0.233	0.223	0.000
Box 2b	Box 1 + RAVLT delayed recall	0.421***	0.180	0.170	0.000
Box 2c	Box 1 + CPT hit rate	0.316***	0.105	0.095	0.010
1st generation ($N = 138$)					
Box 1	Gender + age	0.001	0.012	–	0.463
		−0.110			
Box 2a	Box 1 + RAVLT immediate recall	0.365***	0.140	0.128	0.000
Box 2b	Box 1 + RAVLT delayed recall	0.316***	0.109	0.097	0.002
Box 2c	Box 1 + CPT hit rate	0.200*	0.050	0.038	0.085

Asterisks denote significant betas (β)

RAVLT Rey Auditory Verbal Learning Task, *CPT* continuous performance task

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

that none of the immigrant subgroups scored one SD or more below the Dutch patients (range 0.19 to –0.95 ΔSD), although the Turkish (−0.89 ΔSD) and Moroccan (−0.96 ΔSD) subgroups approached this mark. However, all immigrant subgroups, except the Western subgroup (−0.32 ΔSD), scored more than one SD below the Dutch patients on sustained attention (range −1.17 to −2.70 ΔSD).

Based on these findings we conclude that (1) both immigrants and non-immigrants with psychotic disorders show marked cognitive deficits in immediate recall, delayed recall and attention, (2) there are marked differences in cognitive deficits between immigrant- and non-immigrant patients, where no clear differences in psychotic symptom profiles were evident in our subsample analysis [1–9, 12–14], and (3) second-generation immigrants show better performance than first-generation immigrants, especially for sustained attention.

Examining these results further, we assessed if cross-cultural measurement bias accounts for ethnic differences in cognitive performance. Figure 3 illustrates that the Dutch subgroup and first-generation immigrant subgroup mainly differ in intercept, while the second-generation immigrant subgroup primarily differs from both groups in slope in these plotted regression models. Subsequently, we did find a significant ethnicity × cognition interaction in the Dutch patients versus second-generation immigrant patients' comparison (Fig. 3; Table 4), but this interaction explained between 0.0 and 2.2 % only of the variance in education in all

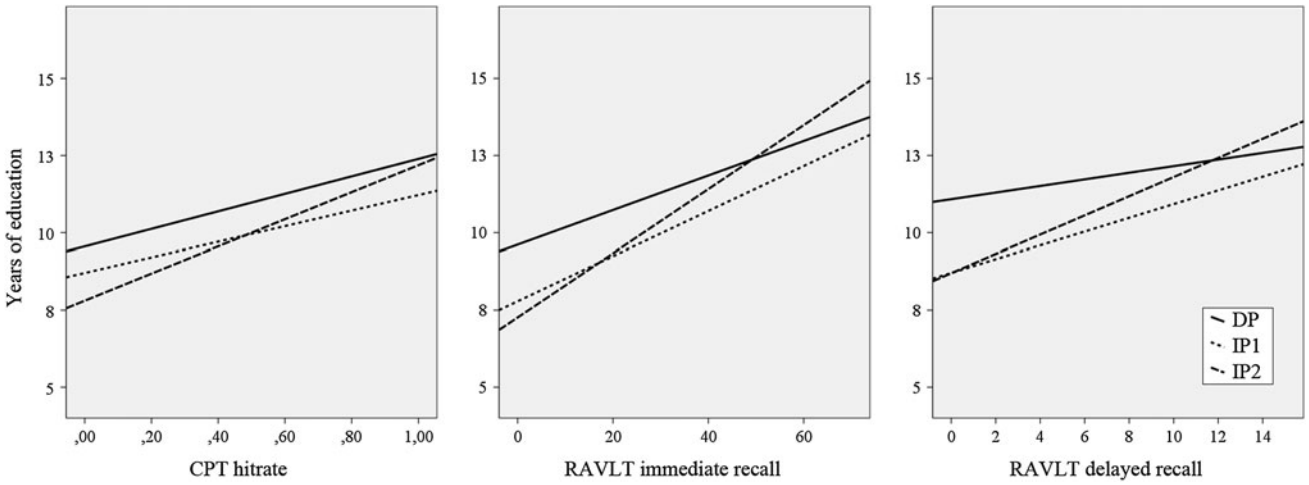

Fig. 3 *Plotted* regression *lines* for the education × cognition (sustained attention, immediate recall and delayed recall) interaction per ethnic subgroup. *DP* Dutch patients, *IP2* second-generation immigrant patients, *IP1* first-generation immigrant patients

Table 4 Assessment of homogeneity of regression slopes in DP versus IP1 and PD versus IP2 comparisons

	Dutch versus 1st generation			Dutch versus 2nd generation		
	F value	*p* value	Partial η^2	*F* value	*p* value	Partial η^2
Immediate recall, corrected model	21.86	0.000	0.186	17.16	0.000	0.164
Ethnicity	3.88	0.050	0.013	6.19	0.013	0.023
RAVLT immediate recall	26.96	0.000	0.086	41.12	0.000	0.136
Ethnicity × RAVLT IR	0.65	0.422	0.002	4.598	0.033	0.017
Delayed recall, corrected model	17.84	0.000	0.158	11.45	0.000	0.116
Ethnicity	10.15	0.002	0.034	9.51	0.002	0.035
RAVLT delayed recall	14.39	0.000	0.048	22.35	0.000	0.079
Ethnicity × RAVLT DR	1.92	0.167	0.007	5.76	0.017	0.022
Sustained attention, corrected model	13.75	0.000	0.126	6.98	0.000	0.075
Ethnicity	0.34	0.561	0.001	1.16	0.283	0.004
CPT hit rate	8.81	0.003	0.030	13.77	0.000	0.050
Ethnicity × CPT	0.04	0.841	0.000	0.62	0.431	0.002

RAVLT IR Rey Auditory Verbal Learning Task, immediate recall, *RAVLT DR* Rey Auditory Verbal Learning Task, delayed recall, *CPT* continuous performance task

ethnic groups (Table 4, partial η^2). Compared to the overall explained variance for the cognitive models of education (between 7.5 and 18.6 %) the impact of cross-cultural measurement bias on the between-group differences in cognitive performance is found to be modest. Therefore, we conclude that cross-cultural measurement bias is no valid explanation for ethnic differences in cognitive performance. In addition, smaller rather than larger cognitive deficits would be expected in ethnic minority patients, if a substantial number of these ethnic minority cases had been incorrectly diagnosed with a psychotic disorder. Since test scores of immigrant patients on sustained attention differed more than 1 SD from non-immigrant patients' scores, it is unlikely that the observed differences can be attributed to measurement bias [28]. These combined findings argue against diagnostic bias as an explanation for the increased incidence rates of psychosis in immigrant groups [10, 11].

Explanations for the associations

The association between psychotic illness, cognitive functioning, measures, culture and language are complex and difficult to disentangle. While we do not have a definitive explanation for the results, several factors are likely to have contributed to the observed differences.

Illness severity

The observed cognitive differences between groups might be due to more severe illness in immigrant patients

compared to the Dutch patients. However, subsequent subgroups analysis revealed no differences in global functioning. In addition, we previously performed an analysis of a subset ($N = 361$, with and without cognitive assessment) of this sample described elsewhere [14] that revealed no significant differences between the subgroups on positive symptoms and a significantly raised score on negative symptoms only for the Moroccan subgroup ($p \leq 0.05$). In addition, none of the groups in this subset showed increased rates of comorbid current manic episodes and only the Moroccan ($p \leq 0.01$) and the Turkish ($p \leq 0.05$) subgroups showed increased prevalence of comorbid current depressive symptoms. These findings suggest that differences in psychotic symptoms, comorbidity or global functioning between immigrant patients and Dutch patients are unlikely to explain the lower scores of immigrants performed on the cognitive measures. Although cognitive dysfunctioning in itself can obviously be considered an indicator of illness severity, it appears the only severity indicator clearly differing between immigrants and non-immigrants with psychosis, warranting further investigation.

Language

An evident factor that most likely has significantly influenced our findings is familiarity with the Dutch language. Immigrants from Surinam and The Netherlands Antilles (both former Dutch colonies) as well as second-generation immigrants from all backgrounds are generally fluent in the Dutch language. In addition, second-generation immigrant patients most often have lived in The Netherlands all their lives. In most cases, neither is true for first-generation immigrant patients. This obviously might account for some of the observed differences in verbal memory performance, even though research on this matter has classified the impact of assessment-language on test scores as small [41]. Aside from this, the difference in language and cultural familiarity still do not provide means to interpret the large difference between first- and second-generation immigrant patients on the non-verbal sustained attention task (Δz-score $= 1.64$).

Cannabis use

Differences in cannabis use may account for some of the observed cognitive differences between immigrant patients and Dutch patients. The findings indicate that cannabis use is not a likely candidate to explain worse cognitive performance for ethnic subgroups. On the opposite, the first-generation immigrants, with the poorest cognitive performance, used little cannabis. This is in accordance with a recent meta-analysis where first-episode psychosis patients with a history of cannabis use show smaller cognitive deficits compared with non-using patients [42]. The authors concluded that this effect might be driven by a subgroup of "neurocognitively less impaired" patients, who developed psychosis only after cannabis use, which would subsequently be more frequent in groups with more cannabis use.

Cultural background

A body of literature has shown that cognitive styles differ substantially across cultures [43–47]. A well-known example of such a difference is analytic versus holistic. Western(ized) cultures tend to be more analytic, focusing more on elements and details, whereas non-Western cultures tend to be more holistic, focusing more on context and inter-element relationships [48, 49]. An analytic or "western" cognitive style might be better suited for our sustained attention task [50–52], since this task focuses exclusively on the target rather than on context. A similar advantage might be present in our verbal learning task [41]. However, this remains speculative. Research examining this issue is sparse and has thus far focused on "Western" versus "East Asian" samples and not "Arabic" or "African" samples.

In a more general sense, it is also possible that an underlying stress-factor associated with minority status could result in both the lower cognitive scores and the higher incidence rates in immigrants. Factors like stereotype threat (i.e., being at risk of confirming a negative stereotype about one's group) have been found to predict worse cognitive performance in immigrants [53], whereas other social stress factors such as discrimination [7, 54, 55] and urban ethnic density [56] appear to be related to the increased incidence of psychotic disorders in immigrants. Further research is warranted to expand and integrate existing cognitive [57] and ecological [58–60] models linking large cognitive deficits and increased incidence of psychosis in immigrant groups.

Strengths and limitations

A strength of this study is that it, to our knowledge, presents the largest representative first episode schizophrenia spectrum patients sample examining cognitive deficits and migration to date. Another strength is that this study is the first to compare cognitive measures between seven different ethnic subgroups and multiple generations from one urban area. A final strength of this study is that all data were collected from first episode psychosis (FEP) patients within the first 3 months after they had made contact with psychiatric services, limiting the impact of confounding variables associated with chronic psychoses and long-term treatment.

The study also has a number of limitations. First, although the normative data that was used to standardize and compare cognitive performance scores between groups was corrected for the demographic variables age and gender, the use of either ethnic subgroup specific normative data or descriptive data obtained from healthy control subjects for all various subgroups in this study would have been preferable. Unfortunately, no such data sets were available, so investigations were limited to normative-, between- and within-subgroup comparisons. Second, we have not obtained the completed years of education from those who did not complete cognitive assessment. Therefore, we are unable to investigate the extent of which this selection effect has influenced our results. Third, since psychotic symptoms and comorbid depressive symptoms were only available for a subset of the sample, the exact differences in psychotic symptoms and comorbid depressive episodes between groups cannot be defined. Fourth, information on current antipsychotic medication use was not available. We expect the effect of this confounding variable on our findings to be small, however, since all data were collected within 3 months after first-contact with mental health services. In addition, meta-analyses indicate that there is only a marginal effect of antipsychotic medication use on cognitive performance [61, 62]. Fifth, duration of untreated psychosis (DUP) was not assessed, and therefore possible effects of (variations in) illness duration prior to first contact cannot be assessed. However we do expect these effects to be very small or absent, since a previous publication on a subset of our sample using identical methodology and performed in the same urban area did not show any differences in DUP between groups [14]. Sixth, our neuropsychological battery had a limited span with only three cognitive measures, albeit that these measures assess core domains of neurocognition in psychotic disorders. Finally, cannabis use was assessed in a practical but limited way in our study. Although our findings based on these measures are supported by meta-analytic data [42], these counterintuitive findings warrant further studies, preferably with standardized questionnaires and laboratory drug testing.

Conclusions and implications

In summary, our findings demonstrated (1) substantial cognitive deficits for all subgroups compared to demographics-corrected normative data, (2) markedly poorer cognitive performance on immediate recall for the Moroccan, Turkish and other non-Western subgroups and for all but the Western subgroup on sustained attention compared to Dutch patients, and (3) larger deficits for first generation compared to second-generation immigrants. Furthermore, none of these differences was explained by variations education, cannabis use, or cross-cultural measurement bias. The analyses of the subsample [14] indicate that these differences are likely to be unrelated to psychotic symptoms and comorbid disorders. Our findings render diagnostic bias implausible as an explanation for increased incidence of psychosis in immigrants.

The results have a number of implications. First, this study clearly shows large differences in cognitive deficits both between and within ethnic subgroups, indicating the necessity and wisdom of integrating a form of cultural assessment in both diagnostic measures and treatment programs for first-episode psychosis patients to expand our knowledge on cross-cultural differences in psychotic disorders and to optimize accuracy and effectiveness of clinical diagnoses and treatment. Second, from a research perspective, these findings further strengthen the need for the development of either truly cultural neutral psychometric tools, or the development of standardized versions for every subgroup, or at least subgroup-specific normative data for every instrument. The obvious drawbacks and complications of these various pursuits will not be discussed here; we just argue the need to find a practical and psychometric sound approach to this issue that will allow future researchers to investigate these cross-cultural between- and within-subgroup effects. Finally, the fact that some part of the observed cognitive deficits appears to be culture- and/or language-related, does not change the fact that these patients live in the Dutch society, an environment where they experience these culture- and or language-related difficulties every day. From a clinical perspective, the observed deficits therefore are likely to accurately reflect cognitive difficulties these patients experience in daily life.

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

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