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SUPPLEMENT ARTICLE

Cross-cultural Differences in Hallucinations: A Comparison Between Middle Eastern and European Community-Based Samples

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***Background and Hypothesis*: While literature indicates that culture modulates phenomenological characteristics of hallucinations in schizophrenia-spectrum disorders, little is known about the extent culture modulates these characteristics in nonclinical samples. *Study Design*: We compared lifetime prevalence, age of onset, and phenomenology of hallucinations as assessed with the Questionnaire for Psychotic Experiences between samples of nonclinical participants used from the Netherlands ($N = 2999$) and Qatar ($N = 2999$). While participant recruitment differed between the 2 countries, the samples were relatively equal in terms of demographic factors. *Study Results*: Our findings indicate that the lifetime prevalence of tactile and olfactory hallucinations are the same across countries. However, the prevalence of auditory hallucinations (AH) and visual hallucinations (VH) were twice as high in the Dutch sample. The reported age of onset for auditory and tactile hallucinations was younger for the Dutch sample. Findings from the measurement invariance supported cross-cultural comparisons with exception for duration, distress, and insight. Qatar's and Dutch participants reported similar valence and extent of interaction with AH and VH. However, compared to those in the Netherlands, participants from Qatar reported significantly more impact on daily functioning and a higher prevalence of receiving commands from hallucinations in the past week. *Conclusions*: While AH and VH were more often reported in the Dutch sample, participants in Qatar generally had higher mean factor scores for past week AH and VH than in the Netherlands. The phenomenology of hallucinations in the Qatar sample was of greater clinical relevance, with potentially important implications for early screening and prevention.**

Key words: prevalence/phenomenology/measurement invariance/Questionnaire of Psychotic Experiences/Qatar/Netherlands

Introduction

Psychotic experiences are characterized by an altered perception and experience of reality. Given that culture helps define what is considered and experienced as "reality",[1] it is unsurprising that cultural variations in symptoms, clinical course, and outcomes of schizophrenia-spectrum disorders (SSD) have been reported consistently.[2] Cultural factors are reported to determine the prevalence of hallucinations in clinical populations. Specifically, high prevalence of auditory hallucinations (AH), visual hallucinations (VH), and tactile (TH) hallucinations are reported in patients from Africa and Asia[3–6] and in non-European compared with European patients.[6] In a cross-cultural comparison among patients with SSD, a study showed that the prevalence of some types of hallucinations varied by culture.[7] West African patients reported more VH compared with patients from European and Middle Eastern countries and AH had relatively low

occurrence in European patients. Cenesthetic hallucinations, (a type of somatic hallucinations that are experienced as originating from visceral organs) were most prevalent in West African patients.[7] Culture seems to influence the degree of negative content and form of hallucinations. For example, a cross-cultural study reported higher frequency of auditory verbal hallucinations that were commanding, abusive, cursing, arguing, and frightening among European compared to West African patients. Furthermore, the extent of third-person perspective in the voices were more frequent among European than West African patients.[8] The most recent cross-cultural study involving SSD patients from the Middle-East (Saudi Arabia) and Europe (United Kingdom) was conducted in the 1990s.[9] The study showed that SSD Middle Eastern patients often reported culture-based content (including religious and supernatural/superstitious themes) of their auditory verbal hallucinations, while European patients predominantly reported persecutory or hostile contents of the voices they heard.[9]

It is important to recognize that cross-cultural differences in hallucinations in clinical samples may be due to reporting bias, due to stigma and sociopolitical factors related to psychiatric diagnosis. Countrywide differences in treatments may also confound cultural differences in prevalence and characteristics of hallucinations observed in SSD. A way to overcome these potential confounders is to study hallucinations in nonclinical populations. Studying hallucinations in nonclinical populations is also important in identifying the level of risk for subclinical hallucinations to transition to SSD.[10–12] Furthermore, knowledge of the phenomenological characteristics of hallucinations in nonclinical samples of a culture may help identify which hallucinations could be culture specific and potentially of clinical relevance to that population.[13]

While existing evidence supports the idea that culture modulates phenomenological characteristics of hallucinations[1,4] in SSD, far less is known about the extent culture modulates these phenomena in nonclinical samples. Specifically, we know that the prevalence rates of hallucinations vary widely across countries in a manner exceeding the variability in the prevalence of SSD,[14,15] but little is known about how the phenomenology (eg, content, form, severity) of hallucinations may be influenced by cultural environment.[16,17] Culture can influence the collective social reaction and the meaning assigned to psychotic phenomena, which in turn may influence the distress and functional impairment of those who have such experiences.[1] Also, stigma and taboo of experiencing hallucinations may affect reporting and lead to lower reported events in specific cultures. To date, only few studies compared levels of distress and impairment of nonclinical hallucinations across cultures.[18–21] In the largest cross-cultural investigation to date, the endorsement rates of hallucinations and their associated distress were compared in samples from predominantly collectivist cultures (low-income and middle-income countries: LAMIC, n = 2472) with samples from individualistic cultures (high-income countries [HIC], n = 4669). The study showed that while the rates of endorsement of hallucinations were higher in LAMIC relative to HIC, the reported distress levels associated with these hallucinations were lower in LAMIC relative to HIC after adjustment for the frequency of these symptoms. These findings were interpreted as implying that hallucinations in collectivist societies may be of lower clinical relevance compared to individualistic societies.[21] On the other hand, a recent study compared student populations from European countries (Netherlands, n = 245; Norway, n = 162), and a West African country (Nigeria, n = 478) using the Community Assessment of Psychotic Experiences scale (CAPE-42) found that levels of distress associated with hallucinations were higher in the West African students compared to European countries.[20]

Although there have been several epidemiologic investigations of the lifetime prevalence of hallucinations across countries or ethnicities,[14,22–24] most of these studies employed very brief instruments for the assessment of hallucinations in nonclinical samples.[14,22,25] Hence, the cross-cultural differences in phenomenology and impact on daily life (distress and functional impairment) of hallucinations in community samples needs to be clarified. This is particularly the case in the Middle East where there have been no recent cross-cultural comparisons of hallucinations.

The aim of the current study was to compare lifetime prevalence of different types of hallucinations (auditory, visual, tactile, and olfactory) between a large sample of community-based participants used from the Netherlands and Qatar. The Netherlands is a European country with an individualistic secular society, while the Qatar is a Middle Eastern country with a collectivist Muslim society. Our second aim was to identify cross-cultural similarities and differences in distress and functional impairment along with a broad array of phenomenological characteristics indexing severity (episode duration, negative content or valence, conviction, interaction, commands) pertaining to hallucinations in the past week.

Based on a previous population-based study comparing Arabs and non-Arabs living in Qatar,[26] we hypothesized that participants from Qatar would have a higher prevalence of hallucinations and report higher levels of distress compared to participants from the Netherlands. As this is the first in-depth cross-cultural comparison on phenomenological characteristics of hallucinations, we conducted exploratory analyses to test for the differences in the quality of these phenomena.

Methods

Participants

Qatar Sample. A list of all eligible students for the study (18+ years and registered in full-time academic studies)

was prepared and divided into strata based on: nationality (Qatari, Non-Qatari), program year (5 levels), and gender. Systematic random sampling was carried out to select a representative sample of full-time students at Qatar University from these strata. This was done separately for the 2 waves of data collection spanning the following academic years: 2019/2020 and 2020/2021. The data collection period was February to June of each academic year.

The Questionnaire of Psychotic Experiences (QPE)[27,28] was administered as part of a 25 minutes online survey available in either Arabic or English. Multiple follow-up reminders by email and phone were carried out to maximize the study's response rate. A total of 3193 surveys out of 20 704 invitations were completed, for an overall response rate of 15.4%. The sample for each wave of data collection and for the combined dataset of the 2 waves were weighted to account for the sample design and nonresponse. The study's research protocol was approved by the institutional review boards of the main collaborating institutions at Qatar University (QU-IRB 1021-EA/19) and the Medical Research Council at Hamad Medical Corporation (MRC-03-19-032). For more details about the methodology refer to Khaled et al. (2021) and the study website at http://pe-qatar.com.

The Netherlands Sample. The original dataset was collected using an online survey distributed among the Dutch general population that ran between September 2016 and May 2017 and included the QPE. Participants were recruited by promoting the study on Dutch media channels, as part of the national "Weekend of Science" event (www.weekendvandewetenschap.nl). The study was approved by the ethical review board of the University Medical Center Utrecht (IRB number 16-408). For a detailed report about the survey and sample, see Linszen et al. (2022).[29]

Sample Matching. From the total of 3193 participants from Qatar, a sample of 2999 participants were selected for whom gender and age (> 18 years) were known. With the aim of matching the 2 samples as well as possible for age, gender, and educational level, the R "MatchIt" package version 4.2.0 was used to select 2999 participants from the larger Dutch dataset (N = 10 448) to the preprocessed Qatar's sample (N = 2999).

Procedure

Demographic information on gender, age, and educational background were gathered from both Qatar and Netherlands samples.

Questionnaire of Psychotic Experiences (QPE). The QPE measures lifetime prevalence, age of onset, frequency, and current (past week) prevalence of visual, auditory, tactile, and olfactory hallucinations. The phenomenology of symptoms in the past week was examined using the QPE for AH and VH by asking about duration, distress, valence, impact, insight, interaction, and commands. However, the content and personification of the voices were not examined in this study. Each item was measured on a 6-point numerical scale ranging from 0 to 5, where 0 refers to "least" (e.g. shortest duration: *"very brief, just an instant"*) and 5 to "most" (e.g. longest duration: *"almost continuously"*). Validation studies of the QPE in English-[30] and Dutch-speaking[28] clinical samples were carried out.

In the Netherlands, the Dutch version of the QPE was administered, while in Qatar, the Arabic and English versions of the QPE were administered. The QPE was translated from English to Arabic, and from Arabic back to English, and consolidated differences in translations with the help of a bilingual research team panel. Fine-tuning and adaptation to the Qatari context in the final instrument were also carried out based on findings from qualitative (cognitive) interviews of the Arabic QPE. A clinical validation study of the Arabic version of the QPE was also carried out in Qatar and the results are forthcoming.

The QPE asks questions about the lifetime occurrence and age of onset of hallucinations in different modalities. For those who endorsed lifetime occurrence of any hallucination type, a specific question about the frequency of these experiences was asked as a follow-up. Participants from the Netherlands received questions on the frequency of specific hallucinations only if they had indicated to have experienced it in the past month, while participants from Qatar received those questions if they had ever experienced it. This renders the frequencies of hallucinations incomparable between the 2 samples, and for this reason, these items were not included in the analyses. In addition, 1119 participants from Qatar received the questions about olfactory hallucinations and 1913 participants from the Netherlands received the questions about delusions. Neither of these subsamples differed from the larger matched samples in terms of gender ratio or age.

Statistical Analyses

Measurement Invariance

Before conducting bivariate comparisons between the 2 samples, we wanted to establish at minimum partial measurement (factorial) invariance across groups to validate that the observed differences between the two samples were due to true differences in the underlying latent constructs and not due to differences in measurement.[31] To this end, we carried out multiple-group invariance analysis in Mplus (version 8.0). Because the observed variables are ordinal and nonnormally distributed, we used polychoric correlations and fitted measurement (confirmatory factor analysis or CFA) and structural equation models using the robust Weighted Least Squares Mean and Variance Adjusted Estimator (WLSMV) with Theta parameterization.[32] We used the fixed-factor method

(latent factor mean of 0 and variance of 1) to scale our latent constructs.[33]

As a first step, we fitted 1-factor, 2-factor, and 3-factor measurement models in the entire sample and separately in the Netherlands and Qatar samples. The 1-factor model involved 1 latent construct representing both auditory and VH in general. The 2-factor model involved 2 separate latent factors of AH and VH. The 3-factor model involved 3 separate latent factors including AH, VH, and insight.[27] We evaluated the fit of these models using standard fit indices including Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Root Mean Square Error of Approximation (RMSEA) and standard minimum fit criteria: CFI/TLI ≥ 0.90 and RMSEA ≤ 0.08.[34–36] We tested configural, metric, and scalar invariance by fitting a series of hierarchal (nested models), with each model, building on the assumptions of the previous model.[37] Configural invariance evaluates whether the same items measure the underlying construct in the same way across groups (ie, the scale has the same factor structure or factor-item and factor–factor configuration). Metric (weak) invariance builds on the configural (baseline) model by testing whether the factor loadings (slopes) of these items are the same across groups. Finally, scalar (strong) invariance builds on the metric model by evaluating whether the intercepts of the items (origins of the scale) are the same across groups.

Using the configural model, we tested for metric invariance by comparing it to a model where the factor loadings were constrained to be equal across the 2 groups in addition to having the same factor structure. Using the metric model from the previous stage, we also tested for scalar invariance by comparing it to a model where the item intercepts were constrained to be equal across the 2 groups in addition to having the same factor loadings and same factor structure. The tenability of metric and full-scalar invariance assumptions in these nested models was decided based on a change in CFI of less than 0.01 (ie, assumption holds if ΔCFI does not decrease more than 0.01) and a change in RMSEA of less than 0.015 (ie, ΔRMSEA does not increase more than 0.015).[38,39]

We also explored reasons for lack of tenability of the full-scalar invariance by releasing equality constraints of the item intercepts, one-constraint-at-a-time, and comparing the fit of the model with the previous model where that particular item intercept was not constrained to be equal to the other item intercepts. We repeated this process until the criteria of change in CFI of less than 0.01 or change in RMSEA of less than 0.015 was eventually met, which signaled the arrival at a final model where the tenability of the partial scalar invariance assumption held. This suggests that all indicators, except those freely estimated, have the same origin across groups (ie, similar levels on these indicators when the latent factor mean is 0).

At this point, further comparisons to test for the invariance of factor mean and factor variance-covariance structure across groups were carried out using the final partial invariance model as a baseline for these comparisons. A statistically significant change in $\Delta\chi^2$ at the alpha level of 0.05 was used to determine the tenability of these models.[31]

Bivariate Analyses

Differences between Qatar and Dutch samples in terms of demographic information were examined using a chi-square test (gender) and Kruskal-Wallis test (age). For our analyses of interest, we used chi-square tests to compare the 2 groups with regard to hallucination prevalence, and Kruskal-Wallis tests to compare age of onset and phenomenology characteristics of the hallucinations. All tests were two-tailed and alpha was set at.05, with reported *P*-values being those after FDR correction.[40] All comparisons were run in RStudio version 1.4.1717.

Results

Demographics

In the Qatar sample, 79.9% were women, which is a higher proportion than that among Dutch, 74.8% (X^2_2= 25.4, *P* <.001). Median age of Qatar's participants were 22 years (IQR 5 years), which was younger than the Dutch participants (median 24 years; IQR 7 years) (X^2_1 = 215, *P* <.001). Both Qatar's and Dutch participants had finished or were following higher education. Although the 2 samples differed in terms of gender and age, the differences were considered negligible (4.9% less women in the Dutch sample, mean age difference of ±2 years).

Measurement Invariance

In Supplementary table S1, we present the 1-factor, 2-factor, and 3-factor measurement models that we initially fitted to our data. Compared to 1-factor and 3-factor models, the goodness of fit indices for the 2-factor model was superior in the entire sample and across both groups according to most standard criteria with the following indices for the entire sample: CFI = 0.953, TLI = 0.936, the RMSEA = 0.052 (CI 90%: 0.040–0.063).

In figure 1, we present the results of the standardized factor loadings for the 2-factor configural model in the total sample and in the Netherlands and Qatar, respectively.

In table 1, we present findings from the invariance analysis. Briefly, we found evidence of configural and metric invariance as shown in models 1 and 2. The former was established based on good fit indices reported for the 2-factor model, while the latter based on ΔCFI and ΔRMSEA of less than 0.01 and 0.015, respectively.

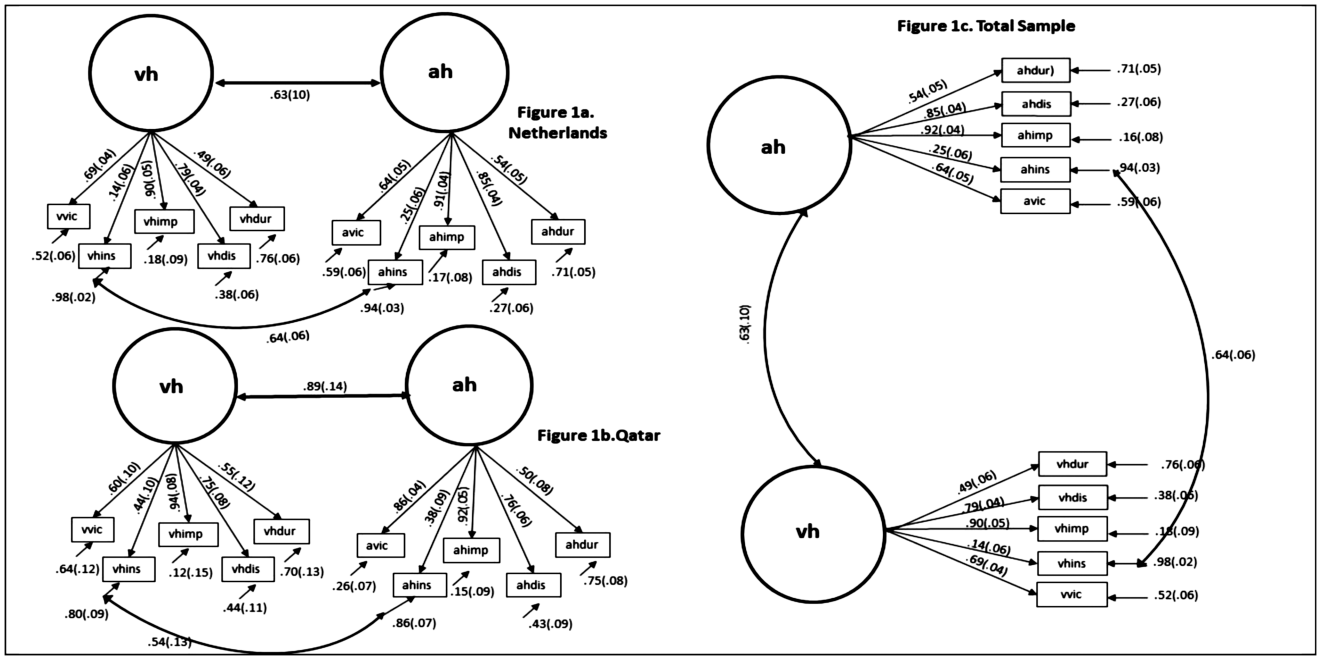

Fig. 1. Factor structure and standardized factor loadings for the 2-factor measurement (configural) model in the Netherlands (Figure 1A), Qatar (Figure1B) and total sample (Figure1C). Note. Circle = Latent factor, Rectangle = observed item, single-headed arrow from circle–rectangle = factor loading, single-headed arrow to rectangle = item-variance, double-headed arrows= correlation. All factor loadings are standardized with standard errors in brackets. Abbreviations: vh = visual hallucination, ah = auditory hallucinations, vvic = items indexing visual hallucinations valence, interaction, and conviction, vhins = item indexing visual hallucinations insight, vhimp = item indexing visual hallucinations impact, vhdis = item indexing visual hallucination distress, vhdur = item indexing visual hallucinations duration, avic = items indexing auditory hallucinations valence, interaction, and conviction, ahins = item indexing auditory hallucinations insight, ahimp = item indexing auditory hallucinations impact, ahdis = item indexing auditory hallucination distress, ahdur = item indexing auditory hallucinations duration.

However, full-scalar invariance was not achieved (ΔCFI = 0.048) as per Model 3 in table 1. Upon further analysis (Models 4–7, table 1), partial scalar invariance was achieved after removing constraints of equality of intercepts for items indexing duration and distress for both AH and VH and for insight item indexing VH only (ΔCFI = 0.008 and ΔRMSEA = 0.001).

At the structural level, evidence that the factor means of both VH and AH were not equal across groups as shown in Models 8–10 (table 1) supported moderation by culture ($\Delta\chi^2 = 32.994$, $\Delta df = 2$, $\Delta P < 0.0001$). In fact, relative to the Netherlands, Qatar had higher standardized mean factor phenomenology scores for AH = 0.696 ($P < 0.0001$) and VH = 0.389 ($P = 0.021$), respectively. However, we found no evidence of moderation by the culture of the latent correlations between VH and AH ($\Delta\chi^2 = 1.867$, $\Delta df = 1$, $\Delta P = 0.1718$). For more details about model comparisons, fit indices, and interpretation of the invariance results, see table 1.

Cross-cultural Comparisons of Hallucinations

An overview of comparisons of lifetime prevalence rates and past week phenomenology of VH and AH across the two samples can be found in table 2.

Auditory Hallucinations. Lifetime prevalence of AH differed between the two groups, with 57% of Dutch participants reporting to have had AH at least once during their lifetime versus 28% of Qatar's participants ($X^2_1 = 509$, $Pp < 0.001$) (95% CI of the difference: 26%–31%). For those who had experienced AH, age of onset was lower among Dutch (median 13 years; IQR 10 years) than participants from Qatar (median 17 years, IQR = 5 years) ($X^2_1 = 10.5$, $P = 0.001$). Follow-up comparisons in the subgroups of participants who had heard an AH in the past week (Dutch $n = 200$, Qatar $n = 126$) showed 2 differences with regard to AH characteristics (figure 2). Qatar's participants reported the AH to have a stronger negative impact than Dutch participants ($X^2_1 = 22.4$, $P = 0.003$). In addition, Qatar's participants indicated to more often receive commands from their voices than Dutch participants did ($X^2 = 9.4$, $P = 0.006$).

Visual Hallucinations. Similar to our finding for AH, lifetime prevalence of VH was higher among the Dutch (44%) than Qatar's (20%) participants ($X^2_1 = 395$, $P < 0.001$) (95% CI of the difference 22%–26%). Age of onset of VH did not differ between Dutch

Table 1. Fit Statistics and Decision Process for Measurement Invariance Analysis of the 2-Factor Hallucinations Phenomenology Model

Model no.	Model type	χ^2	df	*P*-value	Δ χ^2/Δ df	Δ*P*-value	CFI	ΔCFI	ΔRMSEA	Comparison	Decision/meaning
1	Configural invariance	141.5	66	.000	—	—	0.953	—	—	—	Pass. Factor-item and Factor–Factor patterns are the same across groups
2	Metric invariance	157.3	74	.000	18.546/8	.018	0.948	0.005	0.001	Configural vs. Metric	Pass. Factor loadings of all items are the same across groups
3	Scalar invariance	257.8	98	.000	117.744/24	.000	0.900	0.048	0.011	Metric vs. Scalar	Fail. All Item intercepts (item means) are not the same across groups
4	Partial Scalar Invariance[a]	226.2	95	.000	81.646/21	.000	0.918	0.030	0.006	Metric vs. Partial Scalar[a]	Fail
5	Partial Scalar Invariance[b]	197.7	89	.000	47.000/15	.000	0.932	0.016	0.002	Metric vs. Partial Scalar[b]	Fail
6	Partial Scalar Invariance[c]	186.5	86	.000	33.373/12	.001	0.937	0.011	0.001	Metric vs. Partial Scalar[c]	Fail
7	Partial Scalar Invariance[d]	179.4	83	.000	25.588/9	.002	0.940	0.008	0.001	Metric vs. Partial Scalar[d]	Pass. All items intercepts are equal across groups except intercepts for items measuring duration and distress of auditory hallucinations factor in addition to insight, duration, and distress of visual hallucinations factor across samples.
8	Latent Means Invariance[e]	236.8	84	.000	24.970/2	.000	0.905	0.035	0.013	Factor AH Equality of Means vs. Partial Scalar[d]	Means of AH are not equal across groups i.e. evidence of moderation by culture/country
9	Latent Means Invariance[f]	187.7	84	.000	5.911/2	.015	0.935	0.005	0.002	Factor VH Equality of Means vs. Partial Scalar[d]	Means of VH are not equal across groups i.e. evidence of moderation by culture/country
10	Latent Means Invariance[g] (Omnibus)	243.9	85	.000	32.994/2	.000	0.901	0.003	0.014	Equality of Means of both VH and AH vs. Partial Scalar[d]	Means of both VH and AH are not equal across groups i.e. evidence of moderation by culture/country
11	Latent variance invariance[h]	175.2	85	.000	2.601/2	.27	0.944	0.004	0.002	Latent variance invariance vs. Partial Scalar[d]	Variances of AH and VH are equal across groups so we do not need to standardize the variances of our latent constructs across both groups i.e. We can directly compare the covariance as correlations between latent constructs
12	Latent covariance invariance[i]	168.6	86	.000	1.867/1	.1718	0.949	0.005	0.003	Latent covariance model vs. latent variance model	Correlations between our two latent factors do not significantly differ between groups i.e. no evidence of moderation by culture/country of the latent correlations between VH and AH

Note. Change in $\Delta\chi^2$ although reported here is not used to make decision for tenability of measurement models 1 through 7 as it is notoriously too strict or oversensitive. For these models, the pass/fail recommendation was based on ΔCFI of 0.01 or larger and ΔRMSEA of 0.015 or larger. In contrast, the assumptions of structural models 8 through 12 are tested solely through change in $\Delta\chi,^2$ while changes in the other indicators are reported for these models for completion purposes only.

[a]Partial scalar invariance based on releasing the equality constraint on item intercept for measuring insight of VH factor across samples.

[b]Partial scalar invariance based on releasing the equality constraints on intercepts for items measuring distress of AH factor in addition to insight and distress of VH factor across samples.

[c]Partial scalar invariance based on releasing the equality constraints on intercepts for items measuring distress of AH factor in addition to insight, duration, and distress of VH factor across samples.

[d]Partial scalar invariance based on releasing the equality constraints on intercepts for items measuring duration and distress of AH factor in addition to insight, duration, and distress of VH factor across samples.

Table 1. Continued

[e]Latent factor mean invariance based on a model that imposes a constraint of the equality of means of factor AH versus the Partial Scalar model D where the means of AH and VH are allowed to vary across the two samples. The comparison of these two models will test if the assumption of equality of means across the groups is tenable for factor AH.

[f]Latent factor mean invariance based on a model that imposes a constraint of the equality of means of factor VH versus the Partial Scalar model D where the means of AH and VH are allowed to vary across the two samples. The comparison of these two models will test if the assumption of equality of means across the groups is tenable for factor VH.

[g]Latent factor mean invariance based on a model that imposes a constraint of the equality of means of both factors VH and AH versus the Partial Scalar model D where the means of AH and VH are allowed to vary across the two samples. The comparison of these two models will test if the assumption of equality of means across the groups is tenable for both factors.

[h]Comparison of a model where we constrain the variance of AH and VH to equal 1 in both groups versus the Partial Scalar Invariance model D.

[i]Comparison of a model where we constrain the correlation between AH and VH to equal each other in both groups and compare with the previous model where these correlations were allowed to vary.

Table 2. Comparison of Hallucinations Prevalence and Phenomenological Characteristics Across Samples

	Qatar	Dutch	X^2	*P*
Auditory hallucinations				
Lifetime prevalence	28%	57%	509	.003
Age of onset median years (IQR)	17 (5)	13 (10)	10.5	.003
Valence median (IQR)	1 (2)	0 (2)	2.3	.203
Impact median (IQR)	0 (1)	0 (0)	22.4	.003
Insight median (IQR)	1 (2)	1 (1)	2.5	.200
Interaction median (IQR)	0 (2)	0 (2)	0.0	.988
Commands median (IQR)	0 (1)	0 (0)	9.4	.006
Visual hallucinations				
Lifetime prevalence (95% CI)	20%	44%	395	.003
Age of onset median years (IQR)	14 (10)	13 (11)	0.2	.778
Valence median (IQR)	1 (2)	1 (3)	0.0	.988
Impact median (IQR)	0 (1)	0 (0)	10.8	.003
Insight median (IQR)	1 (1)	1 (1)	16.3	.003
Interaction median (IQR)	1 (2)	1 (3)	4.5	.070
Commands median (IQR)	0 (2)	0 (0)	25.0	.003
Tactile hallucinations				
Lifetime prevalence	38%	40%	2.1	.223
Age of onset median years (IQR)	17 (8)	13 (8)	13.9	.003
Olfactory hallucinations				
Lifetime prevalence	30%	31%	0.2	.778
Age of onset median years (IQR)	18 (4)	16 (10)	0.6	.575

Note: X^2 = Pearson's chi-square statistic; IQR = interquartile range; FDR= False Discovery Rate Correction. Lifetime prevalence pertains to the total sample, with the exception of olfactory hallucinations (Qatar sample $n = 1119$). Data were subset to those participants who had indicated to have experienced a hallucination in the given modality at least once during their lifetime for age of onset; and to those participants who had experienced a hallucination in the past week in the given modality for the remaining characteristics. *P*-values are FDR-corrected. Items measuring duration and distress for both auditory and VH and item measuring insight for VH were not compared across samples due to lack of measurement invariance on these items.

(median 13 years, IQR = 11 years) and Qatar's (median 14 years, IQR = 10 years) ($X^2_1 = 0.2$, $P = 0.671$) participants.

Follow-up comparisons in the subgroups of participants who had experienced a VH in the past week (Dutch $n = 184$, Qatari $n = 78$) showed the same differences between the groups (figure 3). Qatar's participants reported the VH to have a more negative impact on their daily functioning than Dutch participants ($X^2_1 = 10.8$, $P = 0.003$). In addition, Qatar's participants indicated to more often receive and act upon commands given by the VH ($X^2_1 = 25.0$, $P = 0.003$).

Olfactory Hallucinations. Lifetime prevalence of olfactory hallucinations (OH) did not differ between Qatar's participants and Dutch participants ($X^2_1 = 2.1$, $P = 0.223$), and neither did age of onset ($X^2_1 = 0.6$, $P = 0.575$).

Tactile Hallucinations

Lifetime prevalence of TH did not differ between Qatar's and Dutch participants ($X^2_1 = 0.2$, $P = 0.778$). However,

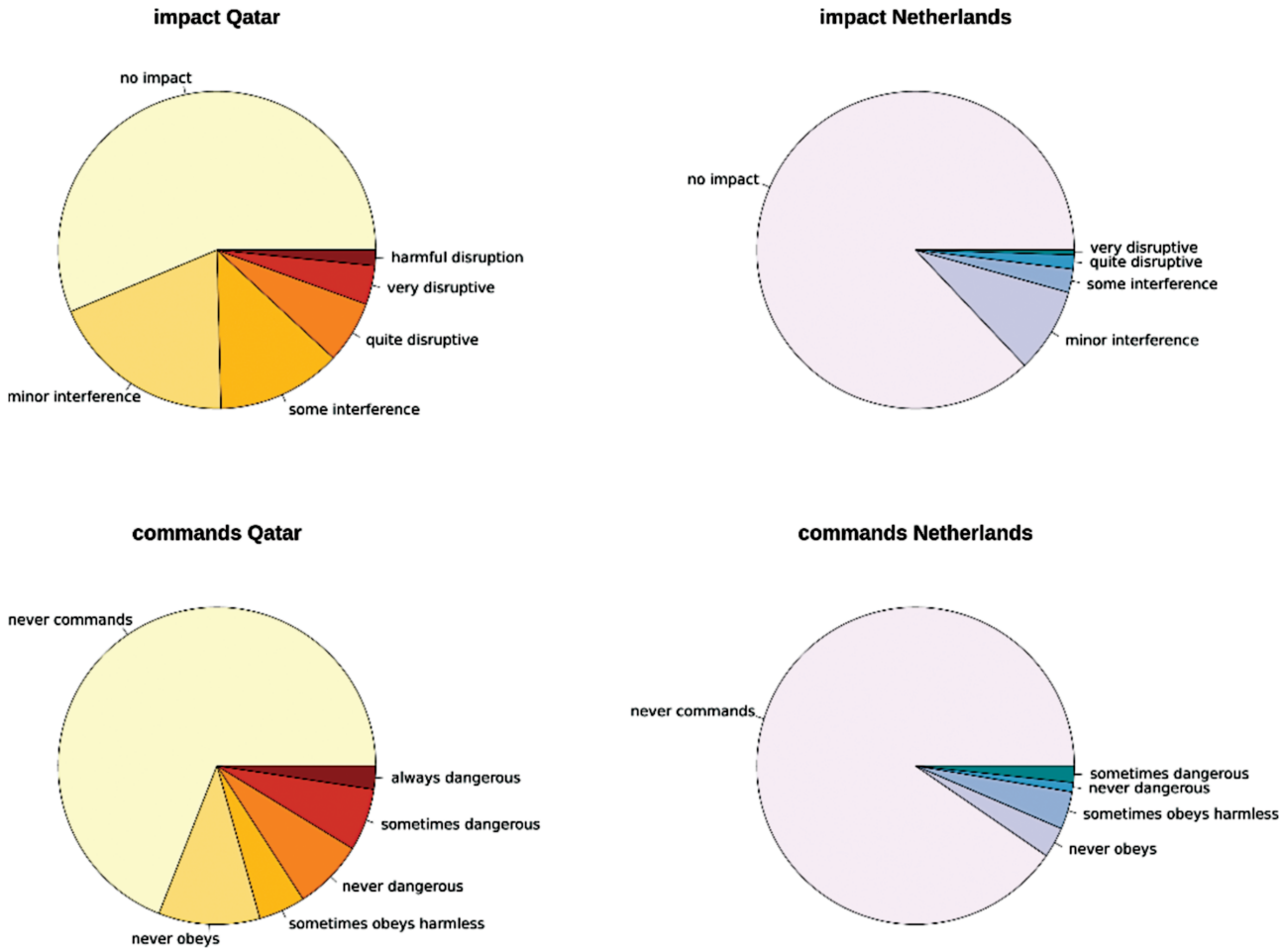

Fig. 2. Differences in characteristics of auditory hallucinations as experienced by participants from Qatar (left panels) and Netherlands (right panels). Participants from Qatar indicate that their auditory hallucinations are more impactful and more often consist of commands than participants from the Netherlands.

Dutch participants reported a younger age of onset of TH (median 13 years, IQR = 8 years) than participants from Qatar (median 17 years, IQR = 8 years) ($X^2_1 = 13.9$, $P = 0.003$).

Discussion

This is the largest cross-cultural study comparing the prevalence and phenomenology of hallucinations between a European and Middle Eastern community-based samples to date. Using the same transdiagnostic instrument, the QPE, we compared lifetime prevalence of AH, VH, OH, and TH, and also compared the mean age of onset of these phenomena in rather well-matched groups. We compared AH and VH of participants from both countries on valence, interaction, commands, and impact on daily functioning in the past week. The 2 samples could not be compared on duration, distress, and insight into the hallucinations, as invariance analyses indicated these items had significant measurement differences.

Hallucination Prevalence

Our findings indicate that the lifetime prevalence of TH and OH are the same across samples of both countries. However, prevalence of AH and VH were twice as high in the Dutch sample compared to Qatar's sample. Of note is the fact that AH and VH prevalence in the current Dutch sample are higher than those reported in other large Dutch population studies (eg, ~17% self-reported psychotic symptoms in the NEMESIS studies by Van Nierop et al., 2014[41]). While the increased prevalence may in part be due to sampling bias, the QPE's deliberately relatable and inclusive phrasing of the questions about hallucinations probably lowered the threshold to indicate their occurrence. Specifically, the terms "hallucination" and "psychotic symptom" were avoided, rather than labeling them as perceptual phenomena that anyone could experience.

The reported age of onset for AH and TH was younger for the Dutch sample compared to Qatar's sample. Although our findings are consistent with other studies in

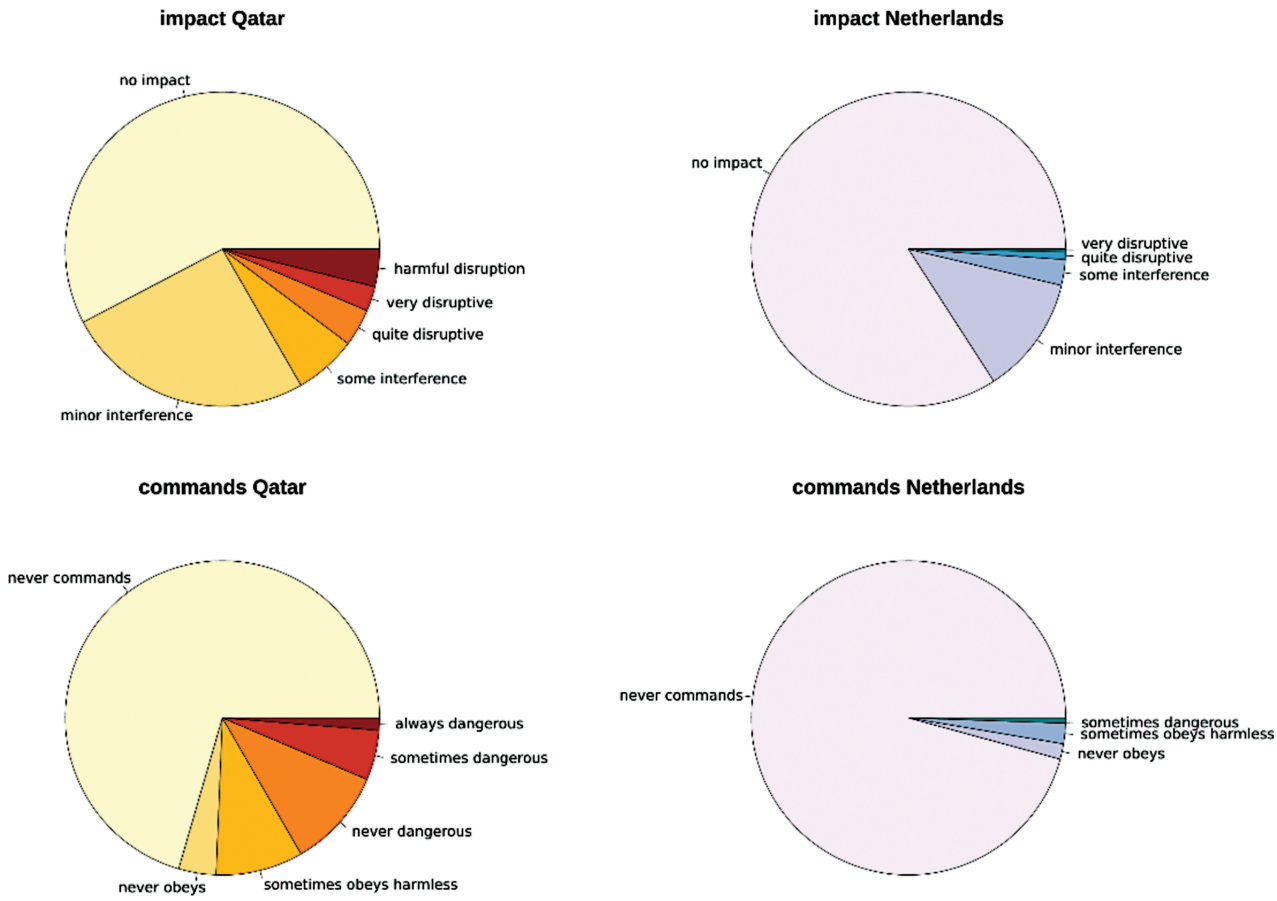

Fig. 3. Differences in characteristics of visual hallucinations as experienced by participants from Qatar (left panels) and Netherlands (right panels). Participants from Qatar indicate that their visual hallucinations are more impactful and more often consist of commands than participants from the Netherlands.

showing differences in lifetime prevalence by type of hallucinations,[3–6] we observed these differences only in the prevalence of AH and VH. Contrary to prior European and West African comparisons,[7] the prevalence of AH and VH was significantly higher in the Netherlands compared to Qatar.

Our observed differences in these specific types of hallucinations could be due to cultural attitudes towards reporting certain symptoms associated with mental illness. Another reason for this finding may be due to sampling differences in the 2 countries. In particular, the convenience sample from the Netherlands may have overrepresented participants with less disruptive hallucinations, while the Qatar sample may have included more participants with prodromal symptoms. A recent study reported that stigma against mental illness in Qatar is high even among postsecondary students from Qatar University.[42] Higher levels of stigma in Qatar than the Netherlands may have contributed to underreporting of AH and VH in Qatar's sample which is traditionally associated with symptoms of severe mental illness such as SSD. As TH and OH are less known to be associated with mental illness, reporting bias due to stigma may be minimal for these categories. Future similar studies could usefully include measures of stigma to test this hypothesis.

Past Week Hallucination Phenomenology

Results from the structural invariance testing showed that participants in Qatar generally had higher mean factor scores for past week AH and VH than the Netherlands further supporting the hypothesis that culture moderates phenomenology of hallucinatory experiences. While, both samples reported similar valence levels and extent of interaction with the hallucinations, compared to the Netherlands, participants from Qatar reported a stronger impact on the daily functioning of AH and VH, and indicated both AH and VH to more often have consisted of commands. Although the prevalence was lower in the Qatari sample, the fact that the impact was more suggests that those psychotic experiences that are reported are more severe and hence more likely to reach a presumably higher threshold for reporting them. The older age of onset in the Qatari sample may also represent a greater reluctance to report these symptoms as abnormal until they become more severe. The reason for this higher threshold

may be due to higher levels of stigma towards these symptoms in Qatar[42] that may minimize the importance of symptoms until they cause significant distress and can no longer be ignored. If true, psychoeducation about the common presence of mental health phenomena such as hallucinations among the general population may help to reduce stigma. Indeed, the Netherlands has seen several of such campaigns for example accompanying the World Congress on Hearing Voices, as did the United Kingdom with the program Hearing the Voice.

Cross-cultural Differences

In addition to the reported cross-cultural differences in prevalence and phenomenology of hallucinations, we demonstrated the difficulty of measuring cultural impact upon hallucinations between countries. Although we used the same instrument to assess and compare the prevalence and phenomenology of hallucinations in both samples, we showed that the questions pertaining to duration, distress, and insight of the hallucinations cannot be assumed to measure the same underlying construct in the Qatar and Netherlands samples. It can be hypothesized that in a collectivist Muslim society such as Qatar, questions regarding the veracity of the hallucinations (ie, visual insight) may be interpreted differently from a secular society such as the Netherlands, possibly due to differences in religiosity. Why items about duration and distress of the hallucinations may have been interpreted differently by the Qatar and Netherlands samples remains to be explored. Perception of time or duration and distress may be interlinked in the sense that people who may perceive experiences to be more distressful may also experience them to be lasting longer in duration. The interpretation of these experiences could be influenced by many factors including previous personal history of hallucinations as well as cultural factors for attributing meaning to extraordinary experiences.

Limitations

Phenomenology of hallucinations were measured using a structured instrument, the QPE, which is limited in terms of obtaining rich qualitative information about these experiences and differences across cultures. While we aimed to match the samples in terms of age, gender, and level of education, slight differences in terms of sex and age remained. However, the minuteness of these differences (ie, 4.9% less women, with a median 2 years older in the Netherlands compared to the Qatar sample) renders it unlikely that they could form a full explanation of the found cross-cultural differences.

Furthermore, the sampling approach and recruitment strategies were different in both countries—a closed probability sample was used in Qatar compared to the open convenience sample in the Netherlands. These differences may have contributed to some of our findings. Even though self-selection into the Dutch sample may in part explain increased lifetime prevalence rates of AH and VH, it cannot explain why the rates were similar for TH and OH in both samples. Moreover, these differences in sampling method could potentially explain why the reported impact on daily function and frequency of receiving commands from hallucinations were higher in Qatar's sample. Early detection and help-seeking for these symptoms are more likely in the Netherlands than in Qatar due to stigma, making community-based samples more enriched with clinically severe cases in Qatar than the Netherlands.

Conclusions

Qatar and the Netherlands provide a good backdrop for the basis of cultural comparisons of the epidemiology and phenomenology of hallucinations in nonclinical samples. In contrast to hypotheses based on prior findings in the literature,[21] we did not find the rates of all hallucinations types to be lower in Qatar than in the Netherlands. The age of onset for some hallucination subtypes was higher in Qatar than in the Netherlands. Together with the impact on daily function of the reported episodes of hallucinatory experiences being greater, this may indicate that in Qatar people are at higher risk for experiencing burdensome hallucinations with greater clinical relevance. These findings highlight the importance of education, early screening, and prevention, particularly in a culture where stigma may be more pronounced.

Supplementary Material

Supplementary material is available at https://academic.oup.com/schizophreniabulletin/.

Acknowledgement

None declared.

Conflict of Interest

The authors have declared that there are no conflicts of interest in relation to the subject of this study.

Author Contributions

All authors have been substantially involved in the planning and execution of the study in their respective countries. All authors have participated in writing and editing the manuscript. All authors have read and approved the final manuscript.

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Ethical Declarations

This work has been approved by the institutional review boards of the main collaborating institutions at Qatar University (QU-IRB 1021-EA/19) and the Medical Research Council at Hamad Medical Corporation (MRC-03-19-032) in Qatar and the ethical review board of the University Medical Center Utrecht (IRB number 16-408) in the Netherlands.

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