Autism spectrum disorder in Qatar: Profiles and correlates of a large clinical sample

Fouad Alshaban
Qatar Biomedical Research Institute, Hamad Bin Khalifa University, Qatar Foundation, Qatar

Mohammed Aldosari
Cleveland Clinic, USA

Zakaria El Sayed and Mohammed Tolefat
Shafallah Center for Children with Special Needs, Qatar

Saba El Hag Hawra Al Shammar and Iman Ghazal
Qatar Biomedical Research Institute, Hamad Bin Khalifa University, Qatar Foundation, Qatar

Eric Fombonne
Oregon Health and Science University, USA

Abstract
Autism spectrum disorder (ASD) is an increasingly prevalent disorder. Although around 15% of cases are caused by specific genetic causes, most cases involve a complex and variable combination of genetic risk and environmental factors that are not yet identified. There is a paucity of studies on ASD in Qatar, mostly in the form of case reports and genetic causes. The current study was designed to describe the clinical characteristics of ASD and its correlates in Qatar. Individuals with ASD were recruited from the Shafallah Center for Children with Special Needs which is the largest special needs center in Qatar. Within the sample of 171 individuals with ASD, 47% were ethnic Qatars, while 53% were nonethnic Qatars (Arabs and other nationalities). The analysis included the following factors: nationality, age, gender, socioeconomic status, consanguinity, prenatal/postnatal complications, and comorbidities. Eighty percent of the identified cases were males, with a 4:1 male to female ratio. Additionally, 83% of the families had one proband, 9.9% with 2 probands, and 7.1% with more than two. Comorbid conditions included: intellectual disabilities (ID) in 83% and epilepsy in 18.8%. 76.6% of subjects were nonverbal. There were 3 (1.8%) children with Rett’s syndrome, 3 (1.8%) with Fragile X, and 1 (0.6%) with tuberous sclerosis. There are currently no publications that clarify the mean age of diagnosis in Qatar, however, the present study showed that more than half of the diagnosed cases were among the ages of 7–14 years (56%). The effect of consanguinity as a risk factor was not found to be significant.

Keywords
Autism spectrum disorder (ASD), prevalence, causes, intellectual disability (ID), Qatar

Introduction
With the emergent global prevalence of ASD (Elsabbagh et al., 2012), research has rapidly advanced efforts to better understand the rise in occurrence, the possible causes, and the optimum interventions. Additionally, research continues to focus on public education and the amelioration of the deficits related to ASD. Despite equal or similar prevalence of ASD in the Arab world compared to Western countries, research into the field is still in its initial stages and

Corresponding author:
Fouad Alshaban, Qatar Biomedical Research Institute, Education City Doha, Ad Dawhah, Qatar.
Email: falshaban@qf.org.qa

Creative Commons NonCommercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 3.0 License (http://www.creativecommons.org/licenses/by-nc/3.0/) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (https://us.sagepub.com/en-us/nam/open-access-at-sage).
has only reached the Arab world’s attention during the late 1990s (Taha & Hussein, 2014). According to the Center for Disease Control (CDC), about 150 per 10,000 children (1 in 42 boys and 1 in 189 girls) have been identified with ASD (CDC, 2014, 2015). Prevalence studies conducted to date within Arab countries yielded an estimate of the prevalence of ASD for Saudi Arabia, Oman, UAE, Jordan, Libya, Egypt, and Tunisia (Taha & Hussein, 2014). A systematic review of the epidemiology of ASD in the Gulf Cooperation Council (GCC) countries reported a prevalence rate ranging from 1.4 to 29 per 10,000 individuals (Salhia, Al-Nasser, Taher, Al-Khathaami, & El-Metwally, 2014). The difference in the prevalence rates compared to other countries does not prove that ASD is less prevalent in the Arab world, but rather reflects under-diagnosis, underreporting, and cultural attitudes (Taha & Hussein, 2014). Under-diagnosis and underreporting are attributed to the limited availability of quality specialized healthcare services for children with neurodevelopmental disorders (Hussein & Taha, 2013). Moreover, the cultural attitudes regarding disability are also related to the underreporting due to the stigma attached to most neurodevelopmental disabilities. In Qatar, ASD was added as a disability category after 2012, and used to be included within the intellectual disability reporting (Ministry of Development Planning and Statistics, 2016). To date, there are no studies clarifying the current diagnostic practice of ASD in Qatar. Yet, most of the centers in Qatar usually use the ADI-R or ADOS as diagnostic tools with the DSM-4 and DSM-5 criteria for diagnosis.

To date, no studies have explored the clinical characteristics in the ASD population in Qatar. The aim of the current study was to describe cases within one of the country’s largest special needs centers, the Shafallah Center for Children with Special Needs. The current study evaluated clinical profiles of ASD and their correlates. Due to similarities in many demographic characteristics between Qatar and the neighboring Gulf States, we think that this study provides important insights to other countries does not prove that ASD is less prevalent in the Arab world, but rather reflects under-diagnosis, underreporting, and cultural attitudes (Taha & Hussein, 2014). Under-diagnosis and underreporting are attributed to the limited availability of quality specialized healthcare services for children with neurodevelopmental disorders (Hussein & Taha, 2013). Moreover, the cultural attitudes regarding disability are also related to the underreporting due to the stigma attached to most neurodevelopmental disabilities. In Qatar, ASD was added as a disability category after 2012, and used to be included within the intellectual disability reporting (Ministry of Development Planning and Statistics, 2016). To date, there are no studies clarifying the current diagnostic practice of ASD in Qatar. Yet, most of the centers in Qatar usually use the ADI-R or ADOS as diagnostic tools with the DSM-4 and DSM-5 criteria for diagnosis.

To date, no studies have explored the clinical characteristics of the ASD population in Qatar. The aim of the current study was to describe cases within one of the country’s largest special needs centers, the Shafallah Center for Children with Special Needs. The current study evaluated clinical profiles of ASD and their correlates. Due to similarities in many demographic characteristics between Qatar and the neighboring Gulf States, we think that this study provides important insights to other countries does not prove that ASD is less prevalent in the Arab world, but rather reflects under-diagnosis, underreporting, and cultural attitudes (Taha & Hussein, 2014). Under-diagnosis and underreporting are attributed to the limited availability of quality specialized healthcare services for children with neurodevelopmental disorders (Hussein & Taha, 2013). Moreover, the cultural attitudes regarding disability are also related to the underreporting due to the stigma attached to most neurodevelopmental disabilities. In Qatar, ASD was added as a disability category after 2012, and used to be included within the intellectual disability reporting (Ministry of Development Planning and Statistics, 2016). To date, there are no studies clarifying the current diagnostic practice of ASD in Qatar. Yet, most of the centers in Qatar usually use the ADI-R or ADOS as diagnostic tools with the DSM-4 and DSM-5 criteria for diagnosis.

To date, no studies have explored the clinical characteristics in the ASD population in Qatar. The aim of the current study was to describe cases within one of the country’s largest special needs centers, the Shafallah Center for Children with Special Needs. The current study evaluated clinical profiles of ASD and their correlates. Due to similarities in many demographic characteristics between Qatar and the neighboring Gulf States, we think that this study provides important insights to other countries does not prove that ASD is less prevalent in the Arab world, but rather reflects under-diagnosis, underreporting, and cultural attitudes (Taha & Hussein, 2014). Under-diagnosis and underreporting are attributed to the limited availability of quality specialized healthcare services for children with neurodevelopmental disorders (Hussein & Taha, 2013). Moreover, the cultural attitudes regarding disability are also related to the underreporting due to the stigma attached to most neurodevelopmental disabilities. In Qatar, ASD was added as a disability category after 2012, and used to be included within the intellectual disability reporting (Ministry of Development Planning and Statistics, 2016). To date, there are no studies clarifying the current diagnostic practice of ASD in Qatar. Yet, most of the centers in Qatar usually use the ADI-R or ADOS as diagnostic tools with the DSM-4 and DSM-5 criteria for diagnosis.

To date, no studies have explored the clinical characteristics in the ASD population in Qatar. The aim of the current study was to describe cases within one of the country’s largest special needs centers, the Shafallah Center for Children with Special Needs. The current study evaluated clinical profiles of ASD and their correlates. Due to similarities in many demographic characteristics between Qatar and the neighboring Gulf States, we think that this study provides important insights to other countries does not prove that ASD is less prevalent in the Arab world, but rather reflects under-diagnosis, underreporting, and cultural attitudes (Taha & Hussein, 2014). Under-diagnosis and underreporting are attributed to the limited availability of quality specialized healthcare services for children with neurodevelopmental disorders (Hussein & Taha, 2013). Moreover, the cultural attitudes regarding disability are also related to the underreporting due to the stigma attached to most neurodevelopmental disabilities. In Qatar, ASD was added as a disability category after 2012, and used to be included within the intellectual disability reporting (Ministry of Development Planning and Statistics, 2016). To date, there are no studies clarifying the current diagnostic practice of ASD in Qatar. Yet, most of the centers in Qatar usually use the ADI-R or ADOS as diagnostic tools with the DSM-4 and DSM-5 criteria for diagnosis.

To date, no studies have explored the clinical characteristics in the ASD population in Qatar. The aim of the current study was to describe cases within one of the country’s largest special needs centers, the Shafallah Center for Children with Special Needs. The current study evaluated clinical profiles of ASD and their correlates. Due to similarities in many demographic characteristics between Qatar and the neighboring Gulf States, we think that this study provides important insights to other countries does not prove that ASD is less prevalent in the Arab world, but rather reflects under-diagnosis, underreporting, and cultural attitudes (Taha & Hussein, 2014). Under-diagnosis and underreporting are attributed to the limited availability of quality specialized healthcare services for children with neurodevelopmental disorders (Hussein & Taha, 2013). Moreover, the cultural attitudes regarding disability are also related to the underreporting due to the stigma attached to most neurodevelopmental disabilities. In Qatar, ASD was added as a disability category after 2012, and used to be included within the intellectual disability reporting (Ministry of Development Planning and Statistics, 2016). To date, there are no studies clarifying the current diagnostic practice of ASD in Qatar. Yet, most of the centers in Qatar usually use the ADI-R or ADOS as diagnostic tools with the DSM-4 and DSM-5 criteria for diagnosis.

Methods

Subjects

The methodology in the current study was designed to review cases within the Shafallah Center for Individuals with Special Needs between the years 2011 and 2015. The center was established in 1999 to provide services for both citizens and expatriates with disabilities, mainly ASD, between the ages of 3 and 18 years of age. The criterion for admission to the center is for any individual diagnosed with ASD. All individuals undergo a full evaluation and assessment including IQ, ADOS, and ADI-R, and only those with a definite diagnosis of ASD are usually accepted to be admitted to the Autism Unit in the center. Depending on the severity of the case and family preference, the child may either get admitted to full-time intervention program, or part-time intervention sessions. A total of 171 cases of ASD were identified through a comprehensive record review which contained diagnostic, medical, and developmental history. This enabled access to information regarding comorbid conditions, intellectual ability, family history of ASD and consanguinity, prenatal and postnatal history, and other relevant information.

Definitions and instrument

ASD diagnosis. The ASD diagnoses for the majority of subjects were confirmed by utilizing the Autism Diagnostic Interview-Revised (ADI-R) and/or the Autism Diagnostic Observation Schedule (ADOS) (136 cases), or by using clinical diagnosis utilizing the Diagnostic and Statistical Manual of Mental Disorders (DSM-4) criteria (35 cases). All cases had a clinically confirmed diagnosis of ASD following an assessment by a multidisciplinary team including a child psychiatrist, neurodevelopmental pediatrician, and a psychologist.

Intellectual disability. Intellectual disability (ID) was diagnosed according to DSM-4 during the initial assessment period; where intellectual disability is considered to be two standard deviations or more below the population, which equals an IQ score of 70 or less. ID cases were categorized as mild (IQ Score 50–70), moderate (IQ score 35–49), and severe (IQ scores 20–34). The Stanford Binet IQ test was used by the assessment team.

Language level. Language level was measured using the ADI-R classification for verbal (i.e., when the patient used at least five different words other than “Mama” and “Baba” meaningfully on a daily basis). Cases were classified as verbal (uses 5+ functional words), delayed (starts using more than 5 words later than the normal developmental milestone), or nonverbal (uses less than 4 words).

Family history. Single families (simplex) and extended families (multiplex) were defined as having one or more than one sibling affected with ASD within the family. Consanguinity was defined in this study as marriage between first and second cousins.
**Genetic testing.** Blood samples were drawn from cases diagnosed with ASD for Fragile X (FMR-1) testing for males, MECP-2 testing for females, and testing for tuberous sclerosis when suspected in the diagnoses.

**Ethical considerations**

Qatar Biomedical Research Institute-Institutional Review Board (QBRI-IRB) approval obtained. Informed consents were obtained from the parents/legal guardians of the subjects who agreed to participate in this study.

**Data analysis**

The Statistical Package for the Social Sciences (SPSS) program was used for statistical analysis. Chi-square was used to ascertain the association between two or more categorical variables. The level $p<0.05$ was considered as the cut off for statistical significance.

**Results**

**Sociodemographic characteristics**

Table 1 illustrates the distribution of families with children with ASD categorized by age (grouped into 5 years intervals), nationality (Qatari, non-Qatari Arabs, and non-Qatari other nationalities); in which nationality refers to ethnicity, that is, Qatari nationals were not selected by citizenship status. Additionally, the following factors were investigated; gender, income (monthly income in Qatari Riyals (QR) grouped into three groups; low (<10,000 QR), middle (10–20,000 QR), and high income (>20,000), number of ASD probands in the family (1, 2, or more than 2), and consanguinity. The largest age group was between 10 and 14 years of age (30.9%), while the lowest was between 0 and 4 years (2.3%). Eighty percent of the subjects in the sample were males, translating into a male-to-female ratio of our sample of 4:1. Within the sample, 47% of ASD cases were Qatari nationals, and 53% were non-Qataris (residents and expatriates). Results showed that 47.5% of families were in the highest income group (>20,000 QR per month), whereas 40.9% had a monthly income of 10,000–20,000 QR, and only 21.5% had a monthly income of less than 10,000 QR.

**Language level and ID**

In terms of language level and ID, 76.6% of the cases were nonverbal while 83% had ID. There were no significant gender differences in the incidence of ID and

| Variable                                | Total ($n = 171$) | Males: $n = 136$ (79.5%) | Females: $n = 35$ (20.5%) | $p$-Value |
|------------------------------------------|-------------------|---------------------------|---------------------------|-----------|
| **Age**                                  |                   |                           |                           |           |
| 0–4                                      | 4                 | 2.3                       | 4                         | 2.9       |
| 5–9                                      | 44                | 25.7                      | 31                        | 22.7      |
| 10–14                                    | 53                | 30.9                      | 43                        | 31.6      |
| 15–19                                    | 49                | 28.6                      | 42                        | 30.8      |
| >20                                      | 21                | 12.2                      | 16                        | 11.8      |
| **Nationality**                          |                   |                           |                           |           |
| Ethnic Qatari                            | 80                | 47                        | 58                        | 42.6      |
| Non-ethnic (non-Qatari Arabs and non-Qatari other nationalities) | 91                | 53                        | 78                        | 57.4      |
| **Consanguinity**                        |                   |                           |                           |           |
| Consanguineous                           | 69                | 40.3                      | 51                        | 37.5      |
| Nonconsanguineous                       | 102               | 59.7                      | 85                        | 62.5      |
| **Number of probands**                   |                   |                           |                           |           |
| Single family (1 proband)               | 142               | 83                        | 112                       | 82.3      |
| Extended family (2 probands)            | 17                | 9.9                       | 14                        | 10.3      |
| Extended family (>2 probands)           | 12                | 7.1                       | 10                        | 7.4       |
| **Monthly family income (QR)**           |                   |                           |                           |           |
| <10,000                                  | 37                | 21.5                      | 32                        | 23.5      |
| 10–20,000                                | 70                | 40.9                      | 52                        | 38.2      |
| >20,000                                  | 64                | 47.5                      | 52                        | 38.2      |
language abilities; with females (91% with ID) only being slightly higher than males (81% with ID) (Table 4).

Consanguinity

Consanguinity (1st and 2nd cousin marriages) among parents of children with ASD was reported by 40% of families. Nearly half (50%) of the consanguineous cases of ASD in this study were Qatari, compared to (32%) non-Qatari-Arabs, and (16%) other nationalities. Analysis of cases of ASD with epilepsy found that 50% of the cases within this sample were from both consanguineous and nonconsanguineous families. However, for ASD without epilepsy, 38% were consanguineous and 62% of the cases were nonconsanguineous (Table 3). Moreover, 87% of cases with ID were consanguineous, compared to 80% nonconsanguineous cases (Table 5).

Simplex and multiplex families

Autism spectrum disorder affected one sibling in 83% of the families with 9.9% of families having two offspring (extended families) affected by ASD and 7.1% of families had more than two siblings affected (Table 1).

Prenatal and postnatal factors

Prenatal and postnatal factors were analyzed including method of labor, neonatal complications, and postnatal complications. Unassisted vaginal delivery was the most frequently reported method of labor (70%). Of the sample, a combination of breast and bottle-feeding represented the majority of feeding practices (77%). Postnatal complications and injuries included: neonatal hypoxia (13%), jaundice (11%), and history of head trauma (5%) (Table 2).

Comorbidities

Comorbid conditions were reported in 24% of the sample (41 cases). Comorbid conditions included epilepsy (32 cases, 18.7%), Fragile X (2.9%; 3 cases with full mutation and 2 cases with premutation (55–200 CGG repeats), Rett’s syndrome confirmed with MECP2 mutation (1.7%; 3 cases), and 1 case of tuberous sclerosis. Eighty-three percent of the ASD cases have some degree of ID, 47.9% of the cases were nonverbal, and 28.6% were language delayed.

Further analysis of the association of comorbidities and syndromic ASD showed that 90% of children with ASD and epilepsy had ID. Additionally, 69% of those with ID and epilepsy were nonverbal.

Table 2. Environmental and genetic risk factors’ analysis of ASD cases; method of labor, feeding practices, prenatal and postnatal factors, syndromic, and other co-morbidities.

| Variable | Total (n = 171) |
|----------|----------------|
| Method of labor | |
| Normal unassisted delivery | 120 | 70 |
| C-section | 38 | 22 |
| Forceps/or suction | 10 | 6 |
| Protracted/induced | 3 | 2 |
| Feeding practices | |
| Breast feeding | 38 | 22 |
| Breast and bottle feeding | 119 | 70 |
| Bottle feeding | 14 | 8 |
| Prenatal and postnatal factors | |
| Hypoxia | 23 | 13 |
| Jaundice | 19 | 11 |
| Head trauma | 8 | 5 |
| Syndromic ASD and other comorbidities | |
| Fragile X | |
| Full mutation | 3 | 2 |
| Pre-mutation (55–200 CGG repeats) | 2 | 1 |
| Rett’s syndrome | |
| MECP2 +ve | 3 | 2 |
| Tuberous sclerosis | 1 | 0.5 |
| Epilepsy | 32 | 19 |
| Total comorbidities | 43 | 25 |

Epilepsy was the highest comorbid diagnosis found among cases with ASD (32 cases, 18.7%), 24 cases in males (17.6%), and 8 cases in females (22.8%). Analysis of cases of ASD and ID found that 83% of the sample had ID with slightly more cases among females (91%) than males (81%) (Table 2).

Discussion

Research on Autism Spectrum Disorders within a cultural context, and in developing countries, has received limited attention (Daley, 2002; Susser, 2014). The current study is the first attempt to characterize ASD in Qatar. This study gives insights to ASD in the entire Gulf region as there are many similarities in population characteristics between the Qatar and its neighboring Gulf States. This study also contributes much needed information to the cross-cultural understanding of ASD in developing countries. One of the main advantages of this study is the utilization of strict diagnostic methodology with the use of ADI-R/ADOS for the majority of the sample (136/171, 80%), and clinical diagnosis using strict DSM-4 criteria for the remainder.
The enrolment of subjects from the main center for ASD in Qatar which is government supported, that accepts both citizens and expatriates, is thought to yield a representative sample of ASD in Qatar. However, the sample under discussion may not be representative of the broader population in Qatar due to the fact that most of the cases referred to Shafallah Center are older than 5 years of age (only 4 cases were 0–4 years of age). Additionally, most of the cases with high functioning ASD attend mainstream schools. The implication of this misrepresentation may have caused the high percentage of cases affected with ID in our sample. Although the study utilized retrospective review of charts, there were consistent clinical data available for each individual, which allowed a detailed analysis of the subjects’ clinical characteristics and comorbid conditions.

The findings of this study of male predominance (4:1) support previous research findings regarding the sex differences in ASD (Werling & Geschwind, 2013). In terms of income, only 21.5% of families in our sample were of low income which probably reflects the general high income in Qatar (Snoj & Tina, 2014) but could also be indicative of the lack of association of autism and low income (Elshabagh et al., 2012). The nationality distribution indicates that almost half of the samples were ethnic Qataris, which is not reflective of the fact that out of the estimated 2.2 million people

### Table 3. ASD with or without epilepsy.

| Variables                              | With epilepsy (n = 32) | Without epilepsy (n = 139) | p-Value |
|----------------------------------------|------------------------|-----------------------------|---------|
|                                        | n  | %   | n  | %   |       |
| Consanguinity                          |    |     |    |     |       |
| Consanguineous                         | 16 | 50  | 53 | 38  | 0.235 |
| Nonconsanguine                         | 16 | 50  | 86 | 62  |       |
| C-section                              |    |     |    |     |       |
| With C-section                         | 9  | 28  | 29 | 21  | 0.357 |
| Without C-section                      | 23 | 72  | 110| 79  |       |
| Hypoxia/and or jaundice                |    |     |    |     |       |
| With                                   | 11 | 34  | 31 | 22  | 0.174 |
| Without                                | 21 | 66  | 108| 78  |       |
| Gender                                 |    |     |    |     |       |
| Male                                   | 24 | 75  | 112| 80  | 0.473 |
| Female                                 | 8  | 25  | 27 | 20  |       |
| Intellectual disability (ID)           |    |     |    |     |       |
| With ID (including mild, moderate, and severe) | 29 | 90 | 113| 81  | 0.297 |
| Without ID                             | 3  | 10  | 26 | 19  |       |
| Communication (language)               |    |     |    |     |       |
| Verbal                                 | 10 | 31  | 30 | 22  | 0.253 |
| Nonverbal (including delayed (28.6%))  | 22 | 69  | 109| 78  |       |
| Syndromic ASD (FRX, Rett’s, TS)        |    |     |    |     |       |
| With                                   | 3  | 9   | 3  | 2   | 0.08  |
| Without                                | 29 | 91  | 136| 98  |       |
| Single or extended families            |    |     |    |     |       |
| Single families (one proband)          | 27 | 84  | 127| 91  | 0.321 |
| Extended families (>one)               | 5  | 16  | 12 | 9   |       |

### Table 4. Gender differences.

| Variables                              | Female (n = 35) | Male (n = 136) | p-Value |
|----------------------------------------|-----------------|----------------|---------|
|                                        | n  | %   | n  | %   |       |
| Intellectual disability (ID)           |    |     |    |     |       |
| With ID                                | 32 | 91.4| 110| 81  | 0.206 |
| Mild                                   | 10 | 28.5| 27 | 20  |       |
| Moderate                               | 18 | 51.4| 65 | 47.8|       |
| Severe                                 | 4  | 11.4| 18 | 13  |       |
| Without ID                             | 3  | 8.6 | 26 | 19  |       |
| Communication (language)               |    |     |    |     |       |
| Verbal                                 | 8  | 22.8| 32 | 23.5| 1.00  |
| Nonverbal                              | 16 | 45.7| 66 | 48.5|       |
| Delayed                                | 11 | 31.4| 38 | 28  |       |
| Epilepsy                               |    |     |    |     |       |
| With epilepsy                          | 8  | 22.8| 24 | 17.6| 0.481 |
| Without epilepsy                       | 27 | 77.2| 112| 82.4|       |
living in Qatar, only 12% are citizens (Snoj, 2013). Further studies are needed to evaluate whether the prevalence in Qatar is higher than Western countries. The impact of high rates of consanguinity and large family size could cause increased prevalence in Qatar (Mezzavilla et al., 2015), however, this needs to be further evaluated on larger samples. The potential effects of consanguinity and family size on prevalence couldn’t have been evaluated on our sample. The consanguinity rates in our study (40%) is slightly lower than that reported in the general population in Qatar (54%) but is still higher than that reported in Western countries (Al Ali, 2005). The percentage of multiplex families in our sample was 17%; which is toward the higher end of reported rates of having more than one person with ASD in the family which ranges from 3% to 18% (Ozonoff et al., 2011). One potential explanation is that a high rate of consanguinity is generally associated with a higher incidence of autosomal recessive genetic conditions and may conceivably be a factor in ASD incidence (Al-Salehi, Al-Hifthy, & Ghaziuddin, 2009; Salhia et al., 2014). However, the current study identified no significant effect of consanguinity on the occurrence rate of ID in this relatively small sample (Table 5).

The rate of epilepsy in our sample (18.7%) was comparable with other reports (22%) although the reported rate of epilepsy in autism is quite variable (20–40%) due to many factors including case ascertainment and inclusion of syndromic autism (Bolton et al., 2011). In our sample, 83% of subjects had some degree of ID which is significantly higher than recent estimates which is between 40% and 55% (Chakrabarti & Fombonne, 2001; Edelson, 2016). The high percentage of ID within our sample might reflect a higher percentage of severe ASD and/or under-diagnosed syndromic ASD. The percentage of nonverbal individuals was found to be consistent with what is reported in literature (48% vs. 25–50%) (Tager-Flusberg & Kasari, 2013).

In conclusion, the current study is the first attempt of clinical characterization of ASD in Qatar. This study provides insights to the similarities and discrepancies to what has been noted in other parts of the world. Additionally, it supports the need of a prospective epidemiological study in this population which might contribute to expanding our knowledge of ASD.

Acknowledgments
We would like to thank Mr Hakam Khair, for his help in ASD diagnosis, Dr Mogahed Ali Gibril, for his help in patient recruiting, Mr Yaser Al Sarraj for his assistance in molecular data collection, and Dr Mohd Al Odat for statistical analysis. We wish to express our appreciation to the families and their children for their time and participation.

Declaration of conflicting interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This project was funded by Qatar National Research Fund (QNRF) (NPRP 6-093-3-024).

References
Al Ali, K. (2005). Consanguinity and associated sociodemographic factors in Qatari population. Qatar Medical Journal, 14, 16–19.
Al-Salehi, S. M., Al-Hifthy, E. H., & Ghaziuddin, M. (2009). Autism in Saudi Arabia: Presentation, clinical correlates and comorbidity. Transcultural Psychiatry, 46, 340–347.
Bolton, P. F., Carcani-Rathwell, I., Hutton, J., Goode, S., Howlin, P., & Rutter, M. (2011). Epilepsy in autism: Features and correlates. The British Journal of Psychiatry, 198, 289–294.
Center for Disease Control and Prevention. (2014). 10 Things to know about new autism data. Retrieved from http://www.cdc.gov/features/dsautismdata/index.html
Center for Disease Control and Prevention. (2015). Facts about ASD. Retrieved from http://www.cdc.gov/ncbddd/autism/facts.html
Chakrabarti, S., & Fombonne, E. (2001). Pervasive developmental disorders in preschool children. Journal of the American Medical Association, 285, 3093–3099.
Daley, T. C. (2002). The need for cross-cultural research on the pervasive developmental disorders. Transcultural Psychiatry, 39, 531–550.

| Table 5. Intellectual disability with consanguinity. |
|---------------------------------------------------|
| Variables                                      | With intellectual disability (n = 69) | Without intellectual disability (n = 10) | p-Value |
| Consanguinity                                  | n | % | n | % | |
| Consanguineous                                 | 60 | 87 | 9 | 13 | 0.261 |
| Nonconsanguine                                 | 82 | 80 | 20 | 20 | |

Autism & Developmental Language Impairments
Edelson, M. G. (2016). Are the majority of children with autism mentally retarded? A systematic evaluation of the data. *Focus on Autism and Other Developmental Disabilities, 21*, 66–83.

Elsabbagh, M., Divan, G., Koh, Y.-J., Kim, Y. S., Kauchali, S., Marcin, C., . . . Fombonne, E. (2012). Global prevalence of autism and other pervasive developmental disorders. *Autism Research, 5*, 160–179.

Hussein, H., & Taha, G. R. A. (2013). Autism spectrum disorders: A review of the literature from Arab countries. *Middle East Current Psychiatry, 20*, 106–116.

Mezzavilla, M., Vozzi, D., Badii, R., Alkowari, M. K., Abdulhadi, K., Girotto, G., . . . Gasparini, P. (2015). Increased rate of deleterious variants in long runs of homozygosity of an inbred population from Qatar. *Human Heredity, 79*, 14–19. doi:10.1159/000371387

Ministry of Development Planning and Statistics. (2016). Retrieved from http://www.mdps.gov.qa/portal/page/portal/gsdp_en/statistics_en/monthly_preliminary_figures_on_population_en

Ozonoff, S., Young, G. S., Carter, A., Messinger, D., Yirmiya, N., Zwaigenbaum, L., . . . Stone, W. L. (2011). Recurrence risk for autism spectrum disorders: A baby siblings research consortium study. *Pediatrics, 128*, 488–495.

Salhia, H. O., Al-Nasser, L. A., Taher, L. S., Al-Khathaami, A. M., & El-Metwally, A. (2014). Systematic review of the epidemiology of Autism in Arab gulf countries. *Neurosciences (Riyadh), 19*, 291–296.

Snoj, J. (2013). Population of Qatar by nationality. Retrieved from http://www.bq-magazine.com/economy/2013/12/population-qatar

Snoj, J., & Tina, N. (2014). *Average salaries in Qatar*. Retrieved from http://www.bq-magazine.com/economy/2014/04/salaries-in-qatar

Susser, E. (2014). Psychiatric epidemiology and global mental health: Joining forces. *International Journal of Epidemiology, 43*, 287–293.

Tager-Flusberg, H., & Kasari, C. (2013). Minimally verbal school-aged children with autism spectrum disorder: The neglected end of the spectrum. *Autism Research: Official Journal of the International Society for Autism Research, 6*, 468–478.

Taha, G. R. A., & Hussein, H. (2014). Autism spectrum disorders in developing countries: Lessons from the Arab world. In *The comprehensive guide to autism* (pp. 2509–2529). Springer Reference.

Werling, D. M., & Geschwind, D. H. (2013). Sex differences in autism spectrum disorders. *Current Opinion in Neurology, 26*, 146–153.