



The Role of Demographics in the Age of Autism Diagnosis in Jerusalem

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Abstract

Early diagnosis of autism spectrum disorder (ASD) in children enables earlier access to services and better ability to predict subsequent development. A vast body of literature consistently shows discrepancies in the age of diagnosis between children from varying socio-economic levels, cultural and ethnic backgrounds. The present study examines the effect of sociodemographic factors on age of ASD diagnosis among the three primary ethnic sectors in Jerusalem region: secular and modern religious Jews, ultra-Orthodox Jews and Arabs. Findings indicate minimal differences in age of diagnosis prior to the age of six, although Arab children of this age were largely minimally verbal. After age six, no Arab children were referred for an evaluation.

Keywords Autism spectrum disorder · Early diagnosis · Socioeconomic · Ethnic · Jerusalem

The core symptoms of autism spectrum disorder (ASD), including difficulty in social communication and interactions and the presence of restricted, repetitive patterns of behavior, interests, or activities, typically appear in early childhood but may not manifest until social demands exceed capacity (American Psychiatric Association 2013). The primary aim of increasing early diagnosis is to provide speedy access to services such as ASD-specific interventions, as concurrent research show that early intensive interventions positively impact many children and their families (Zwaigenbaum et al. 2015). These benefits include short and long-term improvement in a range of proximal and distal measures. Previous studies have revealed improvement in the child's cognitive and language abilities, increasing the family's coping and reducing its stress (Goods et al. 2013; Green et al. 2010; Hall and Graff 2012). On an economic level, early diagnosis may reduce financial expenses for families as well as for public welfare and health services (Peters-Scheffer et al. 2012).

While evidence-based diagnoses given between the ages 18 and 24 months are typically stable (Guthrie et al. 2013; Ozonoff et al. 2015), the median age for an ASD diagnosis given in the US is 52 months (Baio et al. 2018). Children

with increased symptom severity, high socio-economic status (SES), elevated parents' concern regarding primary symptoms, and access to education and health services are often diagnosed earlier (Daniels and Mandell 2014; Mazurek et al. 2014; Shattuck et al. 2009). Counteracting these effects, factors associated with later diagnosis include comorbid health problems, parental tendency to attribute ASD symptoms to behavioral issues or other health problems (Mandell et al. 2005; Perryman 2009), an incorrect primary diagnosis of another disorder due to diagnostic overshadowing (Fonbonne 2005; Goldstein and Schwebach 2004), and better verbal abilities (Salomone et al. 2016).

Recent studies have consistently found a link between high SES, represented by income, parents' profession and/or years of education, and increased rates of ASD (Durkin et al. 2017; Ng et al. 2017). The primary explanation proposed is that with higher parental education and financial means comes increased access to services, including ASD diagnostic services (Durkin et al. 2010, 2017; Thomas et al. 2012). Interestingly, countries with universal healthcare, such as Canada, Norway, Sweden and France, where disparities in access to health services between socio-economic classes are low, higher ASD prevalence was found in lower SES groups, or no link was found between SES and prevalence of ASD (Burstyn et al. 2010; Delobel-Ayoub et al. 2015; Rai et al. 2012).

An extensive review conducted by Mandell and Daniels (2014), examined the association between SES and ethnic

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or race affiliation and age of diagnosis. Of 11 studies that inspected the relationship between SES and age of diagnosis, five found an association between high SES and earlier diagnosis, while the remaining studies found no such association. Twelve studies examined the association between ethnic or racial affiliation and age of diagnosis and revealed contradictory findings. Five of these found that children belonging to ethnic or racial minorities were likely to receive a later diagnosis compared to children of non-minority children, while five other studies did not find a correlation between these factors. The remaining two studies found contrasting results, showing that children of the main ethnic group were likely to receive a later diagnosis compared to children of ethnic or race minorities. The researchers posit that these dyssynchronous findings can be attributed to variables that differ between the reviewed studies, such as study duration, sampling method and geographic location of the study. Further study is no doubt required to clarify the influence of ethnicity and/or race on age of initial diagnosis of ASD.

Israel

The State of Israel is home to multiple ethnic and cultural groups. The current population of Israel consists of approximately 75% Jews, of which 9% define themselves as ultra-Orthodox; 17% Muslim Arabs; and 8% additional minorities. Arabs, both Muslims and Christians, and ultra-Orthodox Jews (UOJ) belong to ethnic minorities with some similar sociodemographic traits, which differ from the main ethnic group. For instance, the prevalence of children below the poverty line is 63% in the Arab population and 67% in the UOJ population, while the comparable group in the rest of the population is 15% (Clarfield et al. 2017). Despite these similarities, Arabs also differ from the UOJ. Disparities in access to healthcare services can be observed in the significantly lower rate of Arab demand for, and availability of, medical specialists, alongside a higher rate of emergency treatments and hospital admissions (Rosen et al. 2015). The Jerusalem municipality is a particularly heterogeneous region, populated by approximately 62% Jews and 38% Arabs. Of the Jews, 34% are UOJ (Korach and Choshen 2018).

Jerusalem is a divided city (Calame and Charlesworth 2011), and so has a unique and complex status. Arabs living in East Jerusalem since the Six-Day War of 1967, who often self-identify as Palestinians, are in a unique position. They became “permanent residents” of Israel shortly after the war. Although they hold Israeli ID cards, few have applied for Israeli citizenship, to which some are entitled, and most maintain close ties with the West Bank and Jordan. Social services in East Jerusalem are chronically under-funded. There are only six infant care centers in East Jerusalem

compared with 27 in West Jerusalem, and only five welfare offices compared to 18 in the western part of the city. Socio-economically, the differences are stark: 75% of the residents live below the poverty level as compared to 29% of secular and modern religious Jews (SMRJ) residents, and 49% of UOJ residents (Korach and Choshen 2018; The Association for Civil Rights in Israel 2014).

Several recent epidemiological studies evaluated the prevalence of ASD diagnosis among Israeli children while attempting to compare between different sociodemographic groups. Gal et al. (2012) examined the records of children born between 1986 and 2005 and found a steep rise in the prevalence of diagnosis of ASD among Jewish children, from 0.12% in 1986–1987 to 0.36% in 2003. Looking at a single point in time, Davidovitch et al. (2013) found that 4.8 of every 1000 children between the age of 1 and 12 were diagnosed with ASD in 2010. These findings also indicated that the prevalence among children of low SES families was significantly lower (0.25%) than that of average (0.47%), high average (0.52%) and high (0.49%) SES groups. Accordingly, the prevalence of ASD diagnosis in the Arab and UOJ populations was estimated as lower (0.12% and 0.26% respectively) compared to the rest of the population (0.55%). A recent study in the south of Israel found that 21 of every 1000 Jewish children were referred for an autism evaluation, with 74% of the referred children receiving a diagnosis of ASD. In contrast, only 3.6 of every 1000 Bedouin-Arab children were referred, with similar rates of eventual diagnosis (73%; Levaot et al. 2019).

The most comprehensive study to date found a prevalence of 5.6 out of every 1000 children among secular and modern religious Jews (SMRJ) diagnosed with ASD, while the prevalence among UOJ and Arab children were significantly lower; 2.5 of every 1000 children and 8.7 out of every 10,000 children respectively (Raz et al. 2015). The same study pointed to a dramatic growth of 10 times the accumulated prevalence of ASD diagnosis among SMRJ, with the steepest growth between the years 1992 and 2004. Overall, the UOJ showed a similar trend over the same years, while the Arab population exhibited similar patterns 10-years later than the rest of the population, with dramatic growth taking place between the years 2002 and 2009, indicating a lag in growth patterns.

Despite the diverse population of Israel, few studies have examined the role of this diversity on the characteristics of children receiving an initial diagnosis of ASD. In the present study, we examined the age of diagnosis of ASD along with additional characteristics of children receiving a diagnosis, in one public child development center in the Jerusalem municipality. This paper aims to: (1) Examine the relationship between age of diagnosis and demographic characteristics. (2) Examine differences in referral source and reason for referral. (3) Examine the association between

ethnic affiliation and clinical characteristics of ASD. (4) Examine the differences between ethnic groups in rate of positive versus negative diagnosis of ASD. This study is the first to closely examine the clinical characteristics of a community-diagnosed sample of children in Jerusalem in attempt to discern patterns, similarities and differences between and within sociodemographic groups. We aim to expand our current knowledge (i.e. Davidovitch et al. 2013; Raz et al. 2015), by examining factors impacting the age of diagnosis in public child development clinic serving an ethnically diverse catchment area.

Method

Participants

Data was collected within a child development center belonging to one of Israel's five health maintenance organizations (HMO), which together provide medical services to all Israeli residents. This child development center is located in West Jerusalem and is the sole service provider for members of this HMO residing in the Jerusalem municipality, including East and West Jerusalem, Beit Shemesh, Modi'in Illit, Beitar Illit, and Jewish settlements in the West Bank. Data for the current study includes all children who received an evaluation of ASD during 2011–2016. This initially included 163 children, of which 126 eventually received an official diagnosis of ASD. A diagnosis of ASD is officially given to children meeting criteria for ASD as per the DSM (DSM-IV through 2013, and DSM 5 from 2014), based on standard assessment tools and according to the best clinical estimate of the diagnostic team. Due to the public nature of this clinic, there are exceptions. Of the 126 children, 26 (17 UOJ, 9 SMRJ) were given a diagnosis without the use of standardized instruments, based on a partial assessment or by an independent professional outside of the HMO.

These groups were excluded from the analyses. All 100 remaining children (28 SMRJ, 52 UOJ, 20 Arab, 77 boys) remaining in the final sample were evaluated by an interdisciplinary team within the child development center, led by a developmental pediatrician or a pediatric neurologist with expertise in ASD diagnosis. Overall, 71 children were assessed using the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2000; ADOS-G until 2012, ADOS 2 from 2013), 24 children were evaluated using the Childhood Autism Rating Scale (CARS; Schopler et al. 1980), two were assessed using both the ADOS and the CARS, and one child was evaluated using the Childhood Autism Spectrum Test (CAST; Williams et al. 2008) and the Social Communication Questionnaire (SCQ; Rutter et al. 2003; See Table 1). An additional four children were diagnosed according to the DSM criteria and best clinical estimate, since these children's behavior and symptom severity did not allow for the use of standardized assessment tools. Children included in the current study were diagnosed by reliable and trained professional physicians and psychologists.

Measures

Intake Form

A parent-report questionnaire administered as part of the admission process to the center. The form is filled in by one or both parents, or by the center's social worker based on the parents' responses. The intake assesses personal and familial characteristics, such as the referrer and the reason for referral, developmental history, such as the course of the pregnancy and birth, the child's health condition, behavior and daily functioning, developmental treatments the child has received or currently receives, background information and demographic and health information of the parents and siblings.

Table 1 Demographic and clinical characteristics of the children in the study

Variable/ethnicity	SMRJ N (%)	UOJ N (%)	Arab N (%)	Total N (%)
Children diagnosed with ASD	28 (28%)	52 (52%)	20 (20%)	100
Gender				
Boys	23 (82.1%)	40 (76.9%)	14 (70.0%)	77
Girls	5 (17.9%)	12 (23.1%)	6 (30%)	23
Measure/ethnicity	SMRJ (N)	UOJ (N)	Arab (N)	
ADOS (N=65) ^a	7.39 ± 1.65 (18)	7.53 ± 1.93 (34)		7.46 ± 1.98 (13)
CARS (N=24)	38.75 ± 9.81 (4)	37.86 ± 6.92 (14)		41.17 ± 5.08 (6)

^aChildren who were administered ADOS modules 1–3 for its comparability

ADOS (Autism Diagnostic Observation Schedule; Lord et al. 2000)

A reliable and valid diagnostic tool for ASD in year-old and older children. The assessment consists of a 30–45 min semi-structured session, which include several standardized tasks that focus on communication, social behavior, play and repetition, in an interaction between child and examiner. The tasks emphasize ASD-relevant behaviors, such as difficulty in symbolic play or usage of eye contact and non-verbal gestures to establish joint attention with another individual. The test consists of five modules, each suitable for a different age and language capability, with each module producing a calibrated severity score (CSS), which reflects the severity of the symptoms. The CSS range is 1–10, and embodies characteristic such as age and language level, thus allowing a comparison between the different modules (Esler et al. 2015; Wiggins et al. 2017). The ADOS was improved and revised throughout the years, with the ADOS-2 (Lord et al. 2012) being the most recent of the versions, subsequent to the ADOS-G (Lord et al. 2000). A number of alterations were made, including revised algorithms, updated protocol and modules, new comparison score and modifications to better align with the diagnostic criteria of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (Dorlack et al. 2018).

CARS (Childhood Autism Rating Scale; Schopler et al. 1980)

A 15-item questionnaire intended for ASD diagnosis among children 2 years old and older, to distinguish it from other developmental disorders and to determine its severity (Schopler et al. 1980). The questionnaire is based on a direct observation of the child's behavior, and its items refer to communicational, social and emotional abilities, repetitive behaviors, play abilities and anomalous sensory interests. The grading range is 15–60, in which ASD diagnosis is given on a 30 and above. 30–37 indicates a low-mediate severity level ASD, while 38–60 indicates a high severity level of ASD.

Cast (Childhood Autism Spectrum Test; Williams et al. 2008)

A 37-item parent report questionnaire measuring social communication skills and social interactions with adults and peers to detect manifestations of ASD. The items are administered in a *yes/no* response format, with 31 of the items contributing to the total score while six items serve as control questions and are not scored. The cut-point for concern of possible ASD is 15.

SCQ (Social Communication Questionnaire; Rutter et al. 2003)

A 40-item parent report questionnaire, administered in *yes/no* response format, for screening of ASD. The SCQ is based on the Autism Diagnostic Interview (ADI; Le Couteur et al. 1989), measuring communication, social interactions, and restricted and repetitive behaviors and interests. The first item is not scored and serves as a distinction between non-verbal and verbal children. The grading range 0–33 for non-verbal children and 0–39 for verbal children, and the cut-point for ASD is 15.

Data

The data was drawn from the center's computerized database as well as diagnostic forms completed by the medical staff during the diagnosis process. The database included the referral documents to the center, intake form and the final diagnosis form. The database was constructed by Excel software, and then extracted into SPSS software for statistical analysis.

Analysis

To address our first aim, we conducted a one-way ANOVA between age of diagnosis and ethnicity, as well as a one-way ANOVA between age of initial referral and ethnicity. A hierarchical regression was conducted to test the contribution of ethnicity to the age of diagnosis beyond familial factors. To address our second aim, we conducted three one-way ANOVAs between ethnicity and the rate of referral, i.e. percentage of children referred to the center by parents, health care system and education system, respectively. In addition, we examined the distribution of reason for referral among the three groups. To address our third aim, we conducted a χ^2 test for independence between ethnicity and the ADOS module completed. A one-Way ANOVA was conducted between ethnicity and ADOS score. To address our final aim, we conducted a χ^2 test for independence between ethnicity and rate of negative diagnosis.

Results

Aim 1

The distribution by age and ethnicity of children in the center diagnosed with ASD from 2011 to 2016 is shown in Table 2. Predictably, a dramatic decline in diagnoses was found after the age of six, with significant differences found between the groups. While a modest number of children in both Jewish groups continued receiving a diagnosis after the

Table 2 Number of diagnoses between 2011 and 2016 per 1000 children insured by the HMO, by age and ethnicity

Age/ethnicity	SMRJ	UOJ	Arab
0–3	2.7	1.2	4.0
3–6	2.3	3.1	4.9
6–9	0.7	0.7	0.0
9–15	0.4	0.2	0.0
Total	1.4	1.2	1.7

age of six and even after the age of nine, no child older than six years old received an ASD diagnosis among the Arab group. Considering these findings, further analysis involving the age of diagnosis was done for children aged six and younger, to maintain homogeneity of the variance between the ethnic groups.

To evaluate the relationship between ethnic affiliation and the age of diagnosis among children 1–6 years of age, a one-way ANOVA was conducted while controlling for “mother’s education”. No significant differences were found ($p = .40$), yet planned comparisons ($p = .05$) found that UOJ children are diagnosed significantly later ($M = 43.03$, $SD = 11.7$) than SMRJ children ($M = 38.61$, $SD = 14.52$). The difference between SMRJ children and Arab children ($M = 39.78$, $SD = 13.38$) was not significant. A one-way ANOVA between ethnic affiliation and the age of initial referral to the center did not reveal significant differences.

A hierarchical regression was used to examine the contribution of ethnic affiliation to the prediction of the age of diagnosis, beyond diagnostic and family history-related variables. First, initial age of concern, mother’s education and relatives with ASD were included. Initial age of concern and mother’s education were included for their significant correlation with age of diagnosis ($r = .40$, $p < .001$; $r = .23$, $p = .01$; respectively), and relative with ASD was included for its theoretical relevance, despite the lack of significant correlation. Second, ethnic affiliation to Arab or UOJ were included (dummy-variables). The regression equation indicated that a considerable percent of the variance of age of diagnosis can be explained by diagnostic and family history (adjusted $R^2 = 0.17$, $R^2 = 0.20$, $F(3, 92) = 7.47$, $p < .001$). Of the variables included in the regression model, age of concern ($\beta = .37$, $p < .001$) and mother’s education ($\beta = .19$,

$p = .04$) were found to significantly predict the age of diagnosis. However, ethnic affiliation did not significantly predict the age of diagnosis beyond the contribution of diagnostic and family history (R^2 change = 0.04, $F(5, 90) = 2.15$, ns).

Further differences between groups were found regarding parental age and level of education. As shown in Table 3, the average age of SMRJ mothers and fathers at the time of birth was significantly higher than those in the UOJ and Arab groups. In addition, the average years of education of SMRJ mothers and fathers were significantly higher than those in the UOJ and Arab groups. A significant correlation between mother’s education and age of diagnosis was found ($r = .23$, $p < .05$).

Aim 2

Three one-way ANOVAs were conducted, using Bonferroni adjusted alpha levels of .017, to determine the relation between ethnic affiliation and the rate of referral by parents, health care system or education system. While no significant difference was found among the parents and health care system referral rate, the result for the education system was found significant ($F(2, 97) = 5.86$, $\eta^2 = .11$, $p = .004$), with planned comparison showing a significant difference between Arab and SMRJ children ($p = .003$), and no significant difference between the UOJ and SMRJ children. As can be seen in Table 4, while 39.3% of SMRJ referrals and 36.5% of ultra-Orthodox referrals were by the education system, not one of the Arab referrals was from the education system. These differences were still significant when limited to children aged 1–6.

Parent’s reports of reason for referral were coded into four categories: language and/or communication difficulties, social, emotional and/or behavioral difficulties, motor

Table 4 Different referrers rates to the Child Developmental Center across ethnic groups

Referrer/ethnicity	SMRJ N (%)	UOJ N (%)	Arab N (%)	Total N (%)
Parents	12 (42.9%)	29 (55.8%)	16 (65%)	54 (54%)
Health system	13 (46.4%)	21 (40.4%)	15 (75%)	49 (49%)
Education system	11 (39.3)	19 (39.3%)	0 (0%)	30 (30%)

Table 3 Demographic characteristics of the families in the study

Variable/ethnicity	SMRJ	UOJ	Arab	Total	p value	η^2
Mother’s age during childbirth	31.57 ± 5.43	27.71 ± 6.97	26.10 ± 6.06	28.47 ± 6.65	.008*	.094
Father’s age during childbirth	35.04 ± 6.42	29.62 ± 6.89	31.05 ± 6.29	31.38 ± 6.98	.004*	.110
Mother’s years of education	13.74 ± 2.10	12.94 ± 1.38	11.95 ± 2.78	12.96 ± 2.03	.01*	.095
Father’s years of education	13.68 ± 2.23	12.40 ± 1.11	11.15 ± 2.41	12.51 ± 1.98	<.001*	.199

* $p \leq .05$

difficulties or developmental delay, and specific suspicion of ASD. Language and/or communication difficulties were the main and most prominent reason among all groups, with an average of 76% across all groups. However, while among SMRJ and UOJ, referrals due to social, emotional and/or behavioral difficulties constitute 35.7% and 38.5% respectively, these reasons account for only 5% among the Arab group. Moreover, both UOJ and Arab children are referred more due to motor difficulties or developmental delay (21.2% and 20% respectively) than SMRJ children (7.1%). See Table 5 for these findings.

Aim 3

To examine the relationship between ethnic affiliation and the ADOS module completed, as an indicator for verbal ability, a χ^2 test for independence was conducted. The results show a significant dependency between verbal ability and ethnicity ($\chi^2(6) = 15.83, p < .05$). While over half of SMRJ and UOJ children possess verbal/linguistic ability (modules 2 and 3), only one Arab child met this criterion. See Table 6. When limiting the analysis to children aged 1–6, the disparities in verbal abilities remain significant ($\chi^2(6) = 12.84, p < .05, \phi = .45$). To evaluate the relationship between ethnic affiliation and symptom severity of ASD, as reflected by the ADOS score, a One-Way ANOVA was conducted. The analysis included only children who completed ADOS modules 1–3 ($n = 65$), and mother's education was controlled for. No significant differences were found. This result did not change when the analysis was limited to ages 1–6. An additional approach to examine the severity of ASD is by analyzing the CARS scores. Due to a small sample of children who completed the CARS, a statistical analysis was not feasible.

Aim 4

Of 110 children who completed the ADOS, 73 received an ASD diagnosis, while 37 did not. To examine the relation between ethnic affiliation and the rate of negative diagnosis following the ADOS, a χ^2 test for independence was conducted. While no statistically significant dependency was found between the variables [$\chi^2(2) = 4.54, ns, \phi = .20$], Arab children appear to receive fewer negative diagnosis

Table 6 Distribution of ADOS modules across ethnic groups

ADOS modules/ ethnicity	SMRJ N (%)	UOJ N (%)	Arab N (%)	Total N (%)
T	4 (18.2%)	2 (5.6%)	2 (13.3%)	8 (11.0%)
1	5 (22.7%)	14 (38.9%)	12 (80%)	31 (42.5%)
2	7 (31.8%)	11 (30.6%)	1 (6.7%)	19 (26.0%)
3	6 (27.3%)	9 (25%)	0 (0%)	15 (20.5%)

(11.8%) compared to SMRJ children (40.5%) or ultra-Orthodox children (35.7%).

Discussion

The current study examined the differences in age of diagnosis and clinical characteristics among children of different sociodemographic backgrounds diagnosed with ASD in the Jerusalem municipality. Studies have shown that low SES and membership in an ethnic minority are related to low access to healthcare and later diagnosis of ASD (Daniels and Mandell 2014), yet the differences in age of diagnosis among socio-demographic populations in Israel have yet to be thoroughly examined. This study indicates differences in age of diagnosis among minority groups relative to the main ethnic group, with different characteristics between the minorities.

The age of initial concern and the mother's level of education, rather than the ethnic affiliation of the child, were found to significantly predict the age of diagnosis. These results indicate that it is SES, rather than ethnicity, is likely to explain the differences. However, in line with international findings, which indicate a later diagnosis for minority groups (Daniels and Mandell 2014), UOJ children were diagnosed later than SMRJ children. It was also found that the age of initial referral to the child developmental center was similar between groups, which suggests that once referred to the center, the diagnostic process takes longer for minority groups. This disparity is likely a symptom of multiple underlying causes, such as cultural differences in the perception of the disorder, awareness of and familiarity

Table 5 Reasons of referral to the Child Developmental Center across ethnic groups

Reason for referral/ethnicity	SMRJ N (%)	UOJ N (%)	Arab N (%)	Total N (%)
Language and/or communication difficulties	22 (78.6%)	38 (73.1%)	16 (80%)	76 (76%)
Social, emotional and/or behavioral difficulties	10 (35.7%)	20 (38.5%)	1 (5%)	31 (31%)
Motor difficulties or developmental delay	2 (7.1%)	11 (21.2%)	4 (20%)	17 (17%)
Specific suspicion of ASD	3 (10.7%)	4 (7.7%)	2 (10%)	9 (9%)

The rates add up to over 100% due to multiple reasons for referral in some cases

with its symptoms, cooperation with the diagnostic process, and insufficient cultural sensitivity of the medical system.

The current study also indicates that no Arab child received a diagnosis of ASD, or was even referred for an autism-specific evaluation, over the age of six. Arab children, as an ethnic minority in Israel, are likely to live in lower SES surroundings in comparison to the main ethnic population (Clarfield et al. 2017). Accordingly, in another Israeli study a group of children diagnosed with ASD over the age of six were generally characterized with high SES (Davidovitch et al. 2015). It is worth noting that this finding did not extend to the UOJ group, which is also characterized as low SES, indicating that additional factors may lead to a discrepancy between the minority groups.

In line with the study by Mahajnah et al. (2015), no differences in age of diagnosis under the age of six were found between Arab and SMRJ children, together with no difference in age of initial referral to the center. However, Arab children referred to the center had significantly lower verbal abilities, were less likely to be referred to the center due to social, emotional and/or behavioral difficulties and were more likely to receive a diagnosis of ASD once referred. In fact, according to our findings, an Arab child being evaluated is approximately three times less likely to receive a negative ASD diagnosis. These findings are similar to those of a study conducted in the United States in which parents of minority groups were less concerned with social and behavioral symptoms characterizing their children, while mainly concerned with low verbal abilities (Donohue et al. 2017). In the current study, it was also found that no Arab child was referred to the center by the educational system, in contrast to about a third of each of the SMRJ and the UOJ groups.

These findings raise important questions concerning the diagnostic process among the Arab community, from the point of initial concern to the receipt of an ASD diagnosis. Public perception of ASD in the Arab community may center more on verbal development than is the case in the Jewish population. It is feasible children with verbal abilities will not be referred for a developmental evaluation, even if other symptoms are present. This may be partially due to the scarcity of resources in East Jerusalem, which are intended to facilitate the screening and referral process to the child development centers (Korach and Choshen 2018). Furthermore, given that there was no diagnosis of Arab children after the age of six and no referrals made by the education system, it is reasonable to suggest a possible lack of familiarity and knowledge of ASD among teachers in the Arab community.

Several limitations of the current study should be noted. The sample of diagnosed children included in the study was relatively small, which influenced the statistical analysis. It is possible that some comparisons, which found clear trends, would have been significant with a larger sample.

Additionally, this study did not include an assessment of cognitive abilities or adaptive functioning, since these constructs are assessed inconsistently and with various instruments at the child development center. Studies have linked cognitive ability with SES (Bhasin and Schendel 2007; Leonard et al. 2011), suggesting a possible intervening variable that was not examined in this study. Finally, this study is descriptive in nature and is therefore limited in its ability to explain patterns or determine causal links.

Despite its limitations, this study provides evidence of the disparities in the diagnosis of ASD between sociodemographic communities in the Jerusalem municipality. These findings may assist in improving the public screening and diagnostic process, including the duration of the diagnostic process and referral rates among minorities, as well as help in narrowing cultural gaps in this process. The three populations in this study are entitled to the same health services, yet differences in the receipt of this service clearly exist. While the findings regarding the age of diagnosis among UOJ are similar to past international studies examining demographically similar groups (Daniels and Mandell 2014), the findings among Arabs are unique, which suggest additional factors at play. Lack of knowledge about ASD and little awareness of the diverse symptoms of the disorder may be addressed among childcare professionals and parents, as well as emphasis on differences arising from varied cultural perceptions and their implications.

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Author Contributions JK and MB conceived of the study, and participated in its design and coordination along with RS; RS was responsible for data collection and organization; MB was responsible for all clinical characterization upon which the study is based; RS and TPG performed the statistical analyses; JK and RS drafted the manuscript with CS; All authors participated in manuscript preparation and approved the final manuscript.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the medical center's research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The data analysis was conducted while separating the relevant data from identifying information, such as name and ID number, to maintain a proper level of anonymity for the children and their families.

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