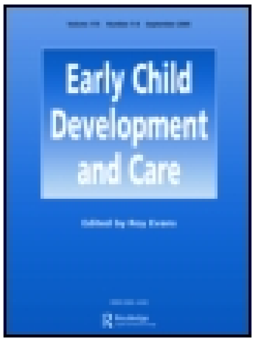

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The prevalence and socioeconomic determinants of undetected developmental delay in preschool-aged children in the northwest of Iran: a population - based study

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ABSTRACT

New estimates indicate that many children in low- and middle-income countries are at risk of developmental delay (DD). This study aimed to assess the prevalence and socioeconomic determinants of undetected DD, and mean developmental scores (MDS) in preschool-aged children in the northwest of Iran. This study was conducted on 615 children aged 36–60 months. For the early detection of DD, the Persian version of the Ages and Stages Questionnaires (ASQ) was used for face-to-face interviews with mothers. Our findings showed that the prevalence of DD was 13.98% (1.63% in communication, 2.28% in gross motor skills, 3.41% in fine motor, 2.67% in problem-solving and 3.58% in social-personal domains). Multivariate analyses showed that DD was higher in preterm children, single-child families, and the second SES quantile. Due to the high prevalence of DD and the importance of early identification and intervention, it is necessary to diagnose DD at early ages.

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Child; developmental delay; age and stage questionnaire; prevalence; Iran

Background

Childhood is a basis for future learning, health and success in life, provided that prevention of potential developmental delays (DDs) (Britto et al., 2017; Lamsal, Dutton, & Zwicker, 2018). DD is defined as the diagnosis of significant limitations in developmental domains including communication, gross motor, fine motor, problem-solving skills, and personal-social skills, in accordance with age (Veldhuizen, 2016). In 2016, about 52.9 million children under five years of age had DD worldwide, with 3.9 million Years Lived with Disability (YlDs) (Olusanya et al., 2018). The prevalence of DD among children in low- and middle-income countries (LMICs) is higher than that in other parts of the world. In LMICs, 33% of children have DD and 43% of them are deprived of their developmental potential due to poverty, socio-demographic and environmental factors (Black et al., 2017; McCoy et al., 2016). Also, the prevalence of DD has increased in the Middle East between 2010 and 2016 (Olusanya et al., 2018). It was reported 18% to 22% in different cities of Iran (Akbari et al., 2012; Shaahmadi, Khushemehri, Arefi, Karimyan, & Heidari, 2015; Zareipour et al., 2017). DD can increase the risk of mental and behavioural disorders, lower school performance, lower employment and earning skill (Kurtz-Nelson & McIntyre, 2017; McDonald, Kehler, Bayrampour, Fraser-Lee, & Tough, 2016; Rubio-Codina, Attanasio, Meghir, Varela, & Grantham-McGregor, 2015).

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One-third of children do not have access to early detection and intervention before entering the education system (Eickmann, Emond, & Lima, 2016). Ages and stages questionnaire (ASQ), as a parent-completed, low-cost screening tool with a short completion time, is recommended at specific intervals to early diagnosis in Iranian health system (Vameghi et al., 2013). Determining the prevalence of DD and its determinants is a necessary step for planning an early intervention and increasing the attention and monitoring (Valla, Wentzel-Larsen, Hofoss, & Slinning, 2015).

West Azarbaijan Province, a north-west frontier province of Iran, is among the top ten deprived provinces of the country in terms of indices of access to health, education and living standards. In addition, it is the fifth deprived province in Iran in terms of access to education (Mohaqeqi Kamal, Ghaedamini Harouni, Basakha, & Makki Alamdari, 2019). Therefore, the socioeconomic conditions of the province increase the DD chances and reduce its detection chance. To the best of our knowledge, most studies in Iran were carried out at primary health facilities; therefore, we conducted the first population-based study in the field to better predict the community prevalence and socio-economic status. This study aimed to assess the prevalence and socioeconomic determinants of undetected DD, and mean developmental scores (MDS) in preschool-aged children in the northwest of Iran.

Methods

Design and subjects

This population-based cross-sectional study was conducted on 615 children aged 36–60 months between June -October2017 in Shahindezh, northwest of IRAN. The study was approved by the Ethics Committee of Tehran University of Medical Science. The multistage systematic sampling was used in this study. Proportional to the population size of each region of the city, the numbers of households with 36–60 month children were randomly chosen. Data were collected by two teams, each consisting of 2 trained questioners. All the questioners had either a bachelor's degree or a higher degree. Face-to-face interviews were held with the mothers at their doorsteps. First, the objectives of the study were explained clearly for parents, and then participants who signed a written informed consent were included in the study. Mothers filled out a supplementary questionnaire reporting the socio-demographic status of the family and the age and stage questionnaire (ASQ) for DD screening. The study inclusion criteria were age between 36–60 months. The study exclusion criteria were those with an apparent DD or disability.

Procedure

The demographic factors included delivery age, delivery type, gender, parental education, socioeconomic status (SES), and family size. To assess the SES, principal component analysis (PCA) was applied to the assets of the household, and the wealth index was created. The PCA conducted on variables of assets including owning a car and motorcycle (not for money-making purposes), smart cellphone, freezer, dishwashing machine, microwave oven, personal computer, vacuum cleaner, washing machine, having a bath in the house, colour television(LED or LCD), video player (VHS, VCD, DVD and others), and per capita number of bedrooms. In PCA, the first component justifies the greatest share of the total variance among the variables, hence it is considered as the household wealth index. In this study, the first component justified 31% of the total variance. Based on the PCA results, individuals were classified into five groups from the lowest to the highest SES.

Data collection tool, ASQ

The ASQ is a developmental screening questionnaire for 4-60months children. Parents answered to 6 items in each of 5 developmental domains (communication, gross motor, fine motor, problem-solving skills, and personal-social skills), eventually, by this way, child development skills were measured. Each item was scored as YES = 10, SOMETIMES = 5, NOT YET = 0 according to the parents' answers. The total score of 6 items was considered as the domain score. The mean of answers was replaced to missing answers in the same domain, as appropriate. Iranian norms are available for each domain. The scores lower than the cut-off in two or more domains were regarded as delay, while scores higher than the cut-off score in five developmental domains were regarded as normal. The scores lower than the cut-off in only one domain were accepted as normal, but their development should be monitored in the following months. The ASQ is a valid questionnaire with the validity and reliability 0.76 and 0.86, and the inter-rater reliability 0.93, in Iran (Vameghi et al., 2013).

Statistical analysis

The descriptive continuous variables were presented as mean and standard deviations; qualitative variables were presented as frequency (%). Kolmogorov–Smirnov test was used to test the normal distribution. Independent t-test and one way ANOVA were used to compare the means of total ASQ score and score for each domain. A stepwise multiple regression analysis was used to assess the factors that associated with the mean developmental scores. Results were reported as the beta coefficient (β) and the 95% confidence interval. To estimate the odds ratio associated with each of the risk factors of DD, unmatched analysis was done by unconditional logistic regression. To adjust the potential confounding effects of risk factors, a multivariable logistic regression analysis was also done. Building multivariable model was based on a stepwise backward selection algorithm using the 10% change-in-estimate approach for confounding adjustment. We assessed univariable, and Multivariable-adjusted odds ratios and a 95% confidence interval. The P value of less than 0.05 was considered as statistically significant.

Result

Of the 615 children involved in the study, 309 (50.2%) were boys. The mean age of children was 48.7 ± 9.5 months (36–60 months). Five hundred and fifty-five (89.9%) of the children were born term. The mothers' and father's mean ages were 32.4 ± 9.6 years and 37.9 ± 10.8; respectively. The socio-demographic characteristics of the participants are given in Table 1.

Table 1 also illustrates the children's characteristics and their correlation with the mean developmental scores (MDS). Overall MDS in females were higher than those in males (243.9 ± 16.9 vs. 238.5 ± 15.5) ($p < 0.0001$); Gross motor ($p = 0.001$) and Fine motor domain ($p = 0.01$) scores were higher in females as compared with males. In all developmental domains, MDS increased in line with age, except Fine motor (all p values were < 0.01). Children of more educated mother had higher overall MDS: university/higher degrees (245.3 ± 16.6) compared to elementary/lower education (236.6 ± 20.9) ($p < 0.0001$); also, this was true about Gross motor and Problem solving domains (all p values < 0.05). Children of families with higher SES, had higher overall MDS compared to those with lower SES ($p = 0.003$). Children with employee mothers had higher overall MDS compared to those with housewife mothers (240.1 ± 36.2 vs. 234.1 ± 38.8) ($p = 0.04$). Full term children had higher overall MDS (242.0 ± 16.1) compared to post term children (234.3 ± 17.9) ($p = 0.002$). The overall MDS was also significantly associated with the number of children ($p < 0.0001$); Children of multiple child (three or more)families had significantly lower overall MDS compared to children of single child families, and this was true for most, but not all, developmental domains. Mother's age, occupation and delivery type were not correlated with any of the MDS (Table 1).

Table 2 shows the predictive factors of MDS domains. The significant variables at the univariate level were entered in the multiple regression, like age, gender, gestational age, mother education, mother occupation, delivery type, and SES quantiles. In the communication domain**,** MDS were associated with Gestational age (higher scores in Full term) ($\beta = -0.09$, $p = 0.027$), maternal education

Table 1. Children characteristics and mean developmental scores by domains.

		$N = 615$ N (%)	Overall score Mean (SD)	Communication Mean (SD)	Gross motor Mean (SD)	Fine motor Mean (SD)	Problem solving Mean (SD)	Personal social Mean (SD)
Gender	Male	309 (50.2%)	238.5 (16.9)	49.7 (7.4)	48.4 (7.9)	47.1 (7.3)	46.9 (6.6)	46.4 (8.1)
	Female	306 (49.8%)	243.9 (15.5)	49.2 (7.8)	50.7 (7.1)	48.7 (7.8)	47.9 (7.8)	47.4 (7.5)
	p-value		**< 0.0001**	0.44	**0.001**	**0.01**	0.07	0.09
Age groups	36 months	112 (18.2%)	237.1 (17.9)	48.7 (7.6)	48.0 (7.8)	49.1 (8.9)	47.9 (7.2)	43.6 (7.7)
	42 months	114 (18.5%)	239.3 (14.8)	49.9 (6.6)	46.7 (6.8)	47.2 (7.3)	46.8 (6.4)	48.5 (8.7)
	48 months	132 (21.5%)	245.1 (18.2)	49.1 (8.0)	51.7 (6.9)	46.4 (7.6)	49.3 (6.9)	48.6 (8.0)
	54 months	97 (15.8%)	237.8 (12.2)	51.9 (7.2)	46.2 (7.9)	48.1 (7.1)	46.4 (5.6)	45.1 (6.6)
	60 months	160 (26%)	244.3 (16.0)	48.6 (7.9)	53.1 (9.6)	48.6 (6.7)	46.3 (7.8)	47.8 (7.6)
	p-value		**< 0.0001**	**0.007**	**< 0.0001**	0.052	**0.001**	**< 0.0001**
Gestational age (weeks)	< 37	553 (89.9%)	242.0 (16.1)	49.7 (7.5)	49.5 (7.5)	48.1 (7.5)	47.6 (6.6)	47.1 (7.8)
	≥37	62 (10.1%)	234.3 (17.9)	47.5 (8.1)	50.1 (8.2)	46.2 (8.2)	45.0 (7.2)	45.6 (8.7)
	p-value		**0.002**	**0.01**	0.68	0.065	**0.003**	0.083
Maternal age (years)	<25	174 (28.3%)	241.2 (15.4)	49.7 (7.7)	49.8 (7.2)	48.3 (7.7)	47.8 (7.0)	45.7 (7.6)
	25–35	282 (45.8%)	242.8 (16.4)	49.8 (7.4)	50.1 (8.6)	47.3 (7.9)	47.2 (6.3)	47.6 (7.4)
	>35	159 (25.9)	239.9 (17.7)	48.6 (7.8)	48.7 (8.0)	48.5 (7.3)	47.2 (7.2)	46.9 (8.6)
	p-value		0.5	0.24	0.25	0.19	0.66	**0.036**
Father age (years)	≤30	99 (16.10%)	240.6 (14.5)	48.9 (7.7)	49.6 (7.2)	48.1 (7.5)	48.8 (7.2)	45.1 (7.7)
	30–40	373 (60.6%)	241.8 (16.9)	49.8 (7.5)	49.9 (7.4)	47.6 (7.8)	47.2 (6.4)	47.3 (8.2)
	≥40	143 (23.25%)	240. 0 (16.5)	48.9 (8.1)	48.7 (8.2)	48.4 (7.1)	46.7 (7.1)	47.5 (8.1)
	p-value		0.48	0.51	0.28	0.64	**0.046**	**0.034**
Maternal education	Elementary and below	80 (13.0%)	236.6 (20.9)	47.7 (7.5)	49.8 (8.2)	46.1 (7.9)	46.4 (6.9)	46.7 (9.1)
	Middle and high school	157 (25.5%)	238.0 (15.47)	49.2 (8.0)	48.1 (7.3)	47.8 (7.9)	46.3 (6.6)	46.5 (8.0)
	Diploma	209 (34.0%)	242.4 (13.9)	49.9 (7.5)	49.9 (7.4)	48.2 (7.2)	48.0 (6.5)	46.4 (7.5)
	University or higher	169 (27.5%)	245.3 (16.6)	50.1 (7.3)	50.6 (7.7)	48.4 (7.5)	48.1 (6.7)	48.2 (7.3)
	p-value		**< 0.0001**	0.08	**0.02**	0.13	**0.03**	0.11
Number of children	1	246 (40.0)	240.4 (16.5)	49.64 (7.9)	49.5 (7.4)	47.5 (7.8)	46.9 (7.1)	46.9 (7.5)
	2	304 (49.4)	242.8 (16.6)	49.6 (7.4)	50.2 (7.64)	48.4 (7.5)	47.65 (6.5)	46.9 (8.0)
	≥3	65 (10.6)	236.6 (14.3)	48.1 (7.)	46.9 (7.7)	46.9 (6.9)	47.7 (5.9)	47 (7.8)
	p-value		**0.01**	0.31	0.006	0.23	0.41	0.99
Mother occupation	Housewife	554 (90.1%)	241.1 (16.4)	49.4 (7.7)	49.7 (7.5)	48.1 (7.6)	47.3 (6.8)	46.8 (7.9)
	Employed	61 (9.9%)	241.6 (17.2)	49.9 (6.9)	48.7 (8.5)	47.5 (7.1)	48.0 (6.1)	47.5 (7.4)
	p-value		0.84	0.67	0.36	0.67	0.46	0.53
SES quantiles	First	135 (21.9)	237.7 (17.3)	49.2 (7.8)	48.6 (8.0)	47.4 (7.9)	46.8 (7.2)	1. 45. 8 (8.3)
	Second	133 (21.6)	238.9 (17.5)	49.8 (7.3)	49.3 (7.6)	46.9 (8.1)	46.9 (6.6)	45.9 (7.5)
	Third	195 (31.7)	242.8 (14.4)	49.5 (8.1)	49.6 (6.9)	48.3 (7.4)	47.6 (6.4)	47.8 (7.6)
	Fourth	79 (12.9)	243.6 (15.6)	48.2 (7.7)	50.3 (5.5)	49.1 (6.9)	49.2 (6.7)	46.8 (8.2)
	Fifth	73 (11.9)	244.8 (17.4)	50.7 (6.8)	50.8 (7.1)	48.0 (7.1)	46.8 (6.6)	48.5 (7.3)
	p-value		**0.003**	0.29	0.32	0.656	0.08	0.03
delivery type	Vaginal	280 (45.5%)	241.5 (15.8)	49.6 (7.8)	49.6 (7.9)	48.1 (7.8)	47.4 (6.3)	46.8 (8.1)
	Cesarean	335 (54.5%)	240.9 (17.00)	49.4 (7.4)	49.5 (7.3)	47.7 (7.4)	47.3 (7.1)	47.1 (7.6)
	p-value		0.66	0.81	0.92	0.56	0.8	0.9

Table 2. Multivariate linear regression analysis for the predictors of each domain.

	Overall score Standardized β *p*-value	Communication Standardized β *p*-value	Gross motor Standardized β *p*-value	Fine motor Standardized β *p*-value	Problem solving Standardized β *p*-value	Personal social Standardized β *p*-value
Gender						
(Male/ fmale)	0.16	−0.034	0.15	0.01	0.07	0.08
	0.0001	0.4	**0.001**	0.016	0.073	**0.044**
Age (continuous)						
	0.12	−0.014	0.21	0.032	−0.08	0.09
	0.002	0.74	**0.001**	0.44	**0.046**	**0.033**
Gestational age (weeks)						
≥37	−0.14	−0.09	0.02	−0.08	−0.11	−0.06
	0.0001	**0.027**	0.62	0.065	**0.005**	0.17
Maternal age (years)						
25–35	−0.03	−0.04	−0.017	−0.11	0.02	0.08
	0.64	0.52	0.78	0.1	0.72	0.216
>35	−0.01	−0.11	0.001	0.002	0.08	0.01
	0.86	0.12	0.98	0.98	0.243	0.88
Father age (years)						
30–40	0.069	0.09	−0.05	0.03	−0.15	0.11
	0.34	0.22	0.48	0.73	**0.04**	0.13
≥40	0.01	0.08	−0.05	0.02	−0.19	0.13
	0.9	0.27	0.49	0.81	**0.017**	0.1
Maternal education						
Middle and high school	0.05	0.11	−0.07	0.1	−0.04	0.003
	0.38	0.07	0.22	0.09	0.51	0.95
Diploma	0.16	0.15	0.02	0.14	0.08	−0.02
	0.006	**0.015**	0.79	0.026	0.17	0.72
University and higher	0.24	0.16	0.04	0.13	0.09	−0.1
	0.001	**0.008**	0.46	**0.024**	0.129	0.09
Number of children						
2	0.04	−0.03	0.04	0.07	0.06	−0.05
	0.31	0.53	0.32	0.08	0.21	0.31
≥3	−0.09	−0.09	−0.09	−0.02	0.03	−0.02
	0.028	**0.035**	**0.03**	0.64	0.56	0.71
Mother occupation						
Employed	0.49	0.02	−0.01	0.004	0.04	0.014
	0.64	0.64	0.63	0.92	0.29	0.73
SES quantles						
Second	0.01	0.02	0.05	−0.04	0.002	−0.01
	0.81	0.73	0.34	0.46	0.97	0.91
Third	0.12	0.02	0.06	0.04	0.04	0.11
	0.016	0.84	0.2	0.42	0.46	0.04
Fourth	0.1	−0.05	0.08	0.06	0.1	0.04
	0.024	0.29	0.08	0.19	**0.032**	0.43
Fifth	0.14	0.06	0.01	0.03	−0.02	0.1
	0.002	0.17	**0.02**	0.53	0.72	**0.02**
Mode of delivery						
Cesarean	−0.02	0.001	−0.02	−0.01	−0.01	0.014
	0.68	0.64	0.63	0.74	0.76	0.77
R2	0.11	0.02	0.09	0.052	0.071	0.068

(university or higher) ($\beta = 0.16$, $p = 0.015$) and Diploma ($\beta = 0.16$, $p = 0.008$), and Number of children (lower scores in multiple child family ($\beta = -0.09$, $p = 0.035$)). In the gross motor domain, predictors of MDS were gender (higher scores in females) ($\beta = 0.15$, $p = 0.001$), age ($\beta = 0.15$, $p = 0.001$), Number of children ($\beta = -0.09$, $p = 0.03$) and SES quantiles (higher scores in Fifth) ($\beta = 0.01$, $p = 0.02$). In the fine motor domain, predictors of MDS was maternal education (university or higher) ($\beta = 0.13$, $p = 0.024$). In the problem solving domain, predictors of MDS were age ($\beta = -0.08$, $p = 0.046$), Gestational age ($\beta = -0.11$, $p = 0.005$), father age (30–40 years ($\beta = -0.15$, $p = 0.04$)) and ≥40 ($\beta = -0.19$, $p = 0.017$) and fourth SES quantiles ($\beta = 0.1$, $p = 0.032$). In the personal social domain, predictors of MDS were gender ($\beta = 0.08$, $p = 0.044$), age ($\beta = 0.09$, $p = 0.03$) and SES quintiles of fourth level ($\beta = 0.1$, $p = 0.02$).

Table 3. The prevalence of developmental delay in various domains among 36–60 months children.

Developmental domains	Number of children with developmental delay (%)	Number of healthy children (%)
communication	10 (1.63)	605 (98.37)
gross motor skills	14 (2.28)	601 (97.72)
fine motor skills	21 (3.41)	594 (3.41)
problem solving	17 (2.67)	598 (97.24)
Personal–social domain	22 (3.58)	593 (96.42)
Overall Score	86 (13.98)	529 (86.02)

Table 4. Multiple logistic regression analysis for exploring factors related to developmental delays.

		Developmental status		Crude OR (95% CI)	Adjusted OR (95% CI)
		Normal (%)	Delayed (%)		
Gender	Male	260 (84.14)	49 (15.86)	1	1
	Female	269 (87.9)	37(12.1)	0.73 (0.46–1.16)	0.73 (0.46–1.16)
Age groups	36 months	94 (83.9)	18 (16.1)	1	1
	42 months	99 (86.8)	15 (13.2)	0.79 (0.38–1.66)	0.81 (0.38–1.73)
	48 months	116 (87.9)	16 (12.1)	0.72 (0.35–1.49)	0.72 (0.34–1.51)
	52 months	82 (84.5)	15 (15.5)	0.96 (0.45–2.02)	0.93 (0.93–1.98)
	60 months	138 (86.3)	22 (13.70)	0.96 (0.42–1.64)	0.76 (0.38–1.52)
Gestational age (weeks)	≥37	481 (87.0)	72 (13.0)	1	1
	< 37	48 (77.42)	14 (22.58)	1.94 (1.02–3.71)	**1.95 (1.2–3.78)**
Maternal age (years)	≥25	147 (84.5)	27 (15.5)	1	1
	25–35	250 (88.4)	32 (11.6)	0.7 (0.4–1.21)	0.56 (0.27–1.16)
	>35	132 (83.0)	27 (17.0)	1.1 (0.62–1.99)	1.21 (0.51–2.86)
Maternal education	Elementary and below	68 (79.1)	18 (20.9)	1	1
	Middle and high school	138 (85.7)	23 (14.3)	0.63 (0.31–1.25)	0.61 (0.3–1.24)
	Diploma	181 (87.9)	25 (12.1)	0.52 (0.28–1.02)	0.53 (0.26–1.06)
	University and higher	142 (88.6)	20 (12.4)	0.53 (0.26–1.07)	0.52 (0.25–1.07)
Number of children	1	210 (85.4)	36 (14.6)	1	1
	2	263 (86.5)	41 (13.5)	0.91 (0.56–1.47)	1.06 (0.47–2.42)
	≥3	56 (86.2)	9 (13.8)	0.94 (0.43–2.06)	**1.13 (1.02–2.21)**
SES quantiles	First	113 (83.7)	22 (16.3)	1	1
	Second	112 (84.2)	21 (15.8)	0.96 (0.5–1.85)	**1.34 (1.11–2.22)**
	Third	170 (87.2)	25 (12.8)	0.76 (0.41–1.4)	0.81 (0.42–1.53)
	Fourth	71 (89.9)	8 (10.1)	0.58 (0.24–1.37)	0.61 (0.25–1.48)
	Fifth	63 (86.3)	10 (13.7)	0.82 (0.36–1.83)	0.89 (0.39–2.04)
Mother occupation	Housewife	474 (85.6)	80 (14.4)	1	1
	Employed	55 (90.2)	6 (9.8)	0.65 (0.27–1.55)	0.71 (0.28–1.73)
Delivery type	Vaginal	238 (85)	42 (15)	1	1
	Cesarean	291 (86.9)	44 (13.1)	0.86 (0.54–1.35)	0.84 (0.52–1.34)

The overall prevalence of DD in this study was 13.98%. The highest prevalence of DD was in the Personal – social domain with 3.58%, and the lowest was in the communication domain 1.63%. (Table 3)

The multiple logistic regression analysis was used to estimate the odds ratio (OR) of DD risk factors (Table 3). These results indicated that compared to Full term children, Preterm children had increased odds of DD with OR = 1.13 (95% CI: 1.2– 3.78). We observed a significant increase in odds of DD in multiple children families compared to single child families OR = 1.13 (95% CI: 1.02– 2.21). As compared with first SES quantile, second quantile increased odds of DD with OR = 1.34 (95% CI: 1.11–2.22). (Table 4)

Discussion

In the current study, we investigated the effect of sociocultural, socioeconomic and the child related variables, while previous studies conducted in Iran have focused on the mother and child's physiological factors. Previous studies were also carried out in large cities, but the present study was conducted in the deprived area. Considering these characteristics, our study in Iran is unique and distinctive.

Establishment the childhood life based on the desired growth and development will reduce the adverse consequences for the child, the burden of disease in society and health costs in both (McCoy et al., 2016; Westgard & Alnasser, 2017). A child's growth and development is highly dependent upon the nutritional status of the mother during pregnancy and the first two years in a child's life (Das, Salam, & Bhutta, 2016). About 90% of children with malnutrition live in low and middle-income countries (LMICs) (Das et al., 2016). For example, stunting prevalence in deprived urban areas of Kenya is 46 percent (Kimani-Murage et al., 2015). A Meta-analysis revealed that child malnutrition may be linked with neurodevelopmental disorders in most LMICs (including Kenya, Pakistan, India, Brazil, Bangladesh, Vietnam, China, and the Philippines) (Hume-Nixon & Kuper, 2018). Also, in Iran, several risk factors of growth and developmental disorders are common, such as anemia in one-fifth of children under six years of age (Nazari, Mohammadnejad, Dalvand, & Gheshlagh, 2019) and, one-third of pregnant women in the third trimester (Motlagh et al., 2019), wasting, stunting and underweight in 10 percent of children (Mohseni, Aryankhesal, & Kalantari, 2018). Also, vitamin D deficiency is very common in all age groups (Tabrizi et al., 2018). Therefore, national and international interventions are needed to reduce the malnutrition disease burden (Das et al., 2016).

According to these statistics, Iranian children are at risk for DD, as in our study, about one-eighth of children had DD. The highest prevalence was in the social-personal domain and the lowest prevalence was in the communication domain. Age, gender, mother's education, SES, mother's occupation, gestational age, and family size were significantly associated with the mean scores of all domains. The multivariate logistic regression analysis showed the gestational age less than 37 weeks, the first SES quintile and the multi-children family increased the chances of the child's DD.

Regarding DD, it is not possible to reach a definite prevalence because the obtained values are due to cross-sectional screenings, it can report different outcomes in different regions and times. In a study conducted by Bajalan in Iran, the prevalence of developmental disorders in children aged 6–18 months is higher than that in our study as three times, which may be due to the different age ranges and geographic region of participants (Bajalan & Alimoradi, 2018). With the same age group as our study, Ahmadipour's study reported 8.6% prevalence in the south west of Iran (Ahmadipour, Mohammadzadeh, Mohsenzadeh, Birjandi, & Almasian, 2019). Studies in LMICs also highlight the prevalence of 45% in Ghana (Bello, Quartey, & Appiah, 2013), 40% in the deprived areas of China (Wei et al., 2015), 17% in Bangladesh (Khan et al., 2013), 37% in Southern Thailand conflict area (Jeharsae, Sangthong, Wichaidit, & Chongsuvivatwong, 2013) and, 26.7% in Amazonian communities of Peru (Westgard & Alnasser, 2017). In consistent with our results, in the Sajedi's study, the highest prevalence is in the social-personal domain (Sajedi, Vameghi, & Kraskian Mujembari, 2014), while in the AhmadiPur's study, the lowest prevalence is in this domain (Ahmadipour et al., 2019).

Also, the study of Sajedi and Ali Akbari in Iran confirms the association between sex and DD in our study (Akbari et al., 2012; Sajedi et al., 2014) in most domains; the mean scores in female are higher than those in males. In the Taiwan study, the male / female prevalence ratio was 1.96 (Lai, Tseng, Hou, & Guo, 2012). Part of the sex difference may be due to genetic disorders, the fragile x syndrome is more expressed in men (Lai et al., 2012; Moeschler & Shevell, 2014). Gender differences may be due to differences in sex steroid hormones (Hanamsagar & Bilbo, 2016). Also, the state of brain inflammation is different depending on gender; more brain inflammation in men causes a change in sensitivity to more neurologic diseases (Casella et al., 2014; Jacquemont et al., 2014). In addition, the male brain needs less physiological changes to reach the diagnostic threshold of neurodevlopmental disorders (Jacquemont et al., 2014).

Our study showed that the Socio-Economic Status was a predictor of DD, the second SES quantiles compared to the first ones, were associated with an increase in the mean scores of the Gross Motor and Social- personal domains. The Demirci study in Turkey also confirmed these results (Demirci & Kartal, 2018). Not only malnutrition due to poverty can be one of the causes of childhood DD, but also the lack of social and financial resources can cause chronic stress in a child that can affect the growth and development of the child's brain (Bitsko, 2016). In confirmation of these results, wei's study in poor rural areas of China showed that the prevalence of DD in this region was very high, approximately 40 percent. Reasons for high prevalence have been highlighted, including most careers of children are depressed because of low family income, and their close relationship with the children is associated with a reduction in child's communication skills. In addition, they are deprived of educational resources, books, and toys, and have less physical activity and more stress (Wei et al., 2015). In addition, the results of meta-analysis performed in Iran showed that recent sanctions against Iran reduced the country's revenues, the national currency value, and people's access to living standards, food, medicine, and general welfare. This impact is more visible in vulnerable groups such as women and children (Kokabisaghi, 2018). In a general approach, studies have shown that the global financial crisis affects health, and increases disorders and diseases at the community level, especially in developing countries (Margerison-Zilko, Goldman-Mellor, Falconi, & Downing, 2016). The economic downturn decreases children's school performance. The housing and job loss, and parental unemployment strongly affect the children development (Gassman-Pines, Gibson-Davis, & Ananat, 2015). These results show a strong and complex relationship between socioeconomic status and DD.

Our study showed the mean scores of the communication and gross motor domains were lower in multiple children families. The greater the number of children, the lower the parent's communication with the children would be; while the relationship between parents and children has a noticeable influence on children's developmental progress (Jeynes, 2015). The populous families are seriously facing economic challenges, such as less income and a reduction in access to resources and facilities, and difficulty in meeting needs (Brown, Manning, & Stykes, 2015), so the number of children can affect the child development through the family economic conditions. While the results of Ozcan in Turkey are in contradiction with our results (Ozkan, Senel, Arslan, & Karacan, 2012) but Chalkiran's results in Turkey confirms our results (Celikkiran, Bozkurt, & Coşkun, 2015).

Our study showed no relationship between delivery type and child development. In contrast with our results, Bajlan's study showed that cesarean section could decrease the chance of DD (Bajalan & Alimoradi, 2018), but in Demirchi's study, most children with DD were born by cesarean section, while there was no statistically significant association between cesarean section and developmental disorder (Demirci & Kartal, 2018). Therefore, it may be argued that the delivery type is not effective, but the emergency conditions requiring cesarean section increase the risk of DDs such as a high-risk pregnancy, teenage pregnancy, pre-pregnancy BMI, preeclampsia, and placental insufficiency (Walker et al., 2015). Preeclampsia through the mechanism of vascular damage and insulin resistance leads to restrictions in oxygen transport in the placenta, fetal hypoxemia and brain damage (Liu et al., 2016; Walker et al., 2015). In support of this argument, a birth cohort study in China showed anxiety scores were higher in the cesarean group than the vaginal delivery group, during the third trimester of pregnancy, which might affect the child health (Huang, Yan, Wu, Zhu, & Tao, 2019). On the other hand, children born by cesarean section, have more emotional problems (Huang et al., 2019). Despite of these, in Huang's study, cesarean section group had higher education levels; education level through lifestyle, more support, and responsiveness of parents could improve the child development (Landry, 2008). Therefore, the relationship between delivery type and DD is unclear and needs further comprehensive studies.

In addition, our results indicated that higher levels of education were associated with an increase in mean scores of the Communications and Fine motor domains, of course, some parents were illiterate in our study and the questionnaire was completed by experts that could change our results, but it should be noted that the illiteracy rate in the general population of Iran in 2012 was more than 80% (Zolala, Heidari, Afshar, & Haghdoost, 2012), so it cannot affect our results. On the other hand, in contrast with our findings in the Bajalan's study, maternal education was not associated with any domain (Bajalan & Alimoradi, 2018). In general, our results are comparable with other studies. Demirchi's study in Turkey also showed that mothers with a lower educational level increase the risk of child DD up 14 times (Demirci & Kartal, 2018). In confirmation of our study, Ahmadipour's study in Iran also revealed that a significant inverse relationship was found between lower parental educational levels and child DD (Ahmadipour et al., 2019). Sometimes these parents also have few abilities and skills and cannot provide a suitable home environment for child development.

In our study, gestational age less than 37 weeks was associated with the reduction in the scores of problem-solving and social- personal domains. Survival has improved for preterm infants via the establishment of neonatal intensive care units (NICUs) in most hospitals (Ballantyne, Benzies, McDonald, Magill-Evans, & Tough, 2016), while they are prone to DD due to complications of preterm delivery, such as hearing and visual impairment, cardiovascular, brain and other congenital anomalies (Lipsey et al., 2016). In the Ballantyne's study, preterm delivery was associated with the risk of the communication and grass motor domains delay, but there was no relationship in the adjusted models based on admission to the neonatal intensive care unit (Ballantyne et al., 2016). In contrast, in Luisa's study in Chile, this relationship was reported (Schonhaut, Armijo, & Pérez, 2015). The Shrestha study in Nepal also reported this relationship (Shrestha et al., 2019). Totally, the relationship between gestational age and development is somewhat unclear, perhaps this is a causal relationship, also perhaps other factors are involved, as confounding or common risk factor, such as maternal infections (Schieve et al., 2016).

One of our study's strengths was that the predictors for each domain identified separately; DDs usually occur in more than two domains simultaneously, so identifying predictive factors in one domain may lead to the identification of delay in other domains. Also, because the parents have a closer and more permanent relationship with the child than health care providers, they can identify childhood DD at early stages. This was helpful for our interviewers. On the other hand, to the best of our knowledge, most studies were carried out at primary health facilities; our study was population-based and less subject to the selection bias. Although we recognised some limitations, such as failure to assess the maternity conditions due to incomplete data. Our reported prevalence may be less than the actual prevalence because of exclusion the children with apparent DD. Also, the cross-sectional designs result in failing to identify the causal relationship.

Conclusion

Finally, our study showed that the prevalence of DD in Shahin dezh (western Iran) was moderate. Identifying the predictive factors of DD such as gestational age, SES and the number of children can be useful in timely detection and treatment. Therefore, it is recommended that longitudinal studies should conduct to identify other risks and confounding factors.

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