



## Developmental delay and its demographic and social predictors among preschool-age children in Palestine

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### ABSTRACT

**Purpose:** This study was designed to assess the developmental outcomes among preschool-aged children and its associated factors in Palestine.

**Methods:** A cross-sectional, descriptive-correlational design involved a representative sample of preschool-aged children from kindergarten in Ramallah governorate. Data were collected using the Ages and Stages Questionnaire, Arabic version-3. Associations between developmental delay (DD), parent, child and family characteristics were analyzed utilizing SPSS-25 version.

**Results:** A total of 249 preschoolers participated in the study. The overall rate of children with Global Developmental Delay (GDD) was 23.7%. The most prevalent DD were in gross motor, personal social, and fine motor skills (25.3%, 17.7%, and 16.5%, respectively). Binary logistic regression analysis revealed that the male gender of a child (OR = 2.66, 95% CI [1.37, 5.19]), the mother's part-time work (OR = 6.01, 95% CI [1.68, 21.52]), low family income (OR = 3.67, 95% CI [1.05, 12.73]), and families with three or more children (OR = 1.43, 95% CI [1.15, 1.781]) were statistically significant independent predictors of GDD.

**Conclusion:** The study findings revealed higher rate of DD among preschoolers in Palestine than regional areas, especially in gross motor, fine motor, and personal social skills, which has consequences for both national and global health. According to the results, factors related to the child, the mother and the family are associated with the cumulative risk of preschoolers having DD.

**Implications:** It is a crucial role for pediatric nurses to detect DD early and its related risk factors through screening programs to limit the burden of problems in childhood and later adulthood.

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### Introduction

Early childhood offers a special opportunity for the development of social and emotional skills within the framework of family, society, and culture (Darling-Churchill & Lippman, 2016). Additionally, this is a time when social and emotional problems may first arise (Blewitt et al., 2021). The preschoolers make tremendous improvements each year in the development of different domains, including physical skills, language, personal-social skills, and problem-solving skills (Black et al., 2017). Children with developmental delays are often those who acquire skills and abilities later than healthy children and who don't have the features and skills that are developmentally suitable for their age (Gil et al., 2020). Developmental delay (DD) may be in a single domain (communication, gross motor, fine motor, problem solving and

personal social skills), or global developmental delay (GDD), which is delay in two or more domains (Squires et al., 2009). Early detection and intervention for developmental problems in children, such as periodic screening for developmental problems throughout the pre-school years, can greatly reduce developmental problems in children later in life, such as learning challenges, behavioral difficulties, and functional impairments (Lipkin et al., 2020).

Because of the importance of early detection and prevention of DDs, many developed countries have made it a policy to track children's developmental milestones from birth through school age through developmental surveillance and screening (Kim, 2022; Lipkin et al., 2020; Velea & Tamburlini, 2014). However, as evidenced by a thorough literature analysis, the problem remains widespread among developing countries, particularly in the Arab world (Almahmoud & Abushaikha, 2023). There are few studies in this region, which accounts for nearly a quarter of the world's population (Eapen et al., 2006; Gil et al., 2020; Salhi et al., 2021; Shatla & Goweda, 2020). Furthermore, many of the revised risk factors linked to DD have already been proven in the Arab

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world, such as low socioeconomic status and, more especially, the occupied Palestinian territories (Salhi et al., 2021).

DDs affect all aspects of children's lives, including physical, cognitive, learning, and behavioral difficulties, as well as functional impairments (Central of Disease Control and Prevention, 2021). Until recently, the Ministry of Health (MOH) in Palestine was the government agency in charge of the care of children in Palestine from birth until age two. For vaccines and to have their growth and development tracked, mothers frequently brought their children to primary health care (PHC) clinics. On the other hand, students are screened by the school health department of the MOH and Ministry of Education (MOE) when they enroll in public schools at the age of six (Giacaman, 2021). Children aged three to five years fell between the gaps and were not checked at all because mothers don't bring their children to PHC clinics until they are ill with fever, diarrhea, or vomiting (Giacaman, 2021). Currently, there is no defined system for the developmental screening of preschool-aged children in Palestine. Hence, there is a need for studies that identify and measure factors affecting DD in preschoolers. In fact, screening for DD and research on DD predictors and risk factors among preschool-aged children are both limited and inadequate in Palestine.

### Study purpose

The main purpose of the study is to assess the developmental outcomes among preschool children who attend kindergartens in Palestine.

### Study objectives

The specific objectives of the study are:

1. To determine the prevalence of GDD among preschool-aged children in Palestine.
2. To identify the prevalence of DD in each of the five main developmental domains: communication, gross motor, fine motor, problem solving, and personal-social skills.
3. To assess the relationship between child, parent, and family characteristics and DD among preschool-aged children.
4. To assess predictors of DD in preschool-aged children in Palestine.

## Methodology

### Design

The study used a cross-sectional, descriptive-correlational design, including an Ages and Stages Questionnaire (ASQ) screening survey, to collect data on preschool-aged children who lived in different areas of Palestine.

### Population and sample

All preschool-aged children in Palestinian kindergartens, aged three to five, are the study's target population. The accessible population is preschool-aged children who are enrolled in public kindergartens in Ramallah in the academic years 2021–2022. Inclusion criteria were: 1) were aged three to five years old; 2) were enrolled either in a public or private kindergarten in Ramallah governorate; and 3) the children's mothers were able to read and write Arabic. Participants were excluded if they were absent at the time of data collection. The mothers of the participating children were asked to complete the ASQ, which is a mother-reported questionnaire.

The prevalence formula,  $n = (Z^2 P (1-P)) / (d^2)$ , was used to estimate the sample size needed to determine the prevalence of DD in the study area. Where  $n$  is the required sample size,  $Z$  is the confidence level at 95%,  $P$  is the estimated prevalence of DD in the study area, and  $d$  is precision (Pourhoseingholi et al., 2013). According to Almahmoud

and Abushaikh (2023), the prevalence rate of DD in the research area was 23.7% (Almahmoud & Abushaikh, 2023). The sample size is determined to be 246 participants after taking into account all the values mentioned above and the predicted 20% prevalence. In addition, since a 20% non-response rate was anticipated, a further 49 participants were added to the sample set. A total of 295 preschoolers, presented by their mothers, make up the entire sample.

Multi-stage sampling was utilized to recruit participants from the Ramallah governorate. In Ramallah, there are 14,143 preschool-aged children enrolled in public kindergartens. In Ramallah city (urban), there are 6332 children in 90 kindergartens; in 70 villages (rural), there are 4591 children in 83 kindergartens; and in five refugee camps, there are 3220 children in 30 kindergartens. Based on the proportions of the requested sample to the overall population (295:14143), 131, 96, and 68 preschoolers were selected from the urban, rural, and camp regions, respectively. Ten kindergartens were chosen at random from urban areas, nine from rural areas, and five from refugee camps. Then, at each selected kindergarten, a simple random selection was conducted to determine the final required study participants, who were asked to participate through their primary caregivers (biological mothers).

### Setting

The governorate of Ramallah was the site of the study. Ramallah, which is located in the middle of Palestine, has a total population of 38,998 people who come from different socioeconomic backgrounds and live in the city as well as nearby villages and refugee camps (Palestinian Central Bureau of Statistics, 2021). As Palestine's main administrative and economic center is the Ramallah governorate, it seems representative to start there in order to have an impact on the rest of the country. For the academic years 2021–2022, the current survey included all preschoolers enrolled in Ramallah's public or private kindergartens.

### Ethical consideration

Before beginning data collection, ethical approval was received by email from the Scientific Research Committee at the School of Nursing at the University of Jordan, the Palestinian Center for Educational Research and Development (CERD), and the Ministry of Education.

### Instrument

A structured instrument with two sections was employed to collect the required data for the current study. **Section 1:** Socio-demographic Data: the child's age, gender, and birth weight; the parent's age, educational level, and marital status; the family's monthly income and residence; consanguinity; the place and kind of delivery; pregnancy and delivery difficulties; and DD history. **Section 2:** Children's Development: The Ages and Stages Questionnaires Arabic version 3, with a Chronbach's alpha ranging from 0.60 to 0.85 (Squires et al., 2009), comprises 21 individual questionnaires created for 21 age intervals from 1 month to 66 months to measure children's development on the five domains. Five of these 21 questionnaires were chosen by the researcher. These are questionnaires for preschoolers ages three to five, at intervals of 36 and 60 months.

### Data collection

Participants in this research were preschoolers' mothers. Data collection started at the beginning of January 2022 and continued until the end of March 2022. The targeted kindergartens were approached to obtain consent to collect data from the mothers of the children. The principal of the kindergarten, in addition to the kindergarten's teachers, worked as liaisons and took responsibility for approaching the mothers

and asking them to be a part of the study. Mothers who agreed to participate in the study were contacted and invited; they were then directed to the principal investigator (pediatric nurse) or research assistant, who was on site at the kindergarten and available to explain the study, provide all the details, and answer any questions they had. The mothers were given the package and informed to return it after a week.

### Data analysis

The statistical package for social sciences (SPSS) version 24 was used to examine the data. Descriptive frequency statistics were employed to determine the prevalence of DD. Inferential statistics: the relationship between selected child, parent, and family factors and the major research variables (child developmental outcomes) was examined using the *t*-test or an ANOVA. Finally, a binary logistic regression analysis was done to see if preschoolers' DD was predicted by factors connected to the child, parent, and family. At a *p* value of 0.05 and a 95% confidence interval (CI), all tests were considered significant.

## Results

### Socio-demographic characteristics of the parent, child and family

Two hundred and ninety-five preschool-aged children's mothers from kindergartens in three locations of the Ramallah governorate (the city, the village, and the camp) were invited to participate in the study. Only 249 of the 271 mothers who agreed to participate actually finished and returned their questionnaires, yielding a response rate of 88.4%.

### Characteristics of the parents

The mothers ranged in age from 20 to 49, with a mean age of 31.2 (SD = 5.7). The age of fathers ranged from 25 to 55, with a mean of 36.4 (SD = 6.2). The majority of the mothers were married (97.6%, *n* = 243) and had an undergraduate degree (college or university), while 45% (*n* = 112) of the fathers had a high school education. Furthermore, the majority of the mothers were housekeepers (68.3%, *n* = 170), whereas the majority of the fathers were in full-time jobs (75.9%, *n* = 189). Moreover, the majority of the mothers delivered in hospitals (98.4%, *n* = 245), 66.3% were delivered normally, and they did not experience either pregnancy or delivery complications (92.4% and 90.8%, respectively) (Table 1).

### Characteristics of the children

The children were between the ages of 34 and 66 months, with a mean age of 54.4 months (SD = 9.8). About two-thirds of the children (67.5%) were aged between 54 and 60 months (*n* = 168). In addition, 55.4% (*n* = 138) were female, while 44.6% (*n* = 111) were male. The majority of the children (85.1%, *n* = 212) weighed 2.5 kg or more at birth, were born full-term (92%, *n* = 229) and did not require hospitalization after delivery (91.2%, *n* = 227) (Table 1).

### Characteristics of the family

The majority of the families had more than two children (61.4%, *n* = 153), and were not blood relatives (83.1%, *n* = 207). In addition, most families did not have a history of DD (97.6%, *n* = 243). In terms of family monthly income, it is estimated that around half of the households were of average income (47.8%, *n* = 119) (Table 1).

### Prevalence of developmental delay among preschool-aged children

The study found that 23.7% (*n* = 59) of preschool-aged children had GDD, which is defined as a DD in two or more areas (Table 2). The

**Table 1**  
Socio-demographic characteristics of the parent, children, and family (*N* = 249).

	N	(%)	M	SD
<b>Parent ch.ch.</b>				
Mother's age (years)			31.2	5.7
<25	34	13.7		
25–30	164	65.9		
>30	51	20.5		
Father's age (years)			36.4	6.2
<30	48	19.3		
30–40	144	57.8		
>40	57	22.9		
Marital status				
Married	243	97.6		
Separated not divorced	3	1.2		
Divorced	3	1.2		
Mother's education level				
Never been to school	4	1.6		
Elementary-middle school	13	5.2		
High school	73	29.3		
College/University	159	63.9		
Father's education level				
Never been to school	7	2.8		
Elementary-middle school	31	12.4		
High school	112	45.0		
College/University	99	39.8		
Mother's work				
House keeper	170	68.3		
Part-time work	25	10.0		
Full-time work	54	21.7		
Father's work				
Not working	6	2.4		
Part-time work	54	21.7		
Full-time work	189	75.9		
Place of delivery:				
Hospital	245	98.4		
Private clinic	4	1.6		
Type of delivery				
Normal delivery	165	66.3		
C/S	84	33.7		
Any complications during pregnancy				
Yes	19	7.6		
No	230	92.4		
Any complications during delivery				
Yes	23	9.2		
No	226	90.8		
<b>Children ch.ch.</b>				
Age (months)			54.4	9.78
Age groups				
36 months	32	12.9		
42 months	20	8.0		
48 months	29	11.6		
54 months	72	28.9		
60 months	96	38.6		
Birth weight (gm)			3098.58	519.76
<2500	37	14.9		
2500–4000	209	83.9		
>4000	3	1.2		
Gender				
Male	111	44.6		
Female	138	55.4		
Gestation at delivery				
<37 weeks	20	8.0		
>37 weeks	229	92.0		
Baby needed hospitalization immediately after delivery				
Yes	22	8.8		
No	227	91.2		
<b>Family ch.ch.</b>				
Number of children				
1	32	12.9		
2	64	25.7		
>2	153	61.4		
Family permanent residency				
City	105	42.2		
Village	90	36.1		
Camp	54	21.7		

**Table 1** (continued)

	N	(%)	M	SD
Is your husband a relative of yours				
Yes	42	16.9		
No	207	83.1		
Family history of other children with Developmental Delays				
Yes	6	2.4		
No	243	97.6		
Family monthly income				
<1800 Shekels	31	12.4		
1800–4000 Shekels	119	47.8		
>4000 Shekels	99	39.8		

scoring for each domain of ASQ varies from 0 to 60, with higher scores indicating more appropriate development in that domain. The highest mean scores were found in the problem-solving domain ( $M = 51.7$ ,  $SD = 12$ ), whereas the lowest were found in the fine motor domain ( $M = 45.6$ ,  $SD = 14.5$ ). Moreover, the analysis revealed that the highest rate of DD was in the gross motor domain ( $n = 63$ , 25.3%), followed by the personal-social domain ( $n = 44$ , 17.7%). Furthermore, 41 children (16.5%) had fine motor DD, 36 children (14.5%) had communication DD, and the lowest rate of DD was in the problem-solving domain ( $n = 30$ , 12%) (Table 2).

#### Association between the developmental screening outcomes of preschool-aged children based on child, parent and family characteristics

The variables at the bivariate level that were significantly ( $p < .05$ ) associated with the overall mean development score (MDS) were the child's age, gender, and hospitalization after delivery; the mother's education; the father's education; the mother's work; the number of children; the family history of children with DD; and the family's monthly income. Regarding single domain MDS, mother's educational level, mother's work, number of children, family history of a DD child, and family income were associated with communication MDS. Mother and father educational level, mother work, father work, and family income were associated with gross motor MDS. The child's age and gender, hospitalization after delivery, father's educational level, and family income were associated with fine motor MDS. The child's age and gender, marital status, mother's educational levels, mother's work, number of children, and family history of a DD child were associated with problem-solving MDS. Finally, mother and father age, hospitalization after delivery, and the child's age and gender were significantly associated with personal social MDS (Tables 3).

#### The predictors of developmental delay of preschoolaged children

To investigate the predictors of both global and specific DDs as well as to estimate odds ratios (OR) and 95% confidence intervals (CI) for the OR of a group of predictors against the dependent variable, Binary

**Table 2**

Prevalence of developmental delays in five domains among 36–60 months children.

Developmental Delay	Mean Developmental Score (SD)	Number of children with developmental delay (%)	Number of children with normal development (%)
Communication	51.3 (11)	36 (14.5)	213 (85.5)
Gross motor	48.9 (12.5)	63 (25.3)	186 (74.7)
Fine motor	45.6 (14.5)	41 (16.5)	208 (83.5)
Problem solving	51.7 (10.7)	30 (12.0)	219 (88.0)
Personal social	50.7 (9.6)	44 (17.7)	205 (82.3)
Global Developmental Delay	265.1 (23.9)	59 (23.7)	190 (76.3)

logistic regression analysis was utilized. For all statistical tests, the significant level was set at  $p < .05$ . Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (VIF values  $< 10$ , and the Tolerance is  $> 0.1$ ). Moreover, an analysis of standard residuals was carried out, which showed that the data contained no outliers.

#### Predictors of global developmental delay

The variables at the bivariate level that were significantly associated with overall MDS were entered in the logistic regression model. The logistic regression model was statistically significant:  $\chi^2 (16, N = 249) = 47.9$ ,  $p < .01$ . The model explained 26.3% of the variance in GDD and correctly classified 80.3% of cases. The results indicated that: male preschoolers were more likely to have GDD compared to female preschoolers (OR = 2.66, 95% CI [1.37, 5.19]); children of part-time working mothers were more likely to have GDD compared to full-time working mothers (OR = 6.01, 95% CI [1.68, 21.52]); children of low-income families (< 1800 Shekels) were more likely to have GDD compared to high-income families (OR = 3.67, 95% CI [1.05, 12.73]); and preschoolers in families with three or more children were more likely to have GDD than those in single-child families (OR = 1.43, 95% CI [1.15, 1.781]) (Table 4).

#### Predictors of developmental delay by domains

Mother's work, family income, and the number of children were all significant predictors of communication DD in the communication domain. Child gender and the number of children were discovered to be significant predictors of fine motor DD in the fine motor domain. Three variables were significant independent predictors of problem-solving DD in the problem-solving domain: child age, number of children, and family functioning. Finally, logistic regression analysis revealed that mother age was a substantial predictor of personal social DD in the personal social domain (Table 5).

## Discussion

One of the significant aims of the study is to identify the gap, which is the DD among preschoolers. The prevalence of GDD was found to be 23.7%, which is greater than other studies conducted in Arab countries, such as Egypt, the United Arab Emirates, and Saudi Arabia, where the prevalence of GDD was 3.6%, 8.4%, and 16.4%, respectively (Eapen et al., 2006; El-Ella et al., 2017; Shatla & Goweda, 2020), and in Western countries as well; for example, in the United States of America, the prevalence of GDD increased significantly from 5.76% to 6.99% between the years 2014 and 2016 (Central of Disease Control and Prevention, 2021), and this is the picture from developed countries such as Canada and Australia, where DD is reported to occur at a rate of 10%–15% (Vitrikas et al., 2017). This high rate of GDD could be explained by the time period in which the researcher collected the data, which was after the country was closed for about two years due to the COVID-19 pandemic, which prevented children from attending kindergarten and, as a result, impacted their developmental processes in general. Quarantine times are reported to have a number of negative psychological impacts on the general public, including increased financial anxiety and post-traumatic stress disorder (PTSD) symptoms, particularly in parents of young children (Patrick et al., 2020), which may have an impact on the children's development. In some cases, parents may be separated from their children as a result of the infection and leave the child with a maid or in the neighborhood, resulting in insufficient care and support, which impedes the acquisition of developmental skills (Egan et al., 2021).

The researcher found developmentally delayed children in the developmental domains of communication, gross and fine motor skills, problem solving, and personal social skills throughout this screening

**Table 3**  
Differences of MDS according to the child, parent and family-related variables.

Child-related Variable		Overall MDS (SD)	Communication MDS (SD)	Gross motor MDS (SD)	Fine motor MDS (SD)	Problem solving MDS (SD)	Personal social MDS (SD)
Age groups	36 months	245.3 (41.2)	52.5 (11.4)	50.6 (12.4)	41.7 (16.6)	49.2 (11.8)	51.3 (8.9)
	42 months	243.3 (45.5)	52.5 (10.6)	50.5 (10.7)	45.3 (14.2)	50.8 (13.5)	44.3 (12.5)
	48 months	249.3 (41.1)	48.9 (12.7)	47.9 (12.6)	47.4 (13.5)	52.8 (9.8)	52.2 (8.3)
	54 months	238.1 (48.2)	50.5 (11.8)	47.1 (14.2)	40.9 (15.8)	49.7 (11.7)	49.9 (10.5)
	60 months	257.5 (29.3)	51.9 (9.7)	49.7 (11.6)	49.9 (11.7)	53.9 (8.6)	51.9 (8.9)
	<b>F-value</b>	2.597	0.671	0.748	4.976	2.273	3.092
	<b>p-value</b>	0.037	0.613	0.560	0.001	0.062	0.017
Child birth weight	< 2500	250.5 (39.1)	52.9 (10.2)	48.5 (11.8)	45.9 (15.4)	53.1 (8.1)	50 (9.9)
	2500–4000	247.4 (40.6)	51.1 (11.1)	48.9 (12.7)	45.3 (14.4)	51.4 (11.1)	50.7 (9.6)
	> 4000	271.7 (36.9)	48.3 (16.1)	51.7 (7.6)	58.3 (2.9)	60 (0)	53.3 (11.5)
	<b>F-value</b>	0.608	0.591	0.092	1.202	1.331	0.209
	<b>p-value</b>	0.545	0.555	0.913	0.302	0.266	0.811
Gender	Male	238.6 (44.4)	50.1 (11.3)	47.8 (13)	41.4 (16.5)	49.9 (11.3)	49.5 (10.1)
	Female	255.9 (34.9)	52.3 (10.6)	49.8 (12)	48.9 (11.7)	53.2 (9.9)	51.6(9.1)
	<b>t-value</b>	−3.427	−1.562	−1.210	−4.266	−2.428	−1.760
	<b>p-value</b>	0.001	0.117	0.224	< 0.001	0.016	0.076
Premature delivery (< 37 weeks)	Yes	245.5 (38.6)	49.8 (12.8)	49.3 (11.2)	45.3 (12.2)	50.5 (9.7)	50.8 (8.3)
	No	248.4 (40.5)	51.4 (10.8)	48.9 (12.7)	45.6 (14.7)	51.8 (10.8)	50.7 (9.7)
	<b>t-value</b>	−0.324	−0.572	0.138	−0.125	−0.583	0.048
	<b>p-value</b>	0.749	0.573	0.891	0.902	0.565	0.962
Baby needed hospitalization after delivery	Yes	230.5 (54.8)	47.5 (15.1)	47.9 (12.7)	39.8 (15.2)	48.6 (15.4)	46.6 (9.8)
	No	249.9 (38.3)	51.8 (10.5)	49.0 (12.5)	46.1 (14.4)	52.0 (10.1)	51.1 (9.5)
	<b>t-value</b>	−1.628	−1.710	−0.377	−1.892	−1.014	−2.095
<b>p-value</b>	0.030	0.088	0.713	0.049	0.156	0.037	
Parent-related Variables		Overall MDS (SD)	Communication MDS (SD)	Gross motor MDS (SD)	Fine motor MDS (SD)	Problem solving MDS (SD)	Personal social MDS (SD)
Mother's age (years)	< 25	250.9 (39.7)	52.5 (10.5)	46.9 (13.4)	45.1 (15)	52.2(9.6)	54.1 (8.9)
	25–30	247.9 (38.9)	51.4 (10.6)	49 (12.1)	45.1 (14.9)	51.9 (10.1)	50.5 (9.2)
	> 30	247.1 (45.8)	50.2 (12.4)	49.9 (13.3)	47.5 (12.9)	50.7 (13)	48.8 (10.9)
	<b>F-value</b>	0.098	0.467	0.598	0.530	0.310	3.204
	<b>p-value</b>	0.907	0.628	0.551	0.589	0.734	0.042
Father's age (years)	< 30	245 (43.9)	52.1 (11)	46.8 (12.5)	42.9 (16.9)	51 (10.9)	52.2 (9.4)
	30–40	250.6 (37.5)	51.5 (10.7)	49.2 (12.7)	45.8 (14.3)	52.9 (9.3)	51.2 (9)
	> 40	244.9 (43.9)	50.2 (11.6)	50.1 (12.1)	47.4 (12.6)	49.3 (13.2)	47.9 (10.7)
	<b>F-value</b>	0.586	0.442	0.983	1.255	2.490	3.110
	<b>p-value</b>	0.557	0.643	0.376	0.287	0.085	0.046
Marital status	Married	248.8 (40.2)	51.5 (10.9)	49.2 (12.4)	45.5 (14.7)	51.9 (10.6)	50.7 (9.7)
	Separated but not divorced	231.7 (30.1)	41.7 (10.4)	36.7 (7.6)	50 (8.7)	53.3 (7.6)	50 (9.7)
	Divorced	215 (48.2)	45 (15)	40 (17.3)	48.3 (2.9)	35 (13.2)	46.7 (2.9)
	<b>F-value</b>	1.304	1.702	2.273	0.196	3.827	0.269
	<b>p-value</b>	0.273	0.184	0.105	0.822	0.023	0.764
Mother's education Level	Never been to school	232.5 (27.5)	41.3 (13.1)	47.5 (2.9)	45 (7.1)	51.3 (14.4)	47.5 (6.5)
	Elementary-middle school	252.7 (42.5)	46.5 (14.2)	52.7 (12.8)	42.3 (16.5)	53.8 (6.5)	57.3 (3.9)
	High school	235.8 (47.7)	50.3 (12.5)	44.8 (14.4)	42.7 (16.2)	48.3 (12.6)	49.7 (9.9)
	College/University	253.9 (35.2)	52.4 (9.7)	50.5 (11.3)	47.2 (13.5)	53.1 (9.6)	50.7 (9.7)
	<b>F-value</b>	3.780	2.759	4.082	1.808	3.742	2.527
	<b>p-value</b>	0.011	0.043	0.007	0.146	0.012	0.058
Father's education Level	Never been to school	250 (24.3)	49.3 (13.4)	53.6 (9.9)	45.7 (14.6)	50.7 (9.8)	50.7 (3.5)
	Elementary-middle school	231.8 (52.3)	48.1 (13.4)	41.9 (16.1)	39.5 (18.2)	50.6 (9.6)	51.6 (9.5)
	High school	245.4 (39.6)	51.5 (10.2)	48.1 (12.6)	44.9 (14.4)	50.7 (11.9)	50.2 (9.6)
	College/University	256.3 (35.9)	52.3 (10.8)	51.7 (10.4)	48.2 (12.8)	53.3 (9.4)	50.9 (9.9)
	<b>F-value</b>	3.332	1.250	5.571	3.005	1.240	0.191
	<b>p-value</b>	0.020	0.292	0.001	0.031	0.296	0.903
Mother's work	House keeper	245.1 (42.1)	50.6 (11.8)	48.1 (13.2)	44.9 (14.5)	50.8 (11.1)	50.4 (9.7)
	Part-time work	240.2 (43.2)	48.8 (10.8)	46.8 (12.3)	43.6 (16.9)	51.2 (12.2)	49.8 (9.5)
	Full-time work	261.8 (28.7)	54.8 (6.9)	52.5 (9.5)	48.8 (12.9)	54.9 (8)	50.7 (9.4)
	<b>F-value</b>	4.179	3.897	2.990	1.783	3.118	0.111
	<b>p-value</b>	0.016	0.022	0.052	0.170	0.046	0.895
Father's work	Not working	258.3 (42.9)	58.3 (4.1)	50 (11.8)	46.7 (16.6)	50 (12.6)	53.3 (5.2)
	Part-time work	238.9 (47.4)	49.6 (12.4)	44.6 (14.5)	43.7 (15.7)	49.7 (12.5)	51.3 (10.6)
	Full-time work	250.5 (37.7)	51.6 (10.6)	50.1 (11.7)	46.1 (14.1)	52.4 (10)	50.4 (9.4)
	<b>F-value</b>	1.930	1.926	4.145	0.580	1.357	0.419
	<b>p-value</b>	0.147	0.148	0.017	0.560	0.259	0.658

(continued on next page)

Table 3 (continued)

Parent-related Variables		Overall MDS (SD)	Communication MDS (SD)	Gross motor MDS (SD)	Fine motor MDS (SD)	Problem solving MDS (SD)	Personal social MDS (SD)
Place of delivery:	Hospital	247.7 (40.3)	51.2 (11)	48.8 (12.5)	45.4 (14.5)	51.6 (10.7)	50.7 (9.6)
	Private clinic	277.5 (30.7)	57.5 (5)	53.8 (12.5)	57.5 (5)	57.5 (2.9)	51.3 (10.3)
	<b>T-value</b>	2.165	1.298	0.605	2.761	1.186	0.015
	<b>p-value</b>	0.142	0.256	0.437	0.098	0.277	0.902
Type of delivery	Normal delivery	246.7 (42.4)	50.5 (11.6)	48.3 (13.2)	45.9 (14.5)	51.3 (11.4)	50.8 (9.6)
	C/S	251.1 (35.8)	52.9 (9.5)	50.2 (11.1)	45 (14.7)	52.6 (9.2)	50.5 (9.7)
	<b>T-value</b>	-0.867	-1.766	-1.137	0.448	-0.938	0.217
	<b>p-value</b>	0.387	0.079	0.257	0.654	0.349	0.828
Any complications during pregnancy	Yes	244.7 (43.8)	52.4 (7.9)	46.6 (13.9)	45.3 (15.4)	48.2 (14.3)	52.4 (8)
	No	248.5 (40)	51.2 (11.2)	49.1 (12.4)	45.6 (14.5)	52 (10.3)	50.5 (9.7)
	<b>T-value</b>	-0.360	0.589	-0.766	-0.094	-1.156	0.944
	<b>p-value</b>	0.722	0.561	0.453	0.926	0.130	0.355
Any complications during delivery	Yes	237.2 (48.3)	50 (12.9)	46.5 (12.7)	41.3 (16.3)	48.3 (13.6)	51.1 (9.2)
	No	249.3 (39.3)	51.4 (10.8)	49.2 (12.5)	46 (14.3)	52.1 (10.3)	50.6 (9.7)
	<b>T-value</b>	-1.167	-0.514	-0.953	-1.334	-1.637	0.232
	<b>p-value</b>	0.254	0.612	0.349	0.194	0.103	0.818
Family-related Variable		Overall score Mean (SD)	Communication Mean (SD)	Gross motor Mean (SD)	Fine motor Mean (SD)	Problem solving Mean (SD)	Personal social Mean (SD)
Number of children	1	261.1 (32)	54.8 (7.6)	51.4 (11)	48.1 (13.9)	55.8 (6.4)	51.1 (9.8)
	2	246.6 (37.4)	52.2 (10.2)	47.8 (12)	44.2 (13.2)	51.3 (10.1)	51.1 (9.1)
	>2	243.1 (42.8)	49.6 (11.9)	48.1 (13.1)	44.8 (14.9)	50.1 (11.8)	50.4 (9.7)
	<b>F-value</b>	4.772	5.377	1.722	1.347	6.624	0.156
<b>p-value</b>	0.009	0.005	0.181	0.262	0.002	0.856	
Family residence	City	252.9 (34.4)	52.5 (9.5)	49.7 (11.8)	46.9 (14)	52.8 (9.4)	50.9 (8.9)
	Village	246.1 (44.4)	49.9 (12.4)	49.4 (12.9)	45.6 (14.3)	50.4 (12.3)	50.7 (10.3)
	Camp	242.6 (43.2)	51.2 (11)	46.6 (13)	42.9 (14.5)	51.9 (10.1)	50.1 (9.9)
	<b>F-value</b>	1.352	1.346	1.216	1.415	1.249	0.129
<b>p-value</b>	0.261	0.262	0.298	0.245	0.289	0.879	
Is your husband a relative of yours	Yes	243.3 (36.2)	50.5 (9.5)	47.9 (11.8)	43.2 (14.8)	51.9 (8.9)	49.8 (9.9)
	No	249.2 (41)	51.5 (11.3)	49.1 (12.7)	46.1 (14.5)	51.7 (11)	50.9 (9.6)
	<b>t-value</b>	-0.931	-0.601	-0.559	-1.144	0.136	-0.648
	<b>p-value</b>	0.355	0.550	0.578	0.257	0.892	0.519
Family history of other children with DD	Yes	211.7 (89.5)	42.5 (23.4)	41.7 (19.1)	38.3 (16)	40 (23.5)	49.2 (14.9)
	No	249.1 (38.2)	51.5 (10.5)	49.1 (12.3)	45.8 (14.5)	52 (10.1)	50.7 (9.5)
	<b>t-value</b>	-2.269	-2.002	-0.94	1515	-1.124	-2.755
	<b>p-value</b>	0.024	0.046	0.216	0.310	0.006	0.813
Family monthly income	<1800 Shekels	228.9 (56.8)	44.8 (16)	41.6 (15.8)	40.2 (17.9)	49.5 (13.1)	52.7 (10.2)
	1800–4000 shekels	247.6 (40)	51.4 (10.3)	49.6 (12.3)	45.5 (14.5)	50.9 (11.2)	50.1 (9.9)
	>4000 shekels	254.9 (31.9)	53.2 (8.9)	50.4 (10.9)	47.4 (13)	53.3 (9)	50.7 (8.9)
	<b>F-value</b>	5.144	7.265	6.384	2.964	2.099	0.910
<b>p-value</b>	0.006	0.001	0.002	0.053	0.125	0.404	

process. This study finding was incongruent with a survey conducted in 63 low- and middle-income countries to detect early childhood suspected DD utilizing national health surveys (Gil et al., 2020), which showed that the lowest prevalence was in gross motor domains and the highest was in personal-social domains. This discrepancy may be explained by a protracted period of quarantine brought on by the COVID-19 epidemic, during which time children were not allowed to attend kindergarten or engage in any physical activity outside of their homes. Additionally, parents' fears and anxiety about social interaction with the wider public may have contributed to this issue. There are certain advantages to parents staying at home during a country shutdown, despite these adverse psychological effects of home quarantine. One of the key pillars of child development is spending time with parents, which helps children form secure attachments and develop positive social and cognitive skills (Dexter & Stacks, 2014; Lamb & Lewis, 2010). Furthermore, a number of studies have suggested that less parental time due to rising occupational demands in modern civilization has a detrimental effect on child development (Hosokawa & Katsura, 2018; Hsin & Felfe, 2014). Parents have the chance to spend more time involving their children in educational and social activities during home quarantine periods, which are particularly crucial for development (Fomby

& Musick, 2018). In light of this, home quarantine may present a special chance to enhance parent-child interactions, parenting abilities, and ensuing child development (Toran et al., 2021), which may explain the lowest delay in social and communication domains.

Using logistic regression analysis, a child's gender was found to be an independent predictor of GDD and fine motor delay, which is consistent with other studies; males were more likely than females to experience DD (Alwan et al., 2013; El-Ella et al., 2017; Sinno et al., 2018). According to a previous study, females in their early years of life tend to be more social and empathic, which allows them to develop communication, cognitive, and intellectual abilities earlier than males (Adani & Cepanec, 2019). Another study proposed that there are gender differences in brain structure development in favor of females, which may have an impact on children's developmental milestones as well (Jacquemont et al., 2014). Child age was found to be a predictor only for problem-solving delay. This result was congruent with a study done in Lebanon, which revealed that MDS increased as children's ages increased (Sinno et al., 2018). This might be interpreted by the fact that as the child's age increased, their intellectual and cognitive developmental abilities became more apparent and predominant, which improved their comprehension of and cooperation with the examined

**Table 4**  
Binary logistic regression analysis of factors associated with GDD.

Factors	OR	95% CI for OR
Child gender	Female	1
	Male	<b>2.66</b>
Mother work	Full-time work	1
	Part-time work	<b>6.01</b>
	House keeper	1.90
Family income	>4000 Shekels	<b>1</b>
	1800–4000 shekels	1.32
	<1800 Shekels	<b>3.67</b>
Number of children	≥3 child	<b>1.43</b>
Child age	(continuous)	0.97
Mother education	College/University	1
	High school	0.23
	Elementary-middle school	1.324
	Never been to School	3.50
Father education	College/University	1
	High school	0.72
	Elementary-middle school	1.41
	Never been to School	0.11
Baby needed	No	1
Hospitalization	Yes	2.18
Delay history	No	1
	Yes	0.87

Variables with significant OR at  $p < .05$  were shown in bold formatting.

task, which enabled the early detection of DD cases (Allen et al., 2015; Demetriou & Spanoudis, 2017).

The mother's work (a part-time job) was identified as a predictor of GDD and communication delay. This finding was consistent with research from western and Arab countries (Gassman-Pines et al., 2015; Sinno et al., 2018). This outcome may be attributed to the parent's lack of quality time with the child and the financial instability brought on by the parent's part-time employment or unemployment (Hsin & Felfe, 2014; Perry-Jenkins et al., 2019), both of which have a detrimental effect on the child's development. Additionally, the educational level of the mother and father (elementary-middle school) was found to be a predictor for both gross motor and fine motor delays. The Lancet 2019 report on monitoring the health-related Sustainable Development Goals made the recommendation that, in order to maximize a child's developmental potential, both parents' educations are essential (Asma et al., 2020), which is consistent with our findings. Furthermore, the mother's age was discovered to be a predictor of personal social delay. Mother's age is associated with personal social delay; this actually runs counter to other studies' conclusions that there is a strong association between young maternal age and DD in children (Hediger et al., 2002; Ryan-Krause et al., 2009).

Our study demonstrated that DD was generally predicted by family socio-economic status (SES), which was shown by family income and family size. Studies have demonstrated that the global financial crisis had an overall negative impact on community health, particularly in

**Table 5**  
Binary logistic regression analysis of factors associated with different developmental domains.

Domain	Factors	OR	95% CI for OR
Communication	Mother work (part-time)	6.56	1.11–38.79
	Family income (poor)	4.02	1.18–13.62
	Children numbers (≥ 3 child)	1.32	1.03–1.68
Fine motor	Child gender (male)	2.61	1.37–6.04
	Children numbers (≥ 3 child)	1.26	1.01–1.59
Problem Solving	Children numbers (≥ 3 child)	1.43	1.11–1.87
	Child age (continuous)	0.94	0.89–0.98
Personal Social	Mother age (continuous)	1.07	1.03–1.13

developing countries (Margerison-Zilko et al., 2016). Recently, the COVID-19 pandemic is to blame for this view's duplication (Wang et al., 2021). The effects of SES, particularly poverty, on children's cognitive abilities have been the subject of various research conducted all over the world (Davidson et al., 2006; Schoon et al., 2012). According to this argument, having sufficient finances enables parents to provide a home environment that is conducive to learning, stimulates children's learning, and offers better services, all of which have a positive effect on a child's development (Propper et al., 2007). Our findings indicated a significant and substantial relationship between DD and socioeconomic status.

#### Limitations and strengths

This research depends on the mothers of participants utilizing a self-report questionnaire to assess their children's development. Therefore, it was crucial for the principal researcher and research assistant to accurately capture participants' perceptions and ensure that there were no misunderstandings when respondents filled out the questionnaires.

The study has the following strengths. In order to increase the study sample's heterogeneity, it was chosen from a variety of kindergartens, both public and private, located in various geographic parts of the Ramallah Governorate, including the city, villages, and camps. Second, unlike earlier studies in the literature that concentrated on the first two years of life, the current research covered preschoolers aged three to five to fill the gap in the literature regarding Palestine. Third, unlike other studies that frequently evaluate distinct child, parent, and family-related factors separately, the current study was able to examine them all at once. Fourth, each item used in this study had excellent psychometric properties, including high reliability and validity. Finally, in addition to identifying GDD predictions, our analysis also identified different predictors for each domain. Because DD sometimes involves more than two domains at once, understanding predictive variables in one area may help uncover delays in other domains and result in the early detection of a GDD. Finally, the current study can be regarded as one of the few that investigates the association between family functioning and delayed child development.

#### Implications to practice

The curriculum for nursing education at the undergraduate and graduate levels should include updated evidence-based information regarding child development. Furthermore, guidelines for the screening and treatment of DD in children should be taken into account in continuous educational programs in clinical practice by pediatric nursing specialists. Pediatric nursing professionals should be aware of the significance of diagnosing and treating children with DD. Additionally, it's critical for pediatric nursing to support children with GDD in reaching their full potential through providing appropriate interventions, which could result in optimal development. Health care professionals, especially pediatric nurses, should lead and employ focused interventions with delayed children to significantly improve these children's developmental progress. Palestine needs to acknowledge screening as a mandatory test for all preschoolers as a policy incorporated between MOH and MOE in Palestine. This could be done by pediatric nurses lobbying for or being involved in policymaking that may enhance and improve child development. Finally, children who display delayed development must be treated immediately by a multidisciplinary team that includes their parents, pediatric nurses and other health professionals. Early detection of delayed development and the initiation of intervention prior to the start of school are crucial roles of the pediatric nurse and will be made possible with the help of parents' and caregivers' education and involvement in child development. So that early assessment by a pediatric nurse may enable early and more effective treatment. Last but not least, pediatric nursing needs to be

involved in updated primary health care planning that supports child development protocols in accordance with international health care standards.

### Recommendations

Based on observing the study's findings, the researchers would like to recommend the following for pediatric nursing:

- More intensive investigation is required to fill the gaps in developmental milestone screening and other DD risk factors and predictors by pediatric nurses.
- Conduct experimental studies that examine interventions aimed at the study's key variables in accordance with the recommendation of the A&S instrument for evaluating the development of children in order to ascertain their impact on DD in this group.
- Focus on qualitative research on child development. Future studies must thoroughly examine the risk factors and indicators of DD that preschoolers' parents and other caregivers encounter. In-depth understanding of mothers' experiences with DD children and their relationship to their socio-demographic features may be gained through future studies using focus groups and interviews.

### Conclusion

In conclusion, according to local and international studies, Palestine has a disproportionately high rate of DD among preschoolers, which has consequences for both national and global health. According to the results of the current study, factors related to the child, the mother and the family are associated with a large cumulative risk of preschoolers having DD. Pediatric nurses played a crucial role in limiting the burden of DDs in childhood and adulthood through early detection and diagnosis of DD, as well as their related risk factors, through screening programs.

### CRedit authorship contribution statement

**Omar H. Almahmoud:** Conceptualization, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing. **Lubna Abushaikha:** Conceptualization, Supervision, Validation, Writing – review & editing.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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