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Investigation of Non-Structural Safety of Kindergartens in Tehran-Iran in 2020

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Abstract

Background: Accidents are among the most important causes of preventable death in young children, so it is of paramount importance to pay attention to safety principles in kindergartens.
Objectives: This study was conducted to assess the non-structural safety of kindergartens in Tehran in 2020.
Methods: This descriptive cross-sectional study was performed in 175 kindergartens in Tehran-Iran during the autumn of 2020, which were selected by two-step cluster sampling. Data collection tools included checklists for manpower information and construction specifications, as well as a revised safety checklist designed by the Ministry of Health. Data analysis was performed by SPSS 16 software applying descriptive statistics and the Chi-square test.
***Results*:** The safety of 65.1% and 34.9% of the kindergartens was very good and good, respectively. Based on the findings of this study, the non-structural safety of the kindergartens was significantly associated with neither manpower information nor construction specifications (P>0.05).
Conclusion: Tehran's kindergartens were in good condition in terms of non-structural safety. As the safety status of toys was lower compared to other areas, it is suggested to pay special attention to improving the safety of toys.

Keywords: accidents, non-structural safety, kindergarten

Introduction

Accidents are among the most important causes of childhood death in Iran [1,2], accounting for about 21% of all deaths among children [3]. Accidents can occur in various forms such as poisoning, falls from heights, electric shocks, suffocation, burns, injuries caused by physical punishment, and traffic accidents (including the collision of vehicles with each other or with pedestrians or throwing stones or other objects towards moving vehicles) [3]. Accidents have been reported among important causes of death in children in Tehran [2]. Studies indicate that children are more vulnerable to accidents because they are at a developmental period, as well as due to childhood-specific physiological and psychological features [4].

On the other hand, the number of children registered in kindergartens is increasing annually due to both parents working outside [5]. This

ascending trend raises concerns for parents over their children's safety. Accordingly, special attention has been paid to the safety standards of the living environment and playgrounds in kindergartens in international urban plans such as "healthy city" and "safe community" [6]. Safe toys, standard equipment, and safe playgrounds in kindergartens are among the factors that can directly affect children's physical and mental health and their motor development [7,8]. As young children cannot understand the risk of injury and do not know how to secure their own safety, it is essential to provide a safe child care environment with educated staff qualified to supervise children [5].

In general, buildings, including kindergarten buildings, comprise of two structural and non-structural components. Non-structural components encompass all contents and objects inside the building (excluding structural parts, i.e., posts, columns, floors, and walls) [9]. Non-structural elements can cause death or injury if being displaced, thrown, or broken or if they block exit routes. Thus, it is necessary to identify possible non-structural threats and defects and obviate them [10].

According to the evidence, kindergartens are among locations vulnerable to natural and man-made disasters. Failure to fulfill safety measures in kindergartens makes children even more vulnerable to accidents and disasters, including earthquakes [11]. Meanwhile, the results of a 2010 study conducted in 16 European countries showed that the safety of kindergartens was unsatisfactory, with four million preschool children suffering from injuries such as falls, poisoning, and burns every year [12]. In a study by Intraratsamee et al. conducted in eight provinces of Thailand on 1871 child care centers, three main causes of injuries in children were reported as falling, being hit by objects, and either eating or placing strange objects in the nose or mouth [13].

A few studies have been conducted on the safety of kindergartens in Iran, indicating their undesirable safety. For example, Mahdavidoost et al. studied the safety condition of 35 kindergartens in Qazvin and reported that 83% of the kindergartens did not have a first aid kit or its equipment, and 63% of the staff did not own a certificate showing their participation in health courses. In 60% of the kindergartens, the playground's devices did not have adequate safety and health requirements, and 57% of the kindergartens had not prepared preventive fire measures [7]. Also, in another study by Loloui et al. in 2013, who evaluated 22 kindergartens in Kerman, the kindergartens assessed did not fulfill appropriate safety requirements [14]. In another study by Shabani Monfared in Qazvin in 2017, the safety of the sports facilities of kindergartens was assessed, showing poor safety in 75% of the sports facilities [5].

Based on a literature review, a few studies have addressed the safety of kindergartens in Iran, and the studies conducted on this issue indicate the unsatisfactory safety of these places. Considering the high prevalence of childhood accidents, it is important to observe safety regulations in kindergartens. On the other hand, Tehran is a disaster-prone city located on different faults [15,16], highlighting the need for paying double attention to the non-structural safety of kindergartens in this city. Therefore, in this study, we aimed to investigate the non-structural safety of kindergartens in Tehran in 2020.

Methods

This descriptive cross-sectional study was conducted in Tehran in 2020. The statistical population of this study included all kindergartens in Tehran (410 kindergartens). Inclusion criteria encompassed having a license from the Welfare Organization, being open during the coronavirus pandemic and giving consent to participate in the study. Exclusion criteria included declining to participate in the study and either closure or inactivity. The sample size was determined using the formula for proportion estimation in a specific population:

$$n = \frac{N Z^{2}_{1-\alpha/2} p(1-p)}{N d^{2} + Z^{2}_{1-\alpha/2} p(1-p)}$$

Due to the unavailability of a similar study, a pilot study was initially conducted on 15 kindergartens. The scores obtained from the checklists for each kindergarten ranged from zero to 100 and were expressed as percentages. Then the safety level was categorized into five classes: 0-20% as very poor, 21-40% as poor, 41-60% as moderate, 61-80% as good, and 81-100% as very good. Then by entering the following values in the mentioned

formula, the sample size was calculated as 153 kindergartens. Considering a probability for drop-out, the final sample size was considered 175 ($p = 0.2$, $z_{1-\alpha/2} = 1.96$, $d = 0.05$, $N = 410$).

Sampling was conducted in two steps. In the first step, considering that based on the classification by the Welfare Organization, all kindergartens in Tehran were under the supervision of the four bases of Molavi, Vardavard, Narmak, and Ayat, these centers, which had comparable socioeconomic conditions, were considered as clusters. In the second step, out of 410 kindergartens that were licensed by the Welfare Organization, the samples were randomly selected based on the number of kindergartens assigned to each base.

Data collection tools included: a) a checklist for manpower information and the kindergarten's building specifications and b) a checklist for kindergarten safety items. The checklist of manpower information and construction specifications included queries about the age and area of the kindergarten building, the area of the kindergarten yard, and the number of instructors working in the kindergarten. The data were collected by interviewing the manager of the kindergarten, as well as by visiting the centers and field observations.

The kindergarten safety checklist consisted of 85 questions. This checklist was a modified version of the Kindergarten Safety Checklist (including 130 questions) provided by the Department of Child Health of the Ministry of Health and Medical Education to assess the non-structural safety of kindergartens [17]. This 130-item checklist was initially sent to safety professors and experts to gather their viewpoints. Then in a joint session by the research team, experts' comments were discussed and applied, and items with unequal weights were omitted. Based on the final checklist, kindergarten safety was assessed in six dimensions: 1- physical space, 2- kitchen, 3- bathroom and toilet, 4- toys, 5- outdoor space and playground, and 6- computers, TVs, and electric appliances. Thirty-five items (questions 1-35) were related to physical safety, including queries about the kindergarten's physical environment (e.g., temperature, ventilation, light) and other important physical safety elements. Ten items (questions 36-45) were related to kitchen safety, consisting of queries about the safety of faucets, stoves, and sharp objects. Eleven items (questions 46-56) covered the safety of the bathroom and toilet and included questions on the slipperiness of surfaces, detergents used, and the safety of chimneys. The safety of toys was assessed by 10 items (questions 57-66) addressing the types of toys and their manner of application. Fifteen items (questions 67-81) were related to the safety of outdoor spaces and playgrounds, and finally, four items (questions 82-85) addressed the safety of computers, TVs, and electrical appliances. All the items were positively designed and scored as zero or one, with the total score ranging between zero and 85. Based on previous studies, safety was categorized as very poor (0-20%), poor (21-40%), moderate (41-60%), good (61-80%), and very good (81-100%) [18,19].

Both qualitative and quantitative methods were used to evaluate content validity. For qualitative content validity analysis, the checklists were provided to 12 experts, and necessary amendments were executed based on their comments. For quantitative content validity analysis, the content validity index and the relative content validity coefficient were used. The questionnaire was provided to 12 experts in the field, and CVI and CVR were calculated as 0.89 and 0.60, respectively. To assess reliability using the coefficient of agreement, two evaluators independently examined five kindergartens each and completed the checklists accordingly. The coefficient of agreement in the scoring of the checklist's items between the two evaluators was calculated as 93%.

Statistical analysis was performed in SPSS software version 16 using descriptive and inferential statistics. The Kolmogorov-Smirnov test was used to assess the normality of data distribution. Because the data were non-normally distributed, they were reported using frequency (percentage), median, and the interquartile range (IQR). Also, the Chi-square test was utilized to compare the safety status of Tehran's kindergartens based on manpower information and construction specifications. The statistical significance level was considered $P<0.05$.

Results

Table 1 shows the median, IQR, minimum, and maximum values of manpower information and construction specifications of the 175

kindergartens studied. Regarding the age of the kindergartens' buildings, about 50% of them were around twelve years old. The number of instructors was below 10 in about 50% of the kindergartens. The building area was about 400 square meters in 50% of the kindergartens, and the yard area of half of the kindergartens was less than 70 square meters (Table 1).

Table 1: Manpower Data and Construction Specifications in Tehran's Kindergartens in 2020

Variables	Median	Interquartile range*	Minimum	Maximum
The building's age (year)	11.75	10	2	43
Number of instructors	9.33	8	3	32
The building's area (m^2)	393.65	350	80	1200
Area of kindergarten yard (m^2)	68.45	60	50	300

***IQR; 25%–75%**

Table 2 shows the median, IQR, maximum, and minimum values of safety scores in different dimensions (including physical space, kitchen, bathrooms/toilet, toys, outdoor and playground, and computers/televisions/electrical appliances) in the kindergartens studied. According to the findings, the lowest and highest safety scores were 56 and 83, respectively (Table 2).

Table 2: Medians and Interquartile Ranges of Safety Dimensions' Scores in Tehran's Kindergartens in 2020

Variables	Median	Interquartile range*	Minimum	Maximum
Physical space	29.10	29	23	34
Kitchen	8.59	9	4	10
Bathroom/toilet	9.21	9	7	11
Toys	8.13	8	3	10
Outdoor/playground	11.85	12	7	15
Computers/TVs/electrical appliances	3.96	4	2	4
Total safety	70.87	72	56	83

Table 3 shows the absolute and relative frequencies of safety levels in Tehran's kindergartens in 2020. Based on the findings, the safety of all the kindergartens was categorized as either good or very good, with most of them (65.1%) fulfilling good safety requirements (Table 3).

Table 3: Distribution of the Absolute and Relative Frequencies of Safety Levels in Tehran's Kindergartens in 2020

Safety level	Number of kindergartens	Percentage of kindergartens
Good	61	34/9
Very good	114	65/1

Table 4 displays the absolute and relative frequencies of safety levels in Tehran's kindergartens in 2020 in terms of various dimensions, including physical space, kitchen, bathroom/toilet, toys, outdoor and playground, and computers/TVs/electrical appliances. According to the findings, 100%, 94.8%, 100%, 97.1%, 81.7%, and 93.7% of the kindergartens studied attained good and very good safety levels in the physical space, kitchen, bathroom, computers/TVs/electrical appliances, toys, and outdoor/playground dimensions, respectively. The kindergartens had lower safety levels in terms of toys (Table 4).

Table 4: Distribution of the Absolute and Relative Frequencies of Safety Levels Based on Various Safety Dimensions in Tehran's Kindergartens in 2020

Variables	Safety level	N	%
Physical space	Good	73	41.7
	Very good	102	58.3
Kitchen	Poor	2	1.1
	Moderate	7	4
	Good	65	37.1
	Very good	101	57.7
Computers/TVs/electrical appliances	Poor	2	1.1
	Moderate	3	1.7
	Good	170	97.1
	Very good	0	0
Toys	Poor	4	2.3
	Moderate	28	16
	Good	59	33.7
	Very good	84	48
Outdoor/playground	Moderate	11	6.3
	Good	115	65.7
	Very good	49	28

The Chi-square test was used to compare the safety levels of the kindergartens based on manpower information and construction specifications. The results showed that kindergartens with a building area between 401 and 600 square meters had better safety levels than others; however, this difference was not statistically significant (P>0.05). Also, a higher ratio of kindergartens with a yard area of more than 50 square meters had very good safety levels, but again, this difference was not statistically significant (P>0.05, Table 5).

Table 5: Safety Status of Tehran's Kindergartens in 2020 Based on Manpower Information and Construction Specifications

Manpower Information and Construction Specifications		Safety level		P-value *
		Good N (%)	Very good N (%)	
The building's age (year)	≤10	(34.7)34	(65.3)64	0.998
	11-20	(35.2)19	(64.8)35	
	>20	(34.8)8	(65.2)15	
Number of instructors	≤10	(32.8)41	(67.2)84	0.367
	>10	(40)20	(60)30	
The building's area (m^2)	≤200	(52)13	(48)12	0.195
	201-400	(34.3)34	(65.7)65	
	401-600	(25)8	(75)24	
	>600	(31.6)6	(68.4)13	
Area of kindergarten yard (m^2)	≤50	(39)32	(61)50	0.277
	>50	(31.2)29	(68.8)64	

*The Chi-squared test

Discussion

The aim of this study was to determine the non-structural safety status of kindergartens in Tehran in 2020. In this study, 175 kindergartens were evaluated. The results showed that all kindergartens had good and very good safety levels, and most (65.1%) of them acquired very good safety levels. Non-structural safety is one of the safety issues that generally receives less attention in kindergartens. This issue is closely related with creative measures, beautification, making the environment childish, and equipment

juxtaposition. However, the results of the present study showed that the kindergartens surveyed had good levels of non-structural safety. Evidence indicates that most earthquake-caused damages are related to the non-structural components of the building. About 50% of damages in the 1999 earthquake in Turkey were caused by buildings' non-structural components, including bookshelves, glass, electrical equipment, etc. [9].

It seems that the transformation of the urban culture and the rising population have made the presence of children in kindergartens inevitable. Therefore, parents' attention in choosing their children's care environment has created a competitive situation between kindergartens in attracting customers and caused their managers and custodians to pay special attention to upgrading various safety dimensions and, in addition to creating beautiful and attractive environments, promote the non-structural safety of kindergartens as well. Nevertheless, as Tehran is the capital city of the country, this advantage could have positively affected the safety of kindergartens that may be far better than the safety of these places in other cities. In accordance, Loloui et al., in their study, reported that the safety status of kindergartens was inappropriate in Kerman [14].

The results of our study also showed that in terms of the type and quality of toys and their manner of application, the kindergartens had relatively lower safety compared to other safety dimensions. Given the paramount importance of this issue, measures should be considered to resolve defects in this area. Toy-related accidents in child care centers are the most common types of accidents, accounting for 67% of these events [20]. Therefore, it is necessary to improve this dimension of safety by using safe toys, which is an important strategy to prevent childhood injuries [21]. However, Dehdari et al. reported that public awareness was low regarding high-risk toys (such as rattles, magnetic toys, toys within chocolate eggs, etc.) [22]. The three main criteria that should be considered in choosing toys are their appropriateness for the child's age and sex, as well as the toy's application [23].

In the present study, most kindergartens had good and very good safety levels in terms of the outdoor space and playgrounds. The poor safety of kindergartens' playgrounds and their equipment is one of the main concerns over the safety of these places [24]. In the study of Intraratsamee et al., falls were among the most important accidents happening to children in the kindergartens studied [13]. In another study in 2013 on the safety status of kindergartens in Kerman city, more than 70% of playground equipment was unsafe [14]. The good safety of kindergartens in the present study can be related to the strict regulations implemented by the organizations granting licenses for continuing operation, which have persuaded kindergartens' managers to upgrade their safety situation to the required standard levels. The implementation of monitoring measures in vulnerable areas can be helpful in reducing damages.

Also, according to the findings of the present study, the safety situation of Tehran's kindergartens was not significantly associated with neither manpower information nor construction specifications (i.e., the age of the building, the number of instructors, and the areas of the building and playground). Three main reasons can be noted for this observation: 1) Most of kindergartens' aged buildings had been renovated or retrofitted; 2) Strict standards applied by the Welfare Organization for issuing licenses and renewing them every four years, 3) Strict regulations implemented by Tehran's Fire Department (e.g., the need for being equipped with extinguishers and educating staff how to use them, performing fire drills, mandatory use of smoke sensors).

However, various studies conducted in Iran have emphasized the neglect of kindergartens' construction spaces and design (Taghizadeh et al.) [25], as well as poor attention to the architectural requirements of children's educational spaces [26]. One of the limitations of the present study was its coincidence with the Covid-19 pandemic, so many organizations and centers were either partially or completely closed. Similarly, many of Tehran's kindergartens were operated intermittently, which prolonged the sampling time.

Conclusion

According to our results, Tehran's kindergartens were in a good non-structural safety condition. However, due to the lower safety status of toys, it is recommended to pay special attention to

improving toy safety. The authorities of in-charged organizations are advised to regularly monitor the structure and function of kindergartens and take necessary preventive measures to upgrade children's health and the safety of toys to avoid the occurrence of common accidents.

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