Chapter 8

Do Short-term Indoor Park Programs Improve Preschool Children's Psychological Health in Fukushima?

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CHAPTER 8
Do Short-term Indoor Park Programs Improve Preschool Childer's Psychological Health in Fukushima?*

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Due to serious concerns about radiation exposure after the nuclear power plant accident, many parents in Fukushima prohibited their children from playing outdoors. The Japanese Red Cross organized short-term and large-scale indoor park programmes for preschool children across Fukushima to mitigate concerns about high stress levels among the children. Our research aimed to quantify the impact of these short-term indoor park programmes on the children's psychological health. We employed the Strengths and Difficulties Questionnaire to try and capture the children's psychological health conditions. Although no causal statement may be made regarding the programme's effectiveness due to lack of randomization, participation in the programme is not negatively correlated with the average stress level; indeed, we observed some signs of positive correlation with the overall stress level and negative correlation with pro-social behaviours. This correlation was largely found among the children whose parents always prohibit them from playing outdoors and who regularly use the indoor playground facilities. This may be due to an actual impact, reporting bias (those who want the program to continue may overstate the stress level in order to appeal the need of the program), or reverse causality. We also found that stress is correlated with the experience of evacuation and parents' prohibition of outdoor play, but not in the cases of those children who participated in the regular indoor programmes.

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1. Introduction

The March 11th 2011 disaster in Tohoku, Japan, was a natural disaster comprising an earthquake and tsunami, which also resulted in a high-level technological disaster involving massive radioactive contamination from the Fukushima Dai-ichi nuclear power plant. One of the most detrimental and long-term consequences of the Fukushima nuclear power plant accident has been the deprivation of an appropriate environment for children to grow up healthily. A number of studies revealed that early childhood development has a significant impact on well-being in adulthood (Carniero and Heckman, 2003; Currie and Almond, 2011; Duncan and Magnuson, 2013), and in Chernobyl the largest public health consequence of the 1986 nuclear disaster was said to be concerning mental health (Bromet, 2012). A recent longtitudinal survey in Fukushima documented that stress levels are significantly higher there than in the other regions of Japan (Fukushima prefecture, 2011; Tsutsui *et al*., 2011). What can be done to mitigate such concerns?

This research aims to estimate the extent to which the short-term indoor park programmes in Fukushima can improve the psychological health of the children whose stress levels are high as a consequence of the nuclear power plant accident. While previous studies on early childhood development have investigated the long-term consequences of nutritional and cognitive deterioration in early life as a consequence of a natural or manmade disaster (Almond *et al*., 2010; Almond *et al*., 2009; Banerjee *et al*., 2010; Yamano *et al*., 2005; Paxson and Schady, 2005), no study so far has examined the effectiveness of a short-run policy intervention. Originally, the programme had intended to incorporate a lottery procedure as it had expected a large volume of applications from kindergartens. This could have helped significantly in the identification of a causal impact. But due to the unexpectedly low number of applications, the programme was able to accept all applications and no lottery took place, making a clear identification of causal impact impossible.

We found that participation in the programme was not significantly correlated with the overall stress level. Nevertheless, three significant tendencies could be observed: first, the stress level was significantly lower than in the surveys conducted in the previous years. Second, the parents' risk aversion

behaviours decreased compared with the previous years. Third, the stress level of children was positively and modestly correlated with the experience of evacuation as well as parents' prohibition of outdoor play. Overall, the study confirmed that the major trends such as the natural decline of stress over time and the experience of evacuation may be a much more important factor than short-term interventions.

Furthermore, participation in the indoor park programmes is occasionally positively correlated with the stress level, which is inconsistent with our qualitative observations. These correlations were concentrated among those who do not regularly play outdoors, and instead use indoor playground facilities. We cannot know whether this was because of actual impact, reverse causality, or reporting bias. Given that the individual participation variables (which are more endogenously decided than the overall participation variable) were not significant, it may be that the parents had reporting bias in the opposite direction of that originally expected—parents who have a need for indoor facilities and realised the benefits of the Red Cross programme may have overstated the children's stress level so as to induce the Red Cross to continue the programme.

The remainder of this paper is organised as follows. In Section 2, we provide the research background including a brief literature survey on early childhood development, the overall psychological and children's environment in Fukushima after the nuclear accident, and a detailed description of the indoor park programme organised by the Japanese Red Cross. Section 3 describes the nature and summary statistics of data, which we collected exclusively for the present study. The results of regression analysis are presented in Section 4, which is followed by concluding remarks in the final section.

2. Background

2.1. Early childhood environment and psychological well-being

Depression has serious consequences on economic productivity, and most adult psychiatric disorders have their roots in early life. Economists have recently begun to explore the issues of depressive disorder and poverty (Haushofer and Shapiro 2013), and point to the possibility of poverty trap

based on poor decision-making capacity (Shah *et al*., 2012). About 22 percent of people in Japan experience depression in the course of their lives (Bromet *et al*., 2011), and this leads to poor decision-making and lower productivity. The prevalence of depressive disorders among the population increased by 37 percent between 1990 and 2010, and is now a leading contributor to the global burden of disease (Murray *et al*., 2012). In 2004, the health issue leading to the highest Years Lost due to Disability for both men and women was unipolar depression. Given the magnitude of this problem, it is critical to identify effective policies to prevent it.

Multiple psychiatric research has found that psychiatric disorders can be traced back to symptoms in adolescence. (Kim-Cohen *et al*., 2003; Pine *et al*., 1998) Furthermore, a number of economists have pointed out the lasting benefits of early childhood interventions in terms of nutrition and educational programmes (Carniero and Heckman, 2003; Currie and Almond, 2011; Duncan and Magnuson, 2013) In 2006, the Chernobyl Forum concluded that mental health was the largest public health concern after the disaster. As the situation in Fukushima is similar in terms of the contamination issue, it is critical to investigate what policies could be effective to reduce stress levels, and the possible psychiatric problems in adulthood that may arise as a consequence.

2.2. Psychological health and children's environment in Fukushima after the nuclear accident

The Fukushima Dai-ichi nuclear power plant radiation accident was classified as level 7 by the International Atomic Energy Agency—the highest level on International Nuclear Event Scale—and had been the most serious nuclear disaster since the 1986 Chernobyl disaster. It has led to stress levels of parents and children substantially higher than in other parts of Japan. This is due not only to multiple socioeconomic changes, such as migration and stagnation of agriculture, but also to conflicting information regarding the safety of nuclear exposure. Because of their concerns, mothers resorted to risk aversion behaviour, such as avoiding to purchase local vegetables or giving up checking radiation meters.

Nevertheless, playing outdoors has steadily resumed at family homes and

kindergartens from 2012 until the present, for the following two reasons: First, while often incomplete, decontamination has been taking place through multiple steps. Second, according to the kindergarten teachers, adults have realized the harm of prohibiting children from playing outside, which leads to a weakening of children's physical capacities. They note, for instance, that children sometimes fall down when first running outside even though they had been running well indoors. So many parents feel they cannot just stop children from going outside. But promoting outdoor play in kindergartens may take a long time as it requires a consensus among mothers. Some children currently play outside as their parents allow it, while others do not. Consequently, as of January 2014, many kindergartens have been limiting the duration of outdoor play, usually to up to 30 minutes per day

2.3. Details of the indoor park programme

Various non-profit organisations (NPOs) and municipalities have been making efforts to provide alternative indoor parks in Fukushima prefecture. The Japanese Red Cross has been organising large-scale and short-term indoor playgrounds throughout Fukushima over the past years. [2] The programme aims to provide outdoor playing facilities for preschool[3] children affected by the nuclear power plant accident, to give them space to reduce their stress levels and improve their physical capacity.

The indoor park programme in Koriyama lasted for 11 days, and brought together a total of around 1,500 children. The number of applications had been significantly lower than originally expected given Koriyama's large population, probably due to the fact that the city already had a permanent large-scale indoor park.[4]

The indoor park provided by the Red Cross consisted of morning and

[2] This was one of many programmes the Japanese Red Cross organised that made use of overseas aid. The overall cost amounted to over one million US dollars, which was covered by overseas donations. A large portion of the cost went into hiring local staff to monitor children's play, as it was critical to avoid injuries in the indoor environment.

[3] In Japan, preschools consist of kindergartens and nursing schools. Kindergartens are for three years whereas nursing schools are for four years, and targeted at households whose mothers also work.

[4] Although the programme was designed to be different from the permanent one, it still resembled it to a large extent.

afternoon sessions—children from selected preschools participated in the morning sessions, while any individuals from the community could participate freely in the afternoon sessions. The programme included air-based equipment and physical education-oriented programmes. Moreover, a show involving the popular character Anpan-man was held, at the end of which children were given small toys.

3. Data

We used a so-called Strength and Difficulties Questionnaire (SDQ) to assess the children's psychological health (Goodman, 1997; Matsuishi *et al*., 2008). We selected SDQ measures because it is one of the most widely used measures of children's psychological attributes and thus its use allows us to preserve comparability with other studies conducted in Japan and Fukushima prefecture. The largest limitation is that SDQs are designed mainly for tracking long-term circumstances and are less well suited for capturing short-term trends. To consider the change over time, we also asked questions regarding how the situation changed over the past month.

To achieve a high overall response rate, we surveyed both parents and preschool teachers regarding the same questions: SDQ has separate sections for parents and teachers. The correlation between the two measurements was significant. At the same time, Analysis of Variance (ANOVA) Interclass correlation coefficient (ICC)[5] was 0.35, which is too low to claim that two measurements are on the same subject. Taken together, these measurements indicate that teachers and guardians are looking at correlated yet different aspects of children's behaviour, which may be the case because children behave differently between homes and preschools. The behavioural questions related to the risk of radiation exposure were taken from the questionnaires of the Children's Stress Assessment Survey developed by Tsutsui *et al*. of Fukushima University. Overall, the response rates were 73.5 percent for preschools, 69.2 percent for teachers, and 79.7 percent for parents (25 preschools out of 34 places; among teachers, 355 out of 513 children; among parents, 409 out of 513 children). These response rates were approximately the same as in the other surveys we conducted. However, it can be questioned

[5] This reliability test was intended in the pre-analysis plan.

how representative the survey is as it targeted only at the preschools that applied to the indoor park programme. If there were to be any directional bias, we expect the reported stress level to be higher among the participating preschools because participation indicates some concern about psychological and physical health. We complemented the quantitative data with some qualitative questionnaires filled out by preschool administrators.

This study was endorsed by the Koriyama City children's support division, the private kindergarten association, the approved nursing school chairman's committee, and the private nursing school association, and the expedited review from the Institutional Review Board of the University of Tokyo.

3.1. Summary Statistics

An overall comparison with the previous survey conducted in 2011 shows that the stress level has decreased significantly over the past two years. Whereas previously 24.9 percent of children needed assistance (above 16 points in the SDQ), this fell to 10.1 percent in our latest survey. The score is still marginally higher than the Japanese average (1 point), but the difference is smaller than the minimum important change (3 point)[6].

We found that 35 percent of the children have experience of evacuation. The amount of time preschools allow children to play outside varies considerably between preschools. The table below shows that the risk attitude remains high even three years after the accident:

Behavioural response to the accident

Percent (n=409)	Regularl	Sometime	Not
Open window to exchange air	43.3	44.5	8.1
Let children play outside	31.6	54.3	11.7
Check radiation meter	39.4	39.6	19.8
Purchase vegetables made in	4.4	73.6	21.5

[6] In epidemiology, it is common to consider about a half of the baseline standard deviation to be the minimum important change. In this survey, the baseline standard deviation was 5.1, so the minimum important change is about 2.55.

This highlights the steady recovery of outdoor play as compared to the Children's Stress Assessment Survey, although the prohibition still remains for some.[7] At the same time, the most anxious parents will perhaps continue to prohibit their children from playing outside.

4. Empirical Analysis

The analysis below was conducted in accordance with the pre-analysis plan. We included some additional analyses of interaction terms to enrich our analysis.

The outcome variables were the scores of SDQs in each of four sub-categories (emotional symptoms, conduct problems, hyperactivity/inattention, peer problems) and pro-social behaviours. Following the SDQ specification, a lower value is desirable for the first four symptoms, and a higher value is desirable for the last symptom. In addition, we also asked how these symptoms have changed over the month prior to the survey. The main concern for using this outcome variable is that recalling is often imperfect: the parents' and teachers' responses are uncorrelated, suggesting lack of consistency.[8] Nevertheless, it may shed some light on the trend, which the current situation variable cannot do, as there were no baseline surveys. The control variables include age, gender, number of siblings, wealth proxied by the preschool's location's land price[9], above-mentioned risk aversion behaviours, type of houses, experience of evacuation, a dummy indicating whether a child is in preschool, the size of the school (number of boys and girls in each year as well as its maximum capacity), the length of time it took to decontaminate the school playground[10], and the frequency of outdoor play

[7] Note that the target age of the survey is different: the Children's Stress Assessment Survey also includes primary school children.
[8] The change variable between teachers and parents indicates a significant degree of inconsistency compared with other outcome variables.
[9] This is arguably an imperfect measure. For instance, preschools near large stations may be used by low-income households of smaller size, but may have a high land price.
[10] The lack of decontamination can also arise from the low level of radiation to begin with. Thus, it is not necessarily clear whether it is better to have a longer or shorter duration.

at preschools[11]. We tried multiple levels of control variable inclusion, but results seem largely unchanged.

4.1. Overall trend

Table 8.1 presents some significant correlation between psychological health level and individual characteristics. Even though the differences are small in magnitude, we still found the following three trends that are statistically significant:

1. Children who have experienced evacuation tend to have higher stress levels (this is consistent with the results of Iwasaki and Sawada (2014), who found evidence of reference-dependence regarding the stress level among the evacuees from Futaba town in Fukushima prefecture), although the significance drops when all control variables are included;

2. Children living in their own family house or in a public servant's dormitory[12]" statistically have significantly lower stress levels than children who live in their relatives' homes;

3. Children whose parents do not permit outdoor play also have higher stress levels. 4.2 Balance check.

[11] Play per week in the preschool may be due to seasonal variation

[12] But note that the sample size is only seven for the public servant's dormitory. So, while it could be reflecting the stability of a public servant's job, it could be driven by small sample bias.

Table 8.1: Overall Trend of Psychological Health

Outcome:	Total SDQ Score											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Evacuation	1.269**	1.464***	0.770	0.750								
	(0.510)	(0.542)	(0.631)	(0.816)								
Public housing					-1.105	-0.833	-0.377	0.350				
					(1.445)	(1.195)	(1.226)	(2.137)				
Privately-owned house					-1.551	-1.858**	-0.195	0.746				
					(0.979)	(0.941)	(1.041)	(1.986)				
Close relative's house					-0.970	-0.735	0.346	1.169				
					(1.030)	(1.040)	(1.136)	(2.123)				
Public servant's dormitory					-5.664***	-5.133***	-5.115***	-4.160**				
					(1.048)	(1.036)	(1.276)	(1.713)				
Charter housing					-0.771	-0.948	0.632	1.530				
					(1.371)	(1.093)	(1.210)	(1.679)				
Company's dormitory					-1.812	-1.886	0.903	2.028				
					(1.874)	(1.968)	(2.417)	(2.616)				
Sometimes let children play outdoor									0.717	0.711	0.195	0.523
									(1.013)	(0.537)	(0.671)	(0.879)
Never let children play outdoor									3.451***	2.989***	2.672**	3.057***
									(1.000)	(0.919)	(1.114)	(1.019)
Constant	8.946***	8.876***	6.690*	8.444***	10.614***	10.705***	6.690*	8.444***	8.577***	8.636***	6.690*	8.444***
	(0.183)	(0.296)	(3.437)	(2.621)	(0.899)	(0.865)	(3.437)	(2.621)	(0.661)	(0.421)	(3.437)	(2.621)
Specification	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Controls	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Observations	402	402	322	322	393	393	322	322	399	399	322	322
R-squared	0.098	0.019	0.186	0.216	0.103	0.027	0.186	0.216	0.118	0.031	0.186	0.216

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.
For column (3) and (4), the omitted variable in the housing regression is the "far relative's house" (sibling's family's house). For column (5) and (6), the omitted variable in the outdoor regression is "always let children play outdoor." The control variables include personal characteristics for FE, and personal and preschools'

Table 8.2 presents the balance tests of the equality of basic individual characteristics between the treated and the control groups. Participation in the parents survey can be defined in six ways: participation (whether the child participated according to the guardian's response either through the preschool programme or individually through afternoon sessions), individual participation (whether the child participated individually through afternoon sessions), number of participations, number of individual participations, preschool participation (whether the child participated through the preschool), and preschool participation intent-to-treat (ITT) (the number of times the child should have participated based solely on the preschool's decision). There are two variables for the teacher's survey: participation (whether the child has participated according to the teachers, complemented by the information from the preschool ITT variable) and the number of participants. Although we do not have the baseline measurement, this can shed some light

on the reliability of these participation variables. We ran the following regression, and Table 8.2 reports α1. Here, i refers to each child and j refers to preschools.

$$x_{ij} = \alpha_0 + \alpha_1 Participation_{ij} + f_j + \varepsilon_{ij}$$

Table 8.2: Balancing Test with Parents Survey

	Outcome:	Gender		Grade		Siblings	
		(1)	(2)	(3)	(4)	(5)	(6)
Parents:	Participation	-0.068	-0.085	-0.143	-0.167	-0.265**	-0.077
		(0.072)	(0.086)	(0.096)	(0.133)	(0.131)	(0.150)
	Individual participation	-0.105*	-0.126***	-0.154**	-0.164*	-0.089	-0.105
		(0.057)	(0.037)	(0.071)	(0.081)	(0.086)	(0.071)
	Participation numbers	-0.079***	-0.092***	-0.119***	-0.091*	-0.077*	-0.028
		(0.027)	(0.021)	(0.045)	(0.048)	(0.041)	(0.037)
	Indiv part numbers	-0.090***	-0.089***	-0.126**	-0.121**	-0.048	-0.055
		(0.032)	(0.017)	(0.050)	(0.051)	(0.049)	(0.049)
	Preschool participation	-0.081	-0.150	-0.071	-0.042	-0.270**	-0.050
		(0.067)	(0.110)	(0.087)	(0.155)	(0.117)	(0.194)
	Preschool part ITT	-0.050	0.067***	-0.134	-1.000***	-0.323***	0.367***
		(0.078)	(0.000)	(0.094)	(0.000)	(0.124)	(0.000)
Teachers:	Participation	-0.012	0.131	-0.077	-0.559**		
		(0.080)	(0.163)	(0.085)	(0.214)		
	Participation numbers	-0.076	-0.128	-0.215***	-0.345***		
		(0.057)	(0.096)	(0.074)	(0.089)		
	Specification	OLS	FE	OLS	FE	OLS	FE

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.
The sample size ranges between 369 and 405 for each specification test. No control variables are included.

Both for parents' and teachers' surveys, we observe that the "participation" variables are the most balanced, both with respect to ordinary least squares (OLS) and preschool-fixed effect (FE). However, in general, female children with lower grades and fewer siblings are most likely to have participated many times. Participation numbers are largely driven by individual decisions, and therefore are more highly correlated with their characteristics than with

the decision by the preschools. For pre-school ITT, we observe that the coefficient on the FE regression of grade is -1. This is a mechanical result because the variation within the ITT variation was limited to only one preschool, where three upper class (5-6 year-old) children did not participate. Therefore, ITT-FE regressions should not be taken too seriously as they would be driven by only three observations.

4.3. Total participations

Table 8.3 and 8.4 present the following regression on the participation variable, both for parents' and teachers' surveys.

$$y_{ij} = \beta_0 + \beta_1 Participation_{ij} + X_{ij}\beta_2 + f_j + \epsilon_{ij}$$

Table 8.3: Overall Regressions with Parents' Survey

	Total difficulties	Emotional symptoms	Conduct problems	Hyperactivity /inattention	Peer problems	Prosocial behaviors	Change in total score	Change in prosocial behaviors
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS:								
Without controls								
Participation	0.524	-0.123	0.370	0.227	0.049	0.043	0.012	-0.007
	(0.711)	(0.288)	(0.239)	(0.300)	(0.189)	(0.273)	(0.033)	(0.032)
Number of participation	0.239	0.113	0.122	-0.079	0.082	-0.017	-0.000	0.003
	(0.323)	(0.135)	(0.102)	(0.127)	(0.088)	(0.124)	(0.015)	(0.015)
With controls								
Participation	0.434	-0.256	0.577*	0.078	0.034	0.179	0.061	-0.037
	(0.985)	(0.388)	(0.333)	(0.415)	(0.236)	(0.366)	(0.043)	(0.040)
Number of participation	0.497	0.310*	0.106	-0.063	0.145	-0.141	0.012	-0.010
	(0.428)	(0.160)	(0.158)	(0.168)	(0.110)	(0.170)	(0.015)	(0.020)
Preschool-FE:								
Without controls								
Participation	0.275	-0.331	0.513	0.159	-0.067	0.355	0.012	-0.009
	(0.980)	(0.361)	(0.325)	(0.364)	(0.192)	(0.453)	(0.031)	(0.030)
Number of participation	0.232	0.163	0.134	-0.128	0.063	0.060	-0.001	0.003
	(0.458)	(0.197)	(0.134)	(0.182)	(0.062)	(0.127)	(0.016)	(0.015)
With controls								
Participation	0.092	-0.350	0.525	-0.044	-0.039	0.528	0.049	-0.030
	(0.920)	(0.399)	(0.381)	(0.299)	(0.149)	(0.333)	(0.041)	(0.047)
Number of participation	0.336	0.271*	0.071	-0.124	0.119	-0.070	0.009	-0.012
	(0.460)	(0.139)	(0.183)	(0.206)	(0.074)	(0.138)	(0.010)	(0.025)

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.

Table 8.4: Overall Regressions with Teachers' Survey

		Total difficulties	Emotional symptoms	Conduct problems	Hyperactivity /inattention	Peer problems	Prosocial behaviors	Change in total score	Change in prosocial behaviors
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OLS:									
Without controls									
	Participation	0.364	0.129	0.082	0.097	0.069	-0.592	0.274***	-0.217***
		(0.798)	(0.192)	(0.284)	(0.412)	(0.218)	(0.368)	(0.057)	(0.055)
	Number of participations	-0.247	-0.044	0.056	-0.093	-0.109	0.233	0.202***	-0.128***
		(0.618)	(0.148)	(0.211)	(0.328)	(0.193)	(0.290)	(0.036)	(0.041)
With controls									
	Participation	-4.983*	-0.354	-1.479*	-2.293	-0.674	3.105**	-0.062	-0.066
		(2.824)	(0.613)	(0.758)	(1.474)	(0.886)	(1.251)	(0.077)	(0.098)
	Number of participations	-1.443	-0.363	0.076	-0.462	-0.701*	1.660***	0.086**	-0.094*
		(1.157)	(0.287)	(0.347)	(0.636)	(0.360)	(0.546)	(0.041)	(0.048)
Preschool-FE:									
Without controls									
	Participation	-1.651	0.114	0.139	-0.943	-0.850*	1.553	-0.045	-0.051
		(2.038)	(0.369)	(0.629)	(1.248)	(0.425)	(1.224)	(0.063)	(0.036)
	Number of participations	0.216	-0.093	0.435***	0.523	-0.704**	0.531	0.222***	-0.145***
		(0.790)	(0.098)	(0.065)	(0.396)	(0.332)	(0.565)	(0.072)	(0.036)
With controls									
	Participation	-3.372	-0.248	-0.538	-1.210	-1.107**	2.978***	-0.089	-0.039
		(2.373)	(0.362)	(0.778)	(1.475)	(0.528)	(0.284)	(0.100)	(0.062)
	Number of participations	-1.027	-0.347	0.201	0.137	-1.064***	1.218***	0.194**	-0.133***
		(1.300)	(0.251)	(0.256)	(0.677)	(0.259)	(0.137)	(0.077)	(0.043)

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.

Although no causal inference can be made from these regressions, the associations are mostly insignificant. For the ones that are significant, they mostly indicate that the programme is positively correlated with the psychological stress of the children. In particular, emotional symptoms and conduct problems are marginally higher among those who participated. In FE for teacher's survey, we found that participation is negatively correlated with stress level, and positively correlated with pro-social behaviour.

One can hypothesis that these trends may be largely due to the endogenous choice of participation. Thus, we move on to the next section, which uses the individual participation decisions rather than preschool decisions.

4.4. Individual Participations

Tables 8.5 and 8.6 present the OLS and FE regressions with respect to individual participation as well as participation determined by the preschools. Though insignificant, individual participation is positively significantly correlated with the total difficulties score, but negatively with pro-social behaviour. These correlations are significant especially with emotional

symptoms and conduct problems.

Table 8.5: Individual Participation OLS Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Individual participation	0.490	1.161	0.155	0.559**	0.293	0.369	0.005	0.042	0.037	0.192	0.118	-0.063	-0.022	-0.012	-0.005	-0.018
	(0.594)	(0.728)	(0.231)	(0.245)	(0.197)	(0.261)	(0.228)	(0.285)	(0.163)	(0.192)	(0.248)	(0.313)	(0.024)	(0.026)	(0.027)	(0.033)
Indiv participation numbers	0.241	0.592	0.164	0.409**	0.101	0.099	-0.061	-0.045	0.038	0.129	0.090	-0.068	-0.007	0.005	0.007	-0.010
	(0.368)	(0.466)	(0.163)	(0.176)	(0.117)	(0.171)	(0.136)	(0.178)	(0.099)	(0.123)	(0.137)	(0.190)	(0.016)	(0.016)	(0.017)	(0.021)
Individual participation	0.399	1.099	0.151	0.595**	0.252	0.293	-0.027	0.029	0.023	0.182	0.138	-0.039	-0.024	-0.023	-0.004	-0.011
	(0.593)	(0.744)	(0.233)	(0.252)	(0.198)	(0.264)	(0.229)	(0.292)	(0.163)	(0.195)	(0.250)	(0.318)	(0.024)	(0.027)	(0.027)	(0.034)
Preschool participation	0.806	0.577	0.040	-0.330	0.364	0.690*	0.278	0.128	0.125	0.089	-0.173	-0.223	0.013	0.102**	-0.002	-0.061
	(0.667)	(1.192)	(0.268)	(0.473)	(0.231)	(0.353)	(0.272)	(0.519)	(0.175)	(0.255)	(0.264)	(0.438)	(0.030)	(0.050)	(0.029)	(0.046)
Indiv participation numbers	0.203	0.552	0.166	0.429**	0.078	0.052	-0.074	-0.053	0.034		0.101	-0.057	-0.008	-0.001	0.008	-0.006
	(0.369)	(0.474)	(0.164)	(0.179)	(0.117)	(0.172)	(0.137)	(0.182)	(0.100)	(0.124)	(0.138)	(0.192)	(0.016)	(0.016)	(0.017)	(0.021)
Preschool participation	0.631	0.666	-0.043	-0.325	0.385*	0.757**	0.221	0.136	0.068	0.098	-0.183	-0.184	0.012	0.094*	-0.004	-0.061
	(0.673)	(1.156)	(0.271)	(0.464)	(0.232)	(0.346)	(0.275)	(0.499)	(0.177)	(0.255)	(0.270)	(0.405)	(0.030)	(0.050)	(0.029)	(0.046)
Individual participation	0.494	1.051	0.205	0.572**	0.305	0.345	-0.021	-0.045	0.004	0.179	0.187	0.054	-0.022	-0.015	0.003	-0.013
	(0.600)	(0.736)	(0.241)	(0.246)	(0.204)	(0.265)	(0.234)	(0.289)	(0.166)	(0.192)	(0.258)	(0.316)	(0.025)	(0.027)	(0.028)	(0.033)
Preschool participation ITT	1.032	3.320	0.108	-0.403	0.294	0.712	0.473	2.630**	0.156	0.381	-0.422	-3.538**	0.005	0.098	-0.004	-0.142
	(0.836)	(2.524)	(0.308)	(0.927)	(0.300)	(0.953)	(0.323)	(1.042)	(0.215)	(0.646)	(0.325)	(1.487)	(0.034)	(0.102)	(0.036)	(0.110)
Indiv participation numbers	0.173	0.546	0.174	0.422**	0.093	0.087	-0.095	-0.084	0.001	0.122	0.144	-0.015	-0.008	0.003	0.012	-0.008
	(0.361)	(0.468)	(0.170)	(0.177)	(0.122)	(0.173)	(0.136)	(0.179)	(0.095)	(0.122)	(0.139)	(0.192)	(0.017)	(0.017)	(0.018)	(0.021)
Preschool participation ITT	0.853	2.597	0.002	-0.723	0.329	0.670	0.415	2.226**	0.107	0.424	-0.487	-3.017**	0.007	0.083	-0.008	-0.117
	(0.850)	(2.426)	(0.313)	(0.851)	(0.304)	(0.928)	(0.332)	(1.073)	(0.221)	(0.702)	(0.337)	(1.335)	(0.035)	(0.104)	(0.037)	(0.109)
Control variables	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8.6. Individual Participation FE Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Individual participation	0.416	1.019	0.130	0.487*	0.333	0.369	-0.069	0.019	0.021	0.145	0.107	-0.062	-0.019	-0.014	-0.016	-0.029
	(0.788)	(0.775)	(0.272)	(0.248)	(0.239)	(0.253)	(0.289)	(0.282)	(0.164)	(0.173)	(0.276)	(0.254)	(0.025)	(0.021)	(0.028)	(0.040)
Indiv participation number	0.242	0.477	0.175	0.360**	0.122	0.087	-0.092	-0.072	0.038	0.102	0.087	-0.053	-0.003	0.004	0.001	-0.014
	(0.452)	(0.443)	(0.190)	(0.127)	(0.125)	(0.167)	(0.180)	(0.194)	(0.068)	(0.077)	(0.127)	(0.134)	(0.018)	(0.010)	(0.019)	(0.030)
Individual participation	0.318	1.005	0.140	0.518**	0.264	0.317	-0.099	0.027	0.013	0.142	0.101	-0.087	-0.021	-0.021	-0.016	-0.025
	(0.816)	(0.774)	(0.290)	(0.242)	(0.244)	(0.268)	(0.299)	(0.281)	(0.168)	(0.175)	(0.284)	(0.267)	(0.026)	(0.022)	(0.027)	(0.038)
Preschool participation	1.049	0.187	-0.098	-0.393	0.736**	0.654	0.322	-0.106	0.089	0.032	0.066	0.313	0.020	0.090**	0.001	-0.049
	(0.923)	(1.247)	(0.449)	(0.484)	(0.291)	(0.505)	(0.408)	(0.444)	(0.200)	(0.214)	(0.381)	(0.405)	(0.040)	(0.041)	(0.032)	(0.046)
Indiv participation number	0.188	0.464	0.181	0.377***	0.082	0.056	-0.109	-0.069	0.033		0.084	-0.066	-0.004	0.000	0.002	-0.012
	(0.477)	(0.455)	(0.202)	(0.121)	(0.130)	(0.179)	(0.188)	(0.198)	(0.069)	(0.076)	(0.131)	(0.141)	(0.019)	(0.010)	(0.018)	(0.029)
Preschool participation	1.069	0.299	-0.131	-0.382	0.784**	0.720	0.337	-0.075	0.079	0.036	0.062	0.312	0.015	0.084*	-0.004	-0.051
	(0.940)	(1.283)	(0.464)	(0.493)	(0.295)	(0.517)	(0.417)	(0.466)	(0.194)	(0.211)	(0.378)	(0.398)	(0.041)	(0.041)	(0.032)	(0.047)
Individual participation	0.450	1.018	0.211	0.515*	0.354	0.374	-0.113	-0.008	-0.002	0.137	0.178	-0.030	-0.020	-0.015	-0.009	-0.028
	(0.869)	(0.794)	(0.285)	(0.249)	(0.263)	(0.258)	(0.307)	(0.292)	(0.183)	(0.174)	(0.300)	(0.260)	(0.026)	(0.021)	(0.030)	(0.041)
Preschool participation ITT	2.707***	0.093	-0.702***	1.478***	0.583**	-0.258	2.290***	1.402*	0.535***	0.427	-1.976***	-1.707**	-0.009	0.048	0.001	-0.035
	(0.695)	(1.690)	(0.228)	(0.482)	(0.210)	(0.729)	(0.246)	(0.680)	(0.146)	(0.511)	(0.240)	(0.771)	(0.021)	(0.054)	(0.024)	(0.107)
Indiv participation number	0.206	0.473	0.194	0.371***	0.120	0.087	-0.125	-0.083	0.017	0.098	0.125	-0.039	-0.003	0.003	0.005	-0.014
	(0.483)	(0.451)	(0.197)	(0.127)	(0.134)	(0.171)	(0.187)	(0.197)	(0.072)	(0.076)	(0.133)	(0.136)	(0.019)	(0.010)	(0.020)	(0.031)
Preschool participation ITT	2.902***	0.470	-0.689***	1.371***	0.771***	-0.064	2.300***	1.450**	0.520***	0.455	-1.933***	-1.702**	-0.022	0.036	-0.010	-0.045
	(0.387)	(1.611)	(0.157)	(0.441)	(0.107)	(0.709)	(0.150)	(0.660)	(0.058)	(0.518)	(0.107)	(0.742)	(0.015)	(0.052)	(0.016)	(0.103)
Control variables	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.

Since these questions are put to the parents, this may be reflecting the perception of parents: because parents feel that the children have stress, they involve them in the indoor park programmes. Even after controlling for school-wide participation (One preschool did not participate due to an unexpected conflict in scheduling.), the significance remains.

Although the change variables are mostly unreliable, change in total score was positively correlated with the participation variables. As discussed in the balance check section, the ITT variable results are most probably not meaningful.

4.5. Sub-group Analyses

Given the unexpected results, we conducted sub-group analyses, which were not in the original pre-analysis plan. To investigate whether the effect was particularly strong across certain groups, we ran the following regressions, both with OLS and preschool-FE specifications:

$$y_{ij} = \gamma_0 + \gamma_1 Participation_{ij} + \gamma_2 D_{ij} + \gamma_3 Participation_{ij} * D_{ij} + \gamma_4 X_{ij} + f_j + e_{ij}$$

Here, $_{Dij}$ indicates dummies for either of the following variables respectively: frequency of outdoor play, regular indoor facilities usage, whether the preschool is a kindergarten or a nursing school (Dj), and evacuation experience after the disaster.

4.5.1. Outdoor play

Tables 8.7 and 8.8 present the regression with respect to frequency/prohibition of outdoor play. The FE regression has generally more significant coefficients, and the overall trend is consistent between OLS and FE. Overall, the children whose parents never permit them to play outdoors had a positive coefficient between participation and stress level, whereas the children whose parents let them play outdoors had zero or negative coefficients. This trend is consistent across many outcomes—total difficulties, emotional symptoms, peer problems, and pro-social behaviours—and stays the same with inclusion of control variables.

Table 8.7. Outdoor Play OLS Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	3.378	1.880	1.750**	1.206**	0.420	0.213	0.330	-0.046	0.878**	0.507*	-0.022	0.428*	0.021	0.044	0.074	0.011
	(2.066)	(1.264)	(0.745)	(0.551)	(0.720)	(0.343)	(1.017)	(0.376)	(0.363)	(0.296)	(0.473)	(0.240)	(0.090)	(0.039)	(0.052)	(0.029)
Always permit	1.917	0.603	1.083	0.747	0.181	-0.063	0.181	-0.191	0.472	0.110	0.431	0.832*	-0.023	0.054	0.115*	0.018
	(2.414)	(1.718)	(0.836)	(0.694)	(0.829)	(0.552)	(1.081)	(0.684)	(0.529)	(0.407)	(0.591)	(0.491)	(0.111)	(0.073)	(0.066)	(0.061)
Sometimes permit	-1.060	-0.718	0.612	0.383	-0.789	-0.407	-0.978	-0.727	0.095	0.034	-0.194	0.770*	0.079	0.113*	-0.009	-0.044
	(1.947)	(1.578)	(0.685)	(0.663)	(0.701)	(0.503)	(1.002)	(0.639)	(0.345)	(0.354)	(0.521)	(0.435)	(0.086)	(0.062)	(0.053)	(0.052)
Always*participatio	-5.739**	-2.863**	-2.606***	-1.536***	-0.858	-0.385	-0.944	-0.323	-1.330**	-0.619*	-0.218	-0.485	0.024	-0.044	-0.169**	-0.041
	(2.610)	(1.361)	(0.949)	(0.583)	(0.887)	(0.387)	(1.156)	(0.424)	(0.581)	(0.335)	(0.688)	(0.332)	(0.120)	(0.048)	(0.082)	(0.040)
Sometimes*part.	-1.469	-1.269	-1.768**	-1.040*	0.457	0.027	0.492	0.147	-0.650	-0.403	0.279	-0.563**	-0.018	-0.043	-0.053	-0.006
	(2.178)	(1.309)	(0.819)	(0.574)	(0.764)	(0.360)	(1.077)	(0.395)	(0.418)		(0.613)	(0.274)	(0.096)	(0.041)	(0.069)	(0.032)
With controls																
Participation	2.764	1.543	1.135	1.202**	0.504	0.107	0.133	-0.251	0.992**	0.485	-0.017	0.402	0.059	0.050	0.043	-0.012
	(2.107)	(1.345)	(0.791)	(0.534)	(0.777)	(0.393)	(0.972)	(0.415)	(0.460)	(0.347)	(0.653)	(0.328)	(0.088)	(0.037)	(0.067)	(0.027)
Always permit	0.837	0.006	0.638	0.682	0.001	-0.130	0.077	-0.268	0.120	-0.278	0.665	1.201*	-0.112	-0.042	0.172**	0.059
	(2.243)	(1.872)	(0.857)	(0.708)	(0.795)	(0.639)	(1.035)	(0.794)	(0.566)	(0.478)	(0.734)	(0.632)	(0.110)	(0.085)	(0.084)	(0.071)
Sometimes permit	-1.184	-1.524	0.562	0.572	-0.758	-0.537	-0.989	-1.198*	-0.000	-0.361	-0.057	1.166**	0.029	0.078	0.017	-0.034
	(1.955)	(1.733)	(0.700)	(0.662)	(0.691)	(0.577)	(0.952)	(0.712)	(0.375)	(0.378)	(0.633)	(0.538)	(0.079)	(0.064)	(0.070)	(0.054)
Always*participatio	-4.329*	-2.277	-1.712*	-1.177**	-0.556	-0.303	-0.729	-0.246	-1.332**	-0.551	-0.015	-0.433	0.026	-0.036	-0.176*	-0.029
	(2.382)	(1.385)	(0.969)	(0.548)	(0.856)	(0.435)	(1.100)	(0.494)	(0.626)	(0.374)	(0.833)	(0.447)	(0.119)	(0.052)	(0.096)	(0.044)
Sometimes*part.	-1.698	-0.744	-1.560*	-0.991*	0.459	0.142	0.378	0.436	-0.974**	-0.331	0.356	-0.736**	-0.011	-0.048	-0.041	0.017
	(2.175)	(1.351)	(0.852)	(0.556)	(0.778)	(0.409)	(1.025)	(0.434)	(0.487)	(0.342)	(0.734)	(0.347)	(0.089)	(0.039)	(0.083)	(0.030)
Participation variabl	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted dummy is "never permit" children to play outside.

Table 8.8: Outdoor Play FE Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	3.468**	2.071**	1.643**	1.299***	0.597	0.303	0.336	-0.065	0.892***	0.534***	0.232	0.492**	0.019	0.035	0.083	0.014
	(1.291)	(0.747)	(0.718)	(0.259)	(0.682)	(0.297)	(0.582)	(0.308)	(0.248)	(0.114)	(0.517)	(0.236)	(0.120)	(0.051)	(0.056)	(0.028)
Always permit	1.793*	0.696	0.965*	0.744	0.193	0.036	0.223	-0.144	0.412	0.060	0.415	0.880	-0.028	0.045	0.134*	0.021
	(1.016)	(1.038)	(0.559)	(0.524)	(0.369)	(0.435)	(0.717)	(0.646)	(0.453)	(0.331)	(0.411)	(0.730)	(0.104)	(0.101)	(0.071)	(0.051)
Sometimes permit	-0.874	-0.641	0.560	0.366	-0.671	-0.287	-0.830*	-0.689	0.067	-0.031	-0.141	0.865*	0.080	0.113	-0.011	-0.049
	(1.254)	(1.244)	(0.450)	(0.463)	(0.716)	(0.535)	(0.460)	(0.591)	(0.268)	(0.228)	(0.413)	(0.475)	(0.109)	(0.078)	(0.035)	(0.043)
Always*participation	-6.114***	-3.311***	-2.686***	-1.666***	-0.876	-0.484	-1.047	-0.418	-1.506**	-0.743***	-0.041	-0.431	0.036	-0.033	-0.203*	-0.050
	(1.410)	(0.824)	(0.757)	(0.245)	(0.514)	(0.349)	(0.858)	(0.400)	(0.542)	(0.225)	(0.543)	(0.335)	(0.114)	(0.064)	(0.105)	(0.047)
Sometimes*part.	-2.142	-1.622*	-1.891***	-1.123***	0.305	-0.101	0.256	0.073	-0.812**	-0.471***	0.384	-0.542**	-0.011	-0.038	-0.062	-0.008
	(1.533)	(0.861)	(0.665)	(0.303)	(0.753)	(0.282)	(0.601)	(0.332)	(0.333)		(0.400)	(0.206)	(0.117)	(0.047)	(0.066)	(0.031)
With controls																
Participation	2.317**	1.423	1.056	1.170***	0.394	0.084	-0.027	-0.284	0.893***	0.453**	0.358	0.482**	0.046	0.044	0.053	-0.015
	(1.085)	(0.899)	(0.629)	(0.294)	(0.668)	(0.348)	(0.663)	(0.347)	(0.305)	(0.174)	(0.402)	(0.187)	(0.119)	(0.044)	(0.063)	(0.029)
Always permit	0.458	-0.290	0.582	0.624	-0.152	-0.249	0.002	-0.286	0.027	-0.379	0.746*	1.285**	-0.119	-0.053	0.165	0.047
	(1.016)	(1.266)	(1.040)	(0.738)	(0.466)	(0.609)	(0.677)	(0.685)	(0.431)	(0.301)	(0.364)	(0.614)	(0.105)	(0.112)	(0.104)	(0.047)
Sometimes permit	-1.389	-1.514	0.529	0.546	-0.839	-0.537	-1.035**	-1.154**	-0.044	-0.368	-0.027	1.163***	0.027	0.074	0.012	-0.041
	(1.453)	(1.437)	(0.578)	(0.546)	(0.779)	(0.676)	(0.471)	(0.513)	(0.324)	(0.220)	(0.393)	(0.359)	(0.110)	(0.098)	(0.044)	(0.035)
Always*participation	-4.323***	-2.274*	-1.787	-1.201***	-0.499	-0.281	-0.717	-0.262	-1.318**	-0.529**	-0.057	-0.496	0.030	-0.030	-0.183	-0.031
	(1.269)	(1.100)	(1.098)	(0.369)	(0.568)	(0.490)	(0.770)	(0.481)	(0.501)	(0.247)	(0.462)	(0.375)	(0.108)	(0.059)	(0.108)	(0.045)
Sometimes*part.	-1.501	-0.797	-1.537**	-0.982***	0.523	0.114	0.438	0.398	-0.924**	-0.327**	0.333	-0.718***	-0.010	-0.046	-0.043	0.019
	(1.570)	(0.870)	(0.690)	(0.297)	(0.801)	(0.300)	(0.761)	(0.348)	(0.342)	(0.154)	(0.417)	(0.226)	(0.107)	(0.050)	(0.065)	(0.036)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted dummy is "never permit" children to play outside. FE also has clustered standard errors at preschool levels.

4.5.2. Regular indoor play at PEP Kids

PEP Kids is the regular indoor play facility in Koriyama city. Tables 8.9 and 8.10 present the regression with respect to frequency of PEP Kids, which is largely considered to be an alternative to outdoor play. Although the PEP Kids and outdoor play variables themselves are not significantly correlated, we observe that the positive correlation is concentrated among those who regularly (at least once a week) use PEP Kids although they have lower stress levels without participation. This is true with total difficulties, conduct problems, hyperactivities, and peer problems.

Table 8.9: PEP Kids OLS Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	1.223	-0.905	0.527	0.179	0.440	-0.287	-0.027	-0.563*	0.282	-0.234*	-0.926	0.328	0.095	0.063**	-0.030	-0.011
	(1.039)	(0.752)	(0.550)	(0.377)	(0.395)	(0.174)	(0.606)	(0.311)	(0.283)	(0.135)	(0.667)	(0.327)	(0.086)	(0.031)	(0.071)	(0.029)
Almost every week	-2.231*	-3.575**	0.821	-0.306	0.000	-0.022	-2.000*	-1.751**	-1.051***	-1.496***	-1.179	0.387	0.190**	0.064	-0.108*	-0.111*
	(1.168)	(1.588)	(1.523)	(0.999)	(0.347)	(0.653)	(1.097)	(0.757)	(0.360)	(0.304)	(1.166)	(0.751)	(0.084)	(0.077)	(0.064)	(0.063)
Sometimes	-0.156	-2.360**	0.179	-0.489	0.025	-0.547*	-0.575	-0.881*	0.215	-0.443*	-0.821	0.674	0.084	0.087*	-0.031	-0.032
	(1.219)	(1.004)	(0.568)	(0.472)	(0.456)	(0.313)	(0.645)	(0.452)	(0.328)	(0.237)	(0.677)	(0.454)	(0.090)	(0.051)	(0.074)	(0.050)
Every week*part.	5.111**	3.768***	-0.727	0.269	1.360**	0.802***	2.893**	1.535***	1.585***	1.163***	0.459	-0.808**	-0.196*	-0.046	0.004	0.008
	(2.154)	(0.982)	(1.677)	(0.542)	(0.626)	(0.297)	(1.240)	(0.444)	(0.557)	(0.169)	(1.291)	(0.402)	(0.102)	(0.037)	(0.100)	(0.033)
Sometimes*part.	-1.313	1.033	-0.878	-0.096	-0.174	0.397**	0.156	0.452	-0.417	0.281*	1.265*	-0.347	-0.098	-0.077**	0.029	0.022
	(1.402)	(0.810)	(0.650)	(0.401)	(0.504)	(0.201)	(0.706)	(0.330)	(0.375)		(0.732)	(0.345)	(0.094)	(0.034)	(0.081)	(0.032)
With controls																
Participation	-0.008	-0.798	-0.289	0.137	0.503	-0.322*	-0.423	-0.475	0.202	-0.137	-1.073*	0.054	0.167*	0.068**	-0.073	-0.029
	(1.380)	(0.842)	(0.603)	(0.438)	(0.558)	(0.191)	(0.725)	(0.346)	(0.361)	(0.155)	(0.626)	(0.302)	(0.093)	(0.033)	(0.089)	(0.032)
Almost every week	-2.697*	-5.020**	0.239	-0.690	-0.190	-0.466	-1.998	-2.433*	-0.747*	-1.431***	-2.931***	-0.473	0.142	0.004	-0.153	-0.162*
	(1.455)	(2.128)	(1.519)	(1.198)	(0.610)	(0.880)	(1.548)	(1.264)	(0.431)	(0.460)	(0.741)	(1.052)	(0.096)	(0.113)	(0.101)	(0.089)
Sometimes	-0.994	-2.611**	-0.514	-0.904*	-0.064	-0.602*	-0.628	-0.702	0.211	-0.402	-1.290**	0.398	0.125	0.093*	-0.069	-0.058
	(1.219)	(1.094)	(0.566)	(0.523)	(0.519)	(0.360)	(0.721)	(0.513)	(0.378)	(0.269)	(0.612)	(0.468)	(0.095)	(0.055)	(0.092)	(0.058)
Every week*part.	5.469**	4.866***	-0.027	0.446	1.456*	1.181***	2.788*	2.036***	1.251**	1.203***	2.315**	-0.276	-0.230**	-0.055	0.062	0.045
	(2.120)	(1.345)	(1.581)	(0.737)	(0.836)	(0.451)	(1.670)	(0.708)	(0.513)	(0.275)	(0.893)	(0.605)	(0.117)	(0.066)	(0.130)	(0.070)
Sometimes*part.	0.039	1.355	-0.020	0.222	-0.082	0.431*	0.466	0.410	-0.325	0.291	1.639**	-0.196	-0.122	-0.066*	0.052	0.028
	(1.422)	(0.868)	(0.641)	(0.444)	(0.565)	(0.225)	(0.784)	(0.368)	(0.428)	(0.181)	(0.683)	(0.333)	(0.097)	(0.037)	(0.098)	(0.036)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted dummy is "almost never" use the PEP Kids indoor facilities.

Table 8.10. PEP Kids FE Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	0.345	-0.814	0.299	0.265	0.348	-0.270*	-0.366	-0.594*	0.065	-0.215	-0.530	0.390	0.090	0.061**	-0.014	-0.011
	(1.033)	(0.878)	(0.832)	(0.495)	(0.324)	(0.143)	(0.603)	(0.291)	(0.361)	(0.195)	(0.455)	(0.276)	(0.071)	(0.025)	(0.064)	(0.030)
Almost every week	-4.040**	-3.681**	0.591	-0.477	-0.636	-0.104	-2.864***	-1.810***	-1.132**	-1.291***	-0.984	0.150	0.179***	0.070	-0.059	-0.109**
	(1.919)	(1.323)	(0.984)	(0.720)	(0.446)	(0.629)	(0.516)	(0.646)	(0.425)	(0.309)	(1.500)	(0.954)	(0.060)	(0.067)	(0.046)	(0.044)
Sometimes	-0.491	-2.072*	0.108	-0.527	-0.060	-0.440	-0.738	-0.801*	0.198	-0.304	-0.816*	0.624	0.078	0.085*	-0.017	-0.033
	(1.277)	(1.055)	(0.776)	(0.595)	(0.459)	(0.366)	(0.522)	(0.394)	(0.515)	(0.359)	(0.401)	(0.535)	(0.062)	(0.048)	(0.048)	(0.038)
Every week*part.	7.171**	3.771***	-0.481	0.283	2.095**	0.869**	3.802***	1.545***	1.754**	1.073***	0.272	-0.658	-0.206**	-0.059	-0.033	0.016
	(3.030)	(0.976)	(1.364)	(0.562)	(0.873)	(0.315)	(0.745)	(0.397)	(0.648)	(0.223)	(1.571)	(0.526)	(0.079)	(0.041)	(0.058)	(0.032)
Sometimes*part.	-0.896	0.918	-0.917	-0.134	-0.025	0.367	0.360	0.434	-0.314	0.251	1.242***	-0.332	-0.089	-0.074**	0.012	0.021
	(1.470)	(0.850)	(0.899)	(0.445)	(0.512)	(0.218)	(0.457)	(0.297)	(0.597)		(0.377)	(0.347)	(0.060)	(0.034)	(0.059)	(0.028)
With controls																
Participation	-0.581	-0.988	-0.386	0.100	0.336	-0.379*	-0.623	-0.529	0.093	-0.179	-0.642*	0.140	0.152	0.063*	-0.071	-0.033
	(1.223)	(0.987)	(0.881)	(0.538)	(0.472)	(0.195)	(0.799)	(0.343)	(0.307)	(0.201)	(0.348)	(0.332)	(0.096)	(0.036)	(0.081)	(0.035)
Almost every week	-3.242***	-5.012**	0.112	-0.759	-0.372	-0.463	-2.137**	-2.302***	-0.844*	-1.488**	-2.865***	-0.650	0.139	0.005	-0.168**	-0.181**
	(1.129)	(1.955)	(0.637)	(0.895)	(0.420)	(0.554)	(0.756)	(0.625)	(0.465)	(0.545)	(0.653)	(1.528)	(0.089)	(0.093)	(0.070)	(0.074)
Sometimes	-1.383	-2.642**	-0.597	-0.942*	-0.194	-0.605	-0.756	-0.674	0.164	-0.421	-1.147***	0.375	0.121	0.091	-0.074	-0.065
	(0.866)	(0.987)	(0.699)	(0.525)	(0.383)	(0.444)	(0.926)	(0.487)	(0.338)	(0.293)	(0.327)	(0.632)	(0.086)	(0.056)	(0.061)	(0.039)
Every week*part.	6.010***	4.908***	0.032	0.475	1.681*	1.206***	2.968***	1.992***	1.328**	1.234***	2.258***	-0.186	-0.231***	-0.057	0.072	0.054
	(1.801)	(1.543)	(0.899)	(0.763)	(0.851)	(0.394)	(0.874)	(0.356)	(0.539)	(0.363)	(0.609)	(0.856)	(0.073)	(0.065)	(0.092)	(0.053)
Sometimes*part.	0.339	1.399	-0.019	0.222	0.070	0.459	0.560	0.405	-0.271	0.313	1.523***	-0.217	-0.117	-0.063	0.055	0.030
	(1.060)	(0.947)	(0.809)	(0.553)	(0.429)	(0.270)	(0.861)	(0.354)	(0.425)	(0.213)	(0.309)	(0.408)	(0.087)	(0.037)	(0.077)	(0.032)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted dummy is "almost never" use the PEP Kids indoor facilities. FE also has clustered standard

errors at preschool levels.

4.5.3. Kindergarten and nursing schools

Table 8.11 presents the OLS regression with parents' survey.[13] The coefficients are significant mostly with and without controls, and for all outcome variables, indicate that (i) among children in the nursing schools, participation is positively correlated with their stress levels; (ii) with no participation, children in the kindergartens have higher stress levels; and (iii) among children in the kindergartens, participation is not correlated with stress levels. Table 8.12 presents the OLS regression with the teachers' survey, with less consistent coefficients compared to the parents' survey. For the ones that are significant (e.g., total difficulties), they indicate almost exactly the opposite results: (i) among children in the nursing schools, participation is negatively correlated with stress levels; (ii) with no participation, children in the kindergartens have lower stress levels; and (iii) among children in the kindergartens, participation is slightly negatively correlated with stress levels. As discussed above in the Data section, this is possible only if parents and teachers are looking at different aspects of children's psychological conditions.

One possible explanation is that the children in the nursing schools were energised by the indoor park only with respect to their time at the nursing schools, but became tired at home so that, from the parents' perspective, the impact appeared negative. Such impact was not seen among children in the kindergartens.

[13] Note that there is no preschool-FE regression because the kindergarten dummy is a preschool level variable.

Table 8.11. Kindergarten Regressions with Parents' Survey

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	2.205**	1.167**	0.397	0.109	0.952***	0.476***	0.458	0.261	0.397*	0.321**	-0.735**	-0.385**	0.068	-0.004	-0.052	-0.015
	(0.944)	(0.492)	(0.354)	(0.186)	(0.262)	(0.139)	(0.531)	(0.194)	(0.231)	(0.127)	(0.338)	(0.191)	(0.054)	(0.025)	(0.053)	(0.024)
Kindergarten	3.104**	2.536***	0.974**	0.239	0.874**	0.781***	0.499	0.742*	0.757**	0.775***	-1.116**	-0.798**	0.079	-0.006	-0.064	-0.037
	(1.213)	(0.910)	(0.487)	(0.366)	(0.384)	(0.292)	(0.605)	(0.384)	(0.315)	(0.247)	(0.447)	(0.357)	(0.064)	(0.042)	(0.062)	(0.044)
Kindergarten*part.	-2.350*	-1.343**	-0.722	0.064	-0.906**	-0.555***	-0.289	-0.535**	-0.433	-0.317**	1.237**	0.580***	-0.089	0.005	0.073	0.030
	(1.331)	(0.596)	(0.534)	(0.251)	(0.423)	(0.174)	(0.645)	(0.229)	(0.350)	(0.156)	(0.499)	(0.220)	(0.068)	(0.027)	(0.067)	(0.027)
With controls																
Participation	1.212	1.549**	-0.002	0.239	0.769*	0.751***	0.038	0.323	0.407	0.236	-1.050**	-0.666**	0.128*	0.017	-0.070	-0.045
	(1.570)	(0.762)	(0.575)	(0.254)	(0.429)	(0.263)	(0.716)	(0.300)	(0.320)	(0.178)	(0.506)	(0.321)	(0.067)	(0.029)	(0.069)	(0.035)
Kindergarten	5.133	13.660**	1.295	2.656	1.434	4.375**	1.149	5.526**	1.255		-1.654	-5.000	0.337	0.349	-0.544***	-0.792***
	(4.450)	(5.958)	(1.956)	(2.428)	(1.486)	(2.021)	(1.805)	(2.599)	(1.414)	(1.659)	(2.443)	(3.350)	(0.232)	(0.273)	(0.188)	(0.252)
Kindergarten*part.	-1.362	-1.497*	-0.445	0.100	-0.336	-0.918***	0.072	-0.549	-0.653	-0.129	2.151***	0.747**	-0.118	-0.008	0.058	0.049
	(2.146)	(0.866)	(0.862)	(0.314)	(0.665)	(0.300)	(0.864)	(0.345)	(0.487)	(0.219)	(0.694)	(0.362)	(0.088)	(0.035)	(0.088)	(0.040)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted dummy is "almost never" use the PEP Kids indoor facilities.

Table 8.12: Kindergarten Regressions with Teachers' Survey

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	-4.285	1.231	-0.581	0.075	-0.329	1.097*	-2.703*	-0.366	-0.674	0.431	0.151	0.890	0.269*	0.170***	0.012	-0.009
	(3.934)	(1.974)	(0.368)	(0.387)	(1.429)	(0.585)	(1.438)	(0.946)	(0.723)	(0.585)	(0.745)	(0.707)	(0.138)	(0.050)	(0.073)	(0.029)
Kindergarten	-5.694	-0.506	-0.778*	-0.188	-0.639	0.977	-3.333**	-1.447	-0.944	0.195	1.368*	1.470	-0.042	-0.047	0.293***	0.225***
	(3.979)	(2.299)	(0.400)	(0.467)	(1.448)	(0.699)	(1.471)	(1.134)	(0.740)	(0.682)	(0.789)	(0.937)	(0.150)	(0.084)	(0.094)	(0.063)
Kindergarten*part.	3.727	-1.638	0.708	-0.120	0.129	-1.221**	2.413	0.271	0.555	-0.548	0.068	-0.688	-0.040	0.002	-0.225**	-0.126**
	(4.026)	(2.039)	(0.431)	(0.409)	(1.462)	(0.616)	(1.505)	(0.991)	(0.762)	(0.609)	(0.850)	(0.762)	(0.153)	(0.065)	(0.098)	(0.054)
With controls																
Participation	10.068**	-1.456	-1.213***	-0.748	2.682**	0.471	-4.907***	-0.884	-1.204**	-0.243	2.566***	1.092	-0.001	-0.010	0.073	0.065
	(1.570)	(2.184)	(0.413)	(0.483)	(0.492)	(0.735)	(0.795)	(1.083)	(0.508)	(0.682)	(0.862)	(0.817)	(0.126)	(0.048)	(0.119)	(0.052)
Kindergarten	-0.195	8.895*	2.180*	3.972***	-0.622	1.536	-3.137	-0.394	1.402		5.404**	3.825	0.543***	0.636***	0.172	-0.139
	(4.829)	(5.308)	(1.186)	(1.270)	(1.420)	(1.743)	(2.370)	(2.345)	(1.608)	(1.526)	(2.517)	(3.207)	(0.149)	(0.122)	(0.183)	(0.154)
Kindergarten*part.	6.079***	1.269	1.027**	0.425	1.440**	-0.454	3.121***	1.058	0.632	0.104	0.644	-0.153	-0.119	0.047	-0.275*	-0.097
	(2.008)	(2.318)	(0.481)	(0.504)	(0.572)	(0.761)	(1.096)	(1.147)	(0.670)	(0.732)	(0.973)	(0.887)	(0.139)	(0.052)	(0.143)	(0.063)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The omitted dummy is "almost never" use the PEP Kids indoor facilities.

4.5.4. Evacuation experience

Intuitively, we expected that the indoor park treatment effect might be different between those who have experienced evacuation and those who have not. Tables 8.13 and 8.14 present the OLS and FE regression results. However, we observe that the interaction term (y3) is mostly not significant in both cases. The only significant coefficient was the FE regression on the peer problems, where evacuation implied significantly positive correlation between stress level and participation. (At the same time, the standard deviation is too small because this method of analysis causes the problem of alpha inflation.) Therefore, the treatment effect was about the same for those who did and who did not experience evacuation.

Table 8.13: Evacuation OLS Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	0.396	0.028	0.110	0.124	0.417	0.085	0.059	-0.145	-0.190	-0.035	0.250	0.101	0.047	0.001	0.002	0.009
	(0.708)	(0.325)	(0.298)	(0.153)	(0.273)	(0.120)	(0.346)	(0.134)	(0.229)	(0.089)	(0.337)	(0.152)	(0.045)	(0.020)	(0.039)	(0.019)
Evacuation	1.286	0.764	1.182**	0.622	0.435	0.161	-0.036	0.093	-0.295	-0.112	0.577	0.482	0.112**	0.038	0.018	0.014
	(1.588)	(1.012)	(0.600)	(0.404)	(0.495)	(0.317)	(0.622)	(0.409)	(0.369)	(0.250)	(0.514)	(0.363)	(0.055)	(0.037)	(0.064)	(0.045)
Evacuation*part.	0.243	0.499	-0.697	-0.047	-0.140	0.088	0.410	0.165	0.671*	0.293*	-0.572	-0.315	-0.094	-0.005	-0.027	-0.016
	(1.690)	(0.649)	(0.645)	(0.274)	(0.530)	(0.195)	(0.666)	(0.251)	(0.403)	(0.165)	(0.567)	(0.223)	(0.060)	(0.024)	(0.069)	(0.027)
With controls																
Participation	0.744	0.340	0.164	0.335*	0.695*	0.056	0.017	-0.086	-0.132	0.034	0.319	-0.022	0.104*	0.014	-0.039	-0.003
	(1.080)	(0.491)	(0.411)	(0.199)	(0.390)	(0.181)	(0.484)	(0.178)	(0.266)	(0.120)	(0.416)	(0.193)	(0.053)	(0.019)	(0.050)	(0.023)
Evacuation	1.527	-0.045	1.562***	0.516	0.287	-0.234	-0.101	-0.089	-0.220		0.548	0.641	0.113*	0.014	0.013	0.044
	(1.419)	(1.077)	(0.602)	(0.422)	(0.436)	(0.375)	(0.650)	(0.487)	(0.381)	(0.267)	(0.564)	(0.430)	(0.068)	(0.043)	(0.077)	(0.053)
Evacuation*part.	-0.883	0.448	-1.196*	-0.072	-0.335	0.141	0.176	0.064	0.472	0.315*	-0.398	-0.336	-0.122*	-0.006	0.005	-0.021
	(1.557)	(0.688)	(0.654)	(0.279)	(0.486)	(0.259)	(0.710)	(0.311)	(0.423)	(0.180)	(0.636)	(0.286)	(0.071)	(0.028)	(0.082)	(0.032)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8.14: Evacuation FE Regressions

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	0.192	0.016	-0.077	0.166	0.512	0.069	0.053	-0.173	-0.297	-0.047	0.502	0.168	0.049	-0.000	-0.003	0.009
	(0.901)	(0.403)	(0.377)	(0.188)	(0.350)	(0.151)	(0.376)	(0.189)	(0.224)	(0.069)	(0.555)	(0.141)	(0.043)	(0.019)	(0.042)	(0.016)
Evacuation	1.259	0.569	1.245	0.574	0.302	0.025	0.063	0.119	-0.351	-0.149	0.706*	0.693*	0.102*	0.020	0.033	0.036
	(1.432)	(0.906)	(0.754)	(0.573)	(0.333)	(0.336)	(0.486)	(0.336)	(0.221)	(0.190)	(0.381)	(0.346)	(0.056)	(0.041)	(0.042)	(0.039)
Evacuation*part.	0.087	0.535	-0.820	-0.043	-0.040	0.158	0.253	0.124	0.694***	0.296***	-0.512	-0.338**	-0.099	-0.002	-0.025	-0.020
	(1.417)	(0.516)	(0.695)	(0.291)	(0.379)	(0.185)	(0.503)	(0.206)	(0.203)	(0.098)	(0.451)	(0.161)	(0.062)	(0.022)	(0.062)	(0.016)
With controls																
Participation	0.332	0.162	0.077	0.300*	0.600	0.007	-0.132	-0.156	-0.213	0.012	0.654*	0.057	0.092**	0.011	-0.033	-0.005
	(1.213)	(0.477)	(0.485)	(0.155)	(0.474)	(0.215)	(0.418)	(0.235)	(0.215)	(0.082)	(0.370)	(0.138)	(0.042)	(0.015)	(0.056)	(0.026)
Evacuation	1.349	-0.027	1.543**	0.509	0.233	-0.224	-0.202	-0.108	-0.225		0.579	0.663	0.117*	0.016	0.014	0.043
	(1.291)	(1.215)	(0.551)	(0.596)	(0.350)	(0.481)	(0.607)	(0.381)	(0.310)	(0.246)	(0.483)	(0.404)	(0.061)	(0.050)	(0.030)	(0.033)
Evacuation*part.	-0.702	0.504	-1.250*	-0.086	-0.219	0.185	0.258	0.094	0.509	0.311***	-0.368	-0.369	-0.127*	-0.007	0.008	-0.021
	(1.557)	(0.511)	(0.672)	(0.275)	(0.463)	(0.231)	(0.629)	(0.212)	(0.302)	(0.094)	(0.511)	(0.233)	(0.066)	(0.029)	(0.051)	(0.016)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.

4.6. Heterogeneities across response time

In the pre-analysis plan, we wrote that we would omit the kindergartens with overlapping participation and questionnaire periods. In fact, there were no such preschools since the question asked about the situation in the past 30 days, and all preschools are included. However, about half of the respondents responded within less than two weeks after participation, making their response 'too early' relative to the intended times. Dropping all of them may have been significantly restrictive in terms of sample size, so instead we interacted to see whether the estimates differed importantly along the response time spectrum.

Tables 8.15 and 8.16 present the regressions from parents' surveys, and tables 8.17 and 8.18 present the ones from teachers' surveys. To get an overall picture, we divided the samples into two groups: early respondents (earlier than median) and late respondents (later than median[14]) Overall, we did not find that the response time significantly alters the regression coefficients. (For one kindergarten that did not participate at all, we assigned 'late' to all the responses because their responses were mostly concentrated in the late part of the response time spectrum.) Table 18 shows many statistically significant

[14] Median was 12 days for parents, and 19 days for teachers.

coefficients, but the round numbers indicate that these are driven only by one sample. And these coefficients go away when the control variables are added.

Table 8.15: Early OLS Regressions in Parents' Survey

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	0.853	0.417	-0.124	-0.075	0.413	0.143	0.338	0.123	0.226	0.225*	-0.117	-0.109	-0.000	-0.033	0.013	0.011
	(0.852)	(0.459)	(0.318)	(0.169)	(0.290)	(0.128)	(0.346)	(0.179)	(0.228)	(0.123)	(0.329)	(0.163)	(0.038)	(0.022)	(0.038)	(0.020)
Early	0.649	-0.286	0.021	-0.665*	-0.506	-0.296	0.517	0.500	0.617**	0.176	-0.334	-0.019	-0.083	-0.103**	0.050	0.001
	(1.363)	(0.905)	(0.791)	(0.377)	(0.365)	(0.291)	(0.713)	(0.377)	(0.286)	(0.236)	(0.504)	(0.348)	(0.079)	(0.040)	(0.067)	(0.042)
Early*part.	-1.092	-0.311	-0.012	0.410	0.235	-0.014	-0.557	-0.423*	-0.759**	-0.284*	0.542	0.176	0.079	0.070***	-0.073	-0.014
	(1.468)	(0.604)	(0.820)	(0.257)	(0.406)	(0.183)	(0.747)	(0.232)	(0.323)	(0.155)	(0.551)	(0.222)	(0.082)	(0.026)	(0.072)	(0.026)
With controls																
Participation	0.449	0.805	-0.203	0.198	0.255	0.032	0.196	0.241	0.201	0.334*	0.384	-0.159	0.041	0.000	-0.006	-0.009
	(1.168)	(0.699)	(0.402)	(0.234)	(0.412)	(0.225)	(0.489)	(0.281)	(0.290)	(0.192)	(0.431)	(0.268)	(0.048)	(0.023)	(0.046)	(0.026)
Early	-0.244	-0.692	0.172	-0.721	-1.255*	-0.628	0.042	0.202	0.798*		0.612	0.132	-0.092	-0.061	0.018	-0.081
	(2.378)	(1.422)	(1.133)	(0.499)	(0.643)	(0.458)	(0.936)	(0.604)	(0.470)	(0.388)	(0.796)	(0.534)	(0.094)	(0.057)	(0.101)	(0.063)
Early*part.	-0.687	-0.412	-0.351	0.252	0.890	0.104	-0.532	-0.452	-0.693	-0.315	-0.487	0.052	0.086	0.025	-0.088	0.014
	(2.417)	(0.802)	(1.151)	(0.302)	(0.658)	(0.274)	(0.959)	(0.329)	(0.464)	(0.225)	(0.825)	(0.324)	(0.092)	(0.029)	(0.108)	(0.031)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8.16: Early FE Regressions in Parents' Survey

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	0.234	0.274	-0.402	-0.147	0.351	0.109	0.179	0.077	0.106	0.234	0.389	0.025	-0.004	-0.053**	0.003	0.012
	(1.342)	(0.584)	(0.389)	(0.186)	(0.411)	(0.167)	(0.392)	(0.248)	(0.320)	(0.145)	(0.587)	(0.250)	(0.038)	(0.023)	(0.030)	(0.023)
Early	-1.065	-0.948	-0.399	-1.011**	-1.028**	-0.669	-0.440	0.062	0.802	0.671*	0.257	0.183	-0.099	-0.187***	-0.003	-0.018
	(2.001)	(1.314)	(1.128)	(0.454)	(0.438)	(0.477)	(0.662)	(0.491)	(0.481)	(0.348)	(0.892)	(0.657)	(0.099)	(0.043)	(0.071)	(0.055)
Early*part.	0.201	-0.030	0.245	0.544**	0.571	0.066	-0.030	-0.335	-0.585	-0.305*	-0.121	0.050	0.056	0.091***	-0.036	-0.014
	(1.927)	(0.577)	(0.921)	(0.224)	(0.459)	(0.202)	(0.838)	(0.214)	(0.405)	(0.173)	(0.810)	(0.284)	(0.104)	(0.025)	(0.062)	(0.029)
With controls																
Participation	-0.069	0.585	-0.347	0.099	0.155	-0.003	-0.017	0.166	0.140	0.323	0.860*	-0.037	0.028	-0.006	0.003	-0.014
	(1.053)	(0.654)	(0.439)	(0.198)	(0.419)	(0.224)	(0.256)	(0.240)	(0.263)	(0.197)	(0.442)	(0.372)	(0.048)	(0.029)	(0.047)	(0.038)
Early	-0.219	-0.244	0.090	-0.919*	-1.157**	-0.373	-0.173	0.330	1.021*		0.803	0.011	-0.091	-0.073*	0.026	-0.089
	(2.382)	(1.645)	(1.467)	(0.452)	(0.540)	(0.582)	(0.698)	(0.657)	(0.508)	(0.447)	(0.805)	(0.746)	(0.118)	(0.040)	(0.088)	(0.053)
Early*part.	-0.067	-0.360	-0.171	0.352	1.014*	0.078	-0.209	-0.434	-0.702	-0.355	-0.894	-0.003	0.088	0.030	-0.096	0.019
	(2.467)	(0.823)	(1.276)	(0.262)	(0.538)	(0.278)	(0.967)	(0.343)	(0.410)	(0.235)	(0.744)	(0.376)	(0.122)	(0.031)	(0.091)	(0.036)
Participation variable	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.

Table 8.17: Early OLS Regressions in Teachers' Survey

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	0.039	-0.186	0.148	0.020	-0.094	-0.153	-0.020	-0.004	0.003	-0.047	-0.453	0.143	0.329***	0.213***	0.254***	0.161***
	(0.891)	(0.567)	(0.216)	(0.139)	(0.313)	(0.208)	(0.462)	(0.314)	(0.241)	(0.177)	(0.397)	(0.279)	(0.061)	(0.045)	(0.059)	(0.046)
Early	-0.838	-1.845	0.257	-0.119	-1.152***	-1.277**	-0.190	-0.179	0.248	-0.209	-2.126**	-1.855**	0.350***	0.098	-0.157	-0.108
	(1.651)	(1.785)	(0.510)	(0.405)	(0.394)	(0.537)	(0.832)	(0.872)	(0.753)	(0.575)	(1.043)	(0.778)	(0.066)	(0.068)	(0.105)	(0.073)
Early*part.	1.389	2.261	-0.255	0.132	1.333***	1.356***	0.406	0.366	-0.067	0.381	1.500	0.954	-0.403***	-0.116**	0.207*	0.130**
	(1.765)	(1.681)	(0.532)	(0.375)	(0.442)	(0.500)	(0.892)	(0.818)	(0.776)	(0.553)	(1.094)	(0.707)	(0.071)	(0.056)	(0.108)	(0.065)
With controls																
Participation	-10.162***	-0.542	-0.245	-0.285	-3.404***	-0.266	-5.155***	-0.098	-1.293	0.042	4.432**	0.666	-0.054	0.037	-0.057	-0.025
	(3.280)	(1.112)	(1.007)	(0.242)	(0.934)	(0.358)	(1.659)	(0.627)	(1.073)	(0.322)	(1.785)	(0.493)	(0.110)	(0.030)	(0.110)	(0.042)
Early	-8.185*	1.291	0.236	0.578	-3.160***	-0.683	-5.045**	0.044	-0.301	1.551**	0.781	-2.873**	0.002	-0.019	0.117	0.061
	(4.576)	(2.359)	(1.191)	(0.622)	(0.908)	(0.666)	(2.136)	(1.238)	(1.695)	(0.776)	(2.431)	(1.152)	(0.107)	(0.072)	(0.198)	(0.095)
Early*part.	9.547**	-0.350	-0.214	-0.429	3.692***	0.906	5.349**	-0.018	0.957	-0.817	-2.089	1.385	-0.019	-0.023	-0.033	0.033
	(4.744)	(1.974)	(1.259)	(0.469)	(0.980)	(0.575)	(2.230)	(1.018)	(1.723)	(0.662)	(2.502)	(0.922)	(0.114)	(0.052)	(0.203)	(0.076)
Participation variable:	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8.18: Early FE Regressions in Teachers' Survey

	Total Difficulties		Emotional symptoms		Conduct problems		Hyperactivity /inattention		Peer problems		Prosocial behaviors		Change in total score		Change in prosocial behaviors	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Without controls																
Participation	-12.000***	0.457	1.000***	-0.113	-3.000***	0.089	-7.000***	0.268	-3.000	0.161	3.000	0.348**	-0.028	0.031	-0.025	-0.021
	(0.000)	(1.059)	(0.000)	(0.155)	(0.000)	(0.315)	(0.000)	(0.553)	(.)	(0.188)	(.)	(0.164)	(0.145)	(0.030)	(0.059)	(0.016)
Early	-11.750***	0.761	1.059**	0.087	-3.625***	-0.491	-7.008***	0.170	-2.150***	1.178**	1.152	-1.127	-0.104	-0.150*	0.124*	0.028
	(1.044)	(3.326)	(0.511)	(0.872)	(0.471)	(0.971)	(0.276)	(1.323)	(0.085)	(0.491)	(1.228)	(1.031)	(0.157)	(0.074)	(0.062)	(0.077)
Early*part.	12.500***	0.034	-1.031***	-0.073	3.744***	0.564	7.206***	0.062	2.771***	-0.500	-2.051	0.234	-0.065	-0.011	-0.028	0.064
	(0.587)	(2.146)	(0.310)	(0.425)	(0.257)	(0.497)	(0.314)	(0.878)	(0.094)	(0.502)	(1.369)	(1.090)	(0.151)	(0.044)	(0.069)	(0.049)
With controls																
Participation	-11.010***	0.816	0.719**	-0.209	-2.908***	0.199	-5.918***	0.543	-2.806***	0.246	2.622***	0.201	-0.047	0.004	-0.005	-0.002
	(1.019)	(1.056)	(0.324)	(0.155)	(0.281)	(0.333)	(0.440)	(0.585)	(0.299)	(0.146)	(0.553)	(0.221)	(0.155)	(0.036)	(0.054)	(0.020)
Early	-8.609***	2.957	1.339***	0.516	-2.727***	0.024	-5.608***	0.721	-1.608***	1.860***	-1.305***	-2.813***	-0.068	-0.177***	0.187***	0.032
	(0.727)	(2.512)	(0.216)	(0.730)	(0.187)	(0.841)	(0.417)	(1.153)	(0.190)	(0.244)	(0.420)	(0.433)	(0.150)	(0.058)	(0.047)	(0.066)
Early*part.	10.551***	-0.766	-1.104**	-0.309*	3.213***	0.502	6.143***	-0.067	2.536***	-0.839***	-0.214	1.169***	-0.115	0.001	-0.070	0.089***
	(1.208)	(1.065)	(0.494)	(0.148)	(0.397)	(0.343)	(0.416)	(0.561)	(0.266)	(0.163)	(0.519)	(0.195)	(0.140)	(0.036)	(0.059)	(0.026)
	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number	Binary	Number

Note : Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. FE also has clustered standard errors at preschool levels.

4.7. Discussions:

There are three possible explanations for these results:

1. Actual negative impact: Though it is possible that some indoor facilities made children tired, it is hard to think of the correlation as causal—this contradicts qualitative evidence from the field and psychological and psychiatric theories cannot explain these. Even after seeking advice from psychologists and psychiatrists, we cannot find any possible reason why playing would negatively affect mental health.

2. Reverse causality: From the analysis of the sub-group with outdoor playing experience, we found that the reported negative correlation was concentrated among the parents who regularly prohibit children from playing outside. They may be the ones that wanted to let their children take part in the indoor park programme, and therefore participation may have been positively correlated with stress levels.

3. Upward reporting bias: These measured stress levels are parents' and teachers' perceived stress levels of the children. One possible explanation, therefore, is that parents and teachers have an incentive to misreport the children's health levels more negatively to demonstrate the usefulness of continuing the indoor park programme. Those who participated may know that the implementation of the programme was very costly, and may have wanted to justify the continuation of the programme by reporting that the children have poor psychological health. Or, those who participated realised the programme is beneficial, and may have wanted to demonstrate the need for the programme because they were aware of the possibility that it may not be continued. This explanation would be consistent with the heterogeneity that the positive correlation was found among those who prohibit children from playing outdoors and regularly use indoor facilities. Because parents and teachers may feel that, if they filled out the survey saying that children do not have stress issues the Red Cross may terminate the programme, they may bias their report in the negative direction if they know the benefit of the programme.

5. Conclusion

Given evidence from psychiatry, some anticipate that high stress levels among children in Fukushima may have long-term consequences. Therefore, many post-disaster charities have aimed to alleviate such concerns. This study aimed to identify the extent to which the short-term indoor park programmes can help improve the psychological health of children. Tsutsui *et al*. (2011) had already suggested that the impact of indoor playground may be limited. Unfortunately, no causal statement can be made regarding the direct effectiveness of the programme due to lack of randomization. However, ambiguous and inconsistent coefficients indicate that the programme is unlikely to have had a meaningful impact on the psychological welfare of the children.

This study has two major limitations: lack of randomization (no causal statement) and problems of outcome measurement. Participation is not random with respect to observable characteristics, so it is unlikely to be random with respect to unobservables either. The survey used was one that had originally been intended to observe annual impressions, and most of the responses came in too soon after the programme was implemented.

During the course of the study, it was decided to finish the programme in 2013 as there was not sufficient funding to continue it. As the circumstances of funding and anxiety change rapidly in a post-disaster environment, our findings here may not be applicable in the years after the conclusion of the programme. This research highlights the challenges of establishing external validity in a post-disaster environment where evidence is needed.

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