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This is the published version of a paper presented at *Internoise*.

Citation for the original published paper:

Sjödín, F., Neely, G. (2015)

Child group constitution and its relation to noise in preschools.

In: Courtney Burroughs and George Maling (ed.), *Internoise 2015*

N.B. When citing this work, cite the original published paper.

Permanent link to this version:

<http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-107639>



Child group constitution and its relation to noise in preschools

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During recent years in Sweden the number of complaints regarding hearing related disorders from employees working in preschools (kindergarten) has increased. It is often assumed that the size of the child group is the crucial factor associated with the high noise levels. However, the association between the noise levels and the size of the child group is not fully understood. Further, it is likely that the gender balance and the age of the children have an effect on the noise levels in the preschools. The aim of the study was to investigate the association between noise in the preschool and the constitution of the child group in terms of number of children, gender balance and the children's age. Noise levels were recorded at 34 preschool sites in Sweden using stationary sound level meters with an external microphone mounted in the ceiling in the dining room and the play halls at each site. Sound level measurements were carried out during 2-3 days in each room during the entire workday. Data regarding the constitution of the child group for every day was collected at the end of the week from the enrollment list.

1 INTRODUCTION

Reports regarding hearing related disorders such as hearing impairment and tinnitus from workplaces traditionally not considered as noisy, such as preschools (kindergarten) has increased during the last years in Sweden.¹ Half of all work related hearing disorders reported by women in Sweden comes from women working as preschool teachers. Beside the risk of developing hearing impairment the noise exposure in the preschool also increases the risk of developing other hearing related disorders such as tinnitus and hyperacusis. The prevalence of tinnitus in the common population has in some studies been suggested to be approximately 10-15%.²⁻⁴

A previous study, made in Swedish preschools, showed a prevalence around 30 % regarding tinnitus among the teachers.⁵ Previous studies has also shown that the main noise source in the preschool is the children's voices.^{5, 6} Studies have also shown that the equivalent

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sound level during the working days for some teachers exceeds the Swedish occupational noise limit of 85 dBA_{Leq} during a working day.⁵

It is often assumed that the size of the child group is the crucial factor associated with the high sound levels. Beside increasing the risk of hearing disorders, high and fluctuating sound level as in the preschool with a speech content is more likely to catch the attention of the personnel.⁵ This in turn make the daily work further demanding when high levels of concentration is needed.⁷ Although the association between the sound levels and the size of the child group in a previous study has been shown to be correlated,⁸ this association is not fully clarified. It is likely that the gender balance and the age of the children also have an effect on the sound levels in the preschools.

The aim of the study was to investigate the association between noise in the preschool and the constitution of the child group in terms of number of children, gender balance and the children's age.

2 METHOD

Noise levels were recorded at 34 preschool sites in Sweden using stationary sound level meters (Brüel and Kjaer 2260 Investigator) with an external microphone mounted in the ceiling at two meters height in the dining room and the play halls at each school. The sound level meter was calibrated using a Brüel and Kjaer Sound calibrator 4231 before each measurement. Sound level measurements were carried out during for 2-3 days in each of the different rooms at the preschools during one work week. Measurements were carried out between 6 am to 6 pm each day. The sound level meters were set to log equivalent dB(A), C peak up to 135 dB(C) and dB(A)max each minute with the release time set to Fast. The range for the recorded sound level was 40-120 dB(A) with 1/3 octave bandwidth.

3 RESULTS

The sound level measurements showed that the equivalent sound level was about 64 dBA for both the dining rooms and the play hall. The maximum registered sound level was about 106 dBA for both rooms. The number of children present during the days of the measurement were in average about 14 children. Lowest number of children registered during the days of measurement was 4 and at most there were 22 children present. The gender balance was equal with about 7 boys and 7 girls in average (see Table 1).

Table 1 - Descriptive data of the sound levels and the constitution of the child groups.

	Mean	Min	Max	SD
Dining room dBA _{Leq}	63,9	56,6	70,7	2,5
Dining room dBA _{Max}	97,9	90,1	106,2	3,4
Play hall dBA _{Leq}	64,2	51,5	69,7	3,0
Play hall dBA _{Max}	97,4	0,0	106,7	11,9
Age of the child group	3,3	1,5	5,0	0,9
Number of children	13,6	4,0	22,0	3,5
Number of boys	6,6	2,0	12,0	2,2
Number of girls	7,0	1,0	15,0	2,3

Pearson's correlation revealed no significant associations regarding the number of children, age and measured sound levels in terms of equivalent or maximum dBA for the two different rooms. A significant positive correlation was however observed regarding the gender balance of the child group and equivalent dBA in the play hall. The results showed that with an increase in number of boys in relation to girls, the noise levels increased ($r = 0.24$, $P < .05$).

No significant results ($P > .05$) were observed in a multiple regression model for the factors number of children, gender balance and age with the sound level in the dining room as dependent variable. However; the same model for the play hall was statistically significant ($P < .05$). The analyses revealed that about 9 % of the variance in the measured sound levels in the play halls could be explained by the constitution of the child group (see Table 2). Noteworthy is that the number of children was not statistically significant in the model.

Table 2 - Summary of the multiple regression model predicting equivalent sound level dBA in the dining rooms and the play halls.

	Model Dining room dBA _{Leq} (Adj R ² = .015, P = .23)			Model Play hall dBA _{Leq} (Adj R ² = .093, P = .02)		
	B	t	P	B	t	P
Number of children	-.12	-1.3	.21	-.12	-1.2	.24
Gender balance	.15	1.2	.09	.32	2.5	.02
Age of the children	.24	0.7	.52	1.02	2.3	.02

4 DISCUSSION

Previous research has shown that the noise levels in the preschools are high and this is mostly due to the noise generated by the children^{5, 6}. On this basis, this study aimed to investigate what factors regarding the constitution of the child group that mostly contribute to the sound level.

Interestingly, the association between the number of children and the measured sound level was not present. Considering the physics of sound, the sound level should increase with 3 dB when doubling the number of noise sources. This seems not to be the case if the children in the preschool are considered as individual noise sources.

The results from the regression models indicate that the sound level in the dining room, where most of the pedagogic activities are carried out together with the support of the preschool teachers, is not associated with the constitution of the child group. This was however not the case when analyzing the sound levels in the play halls. More boys and higher ages seems to be associated with higher noise levels in the play halls where the children to a higher degree are allowed to play freely.

These results indicate that the pedagogic work that is being carried out by the preschool teachers, mostly in the dining room, manages to keep the noise level rather stable overtime regardless of how many children, the age of the children and the gender balance of the child group that are present. It seem as if without the guidance and attention of the preschool teachers the actual impact the characteristic of the child group may have on the noise level become more pronounced.

It is noteworthy that the variance observed in the noise levels for the play halls is only explained to about 9 % by the constitution of the child group. Other factors may explain the variance to a higher extent. Further research need to consider factors such as facilities, outdoor environment, staffing and social economic status of the children.

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