

Opportunities for a health-promoting workplace at preschool

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Preschool occupational environment is predominantly discussed in terms of risks and hazardous exposure to infections and musculoskeletal problems, and indoor environment most commonly studied. However, outdoor environment is increasingly acknowledged as an important factor in triggering healthy behaviors, as has been proven in children. Such impact on the workforce is unknown. Widespread and disparate health risks – e.g. the lack of daily physical activity and solar overexposure are responsible for obesity-related disease and skin cancers. Criteria for occupational outdoor environment are seldom discussed. Data from 52 volunteering employees at 9 preschools involved in a study investigating children's physical activity and sun exposure vs. the quality of the environment are used to discuss the potential of physical environment to trigger healthy behaviours in the workforce as well.

Background

In Sweden a high number of employees work in day care as more than 90 percent of the child population aged 1-5 years attend preschool as both parents work (1). The occupational environment at preschool has been subject to several studies with focus on the exposure to children's infections (2-4), burden on the musculoskeletal system, e.g. when changing nappies (5), high-pitched noise (6) as well as the indoor environment and the emission on substances from building materials which has caused allergies among the staff (7). In recent years, hygiene and the daily run of handling hygiene in order

to prevent the spread of infections has been increasingly surveyed (8). On the other hand the outdoor environment has not been subject to the same interest in spite of several potential health risks such as air pollution from traffic in the city cores, scorching sun, cramped outdoor spaces and other increasingly frequent obstacles to outdoor stay related to understaffing and crowding. In adults the healing impact of greenery has been observed in postoperative inpatients at hospital (9), as well as generally in urban environments (10). But it remains to be seen if a high quality environment at preschool

which promotes children's health also promotes that of the staff.

Low levels of physical activity have been observed to be related to low mobility (11). Adults are recommended >30 minutes of daily moderate to vigorous physical activity, such as to run and to play badminton (12) for cardiovascular health gains, which is estimated to equal >8000 steps per day (13, 14), and for weight control additional 2000 steps are recommended, i.e. 10000 steps per day (15). Studies with pedometry have to our knowledge not been published in Sweden. However, unpublished, non-experimental pedometry has been reported in nurses (12496), office clerks (5144), IT administrators (2459) and plumbers (9807) which gives an indication of workplaces as a potential for the opportunity of physical activity.

Workforces working with children at preschool do seemingly have a physically occupation with a great potential of health promoting outdoor stay. The question is if the employees obtain the recommended levels of physical activity corresponding to 10000 steps per day (15-18) and stay below the threshold values for harmful solar exposure during late spring and summer. In western societies 80-90 % of all skin cancer is caused by an overexposure to solar ultraviolet radiation (UV) (19, 20). Whereas children's overexposure is likely to be unintentional, there may be adults who want to sunbathe, i.e. they intentionally expose themselves to the sun. In young preschool children UV exposure has been observed to

be as high as in adults in environment providing shade, whereas UV exposure in the older children was lower. A plausible explanation was that the younger children stayed close to the adults who preferred to stay in the sun, whereas the older children extended their range of action to play among trees and bushes (21). At the same time outdoor environment may have a health-promoting potential to counterbalance straining assignments indoors. By attracting children's play to lush, low-reflectant vegetation which is integrated in their play they may play outdoors all day long or at least the better part of the day without risking sunburns (21, 22). Such environment further contributes to the level of recommended physical activity for children (23-25), and has a stabilizing impact on attention abilities (26). But does this health-promoting impact apply to the staff?

In Sweden the majority of all 18-month-old children enter preschool (1). Parents are guaranteed admission to preschool for their child within three months after submitting an application to the municipality. Increasing the size of the classes is one way to fulfill this pledge with overcrowding as a result, and one solution is this situation is to take turns using the indoors and the outdoors. Outdoor education preschool has therefore become popular. Thus, outdoor environment has become an important affordance to be developed. But in its occupational context the outdoor environment is a fairly unexplored field, even less its impact on preschool staff. As outdoor stay is more likely to occur when the

environment outdoors is perceived as attractive (27) its role becomes in extension relevant for children's health as well. During one week (5 days) in May 2009 a study was carried out at 9 preschools in Malmö where the combined impact of children's physical activity and sun exposure was studied. The staff in charge of the children was offered to participate, which 52 of the employees did.

Method

The methods applied were multi-faceted due to the transdisciplinary nature of the study. The same methods were used to investigate the staff as those on the children.

Assessment of the outdoor environment: The outdoor environment was assessed according to a tool developed at the Swedish University of Agricultural, as described by F. Mårtensson (OPEC) (23, 25, 26). The assessment is based on the size and topography of the surface, and the vegetation integrated in children's play. Further, the sky view was photographed using a fish eye lens from the positions mostly used for play. Thereafter the proportion of free sky was computed applying an established method (28, 29).

Questionnaires and protocols: The staff was asked to describe their outdoor environment by a validated questionnaire containing 20 adjectives (27) (exciting, multileveled, dull, spacious, small, lush, tidy, varied, cozy, meager, boring, worn, windy, flat, serene, messy, funny, delicate, child-friendly, abundant). The adjectives were scored

in the analysis as positively or negatively relevant for physical activity and sun exposure (positive = +1, negative = -1). The sum of positive and negative adjectives was then used in the analysis. All preschools were fully staffed during the week of measurement. Arrivals, departures, times in- and outdoors and extramural activities were clocked and recorded. The questionnaire also contained questions about time period of employment, education, health, sleep, susceptibility to infections, medication, mental stress or stimulation, the social climate at preschool, cooperation staff and parents, learning goals, policies regarding composition of the classes considering children's age and gender, sick leave and written guidelines for hand hygiene (staff and children), and what is experienced as cumbersome when going outdoors with the children, (bad weather, heat, cold, strong sun, heavy rain etc.), and what encourages outdoor stay (less noise, happy and balanced children, fewer conflicts, boys and girls playing more together, etc.).

Measurement of physical activity: Physical activity was measured with Yamax Digiwalkers SW-200, MLS 2000 (Fig. 3) and is presented as steps and steps per minute (24), and as means for each one of the 9 preschools. For the measurement of erythemally effective solar UV exposure (i.e. the sun's burning capacity) small polysulphone dosimeters were used (Fig. 4). In order to compute relative UV exposure (i.e. exposure in relation to available global UV radiation during outdoor time) diurnal measurement of UV radiation was made

(23, 30, 31). Both relative and absolute UV exposure, expressed as Joule/m² (J/m²) are accounted for.

Evaluation and analysis: Bivariate, non-standardized analysis was applied to compute correlations between OPEC and the staff's assessment of their outdoor environments, and for the correlation between the staff's and the children's physical activity and solar UV exposure (Table 1).

Results and discussion

The 52 participants (7 males) were on charge of totally 718 children aged 3.0-5.9 years (together with staff who did not participate in the study) when the measurements were made. The staff density (one adult per 5-6 children) was the same at all preschools. The staff ranged in age between 24 and 65 years, and had worked in preschool services

between a few months and 42 years. They were evenly distributed across ages but not across preschools.

The preschools that scored high in OPEC were also assessed as more positive by the staff, and vice versa. Positive and negative assessments via the adjectives related to physical activity and UV exposure respectively were significantly correlated as well, i.e. the more positive assessment the more physical activity and the less risk of harmful UV exposure (UV exposure $p=0.01$, physical activity $p<0.001$) (Table 1.) (Figs. 1a and b).

In good environment the staff was exposed to less UV (75 J/ m² daily), and the mean relative UV exposure was 25% of all available UV radiation during outdoor time compared to 38% (120 J/ m²) in those who worked in

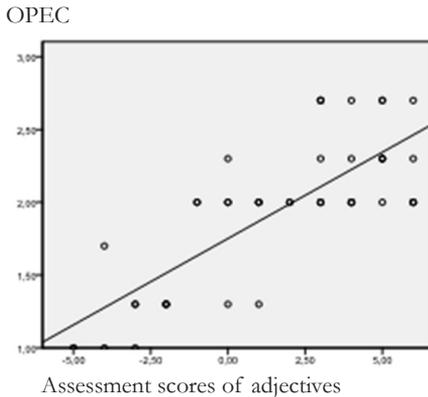
Table 1. Non-standardized correlations, bivariate analysis

	Physical activity (steps/minute), staff, means for each preschool	Relative UV exposure, staff means for each preschool	Physical activity (steps/minute), staff, individual counts	Relative UV exposure, staff, individual values
OPEC*	<0,001	<0,001	Ns	<0,01
Sky view*	Ns	<0,001	Ns	<0,001
Physical activity, girls, means for each preschool	<0,001	<0,001	-	-
Physical activity, boys, means for each preschool	Ns	<0,001	-	-
Relative UV exposure, boys and girls**, means for each preschool	<0,05	<0,001	-	-

*) The correlation between OPEC and sky view was $r=0.18$ (<0.001)

**) UV-exposure did not differ between boys and girls

Figure 1a. The correlation of OPEC and environment assessment and the net value of adjectives positively or negatively related to physical activity. Malmö 2009. ($p < 0.001$).

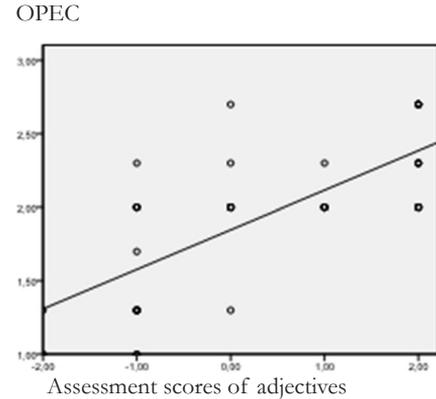


Adjectives assessed as generating physical activity: exiting, multi-leveled, specious, lush, varied, cozy, serene, child-friendly, abundant
 Adjectives assessed as counteracting physical activity: dull, small, meager, boring, flat, worn, windy

the environments that scored lower ($p < 0.01$) (Figs. 2a and 2b). In practice this means that it is possible for the staff to be outdoors during the whole or the better part of the day without getting too much sun if they work in good environments according to our definition. The sky views from the children's favored play locations too were smaller in the environments scoring high compared to those of the ones scoring low (25). Only three staff members exceeded 200 J/ m², which is the critical threshold value for fair, unadapted skin during late spring.

Step counts ranged from 2.8 to 32.5 steps per minute during a whole workday. In high-score environment (dichotomized) 61 % of the total work time took place outdoors, compared to

Figure 1b. The correlation of OPEC and environment assessment and the net value of adjectives positively or negatively related to UV exposure, Malmö 2009. ($p < 0.01$).



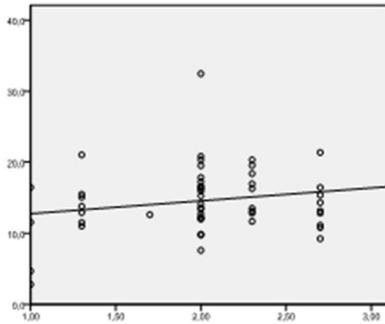
Adjectives assessed as generating sun-protective behavior: lush and abundant
 Adjectives assessed as counteracting sun-protective behavior: meager and windy

25% at preschools with low-score environment ($p < 0.001$). Physical activity did not differ (14.6 vs. 13.1 steps per minute, 7429 vs. 6700 steps). The preschool as a unit explained only 10% of this variation. The children were clearly more physically active than the staff ($p < 0.05$). The difference in physical activity that could be explained by the environment thus only applied to the children but not to the staff. However, a significant positive relationship was observed between the staff's UV exposure and that of the children (Table 1). We do not know why high-score environments added merely 700-800 extra steps for part of the staff during an ordinary whole workday. However, these numbers are uncertain due to certain drop-out. To judge from our experiences of the observations during

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Figure 2a. The correlation between steps per minute and OPEC scores, Malmö 2009 (non-significant but a visible trend)

OPEC



Steps per minute

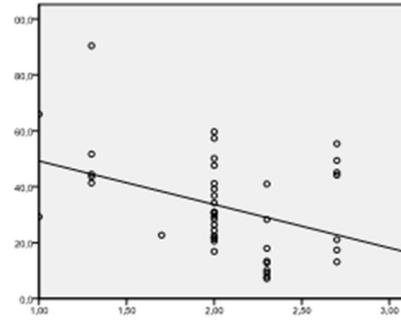
the week of fieldwork we suspect that a representative sample of the staff would have resulted in even lower step counts.

The great difference in step count may depend on varying assignments. Physical activity also varied greatly between days and between members of a work team at almost all of the preschools. These differences were not related to age nor education and possibly reflect differences in assigned duties, e.g. paperwork indoors. So even if there was a potential for increased physical activity in children during an ordinary day at preschool the reasons for physical activity are not the same as for the adults. To encourage physically active play in children does not automatically imply that the adults themselves are physically active.

In this study 20% of the participants obtained >8000 steps per work day (unrelated to age), and only few obtained an average of 10000 steps. Ho-

Figure 2b. The correlation between relative UV exposure and OPEC, Malmö 2009 ($p < 0.001$)

OPEC



Relative UV exposure

wever, time off may contribute considerably, particularly in women who traditionally are more responsible for housework (16, 17). Those who obtained 10000 steps were predominantly found at two preschools, one high-, and one low-score. The low-score one was accommodated in a two-storey building with the sections participating in the study on the upper floor which may explain high step counts. The other one was an outdoor education preschool where taking long walks with the children was a daily routine.

At one of the preschools with 5 male and 11 female participants the considerably higher step counts in the males may tell a story of gendered assignments. The step counts of both boys and girls were considerably higher than those of the staff, and the girls' but not the boys' step counts were significantly correlated to those of the staff ($p < 0.001$) (Table 1). In summary, we conclude from these measurements and observations that activity

levels may reflect gendered coding of how tasks are assigned at preschool. The male staff seems to be closer to the children, more outdoors and more actively participating in the children's playful and social activities. The female staff with generally lower step count rather tends to paperwork and of physically heavy but cumbersome tasks. It is most likely that the more stationary female staff act as role models for the girls in a way that may contribute to less physical activity in them. Other obstacles for both children's and staff's physical activity may be found in unpractical stops on the route between the indoors and outdoors such as locked passages that stop children's joy of mobility and which requires much surveillance for part of the staff.

The staff's step count was not related to the weather but the children were less active during the two days when the weather was rough (wind and rain, cold for the season). But in bad weather too, good rather than poor environments encouraged outdoor stay and thereby higher levels of physical activity which was thus due to the environment and not the weather. The last day of measurement when the weather was fine the staff too presented with higher step counts than on the other days. But previous observations have also shown that rainy weather may contribute to physical activity in poor environments, possibly as rain water may trigger physical activity in meager environment (15). But the staff may have had a feeling of being confined to the area without any chance to leave the preschool area, unless it was

an outdoor preschool which enabled walks straight off without any special preparations as everybody was already outside. Thus, on rainy days the staff took most steps indoors. But by preschool the staff's outdoor time was almost identical to that of the children. The high correlation between the staff's and the children's relative UV exposures was another indicator of the staff being close to the children (Table 1).

Outdoor play is generally regarded as valuable in Swedish preschools (32). A previous study (27), like this one, confirms that the staff spends more time outdoors with the children in high-quality environment or is assessed by the staff as having good qualities (via the adjectives). A preschool with a design that promotes physical activity may also be regarded as a good occupational environment, even though assessment of the own environment was not significantly related to one's own step counts. Obviously something more is required for the outdoor environment to promote physical activity in the staff, and their work situation thus becomes an important parameter to increase "ungendered" play with similar levels of physical activity in boys and girls. With spacious, green environment at hand the staff describes how children safely and smoothly may run off to disappear into physically adventurous games without any major conflicts. It is a challenge to develop outdoor environment that combines high play potential for the children, and that makes the staff feel that they can let the children move freely around, without

needing to spend too much effort on surveillance, with the risk of becoming too stationary themselves and thus get too little daily physical activity.

Conclusion

Although only 48% of the staff participated in the study the results indicate that outdoor environment of good quality (as assessed by OPEC) may also trigger physical activity in the staff though but not sufficiently. A study design needs to be developed that captures the ways in which daily routine in the pedagogical situation is carried out, including solutions that stimulate the workforce's physical activity and recovery, without inhibiting the children's physical activity.

The OPEC tool that was originally developed to assess the elements in the environment that generate physical activity in children was not sensitive for the factors to capture step count in the staff. However the sun-protective potential (as assessed by OPEC) resulted in the same sun-protective behavior that was quite self-triggered in both staff and children even though OPEC had never been applied to adults. Nevertheless OPEC scores were highly correlated to UV exposure (both individually and by preschool means), and to the staff's own assessment via the adjectives which shows that this mode of assessment may work as an alternative method of evaluation for outdoor environment.

Maybe the correlation between OPEC scores and steps per minute as observed in the children but not in the staff

could have depended on the fact that the preferences of the staff were not considered in the study. Maybe they go about their duties indoors, and once outdoors they watch the children from one position from which they can survey the area. But yet the staff's relative UV exposure was strongly correlated to that of the children.

Research so far regarding the risk of skin cancer for various occupational categories does not include preschool staff (33), and the role that their outdoor environment may play in this context has never been previously assessed. Such observations may contribute to the understanding of what encourages or deters them to be physically active and to protect themselves from strong sun. Outdoor occupations imply a doubled risk of non-melanotic skin cancer (19, 34, 35). Preschool staff working in outdoor education preschools would fall into the same category unless the outdoor environment invites to sun-protective behavior. A study among gardeners has shown that natural shade may result in different UV exposures (36). In our study population good environment made relative UV exposure drop by 43% which is sufficient to enable outdoor stay during the better part of the day without and sunburn risk (unless intentionally exposed). Chilly weather could attract activities to open spaces when the sun is out and thus result in intentional exposure. Yet, many trees and much other greenery may be a valuable asset not only for the children but also for the staff. Daily, moderate amounts of UV exposure (<200 J/

m2) is sufficiently low to avoid sunburn but yet enough to form Vitamin D (37, 38). Also, sun exposure by regular work outdoors has even been linked to decreased melanoma risk (34). In conclusion, it is worthwhile to draw on and to develop the potential of such environments to increase physical activity in the preschool workforces.

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