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ORIGINAL ARTICLE

Infection prevention at day-care centres: Feasibility and possible effects of intervention

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Abstract

Objective. To study the effect of an educationally oriented intervention programme, with the recommendations from the National Board of Health and Welfare as a base. *Design*. A prospective intervention study. *Setting.* Six day-care centres in Växjö, Sweden. Three centres comprised the intervention group and three constituted the control group. *Subjects and main outcome measures*. The parents and personnel completed a questionnaire on their views concerning information about infectious diseases. During a nine-month period, parents of all children reported every episode of absence, the number of days absent, the cause of absence, and any contact with doctors or prescription of antibiotics. *Results*. The guidelines were implementable in routine child day-care. Parents found regular information valuable and felt better informed about infectious diseases. Multilevel analyses showed no statistically significant results of the intervention. "Infection-prone" children had more sickness absence, doctor's consultations, and antibiotic prescriptions than those not "infection-prone". *Conclusion*. It is possible to implement an educationally oriented intervention programme directed against infectious diseases in child day-care. No significant effect of the intervention was found, which is why a larger intervention study is needed.

Key Words: *Day-care centre, intervention, parents, pre-school children, respiratory tract infections*

Pre-school children attending day-care centres contract more infections than children who spend the day at home [1,2] and their care utilization is greater [3,4]. Absence due to illness is higher among children in day-care centres than among children in the care of child minders [5].

Infectious diseases account for at least 90% of sickness absence among children at day-care centres, and 60–70% of sickness absence is due to respiratory tract infections [5,6]. The excess morbidity is to a large extent a result of the increased exposure to infectious agents, because many children spend the day together in a confined space [7]. Factors in the indoor and outdoor environment, daily routines, and knowledge among the staff and parents may be of importance for the spread of infection, morbidity, and care utilization.

Although infections rarely pose a serious threat to their health, a number of problems often arise concerning the care of the children, problems that may have important consequences for the children themselves, their parents, and the staff of the day-care centres. Many of the problems with resistant respiratory tract bacteria have led to a focus on day-care centres and the consumption of antibiotics as risk factors [8].

Methods on how to reduce contagion in child day-care are sparsely investigated.

- A small intervention study was carried out at six day-care centres.
- It was possible to implement the educationally oriented intervention programme directed against infectious diseases.
- No statistically significant effect was shown in this small study, which is why a larger intervention study is needed.

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In the end of the 1990s, the Swedish National Board of Health and Welfare drew up recommendations on how to handle infections in children and reduce contagion in day-care centres [9]. Using these recommendations, we carried out a small intervention study at six day-care centres in Växjö to see how personnel and parents comprehended them. We wanted to see if there was a reduction in sickness absence, care utilization, and consumption of antibiotics.

Material and methods

Population

The study was conducted at six municipal day-care centres in Växjö. All centres consisted of one infant department with 12 to 15 children aged 1–3 years, and two departments with 17 to 21 children aged 3–5 years. They were located in the same type of buildings in comparable residential areas, with a similar outdoor environment. Three centres were chosen at random for the intervention, while the others served as controls.

At the start of the study there were 154 children and 31 personnel in the intervention day-care centres and 157 children and 32 personnel in the control group. During the nine-month study (September to May), 10 and 9 children respectively left the centres owing to a new baby in the family. Children who started attending day-care later than one month after the study start were not included.

Questionnaire

At the study start all of the 63 personnel at the six day-care centres anonymously completed a questionnaire on guidelines for how to manage infectious diseases. In the end all personnel, except for two at the control day-care centres, completed the questionnaire once more.

At the beginning of the study the parents of 140 (91%) of the children in the intervention group and of 145 (92%) in the control group completed a questionnaire concerning characteristics of the family.

At the same time 127 (82%) and 117 (74%) of the parents, respectively, also anonymously completed a questionnaire about the receipt of information concerning infectious diseases in children. This questionnaire was answered once more by 111 (72%) and 124 (79%), respectively, at the end of the study.

Intervention

At the beginning all personnel were made aware of the recommendations of the Swedish National Board of Health and Welfare, the provisional version [9] by three of the authors and each department was given a copy.

In the course of the study, liquid soap and paper towels were used instead of terry towels and bars of soap. Personnel were urged to take the children outside as much as possible, but no exact number of hours was specified. A study day on outdoor pedagogy was arranged for the personnel. Posters with information on respiratory tract infections and contagion were placed near the entrances.

In connection with parents' meetings, one at the start of the study and one while the study was in progress, the authors informed the parents about infectious diseases and contagion. The use of antibiotics to cure infections in pre-school children was discussed, as was the risk of developing resistance through overuse.

Control

At the control day-care centres the parents and personnel were informed at the start of the aim and arrangement of the study. No other activities were undertaken.

Monitoring

After each episode of sickness absence, all the parents completed a special form concerning the reason for the child's absence, the length of the sickness episode, whether a doctor had been consulted or if antibiotics had been prescribed. The diagnoses otitis media, tonsillitis, and pneumonia had to be confirmed by a doctor. Otherwise our diagnoses were based on the parents' own reports. The parents' reports regarding sickness absence were validated against the staff's own absence lists regarding the number of sickness episodes and absent days.

Statistics

The children were nested within departments, i.e. a clustering above the individual level. This level could have an effect on the behaviour of the children or the personnel. To make a correct statistical analysis of our material, we used multilevel Poisson regression analyses [10–12].

The analyses were performed using children at the first level and departments at the second level. Sickness absence (total days and total episodes), doctor's consultations, and antibiotic prescriptions were used respectively as dependent factors of intervention. Individual variables at the first level were intervention group (yes or no), age (months and months squared), single parent (yes or no),

siblings (yes or no), smoking in the family (yes or no), own room (yes or no), infection-prone (yes or no according to parents), asthma (yes or no), and other chronic diseases (yes or no).

Analyses were performed using MlWin 1.1 and the results are reported as rate ratios (RR). The analyses with the four outcomes were done in two steps. Model 1 included only individuals and departments, in order to detect clustering in level two. Model 2 also included individual variables.

The values for the second level variance are given both as variance (SE) and as median mean ratio (MMR). MMR is a translation of the variance into the well-known odds ratio (OR) scale and hence is easier to interpret [13].

Ethics

The local ethics committee approved the study and informed consent was obtained from the parents of the children.

Results

Background data according to questionnaire for the two groups are given in Table I.

Personnel's experience

At the end of the study, a greater proportion of the personnel at the intervention day-care centres thought they had enhanced their number of guidelines, and that more children were at home long enough after an infection episode compared with the start of the study (Table II).

Parents' experience of information

At the end of the study more parents in the intervention group felt informed about infectious diseases and when to keep an infected child at home compared with the start of the study (Table III). In a separate question two-thirds in both the intervention and the control group answered that they thought regular information about infectious diseases was desirable.

Table I. Characteristics of the study population according to questionnaire data: Comparison between intervention and control groups.

	Intervention group (n = 140)	Control group (n = 145)
Mean (SD) age (months)	46 (15)	44 (17)
Two adults in the family (%)	88	97
Siblings in the family (%)	64	85
Smokers in the home (%)	13	7
Living in detached house (%)	63	75
Having own room (%)	79	70
Child being infection-prone (%)	16	15
Child having asthma/allergy (%)	24	15

Children's infections

Total absence for illness, as a percentage of the expected presence, was 6.6% (1537/22 610 days) in the intervention group and 6.8% (1678/23 955) in the control group. There were 583 sickness episodes in the intervention group and 698 in the control group reported by the personnel. Sickness absence, doctor's consultations, and antibiotic prescriptions, reported by the parents, are given in Table IV.

Infectious diseases accounted for 96% of sickness absence, and roughly 60% of this was due to respiratory tract infections (Table V).

The multilevel empty models (Model 1) showed significant variance on the second level, i.e. there was a substantial variation on the department level (Table VI). The variance decreased with the introduction of individual variables (Model 2), but remained significant for sickness absence in days.

Table II. Personnel's experience of infections in children at study start compared with study end.

	Number of personnel			
	Intervention day-care centre		Control day-care centre	
	Start (n = 31)	End (n = 31)	Start (n = 32)	End (n = 30)
Respiratory tract infections are always or often problematic	7	5	7	2
Gastroenteric infections are always or often problematic	0	1	3	2
We have guidelines when children ought to stay at home due to infectious diseases	13[1]	25[1]	26	30
Children stay at home long enough after an infection episode	1[2]	6[2]	6	7
It is easier to convince the parents to keep the child at home if the parents are well informed	12	15	15	12

[1]Comparing start vs. end: chi-squared test, p = 0.002; [2]comparing start vs. end: Fischer's exact test, p = 0.05.

Table III. Parents' experience of information concerning infections in children, at study start compared with study end.

	Percentage of parents			
	Intervention day-care centre		Control day-care centre	
	Start (n = 127)	End (n = 111)	Start (n = 117)	End (n = 124)
The information about when to keep an infectious child at home is satisfactory	35[1]	49[1]	44	47
The information from the day-care centre personnel about infectious diseases is enough	38[2]	57[2]	49	48

[1]Comparing start vs. end: chi-squared test, p = 0.03; [2]comparing start vs. end: chi-squared test, p = 0.003.

Even if there were no statistically significant differences, there was a consistent pattern in favour of the intervention, for sickness absence, doctor's consultations, and antibiotic prescriptions (see Table VI). A significant effect was found for "infection-prone" children for all outcomes. For sickness absence in days, a significant effect was found for children with asthma. However, there was no effect for the individual variables single parent, siblings, smoker, or own room. Increasing age had a small effect (not shown in table).

Discussion

Feasibility of intervention

Our model for educating personnel and parents in how to handle infections in pre-school children was manageable. The response we received from personnel and parents was positive and we think it will facilitate contact with primary healthcare in the future.

At our educational meetings the personnel received structured and uniform information and the guidelines were appreciated by the personnel. With little effort it was also possible to provide this information to the parents. At the same time the parents had the opportunity to ask further questions and we were able to discuss when to keep the children at home, when to go to a doctor, and when to prescribe antibiotics. Even if infections have been discussed in the general parental education programme not all parents participate in this [14].

The reply from the parents was good and almost all families participated. There were no obvious problems filling in the questionnaire or the absence reports.

We found that the personnel in the intervention group thought that the children more often stayed at home long enough after an infection episode. The personnel are those who have regular contact with the parents and those who have the possibilities of answering questions in connection with the children's illness. It is therefore important to give the personnel uniform information about infections and who handles them [15]. Other studies have also focused on the provision of information to personnel as part of a more extensive educational programme,

Table IV. Comparison between intervention and control groups regarding sickness absence, doctor's consultations, and antibiotic prescriptions.

	Intervention group (n = 144 children)	Control group (n = 148 children)
Days of absence per child: mean (SD)	10.5 (8.6)	11.2 (7.4)
Episodes of absence per child: mean (SD)	4.1 (2.5)	4.7 (2.4)
Doctor consultations per child: mean (SD)	0.8 (1.2)	1.1 (1.3)
Percentage consulting a doctor	47	59
Antibiotic prescriptions per child: mean (SD)	0.4 (0.8)	0.7 (1.0)
Percentage given antibiotics	38	42

Table V. Reasons for sickness absence: Comparison between intervention and control groups.

	Percentage			
Diagnosis	Intervention day-care centres (n = 577 episodes)		Control day-care centres (n = 696 episodes)	
Respiratory tract infection	55.9		61.6	
Common cold		45.9		49.1
Tonsillitis		2.1		2.4
Otitis media		5.2		7.9
Protracted cough		2.4		1.6
Pneumonia		0.3		0.6
Chickenpox	6.8		2.9	
Gastroenteritis	17.7		13.9	
Other infection	15.4		17.4	
Other illness	4.2		4.2	
Total	100.0		100.0	

Table VI. Multilevel analysis of the effect of the intervention on sickness absence, doctor's consultations, and antibiotic prescription.

	Sickness absence				Doctor's consultations		Antibiotic prescriptions	
	Days		Episodes					
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Fixed effects								
Intervention vs. control RR (95% CI)		0.95 (0.78–1.15)		0.90 (0.78–1.05)		0.81 (0.63–1.04)		0.70 (0.48–1.02)
Infection-prone vs. not infection-prone RR (95% CI)		1.48 (1.35–1.63)		1.36 (1.17–1.58)		2.80 (2.13–3.67)		2.99 (2.06–4.34)
Asthma vs. not asthma RR (95% CI)		1.20 (1.09–1.31)		1.09 (0.95–1.26)		1.10 (0.82–1.47)		0.94 (0.60–1.49)
Random effects								
Dept. variance (SE)	0.09(0.03)*	0.04(0.02)*	0.04(0.02)*	0.01(0.01)ns	0.09(0.05)ns	0.00(0.00)ns	0.18(0.10)ns	0.02(0.05)ns
Median mean ratio	1.33	1.21	1.33	1.10	1.33	1.00	1.50	1.14

*$p < 0.05$; ns = not significant.

even if their experience was not the prime focal point and no outcomes were published [16–18].

No studies have focused on educating parents of children at day-care [19] but an educational programme for families in a community has shown that education can reduce visits to the family practitioner [20].

It is also important that healthcare staff provide adequate information for parents. We found that parents consider regular information to be desirable and the parents felt better informed about infectious diseases at the end of the study.

Effects of intervention

In this small study no statistically significant effect of the intervention was found, but there was a consistent pattern towards lower sickness absence, fewer doctor's consultations, and decreased antibiotic prescription in the intervention group. The results indicate that we might have had significant results in the multilevel analyses if we had included more day-care centres.

A review article mentions that studies have had difficulties in proving any effect on infectious illness after changed hygiene routines [19]. Some studies have found effect of careful hand hygiene on gastroenteritis [21–23], one of them analysed with a multilevel technique [24]. Other studies have shown an effect on upper respiratory tract infections [17,20].

Day-care has been mentioned as a cause of excess morbidity resulting from respiratory tract infections [2,25] and the increased consumption of antibiotics [4,26]. It is therefore important to limit the spread of infections in day-care and to improve the management of infections. In view of the fact that about 80% of respiratory tract infections are viral [27,28] there is a great deal to suggest that the (over)use of antibiotics in early childhood is not rational [29].

Conclusions

It was possible with little effort to inform and train people at day-care centres concerning infections and how they are spread. There was a greater understanding of when a child should be kept at home and when a doctor should be consulted. We found no significant effect on sickness absence, doctor's consultations, or antibiotic prescriptions, which is why it would be valuable to conduct a larger intervention study in Sweden.

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