

## SHORT COMMUNICATION

## HYGIENIC CONDITIONS IN ELEMENTARY AND SECONDARY SCHOOLS IN THE COUNTY OF SPLIT-DALMATIA

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Received May 1999

This paper gives an assessment of hygienic conditions found in 22 primary and 12 secondary schools in the city of Split during the school year 1990/91. The data were compared with the results of a similar investigation carried out in eight primary schools in the neighbouring Sinj area. The assessment consisted of the examination of the facilities, questionnaires, and microbiological analysis of numerous samples. Most schools failed to meet the recommendations for hygienic and sanitary maintenance, particularly with regard to sanitary facilities for students and staff. Exposure to noise, inadequate lighting, and poor maintenance of gymnasiums were noticed. Of the total number of smears taken from the students' hands and various surfaces in schools in the Sinj area, group D streptococcus was isolated in 62% and *E. coli* in 43% of samples. Both bacteria indicate faecal contamination. The data suggest a low level of personal and general hygiene in schools. It is necessary to improve the hygienic conditions in the schools of the Split and Sinj area and to focus on health education. It would reduce the risk of intestinal and respiratory infectious diseases and potential sight and hearing impairments in students.

*Key words:*  
ecological factors, health education, prevention, sanitary conditions

**O**n average, students spend in schools 5 to 7 hours a day for 12 years, that is, in the period of their most intensive mental and physical growth and development. School environment can affect the students' health and development both favourably and adversely. Adverse effects prevail where the number of students in classes exceeds the standard and where the facilities are damp, insufficiently ventilated, inadequately illuminated, and exposed to noise. Adverse effects to students' health may result from the supply of unclean water, from ill-maintained sanitary facilities, as well as from irregular and improper removal of waste (1–3).

Schools should be designed and equipped in such way as to reduce these adverse effects as much as possible. A healthy school environment should meet prescribed hygienic and other educational standards. Proper and regular maintenance, monitoring, and control of hygiene in facilities where students stay and work (4–7), as well as maintenance of personal hygiene prevent the occurrence of infectious diseases, particularly intestinal (typhoid and paratyphoid fever and dysentery). Type A and B infectious hepatitis with its faecal-oral way of transmission deserve particular emphasis (8).

The objective of this study was to assess hygienic conditions in primary and secondary schools in the County of Split-Dalmatia. The data served to evaluate the efficiency of measures undertaken to prevent and reduce infectious intestinal diseases such as typhoid and paratyphoid fever dysentery, type A and B infectious hepatitis, and other diseases in schoolchildren and youth. This and similar future studies determine prerequisites for better protection of schoolchildren and youth from respiratory and intestinal infectious diseases, as well as from other adverse factors in the school environment such as noise and inadequate lighting.

## SAMPLING AND METHODS

The study consists of two parts. The first part refers to investigation of hygienic conditions in all 22 primary and 12 secondary schools in the city of Split in the school year 1990/91. The assessment of hygienic conditions relied on examination of school facilities and questionnaires (1, 2). The second part of the study refers to a pilot study of hygienic conditions in eight primary schools in the Sinj area (both urban and rural) in the 1995/96 school year. The investigation was extended to include microbiological analysis of surfaces in the working and sanitary school facilities. We took smears from various surfaces, consumables, equipment, and students' hands at random, following regulations (9). In smear samples analysed according to standard methods (10–12) we first determined the total number of bacteria, and then species: *Enterobacteriaceae*, *Escherichia coli*, *Proteus*, *Streptococcus faecalis*, and *Staphylococcus* spp. Questionnaires and the examination of the school facilities comprised the following hygienic parameters: location of the object, type of construction, age and technical maintenance, position with regard to the source of light, main roads, and major air polluters. The school facilities (classrooms, laboratories, gymnasiums, and cloakrooms) were subjectively evaluated with respect to noise, lighting, heating, and ventilation. The investigation included the removal of liquid and solid waste, sanitary and technical status of equipment and facilities, and maintenance thereof for both students and the staff. Furthermore, we observed how students drank water, how the building hygiene had been maintained and how disinfection, disinsection, and deratisation had been carried out. Our arbitrary grading of the hygienic status was set as follows:

- satisfactory – we did not find any noncompliance with the standards for technical and/or hygienic maintenance of equipment and facilities
- partially satisfactory – we found some noncompliance with the standards for technical and/or hygienic maintenance of equipment and facilities
- unsatisfactory – we found substantial noncompliance with the standards for technical and/or hygienic maintenance of equipment and facilities.

## RESULTS

The examination of 22 primary school buildings with 21,492 students and 19 buildings in use by 12 secondary schools with 15,905 students (Tables 1 and 2) revealed interesting data. Only a minor number of examined school buildings fully met the sanitary and hygienic recommendations. This primarily refers to sanitary and operational status and maintenance of the students' sanitary facilities. Most of them were found dirty, some were found broken and neglected for years. As a rule, the regular sets of personal hygiene consumables were found incomplete (soap and toilet paper, but no disposable paper towels, or soap without both paper products, or no soap, and so on). The conditions in the sanitary facilities for teachers largely met the sanitary and technical requirements in primary schools, whereas in secondary schools these conditions were much worse.

Table 1 *Assessment of hygienic conditions (%) in 22 elementary schools in the Split area in the school year 1990/91*

Examined parameters	Established situation (%)		
	Satisfactory	Partially satisfactory	Unsatisfactory
Location of the school facilities	46	23	32
Working facilities (space, equipment, technical maintenance)	27	73	–
Lighting	82	18	–
Noise	55	27	18
Students' cloakroom	5	91	5
Gym facilities	5	55	41
Sanitary facilities			
for students	18	73	5
for staff	100	–	–
The means to drink water			
for students	–	–	100
Removal of waste	14	82	5
Cleaning of facilities, furniture, and equipment	18	77	5
Cleaning of surroundings	5	86	9

Table 2 *Assessment of hygienic conditions (%) in 12 secondary schools in the Split area in the school year 1990/91*

Examined parameters	Established situation (%)		
	Satisfactory	Partially satisfactory	Unsatisfactory
Location of the school facilities	42	50	8
Working facilities (space, equipment, technical maintenance)	–	67	33
Lighting	25	25	50
Noise	25	67	8
Students' cloakroom	–	25	75
Gym facilities	–	33	67
Sanitary facilities for students	–	–	100
for staff	50	33	17
The means to drink water for students	–	–	100
Removal of waste	–	75	25
Cleaning of facilities, furniture, and equipment	–	58	42
Cleaning of surroundings	–	58	42

Our subjective assessment of noise was that it interfered with work in various degrees in many schools, as shown in Tables 1–3. As with noise, we subjectively assessed the lighting and found it partially adequate or completely inadequate in 75% of secondary schools. In some secondary schools less than one third of the lighting fixtures were in working order. Very few schools used the additional blackboard lighting as it was, in most cases, out of order. The situation was much better in primary schools, but the situation with gymnasiums was unsatisfactory in half of them (Tables 1–3). A markedly small number of schools, particularly secondary schools, were found to have a gymnasium and even if such did exist, it often was inadequate and ill maintained (including the accompanying facilities such as cloakrooms, sanitary facilities, and showers).

Table 3 shows data obtained through the examination of eight primary schools with 3,760 students in the area of Sinj. Almost all schools lacked work space and were ill maintained both technically and hygienically. Although the situation in some schools was somewhat better, it was far from satisfactory. The data particularly point out the unsatisfactory conditions in gymnasiums. What was specific about the schools from the Sinj area is that, although generally meeting the construction standards, their gymnasiums were so neglected that they were of little or no use. Subjectively,

the noise reduced comfort at work in more than half of the schools, and, comparably, half of them had inadequate lighting due to faulty lighting fixtures.

Table 3 *Assessment of hygienic conditions (absolute numbers) in eight elementary schools in the Sinj area in the school year 1995/96*

Examined parameters	Established situation		
	Satisfactory	Partially satisfactory	Unsatisfactory
Location of the school facilities	2	6	–
Working facilities (space, equipment, technical maintenance)	1	7	–
Lighting	4	4	–
Noise	3	5	–
Students' cloakroom	–	6	2
Gym facilities	–	1	7
Sanitary facilities for students	–	–	8
for staff	–	3	5
The means to drink water for students	–	–	8
Removal of waste	1	5	2
Cleaning of facilities, furniture, and equipment	–	1	7
Cleaning of surroundings	1	3	4

Particularly ill was the maintenance of hygiene in the sanitary facilities of most schools. Building surroundings were also ill maintained.

Instead of drinking water in a hygienic way, that is, from the fountains, the students had to drink it from the palm of their hands, or by pressing the lips on the tap.

Our microbiological findings only corroborated the poor sanitary and hygienic findings in the schools of the Sinj area (Table 4). We took 138 smears and isolated group D streptococcus (*Streptococcus faecalis*) in 85 or 62% and *Escherichia coli* in 59 or 43%. It is essential to emphasise that both bacteria indicate faecal contamination. As some of the smears were taken from surfaces in sanitary facilities, these were expected to show a certain degree of contamination. What is really worrying is the presence of *E. coli* and group D streptococcus in smears taken from other surfaces such as classroom door handles, desks, students' hands, and sponges. Of 27 smears taken from the sponges, group D streptococcus was isolated in 25 or

93%, and *E. coli* in 13 or 48%. Damp as they are, sponges are a favourable medium for the growth of bacteria. Regardless of that fact, the obtained data point to the very low level of general and personal hygiene in schools. Namely, there was almost not a single surface from which *E. coli* was not isolated. The fact is only confirmed by the findings of group D streptococcus and *E. coli* in smears taken from the students' hands. Of 18 smears, the former was found in 9 and the latter in 6, which suggests that the students do not wash hands properly.

Table 4 Results of microbiological analyses of smears taken from surfaces in working and sanitary facilities and from students' hands in eight elementary schools in the Sinj area in the school year 1995/96

Surfaces	Number of smears		
	Total	With indicators of fecal contamination	
		Group D streptococcus ( <i>Streptococcus faecalis</i> )	<i>Escherichia coli</i>
Flush handle	7	3	4
Toilet bowl lid	3	3	3
Toilet door handle	13	7	4
Water tap	24	16	13
Wash basin	20	11	8
Soap			
for students	4	3	1
for staff	3	3	3
Classroom door handle	6	2	0
Desks and chairs	12	1	3
Sponge	27	25	13
Staircase handrail	1	0	1
Students' hands	18	9	6
Total	138	85	59

## DISCUSSION

Beside the prevention of intestinal, respiratory, and other infectious diseases, sanitary measures should include education of students (13–17). This is because only some of them have been accustomed to keep acceptable hygienic standards at home. For them a school should allow to improve their hygienic habits. For those whose family upbringing failed to produce acceptable hygienic behaviour the school environment should give incentive to bridge that gap (1, 2). It is unfortunate that current health-care practice has preferred intervention over prevention (18, 19), as the action seems to be triggered only by an outbreak of a minor or major epidemics in schools.

The results obtained in this study show that the level of general and personal hygiene in schools is very low. The frequent findings of faecal contamination in working and sanitary school facilities are indeed worrying. Particularly alarming is the

presence of faecal contamination in the school sponge. *Konjević* (20) had similar results in his investigation. The indicators of faecal contamination found in the school sponge stress its epidemiological significance. This particularly refers to intestinal infectious diseases – primarily type A infectious hepatitis – which are transmitted via the faecal-oral route. In order to prevent the transmission of intestinal infectious diseases, particularly the infectious hepatitis, frequent and regular disinfection of the school sponge should become obligatory and the students should be able to wash their hands after the use of the sponge. *Konjević's* study (20) showed that damp sponges were a better medium for the growth of bacteria, whereas bacteriological results from classes where a dry sponge was used were satisfactory. Our study corroborates those findings.

The correlation between intestinal infectious diseases and the condition of the school toilet has been confirmed in many investigations reported in literature (21). It is therefore necessary to carry out more intensive and regular investigation, control, and evaluation of the effect of adequate maintenance of hygiene in schools. The bacteriological analysis of smears taken in the school environment shows high circulation of faecal material, and the sponge plays an important role in that circulation.

While examining the cleanness of the flush handle in public toilets, *Ritterman and co-workers* (22) isolated faecal contamination bacteria in 25% of the smear samples. *Serventi and co-workers* (23) examined the microflora of the toilets in catering establishments and isolated faecal contamination bacteria in 30 of 119 analysed smears. Sadly, our study revealed that the number of samples with faecal contamination bacteria taken from flush handles in schools was much higher (Group D streptococcus in 71%, *E. coli* in 57%). This also goes for the total number of smears.

Regular and exact monitoring of noise and light is necessary for objective evaluation and prevention of their possible adverse effects on sight and hearing in the students. The application of established concepts from preventive medicine should help substantially to accomplish the task. It is a well-known fact that rational investment in prevention greatly reduces the expenses of curative medicine.

## CONCLUSION

All schools should provide basic favourable ecological and sanitary conditions to the students. This primarily refers to spacious, light, noiseless, and airy working facilities, large playgrounds, and well-equipped gymnasiums. Moreover, schools should secure adequate means to drink water, enough clean and operational toilets, and proper removal of liquid and solid waste.

This study has yielded a lot of relevant data which encourage the Public Health Institute of the County of Split–Dalmatia to further investigate the issue. Our results point out the low level of general and personal hygiene in schools and urge for preventive work and sustained health education in schools. County Public Health Institutes should annually inspect schools in cooperation with County Sanitary Inspections. Other faults observed in schools (noise, inadequate lighting, ill-maintained buildings, poor condition or entire absence of gymnasiums) should be solved together with other social and professional institutions.

Regular monitoring of hygienic conditions in schools and evaluation of preventive measures are the prerequisites for a timely and proper prevention in an extremely sensitive and important sector of public health – protection of schoolchildren and youth. A part of that work should be directed towards continuous education about the proper and regular use of disinfectants in schools.

All institutions responsible for and interested in the situation in schools should work together and strive to improve hygienic conditions in schools and raise the educational standards and health culture for the benefit of our children and youth.

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### Sažetak

## HIGIJENŠKI UVJETI U OSNOVNIM I SREDNJIJIM ŠKOLAMA NA PODRUČJU SPLITSKO-DALMATINSKE ŽUPANIJE

Tijekom 1990./91. školske godine istraživani su ekološko-higijenski uvjeti u 22 osnovne škole i 12 srednjoškolskih centara u gradu Splitu. Podaci su uspoređeni sa sličnim istraživanjem provedenim 1995./96. školske godine u osam osnovnih škola na sinjskom području. Cilj rada bio je evaluirati učinke preventivnih mjera u sprječavanju bolesti i stanja koja mogu nastati zbog loših higijenskih uvjeta u školskoj sredini.

Ekološko-higijenski uvjeti ocijenjeni su na temelju pregleda objekata, anketnog upitnika i mikrobiološkog ispitivanja. Većina škola nije zadovoljavala preporuke higijensko-sanitarnog održavanja školskog prostora, osobito sanitarnih čvorova za učenike i nastavnike. Uočeni su i nedostaci kao izloženost buci, neadekvatna rasvjeta te nedovoljan broj, loša kvaliteta i održavanje dvorana za tjelesni odgoj. Od ukupnog broja uzetih brisova u školama na sinjskom području iz 62% izoliran je streptokok grupe D, a iz 43% *E. coli*. Navedene bakterije su pokazatelj fekalnog onečišćenja. Dobiveni podaci upućuju na nisku razinu osobne i opće higijene u školama.

Potrebno je sanirati građevinsko-tehničko i ekološko-higijensko stanje u školama na splitskom i sinjskom području te provoditi zdravstveni odgoj. To bi smanjilo rizik pojave crijevnih i respiratornih zaraznih bolesti te mogućih oštećenja vida i sluha učenikâ.

#### *Ključne riječi:*

ekološki čimbenici, preventivne mjere, sanitarni uvjeti, zdravstveno prosvječavanje

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