

Comparison of Pupils' Acceptance of Conventional and Ecological Sanitation in Rural Schools

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ABSTRACT

In rural areas of Eastern Europe, the Caucasus and Central Asia (EECCA) without reliable piped water supply, the conventional school sanitation system is the pit latrine leading to hygienic and environmental problems. The urine diverting dry toilets (UDDT) have been demonstrated to be an alternative, ecological sanitation solution for rural schools of the EECCA region. This study compares the acceptance, perception and absenteeism of pupils of schools served by the two different sanitation systems (ecosan versus pit latrine), comprising 18 schools in six countries of the region. A combination of quantitative and qualitative data collection methods was applied: absenteeism data from official school records (only in Eastern Europe and the Caucasus (EEC)), a standardized questionnaire and focus group discussions (FGDs).

The results of the EEC school records showed that the intervention led to a significant decrease in monthly absenteeism; however a higher school sample is needed to back the results. Good acceptance of school toilets can overall be translated into sanitation conditions providing comfort, cleanliness and privacy. The pupils (both boys and girls) better accepted the UDDTs in all six studied countries, than the pit latrines. The acceptance is significantly higher in areas where pit latrines are predominant, as in Central Asia (CA) in contrast to EEC. There is some indication but no clear evidence that a better accepted sanitation system leads to higher fluid intake in schools. Girls benefit more from the intervention, as they suffer more than boys from the inadequate sanitation conditions of the common pit latrines in rural schools.

Key words: pupils' acceptance, perception, pit latrine, UDDT, ecosan, EECCA, gender-sensitive, school sanitation, MHM

INTRODUCTION

In Eastern Europe, the Caucasus and Central Asia (EECCA region) the water and sanitation infrastructure has deteriorated after the 1990s and service has been further disrupted due to poor maintenance (Valent et al., 2004). There is a big gap between rural and urban areas in terms of hygiene and sanitary conditions which is reflected in the schools. Particularly in rural areas of the EECCA region, many school toilets are in a poor condition (Samwel & Gabizon, 2009). Sanitation facilities in rural schools mostly consist of outdoor pit-latrines which are located far from the school building. Reviews of sanitation in rural Moldovan and Kyrgyz schools show that the sanitation conditions have deteriorated in recent years and are considered one of the most pressing problems (UNICEF, 2011, National Center of Public Health Moldova & UNICEF, 2011).

Sanitation-related infections and parasitic diseases are spreading in school settings, e.g. in Moldova, these diseases had increased by 33% among pupils aged 15-17 years from 2004 to 2007 (National Center of Public Health Moldova & UNICEF, 2011).

Depending on the hydro-geographical situation, a high density of pit latrines and a lack of sufficient safety distance between toilets and wells can result in contamination of potable groundwater supplies by microbes and nitrates (Banks et al., 2002, Herbst, 2006). This puts the rural population at constant risk of contracting waterborne diseases such as diarrhoea, hepatitis A and methaemoglobinaemia. An Armenian review showed that the major cause of water-related outbreaks was the cross-contamination of drinking water by wastewater (Anakhasyan et al., 2012).

The Western standard sanitation system with flush toilet and adequate wastewater management can usually not be installed in areas without reliable piped water supply. According WHO & UNICEF (2014), 49% and 21% of the population in Central Asia and Eastern Europe, respectively, has no

access to pipe water supply. In areas with lacking piped water supply and hence pit latrines are common, an alternative is the ecological sanitation (ecosan) option, the urine-diverting dry toilet (UDDT) (classified as composting toilet in the UNICEF/WHO monitoring system) which is suitable especially for rural areas for example in the EECCA region. The UDDT system separates urine and faecal matter at source, collects and treats both streams safely (Rieck et al., 2012). The installation of UDDTs in schools can immediately improve the hygienic situation, the comfort of the users and reduce the groundwater pollution (Deegener et al., 2009). The UDDT system with hand washing facilities has been introduced by WECF and local NGOs accompanied by raising awareness/training campaigns in 10 countries of the EECCA since 15 years (Wendland et al., 2011). For school sanitation in Moldova, it has been accepted as a relevant technology by the national authorities: UDDT in more than 50 rural schools have been constructed and now a national construction norm is being developed (Hecke, 2016).

The aim of this study was to give answers to the following questions:

How do secondary school pupils in the EECCA region accept rural school toilets, what are the perceived differences between ecological and conventional sanitation systems? Are there relevant differences between the three sub-regions, Eastern Europe, the Caucasus and Central Asia, and between boys and girls? Is there a relation between the two types of sanitation system and fluid intake at school? And what is impact of school sanitation on absenteeism of girls in puberty?

As talking frankly about toilet behaviour and menstrual hygiene management (MHM) is a taboo, the authors of this study selected a combined method to receive quantitative and qualitative data to get a full picture.



Figure 1. European-Asian map indicating the countries included in this study

SELECTION AND DESCRIPTION OF THE SCHOOLS

For this study, two countries from each sub-region of the EECCA region were taken: Moldova, Ukraine for Eastern Europe, Armenia, Georgia for the Caucasus and Kyrgyzstan, Tajikistan for Central Asia. In these countries, 18 public rural schools, 10 with ecosan toilets (ecosan schools) and 8 with the traditional toilets, the pit latrines (reference schools), were chosen. The schools were selected among schools where WECF supported the intervention of installing an ecosan toilet; the schools participated on a voluntary basis. For comparison, “reference schools” were selected, these schools were situated near the “ecosan schools” and had similar frame conditions; the major difference was the sanitation system.

To characterise the schools and their sanitation systems, the size of the rural schools and the installed number of toilets are given in table 1. The size of the school was ranging from a very small school with 36 pupils to a rather big school with 490 pupils. All schools were attended by around half boys and half girls. The availability of toilets, calculated in boys and girls per toilet cabin or/and urinal respectively, average values were similar, however in the ecosan schools the values were a bit lower than in the reference schools. In the majority of both school types, the values were higher than 25 pupils per toilet as recommended by WHO & UNICEF (2009).

In both school types, ecosan and reference, there were segregated toilets with separate entrances for boys and girls. The ecosan toilets had separate cabins with lockable doors for each toilet and the pit latrines mostly had toilets poorly separated with walls at half room height, see photos. The pit

latrines were relatively far away from the school building which is required by the construction norms to avoid odour in the class rooms, whereas the ecosan toilets were inside or adjacent to the school building.

Table 1. No of pupils and availability of toilets/urinals in the selected rural ecosan and reference schools

	Ecosan school (10 schools)		Reference school (8 schools)	
	No of pupils		No of pupils	
Average	262		325	
Min-Max	36 – 490		196 - 449	
	No of boys per toilet/urinal	No of girls per toilet	No of boys per toilet	No of girls per toilet
Average	27	43	36	37
Min-Max	8 – 43	4 – 100	23 – 110	25 – 115

METHODS

Given the sensitivity and subsequent difficulties in measuring personal sanitation related behaviour (which is often a taboo) a combination of quantitative and qualitative data collection methods was applied. The methods applied comprise the extraction of absenteeism data from official school records, a standardized questionnaire and focus group discussions (FGDs). The methods have been designed in a gender-sensitive way.

Official school records

The schools in the EECCA region keep official school records (class books) where teachers note daily absenteeism for each pupil. For this study, records of 10 schools (5 ecosan and 5 reference schools) were screened for at least two years of 8th, 9th and 10th graders, covering one year 6 months before the intervention (“before ecosan”) and one year 6 months after the intervention (“after ecosan”). Absenteeism data from the records were extracted in a sex-disaggregated form for pupils being absent for an entire day. The schools were located in Armenia, Georgia, Moldova and Ukraine. Unfortunately it was not possible to get the data from the Central Asian countries Kyrgyzstan and Tajikistan.

Questionnaire

The standardized questionnaire comprised about 16 closed questions on school toilets, including toilet acceptance and perception (10 questions), skipping school (2 questions), on drinking at school (2 questions) and menstrual hygiene management (MHM) (2 questions). It was drafted in English and translated into Armenian, Georgian, Kyrgyz, Romanian, Tajik, Ukrainian and Uzbek by the local partners (Uzbek because it was the local language in these Tajik villages). After a pre-test at three schools in Tajikistan and Kyrgyzstan, the questionnaire was revised. The female version of the questionnaire contains two additional questions on MHM. At least 15 girls and 15 boys (preferably 9th graders) at each school were asked to complete the questionnaire. In addition to the teacher, a local NGO member was present in the room when the pupils completed the questionnaire.

Focus group discussions (FGD)

Pupils were selected to participate in the FGDs from those who completed the questionnaire. The gender-sensitive discussions were conducted by WECF or local NGO members in a separate classroom and following written instructions. An additional local assistant took notes on the interactions and made observations on group dynamics. Teachers were not present during the discussion. The topics discussed covered the same matters as the questionnaire and some additional information on health. The average duration of a FGD was between 30 and 90 minutes.

Study population

In the EECCA region where the study was conducted, the population is ethnically very diverse. The

pupils usually were aged between 13 and 17 years (average 14 years). In table 2, the pupil numbers involved in each study method are given.

Statistical analysis

Data extracted from the official school records and the questionnaire were analysed statistically using Microsoft Excel, Version 14.0.0, 2010 (Microsoft Corporation), SPSS for Windows, Version 20.0 (SPSS Inc. U.S.A) and R, Version 3.1.1, 2014 (R Foundation for Statistical Computing).

For the questionnaire data, all preconditions for the Chi-squared test were met. A p-value of $p < 0.05$, $p < 0.01$, $p < 0.001$ was regarded as statistically significant, very significant and highly significant, respectively. The official school record data were not normally distributed according to the Kolmogorov-Smirnov test, at a significance of $\alpha = 0.05$. Therefore two-tailed Mann-Whitney U tests were conducted.

Table 2. overview of the study population and methods

Method	No. of schools		Country (no. of ecosan/reference schools)	No. of pupils per school	Total no. of pupils
	ecosan	reference			
Official absenteeism records	5	5	Armenia (1/1), Georgia (1/1), Moldova (2/2), Ukraine (1/1)	72-108 (50% girls)	931
Questionnaire	10	8	Armenia (1/1), Georgia (1/1), Kyrgyzstan (1/1), Moldova (3/2), Tajikistan (3/2), Ukraine (1/1)	at least 15 of each girls and boys	636
Focus group discussion	10	9	Armenia (1/1), Georgia (1/1), Kyrgyzstan (1/1) Moldova (3/2) Tajikistan (3/2) Ukraine (1/1)	at least 6-10 of each boys and girls	145

Weaknesses and sources of bias

As schools with ecosan facilities are not common, a random selection of schools was not possible. The involvement of teachers in the selection of pupils answering the questionnaire and participating in the FGDs might have biased the results in terms of selecting those expected to provide the right answers, but was unavoidable under the circumstances. It was not possible to administer all methods in all countries included in this study. Thus, the absenteeism survey was only carried out in four countries of Eastern Europe and the Caucasus (EEC): Armenia, Georgia, Moldova and Ukraine. A weakness is that the study cannot refer to baseline data.

RESULTS

Absenteeism according to official school records

A total of 931 pupils (with 50 % female pupils) from 10 schools had absenteeism data recorded for one school year (8 to 10 months) before and after the ecosan intervention. Boys are missing significantly more often than girls (Table 3).

Figure 2 shows the absenteeism rate distribution by school before (year 1) and after the ecosan intervention (year 2).

Table 3. statistical results of the absenteeism survey (Mann-Whitney U test)

Factor	Groups	N	U value	p value	Effect Size
Boy or girl	Boys	3894	6391316	0.000	0.417
	Girls	3934			
School (Ecosan)	Year 1	1733	1269307	0.000	0.415
	Year 2	1767			
School (Reference)	Year 1	2075	2225716	0.006	0.476
	Year 2	2253			

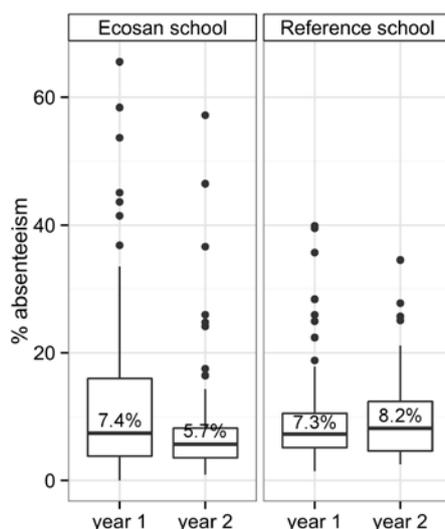


Figure 2. Monthly absenteeism rate distributions by year and type of school

For the ecosan school, the monthly absenteeism rate in year 2 is reduced by 18% compared to that in year 1. The differences in school attendance before and after ecosan are significant, with a probability of 58% that the absenteeism rate in year 1 is higher than in year 2. Pupils of reference schools are significantly more often absent in year 2 compared to year 1.

Questionnaire

The statistical results of the questionnaire are summarised in Table 4. There is always a highly significant difference between the data of the ecosan and the reference schools. For the subregions EE, C and CA, we found that the results are similar for EE and C but significantly different versus CA. As for gender differences, the overall data showed no significant differences between boys and girls.

Table 4. statistical results of the questionnaire analysis (Chi Square test)

Topic of question	Ecosan school / reference school		EEC / CA		Ecosan school:		Reference school:	
	N	p value	N	p value	girls / boys		girls / boys	
					N	p value	N	p value
Acceptance of toilet (4 questions)	573-627	<0.001	573-627	<0.001	328-359	0.238	240-275	<0.001
Use of school toilet (6 questions)	620-629	<0.001		<0.001	349-352	<0.256	271-277	<0.456
Drinking at school (2 questions)	625	<0.001	625	<0.001	350	<0.555	275	<0.288
Skipping school (2 questions)	248-279	0.005	248-279	<0.001				
MHM (2 questions)	248	0.079	248		Not applicable			

Acceptance and use of the school toilet

Most of the questions (10 out of 16) were dealing with acceptance and use of the school toilets.

In the **ecosan schools**: the majority of the pupils are “satisfied” or “very satisfied” with the school toilet. There is a significant difference between EEC and CA, but not between boys and girls. In CA, the satisfaction is higher than in EEC, 98% of the girls and 99% of the boys are “satisfied” or “very satisfied” compared to 82% and 80% for girls and boys in EEC, respectively (Figure 3). Cross-checking the same question with classmate responses, the overall numbers for satisfaction are almost the same. 35 % of the ecosan school pupils replied that they prefer to use the toilet at home, 41% the school toilet and 24% had no preference. 34% of the girls and 24% of the boys replied that they always use the school toilet, 27% of the girls and 33% of the boys sometimes and only 1% of both never use the school toilet.

16% of the pupils replied that they never go to the school toilet to defecate.

In the **reference schools**: many pupils are not satisfied with the existing school pit latrine, especially the girls. 50% and 53% of the girls and 38% and 22% of the boys in EEC and CA, respectively, are “dissatisfied” or “very dissatisfied” (Figure 3). There is a big difference between the regions, the pupils in EEC are less satisfied with the school toilet than in CA which was confirmed by the results of another cross checking question. Most reference school pupils (85%) prefer to use the toilet at home instead of the school toilet. 9% of the pupils never use the school pit latrine, 25% rarely, 38% sometimes and only 4% of both, boys and girls, use always the school pit latrine.

43% of the pupils reply that they never go to the school toilet to defecate.

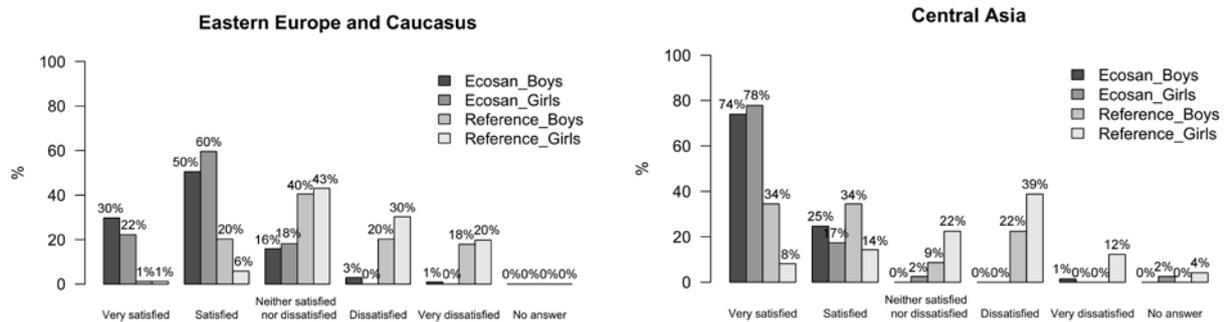


Figure 3: Replies to the question: “Are you satisfied with the school toilet?”

Fluid intake at school

Regarding drinking at school, there is a highly significant difference between ecosan and reference schools in CA but not in EEC. In CA, almost half of the reference school pupils (47%) reply that they do not drink at school, compared to only 16% of the ecosan school pupils. In EEC, 13% and 16% of ecosan and reference school pupils, respectively, do not drink at school.

Self-rated absenteeism (skipping school)

Overall, ecosan school pupils skip school less often than reference school pupils.

When pupils were asked, whether or not they stay at home because of problems with the school toilet, the data show a highly significant difference for: (i) reference versus ecosan schools, (ii) EEC versus CA and a significant difference (iii) for girls versus boys only at reference schools (Figure 4). Almost all ecosan school pupils (96%) in EEC reply that they never stay at home because of toilet problems, while 75% at reference schools do so. In CA, 84% of the girls and 65% of the boys at ecosan schools never skip school because of toilet problems, compared to 58% of the girls and 43% of the boys at reference schools.

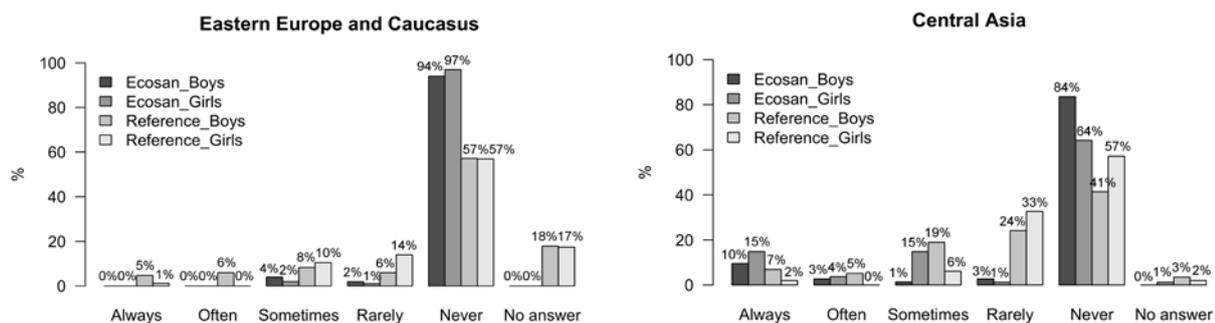


Figure 4: Replies to the question: “Do you stay home because of problems with the school toilet?”

Menstrual hygiene management (MHM) at school

Two questions were asked the girls related to MHM. There were significant differences between ecosan and reference schools, but not between EEC and CA. 70% of the girls at ecosan schools replied that they never skip school during menstruation, compared to 50% of the girls at reference schools. The major reason for skipping school was pain. At the reference schools, a “lack of privacy” was ticked by 15% of CA girls and 3% of EEC girls, in contrast to 3% and 0% at ecosan schools. 9% of the girls at reference schools replied that the “lack of a washing facility” is the reason for skipping school during menstruation, in contrast to 3% at ecosan schools. Other reasons such as “problems in obtaining hygienic material” were ticked by less than 3%.

Focus group discussions (FGD)

In general, pupils, both boys and girls, see a good toilet as:

- hygienic (no odour, clean, no flies),
- providing privacy/dignity (separate cabins for boys and girls, door locks),
- comfort (comfortable temperature, no odour) with appropriate toilet facilities (hand washing possibilities, towels, toilet paper and soap).

The absence of bad smell was a major advantage of ecosan toilets. A beautiful and clean toilet is seen as hygienic. Pupils in CA sometimes avoided using the new 'beautiful and shiny' ecosan toilet because they feared misusing it and making it dirty.

Odour was associated with discomfort, but also with flies, uncleanliness and lack of hygiene. Pupils of reference schools sometimes avoided using the toilet by drinking less water.

The aspects of privacy and dignity were another benefits of the ecosan toilet design. Mostly girls, but also boys complained that the pit latrines have only half height walls between the cabins, no locks on the door or that the door was even completely missing. Girls at the reference schools reported a lack of privacy, which was mitigated by going home to change menstrual pads. At some schools, girls admitted staying at home for one or two days per month during menstruation, e.g., sometimes older girls avoid using the pit latrine during menstruation, because younger girls could see them.

In general, girls agreed that the ecosan toilets improve MHM due to improved privacy and the better facilities. Their requirements were a closed waste bin, toilet paper and the possibility to wash inside the toilet room. However, not all ecosan schools fulfilled these requirements. Most girls said they still prefer changing their pads at home, however they do not skip school to do so.

The distance between the classroom and the pit latrine and the resulting time constraint was mentioned as a disadvantage. Furthermore, low temperatures in the pit latrine during the winter were mentioned at most schools as a major disadvantage. In Armenia and Tajikistan, reference school pupils avoid using the toilet for these reasons.

When an ecosan toilet is constructed in or adjacent to the school building, pupils view this as a big improvement.

A lack of toilet paper was mentioned as a disadvantage at most reference schools and a few ecosan schools; leading to avoidance of the school toilet for defecation. A few pupils indicated going home or to a neighbouring toilet to defecate (about 1-3 times a week). At the reference schools in Tajikistan, pupils were using “kiznyak” (dried cow dung which is usually used for heating), dry clay or stones for anal cleansing, which they found around the toilet. It was mentioned at one school that the same stone or “kiznyak” can be used by different pupils. Although cultures differ in utilisation of anal cleansing materials, the presence of toilet paper was highly appreciated by pupils visiting schools being equipped with new ecosan toilets.

DISCUSSION

In this chapter, the research questions are being discussed. Overall, pupils prefer the toilet at home, this is particularly the case at the reference schools or when pupils have a flush toilet at home. The

results from the questionnaire and the FGDs confirm that in all ecosan schools the UDDT is preferred over the standard pit latrine. In particular, the absence of bad smell, cleanliness and privacy were seen as major benefits. This is underlined by the record of one ecosan school where the UDDT was not properly operated and smelled bad. Acceptance was therefore low and absenteeism did not decrease after the intervention.

The fact that pupils in CA are more satisfied with the UDDT toilet than those in EEC reflects the level of sanitation at home, because the CA pupils experience the UDDT as a benefit to their standard pit latrine at home, whereas half of the EEC pupils have a flush toilet at home.

The analyses of the school records show that in general boys miss school more often than girls. In rural areas of the region, the children must often take over family tasks or contribute to the family income due to high poverty levels (Informal, 2012). A study in Moldova found that school absenteeism of boys and girls in rural schools was driven by children having parents who were abroad or neglected education, lack of clothing or school requisites and pupils having to work (Anonymous, 2011/2012). Adolescent boys seem to be more prone to these circumstances. The causes mentioned are not limited to Moldova and are overlapping the impact of the WASH intervention at school. However, the significant decrease in absenteeism after the UDDT implementation in EEC implies a relationship with the intervention.

The fact that the intervention comprises the construction of a UDDT including hand washing facilities as well as awareness raising and training can be regarded as a general upgrade of the school and its image. The impact of this set of measures and the resulting improved image is assumed to be the reason for the remarkable improvement in terms of absenteeism. This is the case for both boys and girls.

Drinking at school is important for health and school performance. Drinking less to avoid the toilet use may contribute to a higher risk of associated continence-related issues like urinary tract infections (Jasper et al. 2012). In EEC, there was no difference between both types of school sanitation; only in CA, the intervention had a positive impact on drinking at school. The positive impact of drinking more if a well-accepted sanitation facility is available has however been confirmed by the FGD in all countries. Certainly, other factors such as availability of safe drinking water in the community and school play also a decisive role.

The results of the absenteeism survey confirm the statement by Oster & Thornton (2011) that menstruation has a very small impact on school attendance. In contrary, research by Freeman et al. (2011) showed that girls miss less school due to WASH interventions in developing countries. The authors of this study are not surprised about the lack of a direct significant impact by WASH intervention in the EECCA region on the absenteeism data for girls due to improved MHM because some WASH standards and education are already prevalent in the region. (Since the data of the absenteeism survey are from five schools in EEC they do not allow for any statement on CA. Due to the relatively small numbers, absenteeism surveys at more schools and in CA are needed to confirm the results.) However, the higher positive impact of the intervention for girls should not be underestimated as shown in the results of the questionnaire and the FGD. The FGD showed that some UDDT can be considered as a technological equal to flush toilets in terms of comfort and acceptance.

In general, the school conditions are important for interventions aimed at mitigating the spread of infectious diseases (Koopman 1978). The fact that in Tajikistan the same stone or piece of cow dung is used for anal cleansing by several pupils in reference schools shows not only a tremendous lack of hygiene and awareness but also a lack of institutional responsibility towards public health. A study in rural Uzbekistan revealed the absence of anal cleansing materials in about 30% of the households as a risk factor for diarrhoeal disease (Herbst et al. 2008).

CONCLUSIONS

This chapter gives replies to the research questions. First one was about acceptance and perception of ecological and conventional school sanitation. Good acceptance of school toilets can be

translated into sanitation conditions offering comfort, cleanliness and privacy for the pupils. As this is mainly dependent on the toilet design as well as its operation and maintenance, it can be met by several technologies. In rural areas, UDDTs offer a well-accepted alternative for schools, indoors or adjacent to the building and they stop the soil and groundwater contamination at once.

The intervention (implementation of a UDDT with hand washing facilities, as well as awareness raising/training campaign) leads to a significant decrease in absenteeism for both boys and girls. To give a reliable figure from school records, more schools need to be surveyed to have a statistical relevant sample.

There are significant differences between EEC versus CA: the UDDT are better accepted and perceived in CA where pit latrines are the most common conventional sanitation systems in the homes. Boys and girls appreciate the UDDT implementation similarly. Girls however suffer more from the inadequate sanitation conditions of the pit latrines in the reference schools and thus benefit more from the UDDT intervention.

The second question: there is not always a direct relation between drinking at school and the sanitation situation as other factors are overlapping. However in CA, the results of this study suggest evidence that non-accepted school toilets lead to less fluid intake.

The third question was about the impact of school sanitation on absenteeism of girls in puberty. In general the boys miss school more often than girls certainly due to other reasons than school sanitation. Girls in all countries say that they miss school much less during menstruation when ecosan was implemented. The higher positive impact of the intervention for girls is further underlined by the results of the FGD.

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REFERENCES

- Anakhasyan, E., Hoesser, C., Stenström, T.A. & Kistemann, T. 2012 Cross-contamination of distributed drinking water as the cause of waterborne outbreaks in Armenia 1992-2010. *Journal of Water Sanitation and Hygiene for Development* **2**(3), 146-156.
- Anonymous 2011/2012 *Education in the Republic of Moldova*. Statistical Publication. National Bureau of Statistics of the Republic of Moldova. Available from: http://www.unicef.org/moldova/Educatia_in_RM.pdf
- Banks, D., Karnachuk, O.V., Parnachev, V.P., Holden, W. & Frengstad, B. 2002 Groundwater contamination from rural pit latrines: examples from Siberia and Kosovo. *J Chartered Inst Water Environ Manage* **16**(2), 147–152
- Deegener, S., Wendland, C., Samwel, A., & Samwel, M. 2009 *Sustainable and safe school sanitation - How to provide hygienic and affordable sanitation in areas without a functioning wastewater system*. WECF (Women in Europe for a Common Future), The Netherlands, France, Germany
- Freeman, M.C., Greene, L.E., Dreibelbis, R., Saboori, S., Muga, R., Brumback, B., & Rheingans, R. 2011 Assessing the impact of a school-based water treatment, hygiene and sanitation programme on pupil absence in Nyanza province, Kenya: A cluster-randomized trial. *Trop. Med. Int. Health* **17**, 380–391.
- Hecke, J. 2016 Personal communication with Jonathan Hecke, coordinator of the ApaSan Project in Moldova

- Herbst, S. 2006 Water, sanitation, hygiene and diarrheal disease in the Aral Sea Area (Khorezm, Uzbekistan). *Ecology and Development Series* **43**, Cuvillier Verlag, Göttingen.
- Herbst, S., Fayzieva, D. & Kistemann, T. 2008 Risk factor analysis of diarrhoeal diseases in the Aral Sea area (Khorezm, Uzbekistan). *International Journal of Environmental Health Research* **18**(5), 305-321.
- Hunter PR, Risebro H, Yen M, Lefebvre H, Lo C, et al. 2014 Impact of the Provision of Safe Drinking Water on School Absence Rates in Cambodia: A Quasi-Experimental Study. *PLoS ONE* **9** (3)
- Informal interview 2012 with Kyrgyz socio-economic expert Anarkul Choitonbaeva.
- Jasper, C., Thanh-Tam, L. & Bartram, J. 2012 Water and sanitation in schools: A systematic review of the health and educational outcomes *Int. J. Environ. Res. Public Health* **9**, 2772-2787.
- Koopman, J.S. 1978 Diarrhea and school toilet hygiene in Cali, Colombia. *Am. J. Epidemiol.* **107**, 412-420
- National Center of Public Health Moldova and UNICEF 2011 *Study on the quality of water, sanitation and hygiene practices in the schools of Moldova*. Available from: http://www.unicef.org/ceecis/Raport_sumar_eng_FINAL.pdf
- Oster, E. & Thornton, R. 2011 Menstruation, sanitary products, and school attendance: evidence from a randomized evaluation *American Economic Journal: Applied Economics* **3**, 91-100.
- Rieck, C., von Münch, E., Hoffmann, H. 2012 Technology review of urine-diverting dry toilets (UDDTs) - Overview on design, management, maintenance and costs. Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, Germany
- Samwel, M. & Gabizon, S. 2009 Improving school sanitation in a sustainable way for a better health of school pupils in the EECCA and in the new EU member states *Desalination* **248** (1-3), 384-391.
- UNICEF 2011 *Baseline assessment of access to water, sanitation and hygiene in schools and hospitals in the northern oblasts of Kyrgyzstan* by Domashov, I., Korotenko, V., Gorborkova, G., Ablezova, M. & Kirilenko, A., Bishkek, Altyn Tamga Publishing house.
- Valent, F., Little, d'A., Tamburlini, G. & Barbone, F. 2004 Burden of disease attributable to selected environmental factors and injuries among Europe's pupils and adolescents. *Environmental Burden of Disease Series* **8**, World Health Organization, Geneva, Switzerland.
- Wendland, C., Deegener, S. & Jorritsma, F. 2011 Experiences with urine diverting dry toilets (UDDTs) for households, schools and kindergarten in Eastern Europe, the Caucasus and Central Asia (EECCA), *Sustainable Sanitation Practice* **6**, 6-22.
- WHO & UNICEF 2009 Water, sanitation and hygiene standards for schools in low-cost settings by Adams, J., Bartram, J., Chartier, Y. & Sims, J. (eds) Geneva, Switzerland, World Health Organization. ISBN 978-92-4-154779-6
- WHO & UNICEF 2014 Progress on drinking water and sanitation – 2014 update. Geneva: World Health Organization and UNICEF