



Scholars' Journal

ISSN: 2645-8381

Published by Scholars' Association of Nepal
A Multidisciplinary Peer Reviewed, Open Access Journal

DOI : <https://doi.org/10.3126/scholars.v5i1.55744>

<https://www.nepjol.info/index.php/scholars>

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

Mohan Kumar Sharma^{12*}, Shanti Prasad Khanal³, Ramesh Adhikari³

1 Graduate School of Education (GSE), Tribhuvan University, Kathmandu Nepal

2 New ERA, Rudrapati Marg, Kalopul Kathmandu, Nepal

3 Tribhuvan University, Central Department of Education Kathmandu Nepal

*Corresponding Author: Mohan Kumar Sharma, attrig2019@gmail.com

ORCID Number: <https://orcid.org/0000-0002-7600-8223>

Article History: Received: 4 Sep, 2022; Revised: 15 Nov, 2022; Accepted: 18 Nov, 2022

Abstract

The review was started aiming to assess the effect of school-based Water, Sanitation, and Hygiene (WASH) facilities on students' health status, school regularity, and educational achievement. Two major academic and scientific research journals as Springer and PubMed have been selected, where WASH is the search engines, separately. There were 8,443 relevant publications found, with Springer having 6,888 and PubMed having 1,555. Among these publications, author synthesized 17 with abstracts and full articles, including references for this study. The findings of this study indicates that intervention of school WASH facilities have an effect on students' health status, regularity in school attendance, and educational achievement. It protects students from various infectious diseases caused by poor WASH access; however, ways of handling it is equally important. The intervention in WASH facilities at school improves students' health, school regularity, and educational achievements. Thus, the study strongly suggests interventions in school-based WASH facilities to make students healthier, more regular, and better academic performer.

Keywords: Water sanitation and hygiene, health, absenteeism, educational outcomes, school

Copyright 2022 ©Author(s) This open access article is distributed under a Creative Commons



Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) License.

Introduction

Target 6.1 of the United Nations Sustainable Development Goals (SDGs) is to ensure universal, equitable, and affordable safe drinking water by 2030 (SDG, 2017). Similarly, target 6.2 is to gain access to adequate and equitable sanitation and hygiene for all and end Open Defecation (OD), paying special attention to the needs of women and girls and those in vulnerable situations. Inadequate drinking water supply, poor sanitation facilities, and an unclean environment have been reported as significant hindrances to the achievement of this goal. Literature Jasper, Le, & Bartram (2012) showed that many schools in developing and developed countries lack WASH facilities, with associated potential effects on students health, attendance, and educational outcomes.

UNICEF and WHO (2018) stated that WASH access at school is a critical component of a healthy environment that can assist to mitigate burden raised from WASH born disease. Along the same line, WHO (2009) elucidates that improvements in school WASH may lead to increased attendance and educational attainment, especially for girls. Interestingly, World Bank (2018) showed that it was statistically significant that the implementation of WASH had increased health status and academic performance. Likewise, the availability of functional and private school toilets, including hand washing facilities with running water can positively impact health and learning outcomes, particularly for girls (Jasper et al., 2012). As WHO (2010) stated, many schools serve communities with a high prevalence of diseases that emerged from the causes of inadequate WASH services. Schools are the dominant source of exposure to infectious diseases. On the other hand, students are critical agents of change. Children spend considerable time in schools, where they learn and are motivated to perform good WASH behaviours Freeman (2011), integrating hygiene behaviors into their daily lives. Further, they can be effective messengers for change in their families and the wider communities (O'Reilly, Freeman, & Hoekstra, 2008).

Improvement in school WASH is an opportunity to enhance equitable access to education among children. Girls, especially from low-middle-income countries, often lag behind boys regarding school enrollment and educational attainment (Oster & Thornton, 2011). Sharma and Adhikari (2022) stated that lack of sanitation and hygiene infrastructure at school and poor access to water at school limits the school attendance of girls. Due to a lack of sanitation and hygiene facilities, more than half of the girls missed school during menstruation, which eventually had an impact on their academic performance (Tegegne & Sisay, 2014).

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

The review aims to characterise how poor school WASH can affect children's health, attendance, and educational outcomes. This review further tries to identify both types of school WASH facilities: adequate and inadequate and their effects, through cataloging peer-reviewed journal articles on the subject, defining the scope of impact, and highlighting possible future research directions within the field.

Methods and Procedures

This study followed the systematic search strategy Purssell and McCrae (2020) to find research-based articles. Published peer-reviewed literature was screened and reviewed systematically in significant Springer and PubMed databases. The articles documented the health and educational effects associated with the provision or absence of WASH in sample schools. The results from WASH intervention include an increase or decrease in school attendance, enrollment, dropouts, or any physical, social or psychological illness.

Inclusion and Exclusion Criteria

Articles with WASH and students' health status, school regularity in terms of attendance, and educational achievements are endorsed for the review. Literature without abstracts, full texts, references, other than English languages were excluded in this review. There were no time or location restrictions. Simultaneously, there was no method restriction as both types of studies have been included for this review. Studies with hand sanitizer and baby care were also excluded. Further, dissertations were also excluded from this review process. The researcher categorised "water" as having the following attributes: availability, accessibility, and quality for drinking, handwashing and cleaning. Sanitation was defined based on access to toilet facilities for urination or defecation (private, safe toilets, latrines, and availability of toilet paper) or as facilities for women and girls to manage menstruation (secret location and means for management or disposal of menstrual hygiene materials). Hygiene stands for the availability of handwashing points and the cleanliness of yards. The outcomes targeted by this review included health status, absence in terms of school, and educational products. Health effects included all of the defined social, mental and physical health topics recognised by the National Institute of Health (NIH). Educational outcomes included academic performance.

Search strategy for identification of studies

A thorough literature search strategy was used, which involved the use of different databases to identify and review journal articles. Water, sanitation, and hygiene were used as search terms, as were students' health status, school regularity, absenteeism, and educational

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

achievements. Besides, the researcher has sought related publications in various journals and conference or workshop proceedings by multinational companies, universities and organisations: WHO, UN, and UNICEF.

A literature search approach was developed to address the study's aim and objectives. 'My search', the Tibhuvan University (TU) electronic database for research, was used to find relevant journals because it enables access to many journals via the social sciences and education. The primary source of information used was online databases. Most research articles were cited by online libraries as soon as possible before general publication.

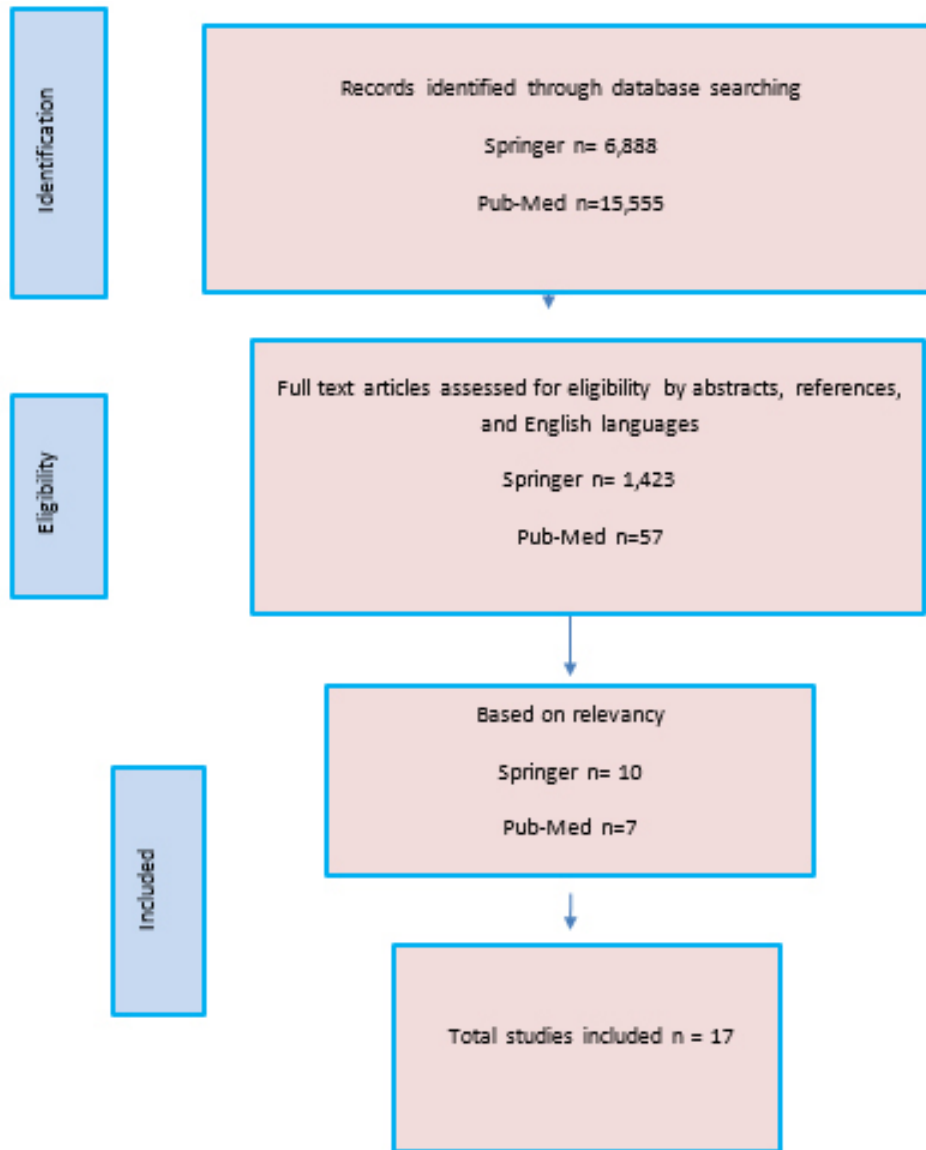
Finally, to filter the articles, narrow the search, and improve relevancy, the Boolean operators "AND" and "NOT" were used. The keywords relating to school health, sanitation and hygiene, as well as South Asia and Nepal were combined using these operators to better utilise search terms. However, to broaden the search with these operators, the OR operator was used, and the keywords were used to come up with relevant search terms. Because a vast amount of literature was produced, which was impossible to investigate, the search was narrowed down using AND operators, resulting in a more manageable number. The keywords used were truncated to search for different spellings, for example, sanitation, educational performance, and regularity.

The two major scientific and relevant electronic databases, "academic journals" Springer and PubMed, which were the core sources of the literature, were selected for the study. The primary search was based on the keywords "*Water, Sanitation, and Hygiene*" in schools and their effect on health and educational outcomes. All references in the documents' bibliographies had abstracts, and articles in English were included in the review. The search included no time or location restrictions.

Initially, literature was searched by titling bases like water, sanitation, and hygiene services in schools. The publications were found altogether (n= 8,443), whereas Springer had (n= 6888) and PubMed had (n= 1555). In the second phase, publications were painstakingly checked based on abstracts, full articles, including references. The journal with the conceptual and full report, including references, consisted of n=1423 and n=57 on Springer and PubMed, respectively. The final screening was based on abstracts, full text with references and English language totals (n=17) articles were used in the data analysis of this study.

Figure 1

Prisma follow diagram of the study



Results

Below table presents several studies that relates WASH facilities and its effect on students' health status, regularity in terms of school attendance, and educational achievements. To make more convenient studies have been presented under seven major domains, such as authors' name and date, country, study design, sample size, study area, effects, and construct and key findings of the study (Table 1).

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

This section is partitioned into three subsections for understanding convenience: WASH and health, WASH and school attendance, and WASH and educational achievement.

WASH and health

A descriptive study in the United States of America (USA) concluded that access to WASH facilities in schools contributes to inclusion, dignity, and equal opportunities among students. The same survey further stated that intervention in school WASH could protect from diarrhoea and other WASH-related disease. A cross-sectional study in Myanmar emphasised that poor handwashing stations in school increases the potentiality of diarrhoea and vomiting among students and other school staff. Further, poor quality sanitation facilities (toilet) impowers the alternative sanitation practice OD. This study stated that the quality of water is less critical than other transmission routes for diarrhoeal disease. A cluster randomized trial conducted in Kenyan schools concluded that providing safe drinking water to schools can only reduce diarrhea and Soil-Transmitted Helminth (STH) infections. Increasing WASH components at school is closely associated with lower diarrhoeal and respiratory infections. The WASH in school with health program has strong potential to contribute to the better health of children in Low and Middle-Income Countries (LMICs). Inadequate WASH conditions significantly contribute to the high infectious disease burden. In contrast, a study revealed that only handwashing does not play a role in protecting students from illness and absence.

WASH and attendance

A descriptive study in the USA found that interventions in school-based WASH-related knowledge and practices reduced students' absence rates. Hygiene facilities and hand hygiene related instruction improves attendance at public elementary schools during the flu season. A study conducted in Kenya showed the strong association between school WASH policies and health and attendance, which ultimately increased the educational outcomes of students. Considering girls' absenteeism, they bunk and dropped out of school due to the embarrassment of having their first menses at school without prior preparation. At least three days of absence per month are standard for the girls due to a lack of sanitary napkins at school. There was a complex interaction between menstrual-related challenges like physical discomfort, teasing, and feeling distracted in class. Factors often compound it in the school environment, such as unhygienic sanitation facilities and inadequate rest area, eventually decreases the girls' school participation during period. A qualitative study conducted in Nepal concluded that interventions in health and nutrition in schools yield positive impacts on students' health and enhance community awareness. Here, the positive effects denote good health status, reduced diarrhoeal infectious disease, worm infections, and anemia, which ultimately decrease the missing and absence proportion of students in schools due to illness.

WASH and educational outcomes

A study in the USA concluded that an increase in school-related WASH knowledge and practices improves educational outcomes for students. Illness-related absenteeism among children constitutes about 75% of all school absences and is primarily attributed to respiratory and gastro-intestinal infections. Furthermore, WASH intervention primarily reduced absenteeism-related illness. Incorporating an educational program with WASH in the interventions effectively improved the outcomes. A comparative study conducted in Burkina Faso and Nepal concluded that school nutrition and health interventions yield good health and educational achievement, growth, and development. Intervention in malaria control with hygiene instruction in schools improves education quality. The girls who did not have enough Menstruation Hygiene Management (MHM) products are more likely to report missing school than those who had good products, which ultimately increases the girls' low educational outcomes. A scientific study in Mali found that providing safe drinking water in schools was closely associated with higher scores on cognitive tests than those not.

Table 1

Findings of Reviewed Articles

Authors	Country	Study Design	Sample	Area	Effect	Construct and Key Findings
(McMichael, 2019)	United States	Descriptive study	47	Access to Water, Sanitation, and Hygiene	Protect from disease (diarrhoea) Increase educational outcomes Reduce absence rate	Access to WASH facilities in school contributes to inclusion, dignity, and equity. Intervention in school-based WASH protects against diarrhoea and other WASH-related diseases. Increase WASH-related knowledge and practices, improve educational outcomes, and reduce the absence rate.

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

(Weaver et al., 2016)	Myanmar	Cross-sectional study	2,082 (s), 116 school	Poor Hand-washing station and behaviour (Hygiene) Availability of toilet but not using (Sanitation) Unimproved (water sources)	Increase diarrhoea and vomiting Increase open defecation No effect on diarrhoea and vomiting	Poor handwashing facilities increases the likelihood of diarrhoea and vomiting. Poor quality toilets (sanitation) increase alternative sanitation practices (open defecation). It found that access in water quality was less important compared to other transmission routes for diarrhoeal disease.
(Garn et al., 2016)	Kenya	Cluster randomised	185 schools	Availability of Water, sanitation, and Hygiene	Reduced diarrhoea and Soil-transmitted helminths infection,	Reduced diarrhoea only among most water-scarce schools that received water provision reduced soil-transmitted helminth infections.
(Garn, Trinies, Toubkiss, & Freeman, 2017)	Mali	study design	916 schools	Water, Sanitation, and Hygiene	Increasing WASH components in schools improve health status and educational achievement. However, there was no sign on WASH facilities and being absent in school.	Increasing WASH components at school is closely associated with a lower diarrhoeal and respiratory infection rate. In contrast, only handwashing does not play a role in protecting students from bunking up or being absent.

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

(Duijster et al., 2017)	Comodia & Indenosia	A non-randomised clustered controlled trail	1847 students	Water, Sanitation, and Hygiene: Health	The prevalence of Social Transformation Helminth (STH) infection was not significantly different in interventions (in WASH) and control group.	The prevalence of Social Transformation Helminth (STH) infection was similar at baseline and follow-up between intervention and control schools (in WASH). The WASH in school health program has strong potential to contribute to better children's health in low and middle-income countries.
(Chard et al., 2019)	Mali	Scientific databases PubMed and Google Scholar	15 Articles	Access to safe Water, Handwashing facilities, and hygiene education.	Access to safe Water, Handwashing facilities, and hygiene education affect waterborne illness, school enrollment, and absenteeism.	Supplementary water provision improves hydration. Water provision in schools was associated with higher scores on cognitive tests.

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

(Joshi & Amadi, 2013)		Scientific databases PubMed and Google Scholar	15 Articles	Safe water, hand washing facilities, and hygiene	Absenteeism and educational outcomes.	Illness-related absenteeism among children constitutes about 75% of all school absences and is attributed mainly to respiratory and gastro-intestinal infections. WASH intervention primarily reduced absenteeism-related illness. Incorporating an educational component in the interventions was found to be more effective in improving WASH related results. Access to hand hygiene facilities with instruction improved attendance at public elementary schools during the flu season.
-----------------------	--	--	-------------	--	---------------------------------------	---

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

(Duijster et al., 2017)	Cambodia, Indonesia, and Lao PDR	Longitudinal study	1847 children	School-based WASH programme to improve child health	Child health	<p>The odds of having Soil-transmitted Helminthes infection were more than two times higher for children in schools with zero clean and functional toilets than for children from schools where all bathrooms are spotless and functional. The prevalence of weight status did not significantly differ between intervention and control schools, neither at baseline nor at follow-up. Similarly, no significant differences in the prevalence of oral health status (odontogenic infections) and PUFA increment were found between intervention and control schools.</p>
(Erismann et al., 2016)	Burkina Faso and Nepal	cluster-randomised trials	1140 (440 Burkina Faso+704 from Nepal) students	School garden, nutrition, water, sanitation and hygiene	Children's nutrition and health status	<p>Inadequate WASH condition plays an essential role in the high burden of infectious disease. Intervention in school nutrition and health yields good health and educational achievement, growth, and development.</p>

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

(Mcdonald, Bailie, Brewster, & Morris, 2008)	Australia	systematically searching electronic databases and hand searching.	19 papers	Hygiene and public health	Health and Educational outcomes	Provision of WASH and related education reduces the rate of diarrhoeal disease. It positively changes students' handwashing behaviour with soap, improving water storage in the home.
(Chatterley et al., 2014)	Bangladesh	Case study	16 schools	Sanitation	School sanitation construction	Financial support from the government, a maintenance plan, and the involvement of the school management committee appears to be required for quality sanitation construction.
(Pradhan, Mughis, Ali, Naseem, & Karmaliani, 2020)	Pakistan	quasi-experimental design	270 children	Personal hygiene and environment	Children's hygiene behavior	Improved hygiene knowledge and practices among school children. Reduced prevalence of infectious diseases among children.
(Brooker et al., 2010)	Kenya	Cluster randomised trial	101 Schools	School WASH	Children's educational achievement and health (anemia)	Intervention in malaria control in schools improves education quality. There is a strong association between firm school WASH policies and Kenya's health and education sectors.

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

(Tegegne & Sisay, 2014)	Ethiopia	cross-sectional survey and qualitative research.	595 adolescents'	Hygiene management in school	Absenteeism	Girls dropped out of school because of embarrassment over having their first menses at school without prior preparation. Absenteeism from school for at least three days per month was expected because of a lack of sanitary napkins.
(Miiró et al., 2018)	Uganda	Feasibility study	359 students	Menstruation health	Absenteeism	Girls missed a median of 2 days of school during their menses.
(Shrestha et al., 2019)	Nepal	Qualitative study	32 stakeholders	Intervention in health and nutrition	Impact and challenges in schools	Intervention in health and nutrition yields positive impacts on students, schools, and communities, including improved students' health, a healthier school environment and enhanced community awareness. The positive impacts on students' health status: reduced diarrhoeal diseases, worm infections, and anemia. Further, it denotes students' better access to SHN services such as deworming, iron, and vitamins.

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

(Crankshaw, Strauss, & Gumedde, 2020)	South Africa	Mixed method study	Quantitative (N=505) qualitative (N=65)	Menstruation health management	Schooling experience	There was a complex interaction relation between menstrual-related challenges (physical discomfort teasing, and feeling distracted in class). Often amplified or compounded by factors in the school environment (unhygienic sanitation facilities and inadequate rest areas), and schooling participation and attendance. Girls who did not have enough MHM products are more likely to report missing school than those who reported satisfactory outcomes (46.27% vs 22.49%, respectively, $p < 0.001$).
---------------------------------------	--------------	--------------------	--	--------------------------------	----------------------	--

Discussions

This further discussion of the systematic data is focused on the impact of three outcome variables: health status, regularity in terms of school attendance, and educational achievements.

Our review found no overall impact of intervention and the availability of improved WASH on students' health status, although there are potential mechanisms by which improved WASH may impact illness. Of the total studies, the majority stated that school intervention in school WASH could protect students' against and other WASH-related diseases, thereby improving students' health. In the same vein of present findings, Sharma et al., (2022) found that the presence of handwashing station in a household impacts the health of the household members, including their school going children. Authors additionally highlighted a fixed handwashing station with soap and running water represents the wealthy status of the households that reduced WASH borne diseases. Equally in the present findings, Martin et al. (2018) with substantial evidence, presented that WASH availability can reduce

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

diarrhoeal infections, microbiological contamination, and STH infection. In contrast, to illustrate findings, Chard et al. (2019) highlighted that intervention in school WASH does not lead to educational improvement for students. This may be due to the WASH component, such as low household WASH access or household economics, which may supersede health and education benefits in a low-income context. Sharma (2020) stated that female street children were highly suffered from WASH borne infection, among them alcohol consumed had higher proportion.

This review concluded that water quality is less critical than other transmission routes for diarrhoeal disease. In line with our findings, Wolfe et al. (2018) revealed that water management, transportation, and storage prevent water from being contaminated by using protected containers such as covered buckets and jerricans that constitute a barrier to faecal-oral contamination (Lantagne, 2015). Literature focuses both presence of safe drinking water and its handling ways are crucial for health. Sharma et al., (2021) found that knowledge level of participants has no association with handwashing practices, having good knowledge does not mean participants have good health behaviour. In the same way, Khanal et al., (2021) highlighted knowledge on Health Literacy (HL) does not play a key role on health habits and health hazards such as smoking and alcoholic practices found nearly same in both health literate and moderate literate people. Unsafe water handling practices include transporting, storing water in unclean containers, storing without a lid, and serving through dirty hands and pots, which predict risk factors as they allow for water contamination. Hence, water quality is less critical than other transmission routes for diarrhoeal and WASH-borne diseases.

Even though there are potential systems by which the availability of school WASH and hygiene instruction may impact school attendance Trinies et al., (2016) our review established that school attendance cannot increase only by WASH intervention and hygiene instruction in the schoolyard. Most studies showed that access to hand hygiene facilities and school instruction decreased the students' absence rate. Further, our review found that hand hygiene instructions during flu seasons can increase the students' school attendance. Simultaneously, Sharma and Adhikari (2022) emphasized that students' school absenteeism was higher in schools that did not have improved WASH services compared to those that had. Unlike other studies by Caruso et al. (2016), our review showed lower rates of self-reported absenteeism due to WASH-borne diseases after the school WASH intervention.

This review also noted that there are controversial findings like a study conducted in Kenya by Brooker et al., (2010) that showed the strong association between school WASH policy with both health and attendance, while another study done in Mali by Garn et al. (2017) revealed that only handwashing does not play a role in protecting students from both bunking up as well as absence.

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

Regarding girls' absenteeism, girls dropped out of school due to compound factors like unhygienic sanitation, the unavailability of menstrual tools, and inadequate rest areas that finally decreased the girls' school participation. The further review concluded that at least three days of absence per month are standard for the girls due to a lack of school sanitation and hygiene. In support of the present findings, a study conducted in Nepal highlighted that the lack of adequate toilet facilities, privacy, and cleanliness are accounts for primary reasons for girls' school absenteeism (Sharma & Adhikari, 2019). Similarly, research conducted in Uganda also found inadequate school WASH facilities in secondary schools influenced MHM that ultimately lead to school absenteeism during the menstrual period (Miuro G. et al., 2018).

This review concluded that increased school WASH-related practices for students improved their educational outcomes. While reviewing the article, it was found that illness-related absenteeism in children accounts for approximately 75% of all school absences. Furthermore, WASH intervention reduced absenteeism-related illness significantly. Incorporating an educational program with WASH into the interventions was very effective in improving the outcomes. Equally, with the present findings, Mahon and Fernandes (2004) revealed that inadequate school WASH services impact students' access to education.

Regarding girl students, due to cultural practices and a lack of MHM in schools, half of the girls attending school were withdrawn by their parents in South Asian region. They were withdrawn from school once they reached menarche, mostly to be married, either because menstruation was regarded as a sign of readiness for marriage or because of the shame and danger associated with being an unmarried pubescent girl. The findings of this review are similar to those of evaluations of school-based hand hygiene programmes in the USA by Guinan et al. (2002) which showed a reduction in absenteeism following the use of hand sanitizers, hygiene education, or a combination of the interventions. Research further revealed that besides impacting school attendance, the burden of diarrhoeal diseases and parasitic infections harms students' growth, nutritional status, physical activities, cognition, concentration, and school performance (Guinan et al., 2002).

Conclusions

The research suggests that intervention on school-based WASH facilities impacts students' health, school regularity, and educational outcomes, whilst no intervention or poor availability deteriorates. Findings of this study further indicates that students with good school WASH facilities have been healthier, regular, and higher academic performer. Additionally, intervention in school WASH can prevent from WASH borne diseases. Poor school WASH facilities increase students' school regularity and decreases school absenteeism. Students who belong to the poor school WASH facilities have lower educational achievements.

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

Though, school's poor WASH facilities impaired students' health status, ways of its handling are equally important than the availability and sufficiency. More than that the poor school WASH facilities, school regularity and educational achievements are equally impaired by other several factors that includes family background, socio-economic status, and student teacher relation, perception towards education. Finally, school WASH facilities are crucial aspect for students' better health, regular attendance, and better educational achievements. The WASH services should be improved, equipped with fixed handwashing facilities with running water and handwashing materials including their quality, being accessible to all aged children, both sexes, and disabled as well.

References

- Brooker, S., Okello, G., Njagi, K., Dubeck, M. M., Halliday, K. E., Inyega, H., & Jukes, M. C. H. (2010). *Improving educational achievement and anaemia of school children : design of a cluster randomised trial of school-based malaria prevention and enhanced literacy instruction in Kenya*. 1–14.
- Caruso, B. B. A., Freeman, M. C., Garn, J. V, Dreibelbis, R., Saboori, S., Muga, R., & Rheingans, R. (2016). *Assessing The Impact Of A School-Based Latrine Cleaning and Handwashing Program On Pupil Absence In Nyanza Province, Kenya : A Cluster-Randomised Trial*. 19(10). <https://doi.org/10.1111/tmi.12360>.
- Chard, A. N., Garn, J. V, Chang, H. H., Clasen, T., & Freeman, M. C. (2019). *And hygiene intervention on school absence*, 9 (2). <https://doi.org/10.7189/jogh.09.020402>
- Chard, A. N., Trinies, V., Edmonds, C. J., Sogore, A., & Freeman, M. C. (2019). The impact of water consumption on hydration and cognition among schoolchildren: Methods and results from a crossover trial in rural Mali. *PLoS ONE*, 14 (1), 1–14. <https://doi.org/10.1371/journal.pone.0210568>
- Chatterley, C., Javernick-will, A., Linden, K. G., Alam, K., Bottinelli, L., & Venkatesh, M. (2014). *A qualitative comparative analysis of well-managed school sanitation in Bangladesh*. 1–14.
- Crankshaw, T. L., Strauss, M., & Gumede, B. (2020). *Menstrual health management and schooling experience amongst female learners in Gauteng, South Africa : a mixed-method study*. 1–15.
- Duijster, D., Monse, B., Dimaisip-Nabuab, J., Djuharnoko, P., Heinrich-Weltzien, R., Hobdell, M., & Benzian, H. (2017). 'Fit for school' - a school-based water, sanitation and hygiene programme to improve child health: Results from a longitudinal study in Cambodia, Indonesia and Lao PDR. *BMC Public Health*, 17 (1), 1–15. <https://doi.org/10.1186/s12889-017-4203-1>

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

- Erismann, S., Shrestha, A., Diabougba, S., Knoblauch, A., Gerold, J., Herz, R., ... Cissé, G. (2016). Complementary school garden, nutrition, water, sanitation and hygiene interventions to improve children's nutrition and health status in Burkina Faso and Nepal: A study protocol. *BMC Public Health*, 16(1), 1–11. <https://doi.org/10.1186/s12889-016-2910-7>
- Freeman, M. C. (2011). The impact of school-based water, sanitation, and hygiene program on health and absenteeism of primary school children. London School of Hygiene & Tropical Medicine.
- Garn, J. V., Brumback, B. A., Drews-Botsch, C. D., Lash, T. L., Kramer, M. R., & Freeman, M. C. (2016). Estimating the effect of school water, sanitation, and hygiene improvements on pupil health outcomes. *Epidemiology*, 27(5), 752–760. <https://doi.org/10.1097/EDE.0000000000000522>
- Garn, J. V., Trinies, V., Toubkiss, J., & Freeman, M. C. (2017). Adherence impacts school-based water, sanitation, and hygiene intervention in Mali. *American Journal of Tropical Medicine and Hygiene*, 96(4), 984–993. <https://doi.org/10.4269/ajtmh.16-0558>
- Guinan, M. M., McGuckin, M. M., & Ali, Y. Y. (2002). The effect of a comprehensive handwashing program on absenteeism in elementary schools. *American Journal of Infection Control*, 30, 217-220.
- Jasper, C., Le, T. T., & Bartram, J. (2012). Water and sanitation in schools: A systematic review of the health and educational outcomes. *International Journal of Environmental Research and Public Health*, 9 (8), 2772–2787. <https://doi.org/10.3390/ijerph9082772>
- Joshi, A., & Amadi, C. (2013). Impact of water, sanitation, and hygiene interventions on improving health outcomes among school children. *Journal of Environmental and Public Health*, 2013. <https://doi.org/10.1155/2013/984626>
- Khanal, S. P., Sharma, M. K., Kharel, S., & Sharma, C. (2021). Role of health literacy on health behaviour change among the college girl students. *Scholar's Journal: A Multidisciplinary Peer Reviewed Journal* 4, 179-189. <https://doi.org/10.3126/scholars.v4i1.42478>
- Mahon, T., & Fernandes, M. (2004). Menstrual hygiene in South Asia: A neglected issue for WASH (water, sanitation, and hygiene programmes). *Gender and development*, 18:1, 99-113.
- Martin, N. A., Hulland, K. R. S., Dreibelbis, R., Sultana, F., & Winch, P. J. (2018). *Sustained adoption of water , sanitation and hygiene interventions : systematic review*. 23(2), 122–135. <https://doi.org/10.1111/tmi.13011>

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

- Mcdonald, E., Bailie, R., Brewster, D., & Morris, P. (2008). *Are hygiene and public health interventions likely improve outcomes for Aboriginal Australian children living in remote communities ? A systematic review of the literature. 14*, 1–14. <https://doi.org/10.1186/1471-2458-8-153>
- McMichael, C. (2019). Water, sanitation and hygiene (WASH) in schools in low-income countries: A review of the evidence of impact. *International Journal of Environmental Research and Public Health*, 16 (3), 1–21. <https://doi.org/10.3390/ijerph16030359>
- Miiró, G., Rutakumwa, R., Nakiyingi-miiró, J., Nakuya, K., Musoke, S., Namakula, J., & Weiss, H. A. (2018). *Menstrual health and school absenteeism among adolescent girls in Uganda (MENISCUS): a feasibility study*. 1–13. <https://doi.org/10.1186/s12905-017-0502-z>
- O'Reilly, C. E., Freeman, M. C., & Hoekstra, M. R. (2008). The impact of a school-based safe water and hygiene program on knowledge and practices of students and their parents: Nyanza Province, Western Kenya. *Epidemiology and Infection*, 136 (1): 80-91. doi: 10.1017/S0950268807008060.
- Oster, E., & Thornton, R. (2011). Menstruation, sanitary products, and school attendance: evidence from a randomised evaluation. *American Economic Journal: Applied Economics*, 3 (1), 91-100.
- Pradhan, N. A., Mughis, W., Ali, T. S., Naseem, M., & Karmaliani, R. (2020). *School-based interventions to promote personal and environmental hygiene practices among children in Pakistan : protocol for a mixed-methods study*. 1–14.
- SDG. (2017). *The Sustainable Development Goals Report 2017*. United Nations, New York, 2017. Retrieved from <https://unstats.un.org/sdgs/files/report/2017/thesustainabledevelopmentgoalsreport2017.pdf>
- Sharma, M. K. (2020). Street children in Nepal: causes and health status. *Journal Health Promotion*. 8, 129–140. doi: 10.3126/jhp.v8i0.32992
- Sharma, M. K., & Adhikari, R. (2022). Effect of School Water, Sanitation, and Hygiene on Health Status Among Basic Level Students in Nepal. *Environmental Health Insights*. <https://doi.org/10.1177/11786302221095030>

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

- Sharma, M. K., & Adhikari, R. (2022). Effects of Water, Sanitation, and Hygiene on the School Absenteeism of Basic Level Students in the Government School of Nepal. *Frontiers in Education* 7:869933. doi: 10.3389/feduc.2022.869933
- Sharma, M. K., Adhikari, R., & Van Teijlingen, E. (2022). Handwashing stations in Nepal: role of wealth status in establishing handwashing stations at home. *World Medical. Health Policy* 1–16. doi: 10.1002/wmh3.523
- Sharma, M. K., Khanal, S. P., Acharya, D., and Acharya, J. (2021). Association between handwashing knowledge and practices among the students in Nepal. *Prithvi Acad. J.* 4, 7–17. doi: 10.3126/paj.v4i0.37005
- Sharma, M. K., Khanal S. K., & Adhikari, R. (2019). *Menstrual Hygiene Management Among Girls in Rural Schools of Rukum Nepal*. (September). https://www.researchgate.net/publication/336086380_Menstrual_Hygiene_Management_Among_Girl's_in_Rural_Schools_of_Rukum_Nepal
- Shrestha, R. M., Ghimire, M., Shakya, P., Ayer, R., Dhital, R., & Jimba, M. (2019). School health and nutrition program implementation, impact, and challenges in schools of Nepal: Stakeholders' perceptions. *Tropical Medicine and Health*, 47(1), 1–11. <https://doi.org/10.1186/s41182-019-0159-4>
- Tegegne, T. K., & Sisay, M. M. (2014). *Menstrual hygiene management and school absenteeism among female adolescent students in Northeast Ethiopia*. 1–14.
- Trinies, V., Garn, J. V, Chang, H. H., & Freeman, M. C. (2016). *The Impact of a School-Based Water, Sanitation, and Hygiene Program on Absenteeism, Diarrhea, and Respiratory Infection : A Matched – Control Trial in Mali*. 94 (6), 1418–1425. <https://doi.org/10.4269/ajtmh.15-0757>
- UNICEF & WHO. (2018). Drinking water, sanitation, and hygiene in schools: global baseline report. New York.
- Weaver, E. R. N., Agius, P. A., Veale, H., Dorning, K., Huang, T. T., Aung, P. P., & Hellard, M. E. (2016). Water, sanitation, and hygiene facilities and hygiene practices associated with diarrhoea and vomiting in monastic schools, Myanmar. *American Journal of Tropical Medicine and Hygiene*, 95(2). <https://doi.org/10.4269/ajtmh.15-0290>
- WHO (2009). World Health Organization. WHO Guidelines for Safe Surgery 2009. Safe Surgery Saves Lives. Retrieved from <http://apps.who.int/iris/bitstream/handle/10665/441>

School Water, Sanitation, and Hygiene: A Systematic Review of an Effect on Health, Attendance, Regularity, and Educational Achievements

85/9789241598552_eng.pdf;jsessionid=78C4DAB28F0ABF4F349B93EFA95B42EC?sequence=1

- WHO. (2010). World Health Statistics 2010. Retrieved from https://reliefweb.int/sites/reliefweb.int/files/resources/DA470C108BACC1E9C125771F003D98AC-WHO_May2010.pdf
- Wolfe, M., Kaur, M., Yates, T., Woodin, M., & Lantagne, D. (2018). *A Systematic Review and Meta-Analysis of the Association between Water, Sanitation, and Hygiene Exposures and Cholera in Case-Control Studies*. 99(2), 534–545. <https://doi.org/10.4269/ajtmh.17-0897>
- World-Bank. (2018). World bank group, world development report 2018: Learning to realize education’s promise, international Bank for reconstruction and development. Washing DC:
- Purssell, E., & McCrae, N. (2020). How to perform a systematic literature review: A guide for healthcare researchers, practitioners and students. Springer. <https://doi.org/10.1007/978-3-030-49672-2>