School-based interventions to promote personal and environmental hygiene among children in Pakistan: Protocol for a mixed methods study

Nousheen Akber Pradhan[1], Waliyah Mughis[2], Tazeen Saeed Ali[1]& Rozina Karmaliani[1,3]

[1]Department of Community Health Sciences, [2]Department of Paediatrics & Child Health, [3]School of Nursing & Midwifery; Aga Khan University, Karachi, Pakistan

Author Note

Corresponding author: Nousheen Akber Pradhan – Senior Instructor, Department of Community Health Sciences, Aga Khan University, Karachi, Pakistan nousheen.pradhan@aku.edu

This study is funded through the Aga Khan University's Faculty of Health Sciences Research Committee.

(PF 90/1016)

Reviewed by Aga Khan University Ethics Review Committee for granting extension: Feb 2019

Abstract

Background: Poor personal hygiene and inadequate sanitation practices among young children in LMICs such as Pakistan can lead to critical, life-threatening illnesses such as respiratory infections, diarrheal disease, malnutrition and developmental delays. An intervention for personal/environmental hygiene practices for primary schoolchildren will be implemented at schools in urban squatter settlements of Karachi, Pakistan, aiming to improve the hygiene knowledge and practices (K&P) amongst primary schoolchildren and their mothers, while identifying facilitating and impeding factors in the adoption of hygiene practices for children.

Methods: The study will be built on quasi-experimental design with mixed methods data collection approaches. To assess primary grade children and their mothers' hygiene-status, K&P survey will be held in the pre-intervention phase. This phase also includes qualitative exploration of mothers' and teachers' perceptions about children's hygiene literacy, factors facilitating and impeding the adoption of the same among school children, for which in-depth guides and focus group discussion tools will be used with teachers and mothers respectively. School physical environmental assessment will be carried out pre-post intervention. This will be followed by multi-component intervention phase with behavior change strategies to improve children's and mothers' hygiene K&P. The post-intervention phase will assess the intervention effectiveness in terms of enhancing hygiene K&P among schoolchildren and mothers, alongside exploration of mothers and teachers' insights into whether or not the intervention has brought changes in improving hygiene practices among children.

Results: Paired T-test will be done pre and post intervention to measure the differences in knowledge and practice scores between mothers' hygiene literacy and practices with their child's knowledge and practices. Similar test will also be run to assess the differences in children' hygiene knowledge and practice scores pre and post intervention. (< 50= poor, 50-75=good and > 75= excellent). Thematic analysis will be used for qualitative data.

Discussion: Multi-component intervention aimed at improving personal and environmental hygiene among primary school children offers an opportunity to design and test various behavioral change strategies at school and home setting. The study findings will be significant in assessing the intervention effectiveness in improving children's overall hygiene.

Keywords: school health program; hygiene practices; Pakistan; hygiene intervention

School-based interventions to promote personal and environmental hygiene among children in Pakistan: Protocol for a mixed methods study

Background

Globally, communicable diseases are prevalent among school age children and the exposure to variety of pathogens causing preventable diseases in school population is inevitable. Underlying factors mainly rests on poor personal hygiene and inadequate sanitation practices [1] leading to school absenteeism and life threatening illnesses among children (if continually neglected in the long run) [2]. The situation is worse in low and middle income countries due to inadequate health care facilities leading to compromised health status of school children [3-5].

Among communicable diseases, respiratory infections and diarrheal diseases are regarded as the deadliest killers of young children [6]. Incidence of diarrheal disease in the initial years has been linked with impaired cognitive performance in the later childhood [7-8]. In addition, in developing countries intestinal helminthic infection is a commonly cited problem among school-age children [9-11]. Furthermore, oral health cavity infections are also commonly found in school going children worldwide [4]. Frequent attacks of infection predispose young children to malnutrition and can form a vicious circle and retard children's physical and cognitive development [12]. Moreover, the contextual factors such as poor socio-economic environment further deteriorate the health status of school children especially in low and middle income countries.

School children’s hygiene literacy and practices have therefore received considerable attention to control the spread of infections among this group [13] Because infections due to poor knowledge and unhygienic habits of young children leads to compromised academic performance [12]. Knowledge, attitude and practice (KAP) survey of primary school students in

Ethiopia indicated that almost half of the students had adequate knowledge of hygiene. However, the practice of hand washing with soap was not appreciable (36%). [1]. Survey in Palestine showed that 68% of the students reported washing hands with soap after using toilets and after playing and eating [14]. Study in India showed that majority of the students have correct knowledge and practice about hand washing before meals, brushing teeth and washing mouth after eating and combing of hairs; interestingly correct knowledge was not found to be translated with correct practice in all the cases [12].

Schools' physical environment also play a crucial role in improving child health. In Nigeria, majority (55.8%) of the school students were dissatisfied about the waste disposal mechanism at school [15]. A study conducted in Ghana indicated lack of hygiene enabling facilities at schools restricted children's practice of hand washing despite being knowledgeable [16]. Thus school physical environment has a strong influence on children's overall hygiene practices. We found a dearth of school-led studies on promoting environmental hygiene among school children.

Various school-based interventional studies have shown improvement in enhancing personal hygiene among school children. A study in Nigeria showed significant improvement in primary students' cleanliness after school based health education on personal hygiene [17]. Likewise, India also showed improvement in KAP of school children age 8-10 year olds on various domains of personal hygiene after health education program [18]. Oral health education program in Bangladesh depicted significant improvement in school children's' (grade 6-8) KAP from baseline alongside reduction in dental cavities [19]. Furthermore, Kenya's school water, sanitation, and hygiene (WASH) interventions documented improvement in diarrhea-related outcomes among children under 5 years of age [20].

Apart from school health education and other infrastructure improvement programs, 'Child to child' approach has been widely used for improving health outcomes among children [21-22]. In Kenya, children were educated to promote hand washing; they built hand washing stations inside their homes and also persuaded their parents to build latrines [21]. Furthermore, school-based hygiene curriculum has also been used as a strategy to promote hygiene practices at school and at home settings among school children [23].

In the Pakistani context, alongside pneumonia and diarrhea [14] worm infestation [24] and scabies [25] among school age children are the commonly reported health issues; manifesting poor personal hygiene. An evaluation study on water, sanitation and hygiene intervention on school child performance in two cities showed that almost 48% of government school children avoid going to school toilets due to poor sanitary condition [26]. In local context, studies are mostly focused on oral hygiene assessment among children, showing satisfactory knowledge about using tooth paste [27]. Comprehensive assessment about personal and environmental hygiene assessment among children, teachers and parents has remained a gap. Poor knowledge and practice of, and attitudes to personal hygiene have negative consequences on their long term development [28]. This necessitates the designing and testing of school-based interventions aiming to improve hygiene behaviors among children, thereby minimizing their potential to capture preventable illnesses.

It is unfortunate that school health remains a neglected aspect of public health in Pakistan [29]. In 2005, School Health Program was launched in 17 districts of the country by Ministry of Education, Pakistan in collaboration with United Nations Educational, Scientific and Cultural Organization (UNESCO). The program focused on various components including personal hygiene and environmental education but its impact was not determined [30]. To the best of our

knowledge, there is paucity of studies in Pakistan on school-based interventions to promote personal and environmental hygiene of school children, with child's parents and teachers' involvement. Towards designing school based programs, role of parents and teachers must be considered as they are the important role models for school going age children. And thus had detrimental effects in shaping children's overall health and hygiene behavior.

In this paper, we present a study protocol using mixed-methods study design to be implemented in schools of a peri-urban community setting, Pakistan. The proposed study aims to improve the knowledge and practices of school children towards personal and environmental hygiene through school based intervention. To our knowledge, holistic assessment of hygiene among school children has not been studied in the local context. And the intervention to be implemented (with behavior change communication using adult to child and child to child approach, assessment of education curriculum on hygiene concepts) has never been studied before.

Primary research questions

1. Does school-based hygiene intervention facilitate improvement in knowledge and practices among primary school children studying in semi urban schools, Pakistan?
2. What are the enablers and barriers towards the adoption of personal and environmental hygiene practices by school children?

Secondary research questions

1. Does improvement in knowledge and practices among the mothers of primary school children studying in semi-urban schools contributes to improved knowledge and practices of school children?

2. Does school based hygiene intervention contribute in prevalence of communicable childhood illnesses?

Methods

Study design

The study will employ a quasi-experimental design (pre-post intervention without control arm). The proposed study design is chosen as it will facilitate in evaluating school based interventions in the selected school settings without randomization. Similar to the randomized trials, quasi-experiments (community based trial) aims to demonstrate causality between an intervention and an outcome at the defined interval [31].

Sampling strategy and study participants

The sample size of the school children was determined using NCSS Pass version 16 software. A sample size of 128 students achieves 80% power to detect a mean of paired differences of 5.0 or more with an estimated standard deviation of differences of 20.0 for knowledge or practices scores and with a significance level (alpha) of 0.05 using a two-sided paired t-test. With 20% inflation to accommodate for refusals and dropouts and after rounding off, the sample turned out to be 256. Universal sampling will be used to obtain a desired sample. To achieve the desired sample size, children studying in primary grade in three schools will be enrolled. Universal sampling will also be used to enroll mothers of the recruited children in the selected schools.

Inclusion and Exclusion Criteria for Participants

Inclusion criteria for children include, students enrolled in primary grade (class 1-5) only and informed consent given by either of the child's parents. After obtaining child's parents consent, assent will be obtained from children at the respective school. Children will only be interviewed after obtaining their free will to participate in the study. If consent from child's parent and/ assent from child is not obtained, child will be excluded from the study. Once the

child gets enrolled into the study, child's mother will be approached for her consent to participate. If informed consent is not given, mother will not be part of the study. For school teachers, those who are available at the time of the study will be recruited after their informed consent. On an average, 2-3 teachers (per school) will be employed in the selected schools. Those teachers who are unwilling to participate will be excluded.

In addition, we will also interview District Education Officers (DEO) and District Health Officer (DHO) to explore their perceptions about enablers and barriers for the adoption of hygiene practices among primary grade school children. Interviews with these respondents will only be held after obtaining their informed consent.

Study settings

The study will be conducted in District Malir, Gaddap town in Karachi, Pakistan. The Gaddap town has 8 union councils with over 400 villages. Male members in the community mainly contribute to household income by working as labors and farmers. Few are also involved in military and protective services. Majority of the married females are housewives and few are employed in health and education sector. Construction of majority of households is pacca. Majority of the households utilize wood as a cooking fuel. Majority of the households fall under lowest to middle wealth quintile. Catchment population usually opts for health care service from private sector due to lack of public sector facilities in the area. Community members mainly use boring as a source of water [32]. Sindh Education Text Book curriculum is followed in the schools. School names are kept anonymous to protect the confidentiality. The government schools charge minimal fees. The cost of the textbooks and other educational expenses are to borne by parents.

To achieve the desired sample of school children, three schools in the catchment area will be selected. One of them is the NGO adopted school and other two are government run schools. The schools will be selected upon the recommendation of DEO to improve the hygiene situation in the sampled schools.

Data collection methods

The study is built on mixed method data collection approaches to gain insight of the hygiene literacy and practices among school children, teachers and child's mothers. Table 1 lists different data collection methods with its purpose and interval.

Operational definition of personal and environmental hygiene

Assessment of personal and environmental hygiene in our study is based on the aspects endorsed by WHO and UNICEF as set of practices and conditions for better health maintenance and prevention of diseases. As defined by Boot and Cairncross (1993), hygiene is "the practice of keeping oneself and one's surroundings clean, especially in order to prevent illnesses or the spread of diseases" [33].

In addition, a set of hygiene indicators assessed by earlier studies [1, 11, 12, 14, 16, 26, 34-35] were also referred and incorporated in this study [Refer to Table 2].

Study phases

The study has been structured into 3 phases – pre-intervention, intervention and post-intervention.

Phase I: Pre-intervention Phase

Before data collection, community stakeholders (teachers and school management) will be taken on board and information pertaining to the overall scope and objectives of the study will be shared with them. Meetings with community and school leadership will remain a significant

step to seek their cooperation throughout the study. All data collection tools will be translated in the local languages (Urdu and Sindhi). This phase will also involve pre-testing of all the data collection tools in the neighborhood school in the catchment area. After pre-testing, necessary modifications will be carried out in the tools.

Quantitative data collection

Survey of school children and mothers

The quantitative data collection instruments include two closed-ended survey questionnaires (for students and mothers). Survey questionnaire for children include questions to gauge child's knowledge and practices on basic personal and environmental health aspects at pre and post intervention phases of the study. Aspects under personal hygiene include: hand washing (pre-post eating, use of toilet, after playing), bathing, tooth brushing, nail hygiene, sneezing, washing fruits and vegetables before consumption and drinking boiled water. Whereas, the focus on environmental hygiene is on the knowledge and practices related to throwing and spitting garbage in the environment and its health effects. Children will be interviewed at the school.

On the other hand, survey questionnaire for mothers include questions about socio-demographic information (including age, qualification, occupation, income, household assets etc.). For demographic information, PDHS 2012-2013 [36] survey tool was adapted. Followed by the demographic questions, mothers will be particularly enquired about their knowledge and practices related to personal and environmental hygiene. Mothers will also be questioned about whether the child suffered from communicable illnesses one month prior to the survey. This includes diarrhea, pneumonia, scabies, oral health infections, typhoid, malaria, hepatitis and mosquitoe borne illnesses. In addition, the questionnaire will also assess the hygiene habits of their child. In case of more than two children belonging to same mother, she will be enquired

about the hygiene habits of a child through random selection. Interviews with mothers will be held at their homes.

Assessment of school physical environment

Role of school in promoting hygiene behavior among school children will be assessed by observing the physical environment. The observations will be categorized as present and absent with comments in six domains. This includes: general maintenance and waste disposal, hand washing facility, toilet hygiene, drinking water facility and hygiene behavior of school children. The checklist has adapted from US environmental assessment checklist for healthy school and water and sanitation standards for schools in low cost setting. [37]

Qualitative data collection

This involves four tools (1) checklist to review the school education curriculum (2) School Hygiene assessment checklist (3) In-depth interview guide with school teachers, DEO and DHO and (4) a Focus group discussion (FGD) interview guide for mothers.

School Education Curriculum checklist *has* been designed to assess the integration of basic health and hygiene aspects into the primary education curriculum (Sindh Text Book of class 1-5 grade). The assessment will revolve around whether or not key themes on personal and environmental hygiene are integrated into the curriculum, which strategies are utilized to increase hygiene literacy in children (such as use of pictures or text only), whether or not the curriculum sensitizes the children that unhygienic condition will lead to illnesses/ sicknesses. Furthermore, while reviewing the curriculum, structure of the language will also be examined in its simplicity and being captive in attracting children's attention. All the findings will be documented on MS Word with columns having the above components. The observation checklist has been adapted from the curriculum integration and instruction alignment guide [38].

In-depth interviews (IDIs) will be carried out with school teachers in the selected schools (associated with teaching in the primary section) and representatives in District Education and Health office. The purpose of IDIs with these stakeholders will be to explore their perception about hygiene literacy and practices in school children. In addition, IDIs will also be meaningful in exploring key stakeholders' views on existing health promotion activities in the school to promote child's behavior. An estimated length of the IDI will be 30-40 minutes. The interviews with DEO and DHO will be meaningful to unfold their role in health promoting activities at the school and the collaboration if any exists between the two sectors.

FGDs will be carried out with mothers of school children. To facilitate interview process, a FGD guide has been developed. FGDs will be instrumental in exploring mothers' views on health and hygiene, their knowledge and practices about hygiene and also their children's hygiene practices. In addition, FGD would also explore perceptions of mothers on innovative strategies to promote knowledge and practices of school children related to personal and environmental hygiene. Approximately 2-3 FGDs with mothers will be carried out per school. Number of FGDs will be increased keeping in view data saturation. Setting for the FGD will be decided in consultation with the mothers. A group of 6-12 mothers will be expected for a single FGD.

IDIs with teachers and other stakeholders and FGDs with mothers will be pivotal in exploring their views on 'what can work and what cannot towards enhancing personal and environmental hygiene' among school children. The perceptions and opinions collected during the FGDs will be meaningful in modifying the intervention package.

Separate interview guides for teachers and mothers have been developed with probes to facilitate the interviews process. Information on the survey form will be filled by data collectors,

whereas IDIs and FGDs will be conducted by the Principal Investigator and Co- Investigators. The data will be obtained in the local languages (Urdu and Sindhi).

Phase II: Intervention Phase

Multi-component intervention package has been designed aiming to improve personal and environmental hygiene of children utilizing behavior change communication (BCC) approaches.

The intervention phase (expected to last for 3-4 months) has been conceptualized by utilizing Albert Bandura's social learning theory [39].

The theory postulates that learning take place within a social context with three different modeling stimulus (live models, verbal instructions and symbolic). Demonstration through live models will be carried out in front of children by teachers and also through role-plays by senior students. Series of verbal health sessions will be held with the students using health education material. In addition, environment will be made symbolic to learn and practice hygiene behavior through display of information, education and communication (IEC) material and through organizing role plays and drama at the school. In addition, various behavioral and cognitive processes will be given attention. This includes, making children attentive to learn through different teaching and learning strategies. Retention of key concepts will be done by repeating the sessions at frequent intervals. To motivate children to practice hygiene behavior, school environment will be made conducive and children will be encouraged by the school teachers to practice and demonstrate the learned behavior. Refer Fig 1.

The intervention phase seeks to involve the community stakeholders in planning and implementation. Alongside 'adult to child' approach, notion of 'child to child' approaches [21-22] in behavior change communication will also be embedded in the intervention. Refer to table 3 for the details of the intervention package. Field manual for the intervention module will be developed to ensure adherence to the proposed intervention. The intervention will be

299 administered by the Principal Investigator and Field Team who will be thoroughly trained in
300 using the intervention modalities.

Phase III: Post Intervention

Post-intervention phase will determine the effectiveness of the school based intervention by measuring the level of change in the hygiene literacy and practices of school children and mothers through survey questionnaire. In addition, mothers will be once again assessed on the prevalence of communicable diseases among their children as assessed in pre-intervention phase (as used in Phase I).

Perceptions of mothers and teachers will also be gathered on how well the intervention modalities worked at the respective school settings and respondents' perceptions of the intervention in influencing children's hygiene knowledge and practices. Inspection of school physical environment will also be carried out to ascertain improvements in the health promoting environment using physical environment assessment checklist.

Across all phases of the study, Principal Investigator and Co- Investigator will randomly visit the field sites to ensure monitoring of data collection and implementation of intervention modalities. Feedback will be shared with the field team to ensure strict adherence to the data collection steps and intervention aspects. Data collection forms, interview recordings and transcripts will be safely stored with Principal Investigator in local and key with access to research team for data analysis.

Data Analysis

Quantitative data derived from survey questionnaires will be entered in EPI Data version 3 and will be analyzed in SPSS 19.0. Proportions will be reported to present knowledge and practices for children personal and environmental hygiene. Proportions will be categorized in to knowledge and practices domains under personal and environmental hygiene. Mean proportions will be then converted into scores. Scoring criteria includes (< 50= poor, 50-75=good and > 75= excellent). The scoring criterion has been customized for the purpose of analysis.

The McNemar test will be used to analyze the differences in the proportions for knowledge and practices of school children before and after the intervention. Similar test will also be applied to analyze the differences between children and their mothers before and after intervention. Paired T-test analysis will also be done pre and post intervention to measure the differences in knowledge and practice scores between mothers' hygiene literacy and practices with their child's knowledge and practices. In addition, paired T test will also be used to assess in difference in the prevalence of communicable diseases among children pre and post intervention. Similar tests will also be run to assess the differences in children' hygiene knowledge and practice scores pre and post intervention. Changes in knowledge and practice of school children regarding hygiene will be assessed. There are no sub-scales used in the study. All knowledge and practice related responses will be measured as scores (pre-post intervention). Scores will be summed together. Less than 50 will be considered as poor, minimum and maximum score for rest of the categories are 50-75 will be considered as Good and 75-100 as Excellent. Higher values in each of the three categories will represent better outcomes for knowledge and practice

This will include assessment of the change in the prevalence of communicable diseases (diarrhea, typhoid, pneumonia, oral health infections, scabies, hepatitis and mosquito borne

infections) through structured questionnaire. Proportions of the children with these conditions will be used to report the change. No scales or sub-scales will be used. Proportions specific for each diseases will be averaged out pre-post intervention study.

Qualitative data including FGDs (with mothers) and IDIs (with school teachers and District Education and Health Officers) will be recorded and transcribed verbatim. Data will be manually analyzed. Thematic analysis will be manually carried out in accordance with steps described by [40]. Refer Fig 2. Text will be read several times to develop in-depth understanding of the data. Meaning units (recorded text) will be read several times to identify the codes (short, meaningful descriptions). Similar codes will be then clustered into groups called “categories”, which will be later classified into themes. Themes generating from the data set will represent the latent content (the underlying meaning of the text) and relationships among the categories.

Data from qualitative and quantitative approaches will be triangulated for analysis at the end of the post-intervention phase. In order to obtain a comprehensive understanding of the hygiene literacy and practices among children and whether or not school based intervention has positively improved knowledge and practices of children, information from multiple sources (surveys, FGDs, IDIs, school physical environment assessment and education curriculum review) will be triangulated.

Discussion

Communicable diseases among school children remains a highly prevalent issue in LMICs such as Pakistan [41-43]. School and home are two of the primary settings to be considered to plan and implement behavior change communication about hygiene [43-44]. The described protocol of the current study aims to test the effectiveness of school-based hygiene interventions to improve the knowledge and practices of school children in urban squatter

settlements in Pakistan. The intervention will be conducted at three schools (one NGO-adopted and two government-managed schools) in urban squatter settlement with multiple stakeholders' involvement (teachers, school management, schoolchildren and their mothers).

Maternal knowledge and practices, as well as those of school teachers, have been shown to play an imperative role in improving hygiene practices of children [46-47]. During baseline, FGDs and IDIs will be conducted with mothers and teachers respectively to seek their perspectives about children's health and hygiene literacy and practices. Their opinions regarding positive and negative influences on children's hygiene practices at school and home will also be sought. Additionally, the school physical environment will be audited to inspect the availability of soap and appropriate hand-washing facilities, general cleanliness, adequate garbage disposal facilities, etc. for the students and staff at the school premises. During the intervention phase, participatory sessions will be organized with teachers to obtain their feedback on the intervention package. And teacher's capacity building session will be carried out to help them facilitate hygiene awareness sessions at the school. In addition, behavior change sessions for mothers will also be conducted at their homes. The study also attempts to analyze the existing school educational curriculum and examine the extent to which it incorporates hygiene principles.

The effectiveness of the intervention will be gauged through an end line survey of children's knowledge and practices, and also by capturing mothers and teachers' perceptions on how the school-based intervention improved the overall hygiene literacy and practices of children. Use of multiple data collection tools will facilitate us to validate our findings and assumptions about the children's hygiene knowledge and practices.

Principles of Bandura's social learning theory are incorporated into the study's intervention phase to reinforce children's hygiene practices through use of different modeling

stimuli (live modeling, symbolic and verbal instructions) and through different behavioral and cognitive processes which can potentially influence the adoption of hygiene behavior among children. Adequate knowledge about hygiene practices will be reinforced at frequent interval at the study settings.

To the best of our knowledge, earlier studies aiming to improve hygiene literacy and practices at schools have not taken the holistic approach as conceptualized in this research protocol. This study therefore intends to undertake a comprehensive assessment of hygiene by not only assessing children's knowledge and practices, but also by understanding the enablers and barriers of hygiene knowledge and practices for school children through teachers and mothers. And by undertaking a comprehensive assessment of school physical environment and educational curriculum. A limitation of the study lies in not involving fathers and by not doing a spot check of children's hygiene behavior at the school.

The study findings would be would be useful in proposing changes in the school curriculum to incorporate hygiene concepts, educating the hygiene principles at the school and ways to improve the school's physical environment for children to practice hygiene behavior. In addition, findings will also indicate the hygiene aspects which must be emphasized at the school and home settings for improved knowledge and practices for school children.

Abbreviations

AKU: Aga Khan University

BCC: Behavior Change Communication

DEO: District Education Officer

DHO: District Health Officer

ERC: Ethics Review Committee

FGDs: Focus Group Discussions

IEC: Information, Education and Communication

IDIs: In-depth interviews

KAP: Knowledge, attitude, practices

K&P: Knowledge and practices

LMICs: Low-middle income countries

NGO: Non-governmental Organization

PDHS: Pakistan Demographic and Health Survey

WHO: World Health Organization

UESCO: United Nations Educational, Scientific and Cultural Organization

UNICEF: The United Nations International Children's Emergency Fund

USAID: United States Agency for International Development

Declarations

Ethics approval and consent to participate

The study has received ethical approval from Ethics Review Committee (ERC), Aga Khan University (AKU) (5013 CHS- ERC-17). Approval will be obtained from the selected schools administration (NGO adopted school and two government run schools) before initiating the data collection. Consent from research participants (mothers, teachers, DHO and DEO) will be requested to participate in the study. Upon obtaining consent from mother, child's assent will be taken. Consent forms are designed for this purpose. Approval process will include verbal explanation to the participants about the purpose of the study and data collection methods followed by their written approval in form of signature/ thumb impression (for illiterate participants). Consent from mothers and children will be taken by the data collectors, on the other hand consent for qualitative interviews (FGDs and IDIs) with mothers, teachers and key informants will be obtained by the Principal Investigator. While obtaining study participants' consent, their anonymity of comments and responses will be also be ensured. All participants will also be provided with an ERC, AKU.

Consent for publication

Consent for publication of the findings has been stated in the consent forms.

Availability of data and material

The data collection tools developed/ adapted in the study and all data sets will be available upon request. Please note that there are no formal publicly available repositories in Pakistan for research manuscripts. Supporting data files will be shared if needed by the Journal Editors.

Competing interests

There are no competing interests to declare.

Funding

This study is funded through the AKU, Faculty of Health Sciences Research Committee (PF 90/1016). Funder has reviewed the overall study and their comments were incorporated before getting final approval. Funding is approved for all the activities related to data collection, hiring of human resources, designing and implementation of intervention etc. The grant does not cover funds for publication fee charges.

Authors' contributions

NAP is the Principal Investigator. NAP in consultation with TS and RK has designed the study protocol. NAP has written the manuscript. Alongside NAP, WM has contributed in writing various sections and formatting of the manuscript. All authors have reviewed the manuscript.

Acknowledgements

The authors would like to acknowledge Ms Naseem Hashmani for translating the study tools and Mr Issa Khan in providing the needed logistics assistance in identification of field sites.

Authors' information

Nousheen Akber Pradhan - Senior Instructor, Department of Community Health Sciences, Aga Khan University – nousheen.pradhan@aku.edu

Waliyah Mughis – Research Associate, Department of Paediatrics & Child Health, Aga Khan University Hospital – waliyah.mughis@aku.edu

Tazeen Saeed Ali – Associate Professor & Assistant Dean, School of Nursing & Midwifery, Aga Khan University – tazeen.ali@aku.edu

Rozina Karmaliani – Professor, School of Nursing & Midwifery, Aga Khan University – rozina.karmaliani@aku.edu

References

1. Vivas A, Gelaye B, Aboset N, Kumie A, Berhane Y, Williams MA. Knowledge, attitudes, and practices (KAP) of hygiene among school children in Angolela, Ethiopia. J Prv Med Hyg. 2010 Jun;51(2):73.
2. Guinan M, McGuckin M, Ali Y. The effect of a comprehensive handwashing program on absenteeism in elementary schools. Am J Infect Control. 2002 Jun 1;30(4):217-20.
3. Marmot M. The health gap: the challenge of an unequal world. Lancet. 2015 Dec 12;386(10011):2442-4.
4. WHO & UNICEF. (2015a). Water, sanitation and hygiene in health care facilities: status in low and middle income countries and way forward. Retrieved from http://apps.who.int/iris/bitstream/handle/10665/154588/?sequence=1
5. WHO (2015b). WHO global disability action plan 2014-2021: Better health for all people with disability. Retrieved from http://apps.who.int/iris/bitstream/handle/10665/69704/a91061.pdf?sequence=1
6. UNICEF. Pneumonia and diarrhea tackling the deadliest diseases. 2014. Retrieved from http://www.unicef.org/eapro/Pneumonia_and_Diarrhoea_Report_2012.pdf
7. Gurrent LR, Walker HD. Tropical infectious diseases. Philadelphia: Churchill Company. 1999:1005-24
8. Niehaus MD, Moore SR, Patrick PD, Derr LL, Lorntz B, Lima AA, Guerrant RL. Early childhood diarrhea is associated with diminished cognitive function 4 to 7 years

later in children in a northeast Brazilian shantytown. Am J Trop Med Hyg. 2002 May 1;66(5):590-3.

9. Oliveira D, Ferreira FS, Atouguia J, Fortes F, Guerra A, Centeno-Lima S. Infection by intestinal parasites, stunting and anemia in school-aged children from southern Angola. PLoS One. 2015 Sep 15;10(9):e0137327.
10. Gabbad AA, Elawad MA. Prevalence of intestinal parasite infection in primary school children in Elengaz area, Khartoum, Sudan. Academic Research International. 2014 Mar 1;5(2):86.
11. Watkins WE, Pollitt E. "Stupidity or worms": do intestinal worms impair mental performance? PSYCHOL BULL. 1997 Mar;121(2):171.
12. Sarkar M. Personal hygiene among primary school children living in a slum of Kolkata, India. J Prv Med Hyg. 2013 Sep;54(3):153.
13. Curtis V, Cairncross S. Effect of washing hands with soap on diarrhoea risk in the community: a systematic review. Lancet Infect Dis. 2003 May 1;3(5):275-81.
14. UNICEF. Motivating Better Hygiene Behaviour: Importance for Public Health Mechanisms of Change. 2014. Retrieved from http://www.unicef.org/wash/files/behav.pdf
15. Ifegbesan A. Waste management awareness, knowledge, and practices of secondary school teachers in Ogun state, Nigeria—Implications for teacher education. The Journal of Solid Waste Technology and Management. 2011 Aug 1;37(3):221-34.
16. Aiello AE, Coulborn RM, Perez V, Larson EL. Effect of hand hygiene on infectious disease risk in the community setting: a meta-analysis. Am J Public Health. 2008 Aug;98(8):1372-81.

513 17. Ilika AL, Obionu CO. Personal hygiene practice and school-based health education of
514 children in Anambra State, Nigeria. Niger Postgrad Med J. 2002 Jun;9(2):79-82.
515 18. Dongre AR, Deshmukh PR, Boratne AV, Thaware P, Garg BS. An approach to hygiene
516 education among rural Indian school going children. OJHAS. 2008 Jan 24;6(4).
517 19. Haque SE, Rahman M, Itsuko K, Mutahara M, Kayako S, Tsutsumi A, Islam MJ,
518 Mostofa MG. Effect of a school-based oral health education in preventing untreated
519 dental caries and increasing knowledge, attitude, and practices among adolescents in
520 Bangladesh. BMC Oral Health. 2016 Dec;16(1):44.
521 20. Dreibelbis R, Freeman MC, Greene LE, Saboori S, Rheingans R. The impact of school
522 water, sanitation, and hygiene interventions on the health of younger siblings of pupils:
523 a cluster-randomized trial in Kenya. Am J Public Health. 2014 Jan;104(1):e91-7.
524 21. Onyango-Ouma W, Aagaard-Hansen J, Jensen BB. The potential of schoolchildren as
525 health change agents in rural western Kenya. Soc Sci Med. 2005 Oct 1;61(8):1711-22.
526 22. Gunawardena N, Kurotani K, Indrawansa S, Nonaka D, Mizoue T, Samarasinghe D.
527 School-based intervention to enable school children to act as change agents on weight,
528 physical activity and diet of their mothers: a cluster randomized controlled trial. Int J
529 Behav Nutr Phys Act. 2016 Dec;13(1):45.
530 23. Patel MK, Harris JR, Juliao P, Nygren B, Were V, Kola S, Sadumah I, Faith SH,
531 Otieno R, Obure A, Hoekstra RM. Impact of a hygiene curriculum and the installation
532 of simple handwashing and drinking water stations in rural Kenyan primary schools on
533 student health and hygiene practices. A J Trop Med Hyg. 2012 Oct 3;87(4):594-601.
534 24. Ullah I, Sarwar G, Aziz S, Khan MH. Intestinal worm infestation in primary school
535 children in rural Peshawar. GJMS. 2009 Dec 31;7(2).

25. Anwar HN, Zafar MI, Hussain S. Health screening of primary school children: a case study of district Sargodha-Pakistan. Pak J Life Soc Sci. 2006;4:40-7.
26. Butt N. Evaluating Water, Sanitation and Hygiene (WASH) affecting school children performance in Lahore and Islamabad, Pakistan (Doctoral dissertation, Albert-Ludwigs-Universität Freiburg). 2014.
27. Vakani F, Basaria N, Katpar S. Oral hygiene KAP assessment and DMFT scoring among children aged 11-12 years in an urban school of Karachi. JCPSP. 2011;21(4):223.
28. Scott B, Curtis V, Rabie T, Garbrah-Aidoo N. Health in our hands, but not in our heads: understanding hygiene motivation in Ghana. Health Policy Plan. 2007 May 25;22(4):225-33.
29. Ahmad, F. and Danish, SH. School Health Services — a neglected sphere of influence in Pakistan. JPMA. 2013. 63:8; 948 – 949.
30. UNESCO. School Health Programme: A strategic approach for improving health and education in Pakistan. 2010.Retrived from [http://unesco.org.pk/education/documents/publications/School%20Health%20Programme.pdf]
31. White H, Sabarwal S. Quasi-experimental design and methods. Methodological Briefs: Impact Evaluation. 2014 Sep;8:1-6.
32. Pradhan NA, Ali TS, Hasnani FB, Bhamani SS, Karmaliani R. Measuring socio-economic status of an urban squatter settlement in Pakistan using WAMI Index. J Pak Med Assoc. 2018 May 1;68:709-14.

558 33. Boot MT, Cairncross S. Actions speak; the study of hygiene behaviour in water and
559 sanitation projects. IRC; 1993.
560 34. Ansari SY, Warbhe PA. Assessment of the Knowledge and Practice regarding Personal
561 hygiene among School Children from an Urban Area. IJCMAAS. 2014 Sep;4(1):1-2.
562 35. Amin, T. T., & Al□Abad, B. M. Oral hygiene practices, dental knowledge, dietary
563 habits and their relation to caries among male primary school children in Al Hassa,
564 Saudi Arabia. Int J Dent Hyg. 2008;6:4:361-370.
565 36. National Institute of Population Studies (NIPS) [Pakistan] and ICF International. 2013.
566 Pakistan Demographic and Health Survey 2012-13. Islamabad, Pakistan, and
567 Calverton, Maryland, USA: NIPS and ICF International.
568 37. Adams J, Bartram J, Chartier Y, Sims J, editors. Water, sanitation and hygiene
569 standards for schools in low-cost settings. World Health Organization; 2009.
570 38. Superintendent of Public Instruction Washington. Curriculum Integration and
571 Instructional Alignment Guide. 2007. Retrieved from:
572 www.k12.wa.us/EnvironmentSustainability/pubdocs/IntegrationGuideDraft9-07.doc
573 39. Grusec JE. Social learning theory and developmental psychology: The legacies of
574 Robert Sears and Albert Bandura. Dev Psychol. 1992 Sep;28(5):776.
575 40. Graneheim UH, Lundman B. Qualitative content analysis in nursing research:
576 concepts, procedures and measures to achieve trustworthiness. Nurse EducToday. 2004
577 Feb 1;24(2):105-12.
578 41. Javaeed A, Tabbasum T, Arif U, Ghauri SK, Khan SH, Wajid Z. Knowledge, attitude
579 and practices of water, sanitation and hygiene of students in Azad Kashmir. Rawal
580 Medical Journal. 2018 Jul 1;43(3):536-9.

42. Anand D, Prakash S. Assessment of the hygiene and sanitation practices of students of class VI to IX in urban government inter college at Allahabad district, India. Int J Community Med Public Health. 2018 Aug 24;5(9):3870-5.

43. Mohiuddin, I., & Ansari, H. (2018). Assessment of Risk Factors of Non-Communicable Diseases among Adolescents. Int J Health Sci Res. 8 (8). Retrieved from http://www.ijhsr.org/IJHSR_Vol.8_Issue.8_Aug2018/33.pdf

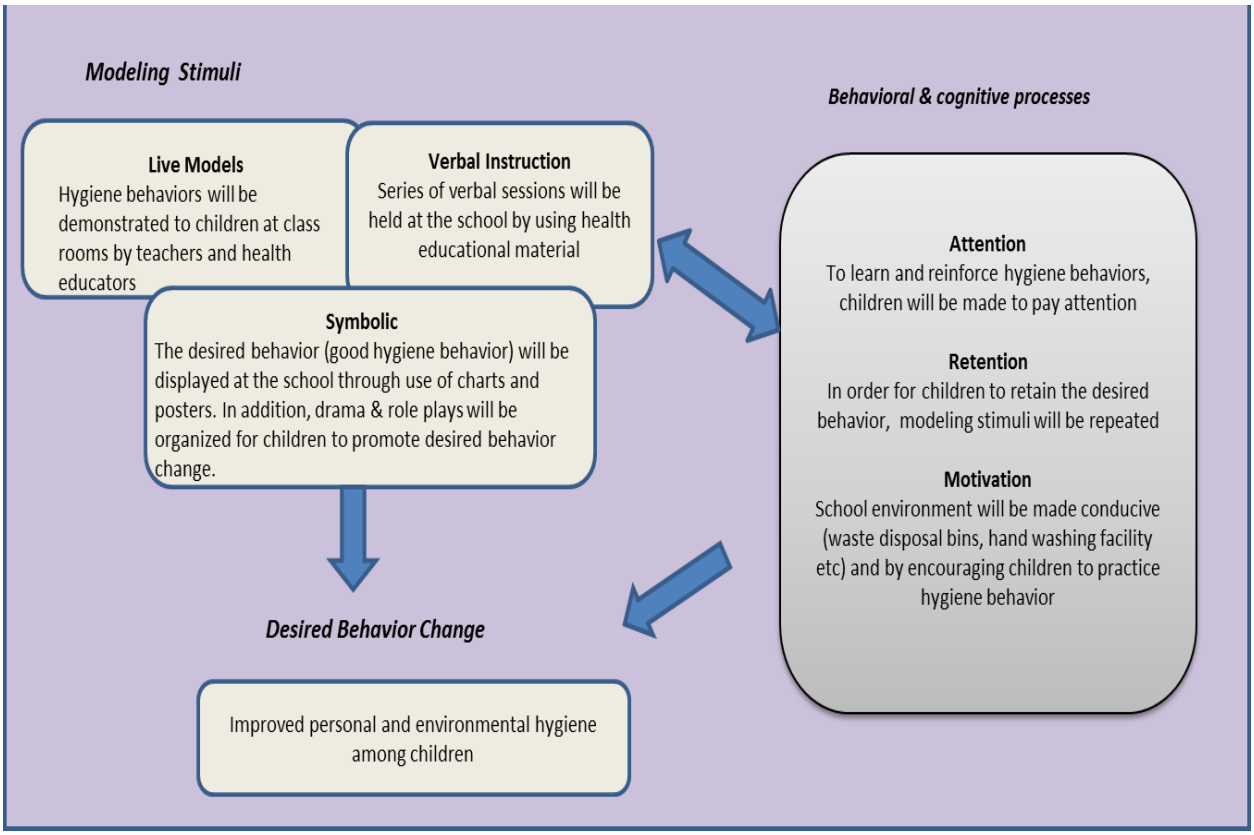
44. Britto PR, Lye SJ, Proulx K, Yousafzai AK, Matthews SG, Vaivada T, Perez-Escamilla R, Rao N, Ip P, Fernald LC, MacMillan H. Nurturing care: promoting early childhood development. Lancet. 2017 Jan 7;389(10064):91-102.

45. WHO. Creating an environment for emotional and social wellbeing: an important responsibility of a health promoting and child-friendly school. Geneva: World Health Organization. 2003. Retrieved from http://www.who.int/iris/handle/10665/42819

46. Hariharan M, Monteiro SR, Asha D, Rao CR. Perceptions of Health: A Developmental Trend in Indian School Children. Child Indic Res. 2018:1-8.

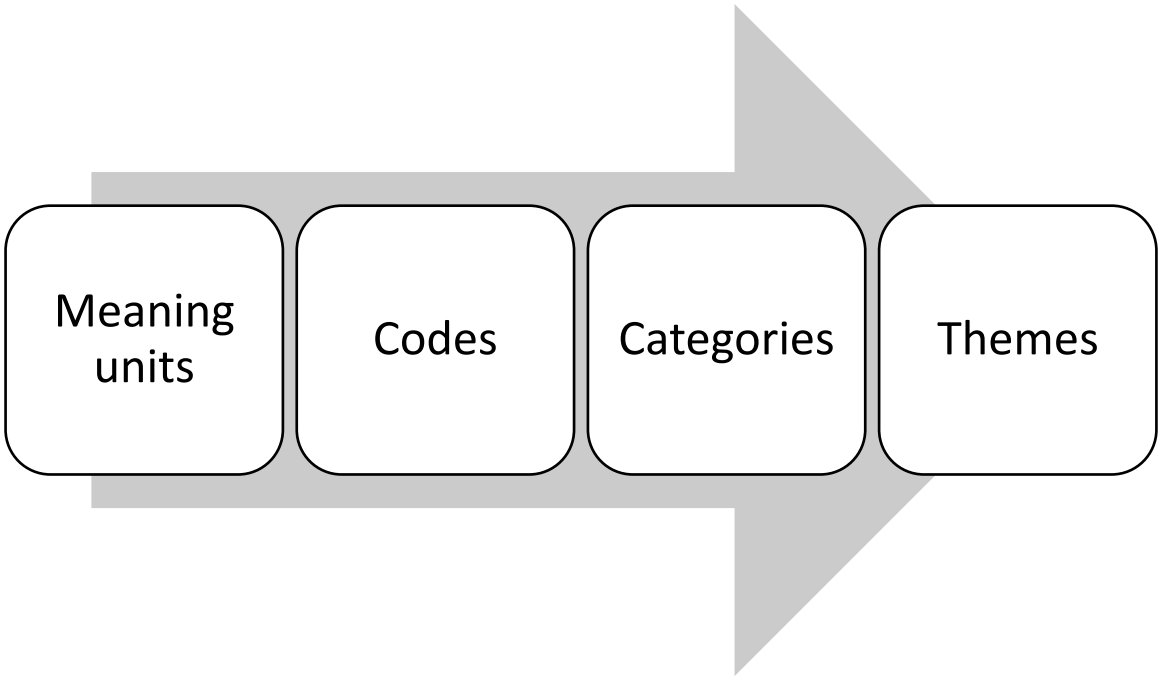
47. Parida LC. A study to assess the knowledge and practices regarding prevention of anaemia among antenatal women attending a tertiary level hospital in Pune. Int J Recent Sci Res. 2018 Aug 24;6(10).

Figure 1: Albert Bandura's Social Learning theory to promote hygiene behavior among school children



618 Figure 2: Graneheim & Lundman's qualitative data analysis process

619



620

621

622

623 Table 1: Data collection methods

624

Serial Number	**Tools**	**Purpose**	**Frequency**
1.	Survey questionnaire for children	• Assess the level of hygiene knowledge and practices among children at baseline & end-line • Assess the level of mothers' own hygiene knowledge and practices and also of their children at baseline and end-line	Baseline and end-line
2.	Survey questionnaire for mothers		

Serial Number	Tools	Purpose	Frequency
3.	Interview guide for FGD with teachers and mothers	• Explore enablers and barriers on school-based interventions to promote personal and environmental hygiene practices among children	Baseline and end-line
4.	School physical environment observation checklist	• Assessment of school physical environment to promote hygiene practices in children	Baseline and end-line
5.	Checklist to review educational curriculum	• Assess the integration of basic health and hygiene aspects in primary education curriculum	Baseline

625

626

Table 2: Operational definitions of hygiene indicators

S#	Hygiene indicator	Operational definition
1.	Personal hygiene	1. Drinking boiled/filtered water 2. Hand-washing (pre and post meal, after defecation, after playing outdoors) 3. Tooth brushing with toothpaste 4. Keeping nails trimmed/short 5. Covering mouth with elbow while sneezing 6. Taking bath regularly at least once daily 7. Washing fruits and vegetables before eating
2.	Environmental hygiene	1. Not spitting on streets 2. Not throwing garbage/waste on streets 3. Maintaining cleanliness of school toilets

632 **Table 3: Intervention package to improve hygiene literacy and practices among primary**

633 **grade school children & their mothers**

Serial Number	Interventions	Frequency	Platform/ channel of communication
1.	Capacity building of master trainers (school teachers and children)		
	1.1 Teachers' training/refresher sessions will be arranged to enhance hands on skills for educating children about improving personal and environmental hygiene	Once during the intervention phase and refresher sessions will be arranged as per need	Training sessions per school through using audio and visual (AV) aids
	1.2 Pool of children with good leadership skills will be selected from the school and will be trained in educating others on personal and environmental hygiene concepts	One time activity of selection of children	School settings
2.	Health awareness sessions by master-trainers at the school settings		
	2.1 Children will be educated about the need for hygiene and how to take care of personal and environmental hygiene. These sessions will be organized by teachers	Once a week for4- 6 weeks.	Use of posters and graphics in local language
	2.2 Role plays and awareness raising sessions by the children (senior students) to promote hygiene among students	Once every 2 weeks	Role plays and theatre
	2.3 Awareness raising sessions for mothers conducted and organized by teachers and health workers, on practice for personal and environmental hygiene	Once every 2 weeks for 4 weeks	Pictorial presentations in local language
3.	Promoting hygienic environment at schools		
	3.1 Environment will be made conducive through AV aids to foster hygiene habits among children	To be displayed during the entire intervention phase	Cartoon character practicing hygiene habits, and posters with hygiene messages
	3.2 Improvement in the school physical environment such as placing garbage disposal bins, ensuring availability of soap at the handwashing facility		Dissemination of the findings from baseline to school administration
4.	Reinforcement of hygiene concepts to children		
	4.1 Reinforcement of hygiene concepts to children will take various forms, such as asking children to mention what they	Once every 2 weeks for 4-6 weeks	Hygiene diary, hygiene games, hygiene quiz

Serial Number	Interventions	Frequency	Platform/ channel of communication
	have learnt by documenting it in their hygiene diaries, involving them in hygiene games, organizing hygiene quizzes at school		
5	Health literacy session for mothers		
	5.1. Mothers of school children will be sensitized on hygiene aspects through group discussion	Thrice in the entire period	Health education flyers and posters to be used during group discussion at home/ school settings