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

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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
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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].
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
mosquito 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
administered by the Principal Investigator and Field Team who will be thoroughly trained in 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 into 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 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.

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Figure 1: Albert Bandura’s Social Learning theory to promote hygiene behavior among school children.
Figure 2: Graneheim & Lundman’s qualitative data analysis process

Table 1: Data collection methods

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Tools</th>
<th>Purpose</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Survey questionnaire for children</td>
<td>• Assess the level of hygiene knowledge and practices among children at baseline &amp; end-line</td>
<td>Baseline and end-line</td>
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<td>2.</td>
<td>Survey questionnaire for mothers</td>
<td>• Assess the level of mothers’ own hygiene knowledge and practices and also of their children at baseline and end-line</td>
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<td>Serial Number</td>
<td>Tools</td>
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<td>3.</td>
<td>Interview guide for FGD with teachers and mothers</td>
<td>• Explore enablers and barriers on school-based interventions to promote personal and environmental hygiene practices among children</td>
<td>Baseline and end-line</td>
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<td>4.</td>
<td>School physical environment observation checklist</td>
<td>• Assessment of school physical environment to promote hygiene practices in children</td>
<td>Baseline and end-line</td>
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<td>5.</td>
<td>Checklist to review educational curriculum</td>
<td>• Assess the integration of basic health and hygiene aspects in primary education curriculum</td>
<td>Baseline</td>
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Table 2: Operational definitions of hygiene indicators

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<th>S#</th>
<th>Hygiene indicator</th>
<th>Operational definition</th>
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<tbody>
<tr>
<td>1.</td>
<td>Personal hygiene</td>
<td>1. Drinking boiled/filtered water</td>
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<td>2. Hand-washing (pre and post meal, after defecation, after playing outdoors)</td>
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<td>3. Tooth brushing with toothpaste</td>
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<td>4. Keeping nails trimmed/short</td>
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<td>5. Covering mouth with elbow while sneezing</td>
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<td>6. Taking bath regularly at least once daily</td>
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<td></td>
<td></td>
<td>7. Washing fruits and vegetables before eating</td>
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<tr>
<td>2.</td>
<td>Environmental hygiene</td>
<td>1. Not spitting on streets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Not throwing garbage/waste on streets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Maintaining cleanliness of school toilets</td>
</tr>
</tbody>
</table>
Table 3: Intervention package to improve hygiene literacy and practices among primary grade school children & their mothers

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Interventions</th>
<th>Frequency</th>
<th>Platform/channel of communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Capacity building of master trainers (school teachers and children)</td>
<td>Once during the intervention phase and refresher sessions will be arranged as per need</td>
<td>Training sessions per school through using audio and visual (AV) aids</td>
</tr>
<tr>
<td></td>
<td>1.1 Teachers’ training/refresher sessions will be arranged to enhance hands on skills for educating children about improving personal and environmental hygiene</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>One time activity of selection of children</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>School settings</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Health awareness sessions by master-trainers at the school settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>Once a week for 4-6 weeks.</td>
<td>Use of posters and graphics in local language</td>
</tr>
<tr>
<td></td>
<td>2.2 Role plays and awareness raising sessions by the children (senior students) to promote hygiene among students</td>
<td>Once every 2 weeks</td>
<td>Role plays and theatre</td>
</tr>
<tr>
<td></td>
<td>2.3 Awareness raising sessions for mothers conducted and organized by teachers and health workers, on practice for personal and environmental hygiene</td>
<td>Once every 2 weeks for 4 weeks</td>
<td>Pictorial presentations in local language</td>
</tr>
<tr>
<td>3.</td>
<td>Promoting hygienic environment at schools</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.1 Environment will be made conducive through AV aids to foster hygiene habits among children</td>
<td>To be displayed during the entire intervention phase</td>
<td>Cartoon character practicing hygiene habits, and posters with hygiene messages</td>
</tr>
<tr>
<td></td>
<td>3.2 Improvement in the school physical environment such as placing garbage disposal bins, ensuring availability of soap at the handwashing facility</td>
<td>Dissemination of the findings from baseline to school administration</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Reinforcement of hygiene concepts to children</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.1 Reinforcement of hygiene concepts to children will take various forms, such as asking children to mention what they</td>
<td>Once every 2 weeks for 4-6 weeks</td>
<td>Hygiene diary, hygiene games, hygiene quiz</td>
</tr>
<tr>
<td>Serial Number</td>
<td>Interventions</td>
<td>Frequency</td>
<td>Platform/ channel of communication</td>
</tr>
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<td>---------------</td>
<td>------------------------------------------------------------------------------</td>
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<tr>
<td>5</td>
<td>have learnt by documenting it in their hygiene diaries, involving them in hygiene games, organizing hygiene quizzes at school</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>5.1. Mothers of school children will be sensitized on hygiene aspects through group discussion</strong></td>
<td>Thrice in the entire period</td>
<td>Health education flyers and posters to be used during group discussion at home/ school settings</td>
</tr>
</tbody>
</table>
