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Research Paper

Integrated behaviour change intervention for sustainable community development: a KAP study of WASH in district Gujrat, Pakistan

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ABSTRACT

Behaviour change interventions are fundamental to achieve sustainability in communities through the identification of new, and strengthening the existing positive practices. It is considered central to the quest for a sustainable future and solves multidimensional community problems, which require large scale shifts in human behaviour with regard to their health, socio-physical activities and long held habits. In this context, the study examines the role of integrated behaviour change interventions for sustainable community development by exploring the direct and mediating impacts through knowledge attitude and practice (KAP) of water, sanitation and hygiene (WASH). The primary data was collected from district Gujrat (Pakistan) through stratified random sampling to explore the impacts of KAP of WASH and its relationship with child health and sustainable community development. The hypotheses of the study were tested with smartPLS software. Findings of the overall sample of the study have revealed that integrated behaviour change interventions have significant impacts on KAP, WASH practices in daily life, child health (CH) and sustainable community development (SCD). Furthermore, the relationships among variables are positively significant and have direct and mediating impacts on sustainable community development.

Key words: behaviour change intervention, integrated interventions, knowledge attitude and practice, sustainable community development, stratified random sampling, water sanitation and hygiene

HIGHLIGHTS

- Integrated behaviour change interventions regarding water, sanitation, and hygiene for the improvement of child health and sustainable community development.
- Knowledge, attitudes, and practices of mothers on a domestic level in daily life and its relationship with community development.
- Water, sanitation, and hygiene work as mediation variables for achieving sustainable community development.

INTRODUCTION

Behaviour change interventions are fundamental to achieve sustainability in communities through the identification of new practices and strengthening the existing positive practices. It is considered central to the quest for a sustainable future and solves multidimensional community problems, which require large-scale shifts in human behaviour with regard to their health, social, physical activities, and long-held habits (Yusliza *et al.* 2020). Behaviour change in individuals and communities is a consultative process, which is considered as a locus of change and is divided into two genres, as initiating behaviour change and maintaining the changed behaviour (Schroé *et al.* 2020). It provides information and motivation to phenomenal knowledge of existing realities, covers the modelling of behaviours, improves individual's self-efficiency, and ensures people empowerment in communities and at a national level as well (Desai *et al.* 2020). Numerous aspects of life such as health status, nutritional conditions, water, sanitation, and hygiene (WASH) practices, and sustainable development in communities are at the core of integrated behaviour change interventions. In the context of growing concern over the quality of human life and development of communities, behaviour change interventions are considered essential to improve living conditions and to achieve sustainability in communities (Dickin & Gautam 2019).

WASH-related diseases and infections continue to be the major contributor to health problems and stand as the second highest leading cause of mortality and morbidity among children. The World Health Organization estimated about 5.2 million children below 5 years die every year, mostly from preventable viral and infectious diseases. Besides this, globally there are billions of (about 1.7 billion) cases reported only of diarrhoeal diseases which are responsible for at least 1.9 million under-five deaths reported due to this (W. H. O. a. UNICEF 2019). The leading causes of these deaths are preterm birth complications, infections during and after birth, diarrhoea, malaria, cholera, hepatitis, and typhoid among many others. This chronic condition can be controlled and improved by providing access to adequate nutrition, safe water, sanitation, and dietary practices. WASH practices are also linked to many other diseases including malnutrition and stunting, internal and external infections, polio, trachoma, cholera, arsenicosis, giardiasis, ascariasis, and lead poisoning among others (Sharma Waddington & Cairncross 2021).

Globally, there are billions of avoidable diarrhoeal and parasitic diseases reported and millions of people especially children die every year before turning 5 years (W. H. O. a. UNICEF 2019). Whereas one-third out of total children's death cases occur in South-east Asia, which is the highest child mortality and morbidity rate in the world (UNICEF 2018). Inadequate access to drinking water combined with meager sanitation and unsafe hygienic practices have detrimentally impacted on human health. It is also the major source of transmission of a number of chronic diseases such as diarrhoea, hepatitis, stunting, polio, typhoid, and skin infections among many others in the communities (Organization 2017).

In developing countries like Pakistan, unsafe water and sanitation hygiene are major challenges and the largest hindrance towards sustainable community development (SCD) (Nations 2017). Poor WASH conditions and practices expose a plethora of infectious and viral diseases that incapacitate and significantly affect the health and reduce productivity (Organization 2017). Although Pakistan has shown some progress in recent decades in improving access to basic facilities of safe drinking water and providing improved sanitation, the country still remains plagued by extremely low levels of WASH conditions. Nearly 25 million individuals do not have access to basic facilities of drinking water which negatively impacts the physical and cognitive growth of children (Organization 2017). According to the Demographic Health Survey, Pakistan is among the top three countries, where high incidences of child mortality and morbidity are reported. Less than five mortality rate is 74 deaths per 1,000 live births. This means that approximately 1 in every 14 children in Pakistan do not survive to their fifth birthday (National Institute of Population Studies Islamabad Pakistan 2019). However, this irreversible loss of young lives could be reduced or saved every year if mothers have awareness, improved knowledge, attitude, practice (KAP), and behaviour regarding WASH (Sands & Aunger 2021).

Sustainable development in communities and improved quality of life for inhabitants is the utmost objective of sustainable development goals (SDGs). Despite huge economic investment and utilization of resources over the years, the desired socio-economic and sustainable development in communities could not be achieved, especially in developing countries. In Pakistan, the situation is more alarming, as a huge number of its population lives below the poverty line (Pakistan Economic Survey 2018). Numerous communicable and non-communicable WASH-related diseases affect communities in resource-poor settings in both tropical and subtropical conditions (Center for Global Health 2018). In addition to the high death rate, there is also a major social and economic loss that can cause long-lasting impacts and troubles to the communities. Many intangible costs were not included in the estimate, such as lack of privacy, security, status, and dignity. Without a better understanding, the importance and complexities of the behaviour change process and the desired results of SCD may be thwarted (Sharma Waddington & Cairncross 2021). Considering the above scenario, it can be assumed that the lack of basic knowledge and practices among mothers has significantly affected children under-five and created the largest hurdle towards SCD. Therefore, a comprehensive evaluation is carried out to know that the integrated behaviour change intervention can change the behaviour of individuals and can play its role in achieving the target of SCD. A conceptual framework of the study is presented in Figure 1 and the prime objectives of this study are as follows:

- To examine the attitude and WASH practices of mothers in intervened and non-intervened communities.
- To understand the impacts of knowledge and practices of WASH on child health and SCD.
- To inquire about the role of integrated behaviour change intervention in terms of SCD.

MATERIALS AND METHODS

A stratified multistage random sampling strategy was applied for the selection of respondents from the target communities. A total of 129 union councils (UCs) of district Gujrat are stratified into three strata according to their characteristics (Figure 2).

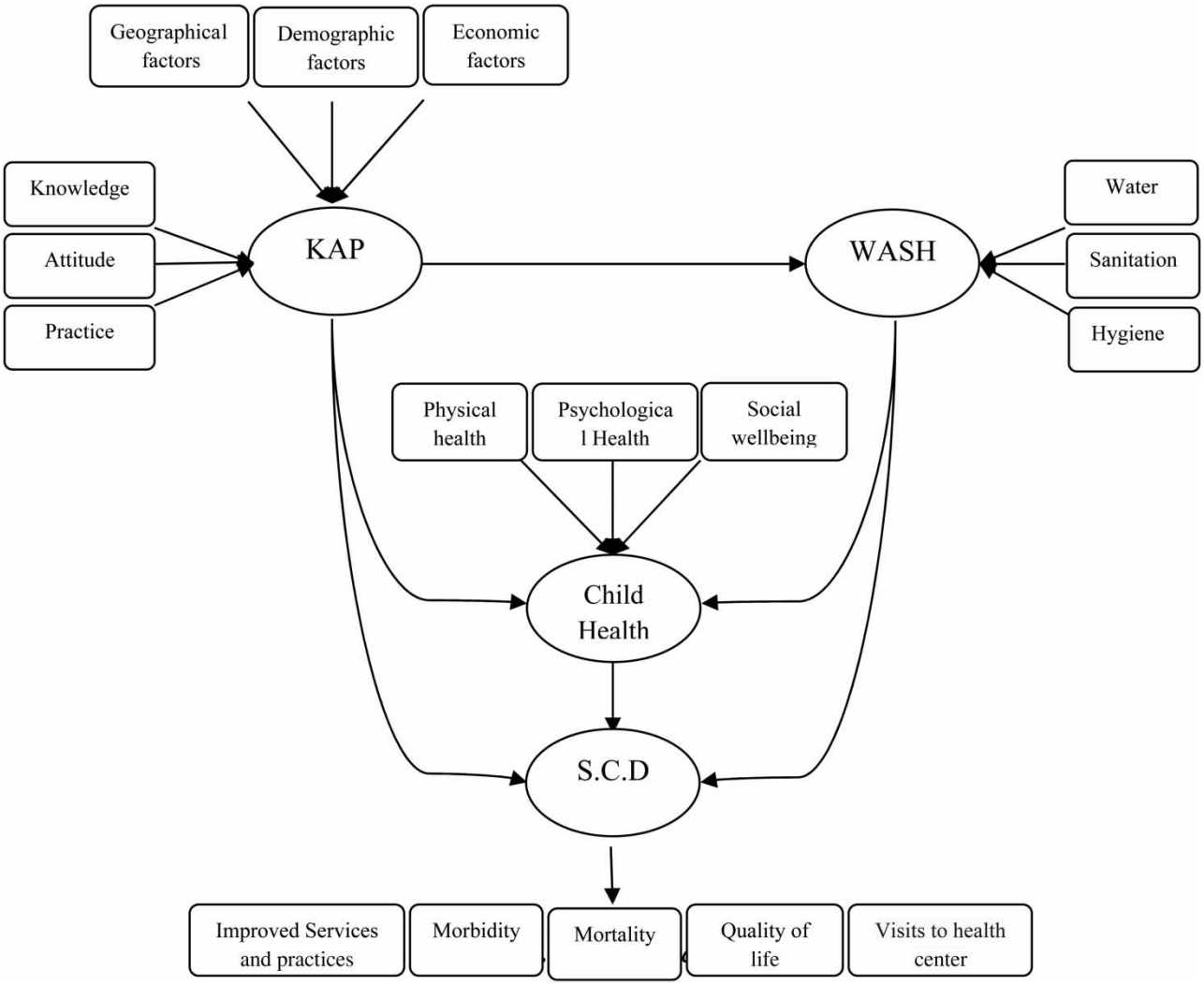

Figure 1 | Conceptual framework of the study.

The selection of the respondents was taken by a list of child birth registration obtained from the Local Government and Community Development Department (LG&CD) Gujrat (January 2017–December 2021). In total, 13 UCs were randomly selected from the above said stratum. From the selected 13 UCs, one ward of these UCs was randomly considered. The selected ward was completely investigated (Figure 2). Women who have children under 5 years are easily found through LG and CD list. A sample of size 400 is selected and calculated using a 5% margin of error in (Yamane 1967; Yamanae 1973) sample size calculation formula. Further as Kanuk & Berenson (1975); Linsky (1975); Armstrong & Overton (1977) and Wright *et al.* (2012) indicated that sample survey contain 30% or more nonresponse, we overcome this issue of nonresponse by adding 30% (120 units) more of sample size and the total sample collected is 520 mothers having children below the age of 5 years. Later, we observed that a 3.5% nonresponse exist in the survey.

A structured questionnaire is the main research instrument. Questions were measured by a 5-point Likert scale where 1 means strongly disagreed and 5 means strongly agreed. The process of primary data collection was completed during the period of December 2021–May 2022.

The study employed household survey methods and techniques. Subsequent to the completion of data collection procedure, collected data were edited, coded, and entered in SPSS-21 for further descriptive and inferential analysis. The preliminary techniques which were utilized in the study to explore the nature of data and its suitability are descriptive

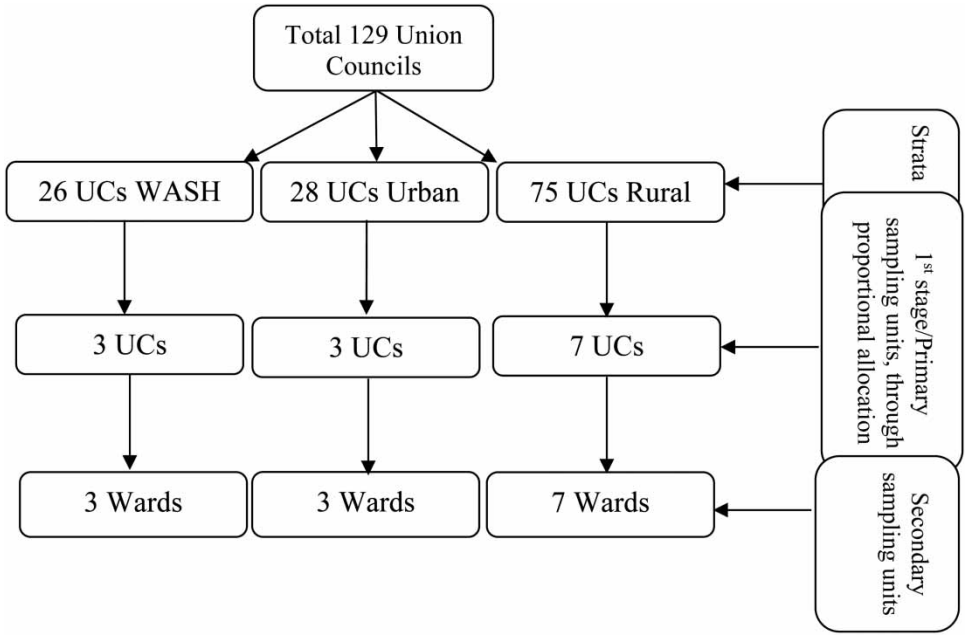

Figure 2 | Sampling procedure flowchart.

analysis, which elaborates the basic feature, nature, and detailed insight into collected data and provides basic information regarding the suitability for further analysis. Confirmatory factor analysis was applied to confirm the most suitable indicators for further analysis such as structural equation modelling (SEM). The measurement of the model was examined to determine the appropriateness of loadings of all considered indicators. The study model is evaluated in order to affirm that items measure the construct they were supposed to measure, consequently ascertaining that the instrument used is reliable. Moreover, the SEM was applied to describe the configuration of a chain of interlinked dependent interactions and depict relationships among observed variables. Finally, mediation analysis was applied for testing the casual relationship where the independent variable directly affects the mediator variable and the mediator variable impacts the dependent variable. Mediation through bootstrapping approach was applied in the present study, which is considered slightly rigorous for estimating the mediation impacts of WASH on child health (CH) and SCD.

RESULTS AND DISCUSSION

The validity and reliability of variables were tested through various parameters as composite reliability (CR) and Cronbach's alpha. In the beginning, all indicators were tested through smartPLS software and the items smaller than 0.600 were discarded from the list of indicators. The data for this were collected from three different respondents' group, the results of reliability and validity of all groups and overall data are presented in Table 1. The calculation of the test highlighted that all the values of alpha and CRs were higher as 0.700 as recommended for these tests.

Similarly, the CRs and the average variance extracted (AVE) were also higher or close to the required values of 0.500 and 0.700, respectively. Cross-loadings also assessed the discriminant validity and multicollinearity assessed with the value of each indicator variance inflation factor (VIF) and the value of each indicator VIF was determined to be less than 10.

Finally, Table 2 presents the loadings of all items taken in this study as KAP, WASH, CH, and SCD. The recommended parameters defined by Chin *et al.* (2003) can be considered as poor if the value of the factor is less than 0.30, and normal or fair if it is about 0.31–0.500. In the same way, if the observed values are between 0.51 and 0.60, the factor looks moderated and considered strong if the range value is between 0.61 and 0.80 or above.

We can see all the observed values are greater than 0.61 which clearly indicated that there are very strong lodgings existed for each selected indicator for the variable of the study. All the alpha and CRs values from each group of respondents were greater than the recommended parameters value of 0.700. In the same way, the CR and AVE were also greater than 0.600 and

Table 1 | Item loadings, reliability and validity

Overall sample						Urban						Rural (intervened)						Rural (non-intervened)					
	Lambda	Alpha	CR	AVE	VIF		Lambda	Alpha	CR	AVE	VIF		Lambda	Alpha	CR	AVE	VIF		Lambda	Alpha	CR	AVE	VIF
KAP1	0.799	0.958	0.964	0.751	2.380	KAP1	0.743	0.913	0.931	0.659	1.186	KAP2	0.923	0.965	0.971	0.827	5.781	KAP2	0.808	0.937	0.949	0.729	2.775
KAP2	0.851				3.117	KAP2	0.848				2.915	KAP4	0.937				6.154	KAP4	0.722				1.626
KAP5	0.869				3.184	KAP4	0.751				1.844	KAP5	0.789				2.147	KAP5	0.933				5.641
KAP7	0.867				3.459	KAP5	0.756				1.995	KAP8	0.898				4.156	KAP7	0.816				2.545
KAP8	0.919				5.679	KAP7	0.848				3.212	KAP9	0.912				4.956	KAP8	0.898				4.746
KAP9	0.849				2.940	KAP12	0.879				3.681	KAP12	0.949				7.461	KAP9	0.925				4.970
KAP11	0.815				2.876	KAP15	0.845				3.420	KAP15	0.949				8.155	KAP12	0.853				3.113
KAP12	0.892				3.976																		
KAP15	0.928				5.771																		
WASH1	0.845	0.961	0.965	0.681	3.732	WASH1	0.827	0.958	0.964	0.747	3.440	WASH1	0.749	0.924	0.938	0.655	1.921	WASH4	0.859	0.949	0.956	0.685	3.309
WASH2	0.906				5.650	WASH4	0.866				3.610	WASH4	0.849				3.782	WASH5	0.902				4.115
WASH4	0.847				3.202	WASH5	0.898				7.340	WASH18	0.807				3.539	WASH17	0.778				2.311
ASH5	0.908				5.687	WASH17	0.891				4.299	WASH20	0.850				3.168	WASH18	0.803				2.509
WASH17	0.784				2.318	WASH23	0.868				5.293	WASH24	0.749				1.973	WASH20	0.725				2.080
WASH18	0.761				2.337	WASH24	0.777				3.341	WASH25	0.694				1.798	WASH23	0.880				3.842
WASH20	0.778				2.336	WASH28	0.897				5.442							WASH24	0.826				3.190
WASH23	0.824				3.068	WASH32	0.792				2.964	WASH28	0.881				3.584	WASH28	0.912				4.744
WASH24	0.795				2.638													WASH31	0.726				2.206
WASH25	0.721				3.303																		
WASH28	0.902				4.662	WASH39	0.947				8.571	WASH39	0.878				3.398	WASH39	0.840				3.518
WASH31	0.745				4.070																		
WASH39	0.884				4.039																		
CH6	0.772	0.816	0.878	0.643	5.193	CH5	0.789	0.789	0.869	0.689	1.171	CH5	0.752	0.821	0.882	0.651	1.554	CH6	0.805	0.799	0.867	0.620	6.386
CH8	0.802				3.462	CH6	0.852				6.390	CH6	0.831				3.389	CH11	0.845				6.904
CH11	0.788				5.315	CH11	0.849				6.309	CH8	0.783				1.552	CH12	0.762				1.398
CH15	0.843				3.655							CH11	0.851				3.614	CH13	0.734				1.292
SCD7	0.922	0.896	0.934	0.825	2.469	SCD7	0.913	0.888	0.929	0.814	2.232	SCD3	0.919	0.625	0.952	0.868	2.736	SCD7	0.944	0.908	0.940	0.840	3.214
SCD10	0.917				3.253	SCD10	0.906				3.062	SCD9	0.951				5.894	SCD10	0.943				3.975
SCD14	0.885				2.740	SCD14	0.888				2.591	SCD13	0.925				4.694	SCD14	0.859				2.567

Table 2 | Discriminant validity (cross-loadings) using the criterion by the Heterotrait–Monotrait Method (HTMT)

Overall sample					Urban sample					Rural (intervened)					Rural (non-intervened)				
	CH	KAP	SCD	WASH		CH	KAP	SCD	WASH		CH	KAP	SCD	WASH		CH	KAP	SCD	WASH
CH11	**0.788**	0.208	0.225	0.165	CH11	**0.849**	0.195	0.305	0.095	CH11	**0.857**	0.302	0.287	0.265	CH11	**0.845**	0.225	0.191	0.166
CH15	**0.843**	0.222	0.308	0.179	CH5	**0.789**	0.367	0.254	0.302	CH5	**0.752**	0.271	0.158	0.365	CH12	**0.762**	0.242	0.33	0.127
CH6	**0.772**	0.194	0.206	0.154	CH6	**0.852**	0.149	0.265	0.086	CH6	**0.831**	0.303	0.27	0.262	CH13	**0.734**	0.292	0.287	0.17
CH8	**0.802**	0.173	0.278	0.174	KAP1	0.325	**0.743**	0.176	0.182	CH8	**0.783**	0.395	0.171	0.407	CH6	**0.805**	0.204	0.154	0.157
KAP1	0.176	**0.799**	0.163	0.207	KAP12	0.211	**0.879**	0.124	0.25	KAP12	0.381	**0.949**	0.17	0.27	KAP12	0.222	**0.853**	0.093	0.194
KAP11	0.106	**0.815**	0.08	0.215	KAP15	0.218	**0.845**	0.058	0.109	KAP15	0.35	**0.949**	0.168	0.295	KAP2	0.231	**0.808**	0.012	0.168
KAP12	0.243	**0.892**	0.135	0.23	KAP2	0.276	**0.848**	0.157	0.229	KAP2	0.34	**0.923**	0.212	0.329	KAP4	0.307	**0.722**	0.246	0.222
KAP15	0.244	**0.928**	0.131	0.216	KAP4	0.22	**0.751**	0.18	0.14	KAP4	0.393	**0.937**	0.17	0.267	KAP5	0.297	**0.933**	0.164	0.23
KAP2	0.203	**0.851**	0.089	0.232	KAP5	0.205	**0.756**	0.109	0.161	KAP5	0.353	**0.789**	0.126	0.213	KAP7	0.213	**0.816**	0.069	0.189
KAP5	0.286	**0.869**	0.174	0.211	KAP7	0.296	**0.848**	0.151	0.048	KAP8	0.309	**0.898**	0.196	0.241	KAP8	0.196	**0.898**	0.056	0.222
KAP7	0.205	**0.869**	0.174	0.211	SCD10	0.252	0.139	**0.906**	0.124	KAP9	0.408	**0.912**	0.206	0.225	KAP9	0.338	**0.925**	0.178	0.234
KAP8	0.192	**0.919**	0.115	0.229	SCD14	0.236	0.113	**0.888**	0.252	SCD13	0.231	0.181	**0.925**	0.158	SCD10	0.299	0.114	**0.943**	0.043
KAP9	0.239	**0.849**	0.128	0.213	SCD7	0.378	0.205	**0.913**	0.172	SCD3	0.292	0.17	**0.919**	0.208	SCD14	0.193	0.094	**0.859**	−0.071
SCD10	0.266	0.103	**0.917**	0.056	WASH1	0.126	0.084	0.143	**0.827**	SCD9	0.229	0.201	**0.951**	0.166	SCD7	0.351	0.191	**0.944**	0.054
SCD14	0.241	0.108	**0.885**	0.048	WASH17	0.251	0.241	0.208	**0.891**	WASH1	0.396	0.246	0.167	**0.749**	WASH17	0.17	0.144	−0.003	**0.778**
SCD7	0.345	0.176	**0.922**	0.1	WASH23	0.216	0.089	0.262	**0.868**	WASH18	0.332	0.306	0.156	**0.807**	WASH18	0.144	0.16	−0.042	**0.803**
WASH1	0.132	0.217	0.042	**0.845**	WASH24	0.103	0.08	0.017	**0.777**						WASH20	0.104	0.105	−0.009	**0.725**
WASH17	0.185	0.226	0.074	**0.784**	WASH28	0.165	0.163	0.124	**0.897**	WASH20	0.293	0.237	0.213	**0.85**	WASH23	0.241	0.226	0.026	**0.88**
WASH18	0.193	0.216	0.084	**0.761**	WASH32	0.15	0.087	0.069	**0.792**						WASH24	0.053	0.163	−0.028	**0.826**
WASH2	0.197	0.23	0.08	**0.906**	WASH32	0.15	0.087	0.069	**0.792**	WASH24	0.298	0.193	0.106	**0.749**	WASH28	0.191	0.281	0.088	**0.912**
WASH20	0.187	0.149	0.057	**0.778**															
WASH23	0.181	0.178	0.073	**0.824**	WASH32	0.15	0.087	0.069	**0.792**	WASH25	0.288	0.098	0.211	**0.694**	WASH31	0.063	0.069	0.003	**0.726**
WASH24	0.11	0.171	0.016	**0.795**															
WASH25	0.147	0.155	0.046	**0.721**	WASH39	0.225	0.241	0.195	**0.947**	WASH28	0.334	0.279	0.176	**0.881**	WASH39	0.145	0.194	0.068	**0.84**
WASH28	0.195	0.247	0.086	**0.902**															
WASH31	0.091	0.092	−0.011	**0.745**	WASH4	0.177	0.29	0.149	**0.866**	WASH39	0.329	0.244	0.084	**0.878**	WASH4	0.138	0.231	− 0.045	**0.859**
WASH39	0.167	0.21	0.091	**0.884**															
WASH4	0.178	0.23	0.043	**0.847**	WASH5	0.218	0.161	0.25	**0.898**	WASH4	0.342	0.217	0.149	**0.849**	WASH5	0.228	0.295	0.052	**0.902**
WASH5	0.218	0.259	0.096	**0.908**															

0.800 respectively, and also corroborates convergent validity. Fornell & Larcker (1981) also recommended the criterion to test the discriminant validity as presented in Table 3. The basic demographic characteristics of respondents such as age, qualification, occupation, family system, physical condition of children and participation in WASH programe is given in Table 4.

STRUCTURE EQUATION MODEL

Variance-based structure equation model is one among the most suitable practicing method in social science for the measurement of multidimensional relationships. This approach also assessed in hypothesis testing and concluding results that evolved from the proposed theoretical framework. SmartPLS software is one of the most suitable tools for measuring the models, as the model of this study was also tested by using this software. The results of the fitted model are presented in the following graph indicated that the KAP of mothers have significant positive impacts on WASH practices in daily life activities. Similarly, the measurement of all other variable and their impact level upon others is also presented in the given graph.

Findings of the study revealed that there is a very strong positive association among KAP of mother and CH. The mothers are the primary caregiver to their children; hence, the caring practice of mothers depends on the knowledge, practices, and behaviour in daily life activities. Findings also support and approved the assumptions of a theoretical model of the study. The structural equation model results confirmed that the KAP of mothers have a positive influence on WASH practices. This leads to suggest that individuals who have knowledge, awareness, and positive attitude can practice more safe WASH activities in their daily life and can prevent their children from various viral/infectious diseases. Structure equation modelling results also depicted that WASH has a positive relation with CH conditions and with SCD.

GOODNESS-OF-FIT

SmartPLS software facilitates the variance-based SEM, deriving the model fit statistics from the discrepancy that existed among the approximated and observed values of the dependent variable of the study and with the values predicted by the model. The findings for estimating the goodness-of-fit value which was found within prescribed limits as χ^2 (5217.391), d_ULS (1.791), d_G (0.651), SRMS (0.052), and RMS-Theta (0.123), see Table 5. On the basis of findings in Table 5, it is suggested that a higher level of safe WASH practice can improve the health conditions of individuals, families, and at community level, which reduced the unbearable economic expenses on medication and infrastructure in Pakistan.

HYPOTHESES TESTING ANALYSIS

An algorithm was processesed on smartPLS software to generate the path coefficients and hypothesis testing and at next stage bootstrapping with 5,000 bootstrap samples were run, and this is basically bigger than the actual sample size of the study to generate the *t*-values and meet the suggested conditions by Wilson (2011); Hair *et al.* (2012); Hashim *et al.* (2012); Lowry *et al.* (2014). The results from bootstrapping technique are presented in Table 6 which indicated that the first hypothesis (H1) has a positive significant relationship among KAP of mothers with WASH practices with $\beta = 0.250$, $t = 4.746$. The study model of Figure 3 presents the flow diagram and the results proved that improved mother knowledge positively impacted attitude that leads to safe practices regarding drinking water, sanitary and hygienic practices.

Similarly, the second hypothesis (H2) also had positive relationships and supported our assumptions as WASH practices had direct impacts on CH with $\beta = 0.158$, $t = 3.066$, $p = <0.002$. Findings endorsed the flow relationship presented in the conceptual model of Figure 1 and revealed that WASH has a direct and significant relation with CH and the change in one variable has significantly impacted the other one (see Figure 3). Thereafter, the third hypothesis (H3) was found accepted and presented a positive relationship among considered variables as WASH have direct impacts on SCD. This positive relationship is significant with a *p*-value of 0.005 and $\beta = 0.131$, $t = 3.021$. The conceptual framework highlighted the mediation role and results show WASH impacts on CH and SCD. Findings strongly recommended that improving the physical, and psychological CH and socialization of young children can positively impact SCD.

H4 of the study was also significant and supported the findings as KAP of mothers have a direct positive relationship with CH with $\beta = 0.210$, $t = 4.328$ (Table 6). Thus, on this basis, it can be clinched that as higher KAP can positively affect all dimensions of WASH, and it will also bear a positive impact and strong significance relationship. Thereafter, H5 considered in this study was found to have a positive relationship between the KAP of mothers and SCD. The variables are significant at *p*-value 0.007 with $\beta = 0.172$, $t = 3.374$. Findings of the study specify a positive influence of higher the level of KAP higher the level of SCD.

Table 3 | Discriminant validity using the criterion by Fornell & Larcker (1981)

	Overall sample				Urban sample				Rural (intervened)				Rural (Non-intervened)			
	CH	KAP	SCD	WASH	CH	KAP	SCD	WASH	CH	KAP	SCD	WASH	CH	KAP	SCD	WASH
CH	**0.802**				**0.830**				**0.807**				**0.788**			
KAP	0.249	**0.866**			0.315	**0.812**			0.399	**0.909**			0.314	**0.859**		
SCD	0.321	0.148	**0.908**		0.331	0.175	**0.902**		0.273	0.196	**0.932**		0.322	0.154	**0.916**	
WASH	0.210	0.250	0.079	**0.825**	0.224	0.205	0.204	**0.864**	0.407	0.289	0.193	**0.810**	0.198	0.249	0.024	**0.828**

Table 4 | Descriptive results

Demographic characteristics	Description of characteristic	*N*	%
Age	18–24	54	10.8
	25–34	254	50.6
	35–44	165	32.9
	45–54	29	5.8
	Total	**502**	**100**
Qualification	1–5	56	11.2
	6–10	190	37.8
	11–12	120	23.9
	13–14	81	16.1
	15–16 or above	55	11.0
	Total	**502**	**100**
Occupation	House wife	363	72.3
	Job (Govt/Private)	98	19.5
	Agricultural/Labour	29	5.8
	Personal business	12	2.4
	Total	**502**	**100**
Family System	Nuclear	169	33.7
	Joint	289	57.6
	Extended	24	4.8
	Single Parent	17	3.4
	Any other	3	0.6
	Total	**502**	**100**
physical condition (Height and weight) of your child	Under weight	71	20.4
	Under height	173	49.7
	Both height and weight issues	65	18.7
	Weakness	39	11.2
	Total	**348**	**100.0**
Participation in WASH programme	Yes	160	31.9
	No	342	68.1
	Total	**502**	**100.0**

Table 5 | Goodness-of-fit measures

	χ^2	d_ULS	d_G	RMS_Theta	SRMR
SEM	5,217.391	1.791	0.651	0.123	0.052
Recommended value for model fit	p-value ≤ 0.05	d_ULS $\leq$99%	d_G $\leq$ 99%	RMS_Theta ≈ 0.000 or RMS_Theta ≤ 0.12	SRMR < 0.10

The H6 predicts a positive relationship between CH and SCD. The relationship observed is positive and strongly significant with $\beta = 0.303$, $t = 7.198$. Results state a positive influence of the higher level of CH conditions, a higher level of SCD. Hypothesis H7, specifies a positive influence of the higher level of participation in behaviour change interventions, and a higher level of improved WASH practiced.

Along with this, in H8, a higher level of participation in behaviour change interventions leads towards a higher level of CH, and in H9, a higher level of participation in behaviour change interventions leads towards a higher level of SCD. The findings of this study confirmed all three (H7, H8, H9) hypotheses and explained that the individuals who participated in integrated behaviour change intervention have better understandings, conditions, and practices regarding WASH, CH, and SCD.

Table 6 | Direct hypothesis relationships (H1, H2, H3, H4, H5, H6)

Hypothesis no.	Hypothesized effect	Path coefficient	Standard error	*T*-value	*p*-value	Decision
H1	KAP > WASH	0.250	0.053	4.746	0.000***	Supported
H2	WASH > CH	0.158	0.051	3.066	0.002***	Supported
H3	WASH > SCD	0.131	0.049	3.021	0.005***	Supported
H4	KAP > CH	0.210	0.048	4.308	0.000***	Supported
H5	KAP > SCD	0.172	0.053	3.374	0.007***	Supported
H6	CH > SCD	0.303	0.042	7.198	0.000***	Supported

***Significant at 1%.

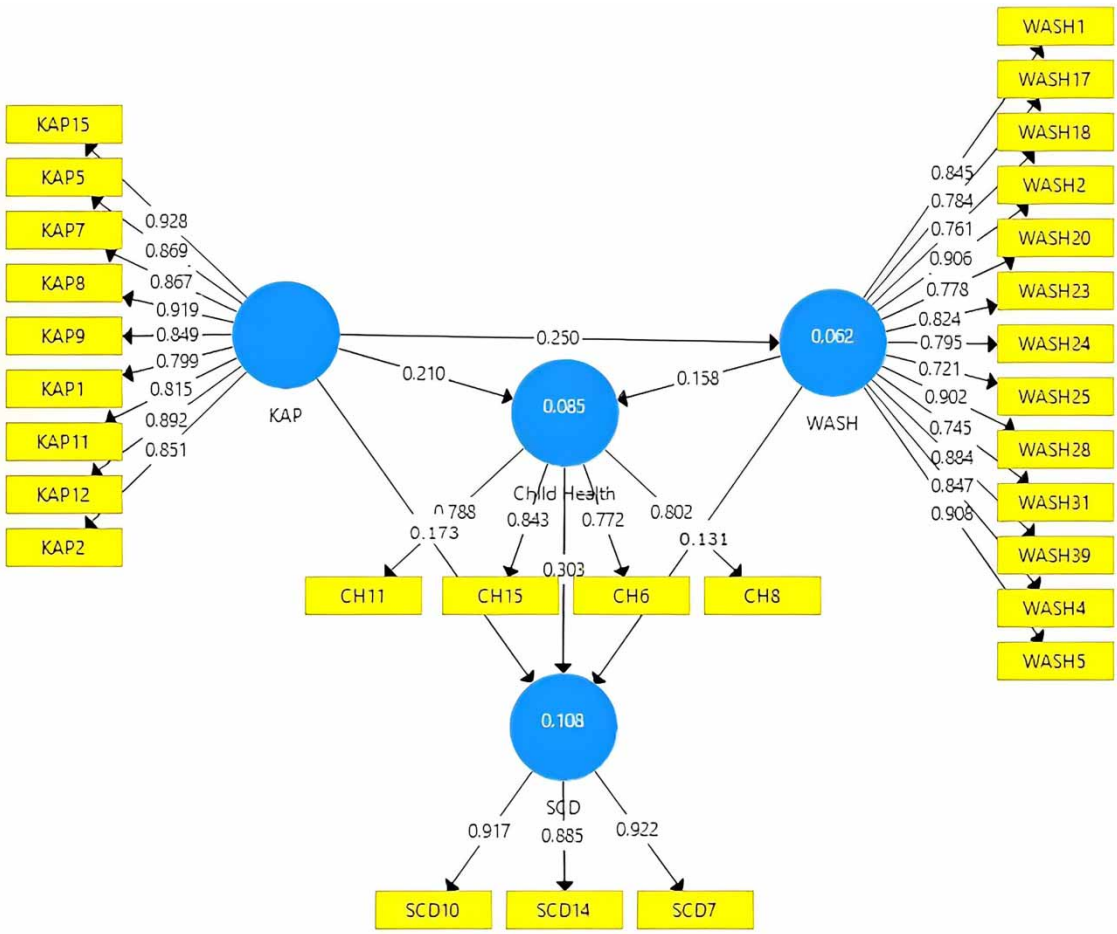

Figure 3 | Fitted model and path results (β-values).

MEDIATION ANALYSIS

The findings of (Table 7) explained the role of WASH as a noteworthy mediator between KAP, CH, and SCD. This primary information led to assume that WASH may play a role more effectively to enrich the child's health conditions and SCD. As discussed earlier in the Introduction section, behaviour change remained centre of the attention for a long period. This process is considered central to the quest for a sustainable future and solves multidimensional community problems, which require large scale shifts in human behaviour with regard to their health, social, physical activities, and long-held habits.

Table 7 | Special indirect effects of variables

Mediation effect	Path coefficient	Standard error	*T*-value	*p*-value	Decision
KAP > WASH > CH	0.039	0.013	3.009	0.009***	Mediation
KAP > WASH > SCD	0.042	0.014	2.781	0.006***	Mediation
KAP > CH > SCD	0.092	0.022	4.138	0.000***	Mediation
WASH > CH > SCD	0.079	0.017	4.531	0.000***	Mediation

***Significant at 1%.

CONCLUSION

The study examined the behaviour change interventions for SCD a KAP study of WASH. As it is evident in the existing literature (Nwokoro *et al.* 2020; Kithuki *et al.* 2021; Ross *et al.* 2021) that every year billions of funds, time, and resources were spent on the development and maintenance of infrastructure regarding water and sanitation, and on the improvement of health conditions in the country. Overall results of the study revealed a positive relationship between KAP and WASH supporting previous findings (Berhe *et al.* 2020; Domini *et al.* 2020). These findings align with the theory of planned behaviour (TPB) and theory of reasoned action (TRA), which support the arguments that the KAP of mothers may affiliate with the behaviour and practice of WASH in daily life. KAP of mother regarding WASH has a significant impact on CH (Andreas *et al.* 2018; Moreno *et al.* 2020) and SCD (Kapsalis & Kapsalis 2020).

Findings indicated that the KAP is a significant factor so the organized integrated behaviour change interventions can build or enhance a conducive environment so that individuals enhance existing understandings, actual practices, and there behavioural impacts on their health and life (Cooper 2019; Weston *et al.* 2020). It is observed during analysis that the respondents participated in behaviour change interventions have better understanding and practice regarding the WASH-related attitude, practices and have better psycho-physical and social health of their under-five children. Behaviour change interventions at school, community, and national level helps to reduce the gap between knowledge and practices of individuals, families, and at community level.

Results of overall sample from each stratum of the study elaborates the mediating effects were significantly found among KAP, WASH, CH, and SCD. Although previous studies on behaviour change and SCD had mostly largely ignored the role of these mediator variables, which highlighted in the results of this study comprehensively. In order to attain SCD, various initiatives would be more focused towards improving individual KAP in everyday life along with better health condition.

The significance values in overall results differ from one another, and the difference of impacts of KAP on CH along with SCD linked with the mediating variable as water and sanitation hygiene. The difference of impacts on the said factors arises from each subsample to overall sample of the study and the aggregation effects make the significant impacts when all responses are considered together. For example, the relationship of KAP are found poorly significant with WASH, CH, and SCD in non-intervened stratum, while it was found highly significant in intervened village and in overall results of the study. The integrated behaviour change interventions in intervened stratum may enhance the significance level among factors. More precisely it is a well known fact that behaviour change awareness has direct impacts on individual's daily life behaviour and practices regarding WASH and CH.

There are some limitations associated with this research study such as the study is limited in its coverage as only one district is covered. There are vast areas that could become part of a larger study which may yield possibly different results. Furthermore, this study considers mothers as respondents, if it had included all family members as respondents and checked their knowledge and practices, the results would have been slightly different. Similarly, researchers applied only quantitative research techniques to examine the relationship, whereas the subject matter of the study is complex for more in-depth evolution-mixed method techniques should be applied to discover the dynamics of relationship between variables. The last limitation associated with this study is the sample size, although the sample size of this study fulfilled the basic requirements and is helpful to run all proposed statistical tests, the study can be improved by collecting more primary data from various communities, so that the results can be generalized.

Pakistan national sanitation policy provides a broad guideline and framework to enhance and support sanitation coverage in the country. Policy strongly recommended that formulation of strategies and programmes at all respective levels

should be done to improve environment, quality of life, human health, and wellbeing. Behaviour change and social mobilization is the key component to address the sanitation issue at household level especially in rural areas. The policy envisions creation of a hygienic environment with safe management of solid and liquid waste. It also encourages and promotes health and hygiene practices through various behaviour change interventions in the country. On the basis of national sanitation policy, Government of Pakistan notified a core group regarding Community Led Total Sanitation (CLTS). The prime stakeholders such as Water and Sanitation Program South Asia (WSP-SA), United Nations International Children Emergency Fund (UNICEF), Water Aid, Rural Support Program Network (RSPN), Pakistan Institute for Environmental Development Action Research (PIEDAR), and plan Pakistan were assigned the responsibilities to chair the whole group.

In accordance with the implementation of national sanitation policy, interventions were adopted by the provincial governments according to the nature of their local context. Similarly, the Public Health Engineering Department (Community Development Unit) from the government of Punjab and UNICEF designed comprehensive planning, implementation, promotion, regulation, monitoring, and evaluation to carry out behaviour change interventions in rural and urban areas of Punjab province. The government of Punjab and UNICEF carried out a behaviour change programme with the title, scaling up Pakistan Approach to Total Sanitation (PATS) Open Defecation Free (ODF) programme. This programme endorses the use of numerous behaviour change interventions, have significant impacts on communities as School Led Total Sanitation (SLTS), CLTS, Behaviour Change Communication (BCC), sanitation marketing, Information, Education and Communication (IEC), community participation, and component sharing among others.

The WASH programme in district Gujrat was designed keeping in view the national sanitation policy. For the purpose of WASH awareness programme (PATS) and according to the national sanitation policy, initially rural UCs were selected. Selected villages and communities were engaged for the period of 1 year and behaviour change interventions were carried out continually with men, women, elders, and children.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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