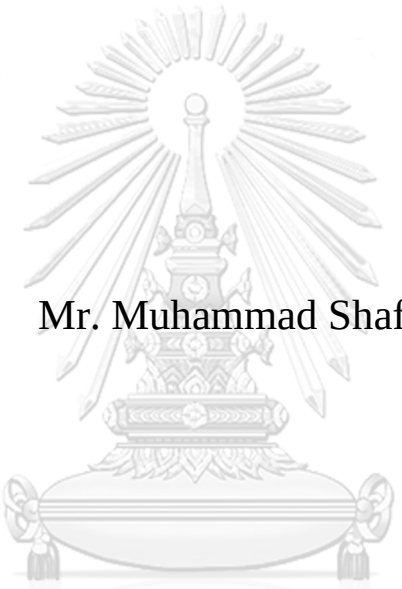
EFFECTIVENESS OF POSITIVE DEVIANCE, A BEHAVIOR CHANGE APPROACH, TO IMPROVE KNOWLEDGE, ATTITUDE AND PRACTICES ON DENGUE PREVENTION AND CONTROL IN SELECTED SLUMS IN ISLAMABAD, PAKISTAN: A MIXED-METHOD STUDY

Mr. Muhammad Shafique



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ประสิทธิภาพของความแตกต่างเชิงบวก แนวทางการเปลี่ยนแปลงพฤติกรรม เพื่อพัฒนาความรู้เจตคติ และการปฏิบัติในการป้องกันและควบคุมไข้เลือดออกในชุมชนแออัดที่เลือกแล้วในอิสลามาบัด ประเทศปากีสถาน: การวิจัยแบบผสมผสาน

นายมูฮัมเหม็ด ชาฟีคิว

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาสาธารณสุขศาสตรดุษฎีบัณฑิต
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Accepted by the COLLEGE OF PUBLIC HEALTH SCIENCES, Chulalongkorn University in Partial Fulfillment of the Requirement for the Doctor of Philosophy

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มูฮัมเหม็ด ชาฟิคิว : ประสิทธิภาพของความแตกต่างเชิงบวก แนวทางการเปลี่ยนแปลงพฤติกรรม
เพื่อพัฒนาความรู้ เจตคติ และการปฏิบัติในการป้องกัน
และควบคุมไข้เลือดออกในชุมชนแออัดที่เลือกแล้วในอิสลามาบัด ประเทศปากีสถาน: การวิจัยแบบผสมผสาน. (
EFFECTIVENESS OF POSITIVE DEVIANCE, A BEHAVIOR CHANGE APPROACH, TO IMPROVE KNOWLEDGE, ATTITUDE AND PRACTICES ON DENGUE PREVENTION AND CONTROL IN SELECTED SLUMS IN ISLAMABAD, PAKISTAN: A MIXED-METHOD STUDY) อ.ที่ปรึกษาหลัก : Assistant Professorอุษณีย์ พึ่งปานPh.D.

การศึกษานี้เป็นการทดลองเพื่อป้องกันและควบคุมไข้เลือดออกครั้งแรกในชุมชนแออัด 2 แห่งในอิสลามาบัด ดำเนินการระหว่างมิถุนายน ถึงตุลาคม 2563 จำนวนตัวอย่าง 112 คน (56 คนอยู่ในกลุ่มทดลองและ 56 คนอยู่ในกลุ่มควบคุม) กลุ่มทดลองจะได้รับ การแทรกแซงความแตกต่างเชิงบวก จากกลุ่มที่มีทักษะในชุมชน ตลอดระยะเวลาทดลอง 2 เดือน จะมีกิจกรรมหลายอย่าง อาทิ แสดงบทบาทสมมติ แข่งขันกัน ร้องเพลง จากการดำเนินการจะเก็บข้อมูล 3 ครั้ง นั่นคือ ก่อนการแทรกแซง หลัง 2 เดือน และ ติดตามหลังจากนั้นอีก 2 เดือน เพื่อที่จะดูการเปลี่ยนแปลงในเรื่องของความรู้ เจตคติและการปฏิบัติในการป้องกันและควบคุม ไข้เลือดออก เมื่อเริ่มต้น เรื่องความรู้เกี่ยวกับไข้เลือดออก พบว่า ไม่มีความแตกต่างระหว่างกลุ่มควบคุม (M=8.93, SD=3.107) กับกลุ่มทดลอง (M=10.09, SD=3.549) (p=0.071) หลังจาก 2 เดือน พบว่ากลุ่มทดลองมีพัฒนาการความรู้ดีขึ้น (M=19.00, SD=6.093) อย่างเห็นได้ชัด เมื่อเปรียบเทียบกับกลุ่มควบคุม (M=13.13, SD=4.953) (p<0.001) ระยะสุดท้าย ความรู้เรื่อง ไข้เลือดออกในกลุ่มทดลองไม่เพียงแต่ดีกว่าแต่ยังคงดีขึ้นกว่าเดิมในกลุ่มเดียวกัน กลุ่มควบคุม (M=14.30, SD=4.944) และ กลุ่มทดลอง (M=25.00, SD=9.607) (p<0.001) หลังการทดลอง 2 เดือน เรื่องของเจตคติและการปฏิบัติ ในการป้องกันและ ควบคุมไข้เลือดออก พบว่า ไม่มีความแตกต่างระหว่างกลุ่มทดลองและกลุ่มควบคุม แต่อย่างไรก็ตาม เมื่อจบการทดลองเจตคติ เกี่ยวกับไข้เลือดออกในกลุ่มทดลองดีขึ้น (M=28.34, SD=3.604) เมื่อเปรียบเทียบกับกลุ่มควบคุม (M=26.52, SD=4.343) (p=0.018) เช่นเดียวกัน เรื่องการปฏิบัติเพื่อป้องกันและควบคุม ไข้เลือดออก เมื่อจบการทดลอง พบว่า การปฏิบัติดีขึ้นในกลุ่ม ทดลอง (M=13.77, SD=2.216) เมื่อเทียบกับกลุ่มควบคุม (M=11.37, SD=1.629) (p<0.001) ดังนั้น การศึกษานี้แสดงว่า ความแตกต่างเชิงบวก มีผลต่อการพัฒนาความรู้ เจตคติ และการปฏิบัติในการป้องกันและควบคุมไข้เลือดออก ในกลุ่มประชากร ที่ศึกษาอย่างมีนัยสำคัญทางสถิติ

สาขาวิชา สาธารณสุขศาสตร์ ลายมือชื่อนิสิต .....
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Muhammad Shafique : EFFECTIVENESS OF POSITIVE DEVIANCE, A BEHAVIOR CHANGE APPROACH, TO IMPROVE KNOWLEDGE, ATTITUDE AND PRACTICES ON DENGUE PREVENTION AND CONTROL IN SELECTED SLUMS IN ISLAMABAD, PAKISTAN: A MIXED-METHOD STUDY . Advisor: Assistant Prof. USANEYA PERNGPARN, Ph.D.

This is the first practical application of positive deviance on dengue in the two selected low-income slums of Islamabad which was conducted during June-October 2020. A total of 112 participants (56 for intervention and 56 for the control group) participated in the study. The intervention arm received the positive deviance intervention through the identified positive deviance role models during the regular PD sessions, role plays, illustration competitions, and songs for two months. Three surveys were conducted, before the intervention, after two months, and after four months to assess the changes in knowledge, attitude, and practices. At the baseline, no statistically significant differences in dengue knowledge were found between control (M=8.93, SD=3.107) and intervention (M=10.09, SD=3.549) groups (p=0.071). After two months, the intervention group demonstrated statistically significant improvements in dengue knowledge (M=19.00, SD=6.093) compared to the control group (M=13.13, SD=4.953) (p<0.001). After another two months at the end-line, dengue knowledge not only persisted but continued to improve with a statistically significant difference between control (M=14.30, SD=4.944) and intervention group (M=25.00, SD=9.607) (p<0.001). After two months, there were no statistically significant differences in dengue attitudes and practice between control and intervention groups. However, after four months, attitude towards dengue disease improved significantly in the intervention group (M=28.34, SD=3.604) compared to the control group (M=26.52, SD=4.343) (p=0.018). Similarly, after four months, at the end-line, practice regarding dengue disease improved significantly in the intervention group (M=13.77, SD=2.216) compared to the control group (M=11.37, SD=1.629) (p<0.001). The study revealed that positive deviance intervention had a significant impact on dengue knowledge, attitudes, and practices in the target communities.

Field of Study:	Public Health	Student's Signature .....
Academic Year:	2021	Advisor's Signature .....

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CHAPTER 1

INTRODUCTION

The introduction chapter reviews the context, statement of the problem and objectives of the study regarding positive deviance approach to improve knowledge, attitude and behaviors on dengue prevention and control in the two selected low-income slums in Islamabad, Pakistan.

1.1. Background and Rationale

The term dengue has been derived from a Spanish word which literally means ‘Fastidious’ or ‘Careful’ and the phrase meaning ‘break bone fever’[1]. Dengue is a mosquito-borne viral infection which has swiftly increased and expanded all over the globe with an estimated 390 million dengue infections each year [2]. The dengue incidence has gone up to 30-folds over the last 5 decades. Around 50-100 million dengue infections are occurring every year in over 100 endemic countries which has put almost 50 percent of the population of the world at dengue risk.

1.2. Dengue

Dengue is caused by the bite of an infected female *Aedes aegypti* mosquito which gains the virus while sucking the blood of an infected person. Dengue has 4 different serotypes of the virus that cause dengue which are called DEN-1, DEN-2, DEN-3, and DEN-4. These 4 serotypes related to the Flaviviridae family. A person recovered from a particular serotype gets permanent protection from that specific serotype. Nevertheless, immunity to the other serotypes is only temporary. Later infections by different serotypes enhance the likelihood of severe dengue. Dengue symptoms can range from milder to severe flu-like symptoms in those infected. Some people (though less common), develop severe dengue, which can cause complications such as severe bleeding, organ damage and/or plasma leakage. If not manage appropriately and in time, people with severe dengue may face the higher risk of death. The severe dengue case was first identified during the dengue epidemics in the Philippines and Thailand in 1950s. Currently, the prevalence of severe dengue has

become a major factor of hospitalization and deaths among children and adult population in the Asia and Latin American countries. Dengue infection not only has a disturbing impact on human health but also affect the national economies.

Before 1970, there were only 9 countries in the world who had experienced dengue outbreaks. Now the dengue is prevalent in over 100 countries in Africa, the Americas, the Eastern Mediterranean, South-East Asia and the Western Pacific. However, over 70 percent of the global burden of disease comes from The Americas, South-East Asia and Western Pacific regions and Asia. In 2019, the highest cases of dengue were reported in the world. It was the first time that dengue transmission was recorded in Afghanistan as well.

1.2.1. Mode of dengue transmission

The dengue infection is caused by the bites of infected female mosquitoes, mostly the *Aedes aegypti* mosquito. After sucking blood on an DENV-infected person, the virus replicates in the mosquito's midgut, before it disseminates to secondary tissues, including the salivary glands. The time it takes from ingesting the virus to actual transmission to a new host is termed the extrinsic incubation period (EIP). The EIP takes about 8-12 days when the ambient temperature is between 25-28°C [3]. Once infectious, the mosquito can transmit virus for the rest of its life.

1.2.2. Dengue breeding places

The *Aedes aegypti* breeds around the densely populated urban habitats and mostly breeds in the water containers including water tanks, mud pots, buckets, old tins, and used tyres etc. *Ae. aegypti* mosquito is a day-time biter and its peak biting periods are early in the morning and in the evening before sunset[4] After a female *Ae. aegypti* mosquito lays her eggs, these eggs can remain intact for many months in dry condition and will hatch when they are in contact with water.

1.2.3. Dengue prevention and control

The proximity of mosquito vector breeding sites to human habitation is a significant risk factor for dengue. At present, the main method to control or prevent the transmission of dengue virus is to combat the mosquito vectors. This is achieved through prevention of mosquito breeding:

- Preventing mosquitoes from accessing egg-laying habitats by environmental management and modification
- Disposing of solid waste properly and removing artificial man-made habitats that can hold water
- Covering, emptying, and cleaning of domestic water storage containers on a weekly basis
- Applying appropriate insecticides to water storage outdoor containers.
- Using personal protective measures to avoid mosquito bites:
- Using of personal household protection measures, such as window screens, repellents, coils, and mosquito sprays.
- Wearing long sleeved shirts and long trousers that reduces skin exposure to mosquitoes is highly recommended

Due to the lack of antiviral treatment or a dengue widely available vaccine, dengue interventions mainly rely on the vector control [5]. Community interventions have demonstrated successes in effectively preventing dengue fever around the globe [6]. The significance of community engagement in primary health programs has been emphasized in the Alma Ata Conference organized in 1978 and therefore it has been regarded as a core objective of health planners and policy makers since then [7]. The active community engagement in all stages of program cycle creates acceptance, ownership, and fosters the sustainability of the interventions and outcomes [8, 9].

Therefore, local, community driven and cost-effective community engagement strategies are required to vector control [10, 11]. Nevertheless, the main obstacles to implementing effective community-based dengue programs are the lack of participation of the community members and stakeholders in health interventions

[12]. There is a strong need to engage communities in the planning, implementation, and decision making of the vector control programs to create their ownership and acceptance [13],[14],[15].

The community's knowledge, preventive behaviors and environmental conditions play a vital role in the prevention and control of dengue outbreaks. In Pakistan, slums present the most vulnerable environment which put the communities at risk of dengue. These slums are characterized by the narrow unlined streets with water filled ditches. There is no regular water supply in the slums. They have bored wells which are linked with households through pipes to distribute water on regular intervals. The community members store water in water tanks, buckets, and small water holding containers which also create an enabling breeding environment for dengue mosquitoes. The rubbish especially plastic bags, empty bottles, empty tins, used packages and old tires are generally scattered all over the streets which provide conducive environment for breeding of *Aedes aegypti* to transmit dengue.

The rationale of the community engagement in dengue prevention and control and especially environmental management activities holds much water on both theoretical and practical basis, as the existence of *Aedes* mosquito mainly hinge on community's actions and behavior. The evidence on the effectiveness of community-driven dengue control interventions is weak owing to the lack of interventional studies and proper documentations or publications [16, 17]. Therefore, the positive deviance study in the most vulnerable slums in Islamabad will not only provide an opportunity to assess the effectiveness of this interesting community engagement approach but also fill in the knowledge gap by properly documenting and publishing this work.

1.3. Statement of the problem

Dengue has become a major health concern in Pakistan since its first epidemic occurred almost 20 years [18]. The dengue infection first time hit Karachi, the economic hub of Pakistan, in 1994 [19]. During the period of 1995-2004 only 699 dengue infections and six deaths were reported from 3 districts. However, the

numbers significantly increased to 93,870 cases and 618 deaths from 105 districts during the period of 2005-2016 (Ministry of Health Pakistan). Pakistan faced some major dengue outbreaks during 2008, 2010 and 2011 which badly affected thousands of individuals and claimed hundreds of deaths[20].

A high number of dengue cases (27,000) were reported in 2011. An estimated 24,938 dengue virus infections were recorded from fifteen districts of KPK in 2017 [21]. Dengue fever infections dramatically increases this year with an estimated 50,535 dengue cases and 83 deaths from various parts of Pakistan until November 2019. The overall case fatality rate reaches to 0.16% in 2019. The capital city of Islamabad was the most affected city with 13,320 dengue cases and 22 deaths by November 2019 (Sitrep Report, MoH). The key vectors, *Aedes aegypti* and *Aedes albopictus* originated from different regions. *Aedes aegypti*, originated from African forests, and currently present in most tropical and subtropical regions in the world [22, 23]. While *Aedes Albopictus* emerged from South Asia forest and expanded to all five continents during the past 4 decades [24, 25]. *Aedes aegypti* and *A. albopictus* are considered to be the most prevalent vectors in Southeast Asia including Pakistan. These vectors usually breed in man-made water containers used to store potable water where municipal water supplies are not reliable. Other breeding places include water containers, pots, drums, water jars, plant bottles, flowerpots, plastic cups, ant-traps, empty tins and old tires.

Figure 1. Local water containers

Figure 2. Local water containers

Figure 3. Local water containers

Figure 4. Local water containers

1.4. Dengue prevention and control activities

Previously, the dengue interventions were carried out on ad-hoc or need basis mostly during the dengue epidemics or outbreaks. However, the recent dengue situation depicts that it is crucial to create awareness with active community engagement on sustained basis in order to prevent or contain dengue outbreaks. The Directorate of Malaria Program has been actively engaged in the dengue control since 2006. The Malaria Programme has been promoting the following interventions: 1) personal protection measure which include long lasting insecticide bed nets, long sleeved clothes, tropical repellents and window screenings; 2) chemical measures which include larvae control, adult control, indoor residual spraying, space spraying and thermal fogging; 3) environmental management control which include source reduction and solid waste management. As the dengue mosquitoes breed in the water containers near the human dwellings and bite during the day, therefore personal protection and environmental cleaning measures should be promoted through tailored and context appropriate community engagement approaches. The Directorate of Malaria Programme have been disseminating and reinforcing the following messages and behaviors to control dengue:

- Mosquito bite causes dengue
- *Aedes* mosquito bites during the daytime
- Cover water containers to avoid mosquito breeding
- Change the stored water from the small (<20 L) containers

- Use long lasting insecticide treated nets during the day
- Use repellants, coils, mosquito mates to avoid mosquito bites
- Clean the household environment
- Seek early diagnosis and prompt treatment if suspect dengue

However, due to the lack of a formative research to understand perceptions, beliefs, attitude, and behaviors of the target communities regarding dengue and absence of a context-specific social and behavior change communication strategy, these messages may not effectively correspond to the need of the communities and therefore may fail to yield the required behavior changes. The existing health education mainly uses the Information, Education and Communication (IEC) materials such as pamphlets, posters, and mass media such as TV and radio and therefore lacks active participation of the target communities in the dengue prevention and control activities.

Therefore, innovative, context-specific, and culturally appropriate community engagement approaches such as positive deviance should be implemented to improve community participation in the vector control in order to disrupt the dengue infections at the community level.

1.5. Positive Deviance

Positive deviance (PD) is an innovative community-led approach to behavior change. PD concept was initially mentioned in the nutrition studies; however, the approach was first time operationalized in Vietnam to improve the nutrition related health outcomes. After the successful experience in Vietnam, the PD approach was further scaled up and implemented in more than 40 countries around the world [26-29]. The PD approach has currently been applied on various health and social issues including breastfeeding, safe motherhood, newborn health, hand washing and hygiene, female genital mutilation, reduction of hospital acquired infection, weight-loss, and retention of antiretroviral patients [30, 31].

The concept of the positive deviance approach is that solutions to the health and social problems already exist within the same populations. Unlike the stereotyped problem-solving approaches where we look out for the gaps and weaknesses of the communities and try to address it, PD emphasizes on the community's strengths and look at what is already working and build on those existing solutions and strengths. These simple, indigenous, and acceptable behaviors or solutions are then disseminated widely to the larger community through an interactive intervention to influence positive behavioral changes in the target communities. The PD approach believes that in all communities there are some role model individuals or positive deviants who practice uncommon and behaviors which are different from the social norm but enable them and their families to have better health outcomes than their neighbors and friends despite sharing the similar risks and resources. The role models enjoy strong acceptance and ownership of the community members as the community members can relate with them and their local and simple messages and behaviors than those messages and behaviors which are shared by the outsiders. The top-down and externally driven approaches often miss the mark as the community members do not accept or relate to the expert driven messages and behaviors and therefore do not continue these behaviors as soon as the external program is phased out [31]. The messages and communication materials developed by the external specialists are not tailored to the cultural context and therefore lack community acceptance. Whereas PD approach provides a social proof by identifying the role models from within the community with similar resource base and challenges, meaning "if he/she can do it, why can't I." Positive deviant practices are local therefore, accessible, affordable and replicable by the other community members facing the similar risk as these are already being performed by some PD role models in the same community [32]. Moreover, community engagement from the beginning of the health programs ensures ownership, sense of belonging and acceptance and guarantee the continuation of the interventions for longer time even after the external support has been withdrawn [33].

In spite of an extensive use of positive deviance as an engaging and empowering behavior change communication tool on a range of social and health

problems around the globe, it has never yet been conducted and evaluated on the dengue infection. PD approach has a tremendous potential as an efficient community participation tool for dengue prevention and control. Therefore, this study envisioned to describe the implementation of the first PD application on dengue control and to assess its effectiveness on dengue in Pakistan.

1.6. Research gap

The literature review revealed that a very few community-engagement studies have been carried out on dengue in Pakistan. Mostly cross-sectional surveys and a couple of pre-post studies were conducted and evaluated on dengue in Pakistan. As dengue is a new emerging disease, there is a limited understanding of the role of communities on dengue control in Pakistan. The existing health education is mainly based on sharing of the messages and materials through mass media i.e., radio and TV which lacks active community participation. This was the first study which used PD approach as a behavior change tool for community engagement in Pakistan which would encourage further studies on the community participation in dengue. The study has also provided rich insights to the key stakeholders and policy makers on the important role of communities in dengue prevention and control.

1.7. Research Question

- Will the Positive Deviance approach be an effective behavior change and community engagement method to improve knowledge, attitude and practices of dengue prevention and control?

1.8. Main objective

- To determine the effectiveness of the Positive Deviance approach in order to improve the knowledge, attitude, and practices regarding dengue prevention and control in the target slums in Islamabad, Pakistan.

1.8.1. Specific objectives

- To assess the knowledge, attitude and practices of dengue prevention and control between the intervention and control communities
- To understand the community's perceptions and beliefs on the dengue

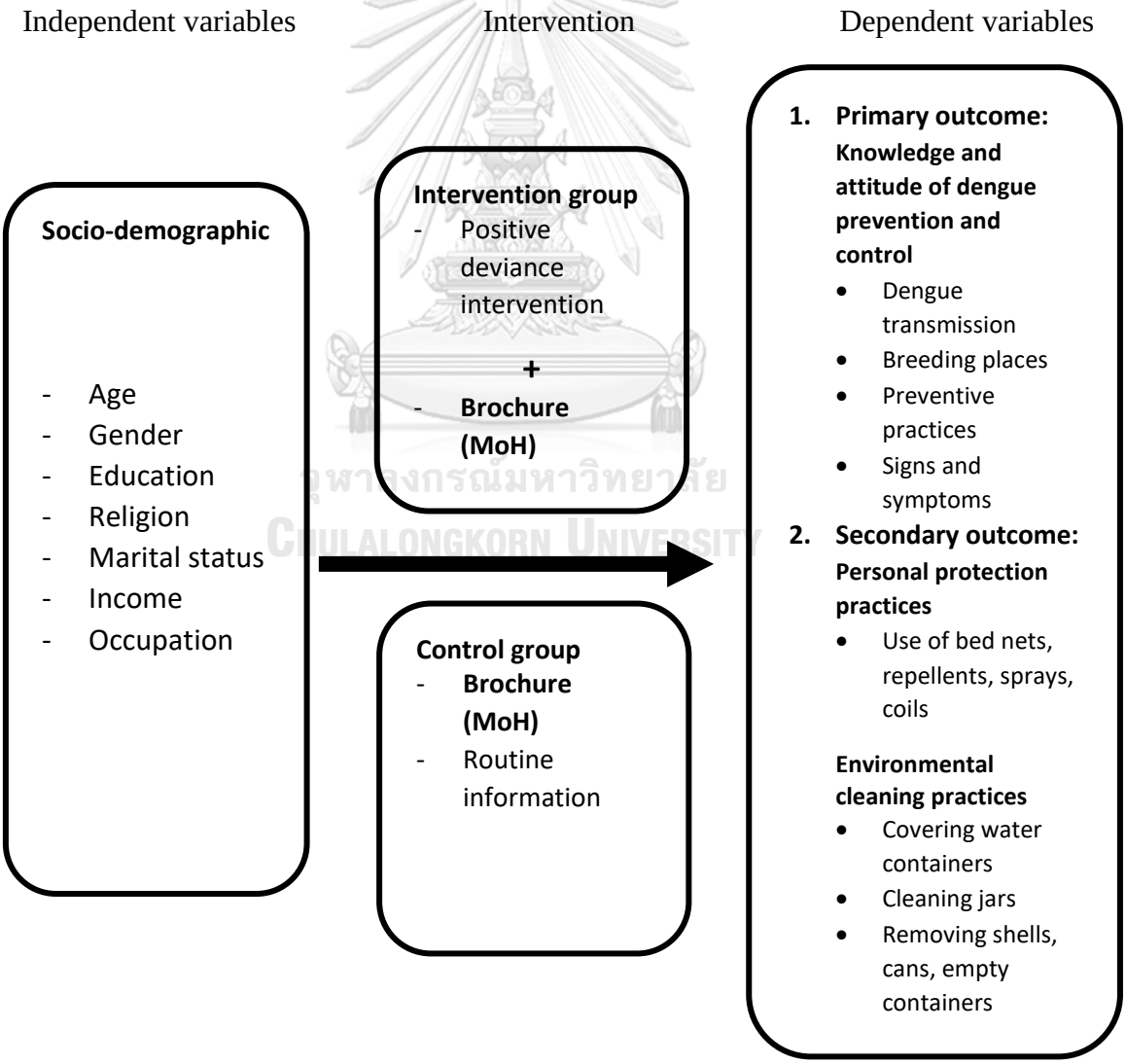
transmission, prevention, and control in the target communities

- To assess effectiveness of the PD-informed community engagement intervention by comparing the mean scores of dengue knowledge, attitude, and practices between the intervention and control groups.

1.9. Research Hypothesis

- There is no change in knowledge and attitude of the community members between intervention and control groups, after the PD intervention
- There is no change in dengue prevention practices of the community members between intervention and control groups after the PD intervention

Figure 5: Conceptual framework



1.10. Operational Definitions

1.10.1. Positive deviance

Positive deviance is a community engagement approach which believes that solutions of the health problems exist within the community. The premise is that ‘in most communities, there are few positive deviant role models, who, because of their unique but positive practices find local solutions to problems than their peers or neighbors despite sharing similar risks and resources [32].

1.10.2. Behavior Change Communication

Behavior Change Communication is an interactive process with individuals and communities to develops tailored messages and martials using variety of communication channels. It also creates an enabling environment for individuals at the household, community and health facility level to follow these positive behaviors (FHI 360).

1.10.3. Community Engagement

Community engagement is a capacity building process for community members, civil society, opinion leaders to engage them as active partners and address the health and development issues using that affect their lives. The community engagement process empowers communities and social groups about their basic rights, issues and improves the responsiveness of the government and development actors [34].

1.10.4. Dengue Fever

Dengue fever is a mosquito-borne disease that is caused by the bite of an infected female *Aedes aegypti* mosquito. Symptoms typically begin three to fourteen days after infection. The symptoms may include high fever, eye pain, headache, vomiting, muscle and joint pains, and skin rash (WHO).

1.10.5. Dengue Preventive practices

The dengue preventive practices can be grouped in four categories: 1) environmental management includes cleaning the bushes, covering of the water containers, cleaning of large containers frequently, burying tires and removing small empty cans and plastic packages; 2) biological measures such as guppy fish and *Bacillus thuringiensis israelensis* (Bti);, 3) chemical measures which include chemical sprays, temephos, repellents and mosquito coils and 4) personal protection measures such as insecticide treated bed nets, long sleeved clothes.

CHAPTER 2

LITERATURE REVIEW

The chapter two describes the dengue disease burden at global and local levels, prevention measures, community engagement in health programs, theoretical model to be used in this study and previous community engagement and behavior change studies on dengue prevention and control. The chapter also explains the positive deviance approach, its conceptual underpinnings and contexts where it has been applied in the world.

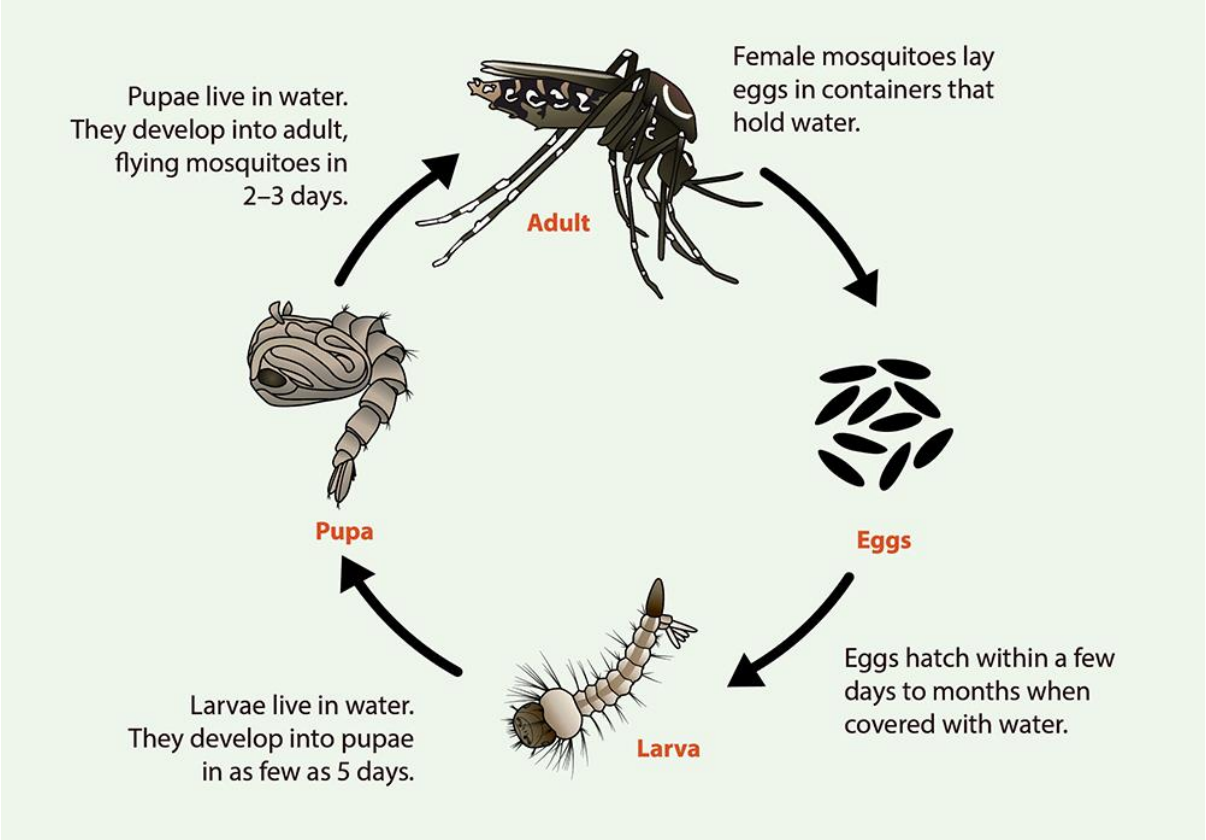
2.1. Dengue fever

Dengue is a viral disease caused by a mosquito bite. Dengue is the mosquito-borne viral infection which is growing at alarming pace in the world. Dengue is caused by the bite of an infected female *Aedes aegypti* mosquito which gains the virus while sucking the blood of an infected person. Dengue has 4 different serotypes of the virus that cause dengue which are called DEN-1, DEN-2, DEN-3, and DEN-4. These 4 serotypes related to the Flaviviridae family (WHO). The dengue mosquito or genus flavivirus also cause Zika virus and yellow fever[35]. The main dengue vectors have different origins. *Aedes aegypti*, originated from African forests, and can be found in most tropical regions all over the world [22, 23]. While *Aedes Albopictus* emerged from South Asia forest and expanded to all five continents during the past 4 decades [24, 25].

A person recovered from a particular serotype gets permanent protection against that serotype. Nevertheless, after the recovery, the immunity against other serotypes is only for short term. If a person gets further infections from other serotypes, the likelihood of severe dengue increases. Severe dengue was first found during the dengue outbreaks in 1950s in the Philippines and Thailand. Currently, the prevalence of severe dengue is one of major cause of hospitalization and deaths among children and adult population in most of the dengue endemic countries.

2.1.1.Life cycle of dengue mosquito

Figure 6. Mosquito life cycle



Usually, the mosquito cycle takes 7 to 10 days to develop an adult mosquito. Following are the 4 stages of mosquito life cycle:

i. Eggs:

A female mosquito lays black color eggs mostly on the walls of the water containers. The mosquito eggs are very sticky which remained attached with the wall of the water container like a glue. The eggs can stay intact for up to 8 months and hatch as soon as they touch the water. They just need a small quantity of water to lay eggs. Empty cups, tins, cans, tires, vases, and other water containers are considered a conducive environment for mosquito to breed.

ii. Larvae:

Larvae hatch from the dengue mosquito's eggs. The larvae is the second stage of mosquito cycle which happens when the eggs are covered by the water. They are very active and can easily beLarvae can be seen in the water.

iii. Pupae:

Pupae is the third stage of mosquito development. It lives in the water and an adult mosquito develops from larvae.

iv. Adult mosquito

The fourth stage is adult mosquito. The adult female mosquitoes bite human beings and animal to suck blood which she needs to produce eggs. After sucking blood on humans or animals, the mosquito finds water container to lay eggs and breed mosquitoes. The *Aedes aegypti* and *Aedes* albopictus cannot fly for long distances. They can hardly fly within a few streets. The dengue mosquitoes mostly live near the households and bite people mostly in the early morning and late afternoon before sun sets. *Aedes aegypti* mosquitoes live inside and outside the household in the water tanks and water containers, while Ae. albopictus usually dwell out of the households.

2.2. Distribution and outbreaks

All across Europe the disease is spreading at an alarming pace. The first-time dengue cases were detected in France and Croatia in 2010 while some imported cases were found in 3 other European countries. In 2012, there were about 2000 cases reported in the Madeira Islands of Portugal and imported cases were detected in 10 more countries in Europe. The most dengue cases ever reported in the world were in the 2019. It was also the first time that dengue cases were detected in Afghanistan as well. There were 3.1 million reports of dengue in the American region, with over 25,000 of them categorized as severe dengue cases. Despite the concerning numbers, dengue-related deaths were lesser than the previous year. Great number of cases were reported in Bangladesh (101,000), Malaysia (131,000) Philippines (420,000), Vietnam (320,000) in Asia. In 2020, dengue outbreaks were experienced in several

countries, with reported increased cases in Bangladesh, Brazil, Cook Islands, Ecuador, India, Indonesia, Maldives, Mauritania, Mayotte (Fr), Nepal, Singapore, Sri Lanka, Sudan, Thailand, Timor-Leste and Yemen. Dengue continues to affect Brazil, India, Vietnam, the Philippines, Cook Islands, Colombia, Fiji, Kenya, Paraguay, Peru and, Reunion islands, in 2021.

2.3. Dengue transmission

The disease is spread through mosquito bites. The infected female mosquitoes, typically the *Aedes aegypti* mosquito transmit the virus to people. The virus replicates in the mosquito midgut after it feeds on a DENV-infected person, it then starts spreading to secondary tissues of the body such as the salivary glands. The Extrinsic Incubation Period (EIP) refers to the time between ingesting the virus and transmitting it to a new host/person. When the temperature is between 25 and 28°C, the EIP takes about 8-12 days. Extrinsic incubation period variations can be influenced by a several factors including the daily temperature fluctuations, the virus genotype and the initial viral concentration. Once a mosquito becomes infected, it's capable of transmitting the virus all its life.

2.3.1.Human-to-mosquito transmission

When *Aedes aegypti* mosquitoes bite an infected person who are viremic with DENV, they get infected. This viremic person can be symptomatic (who has symptoms), pre symptomatic (someone who yet to have a symptomatic infection) or also someone who is asymptomatic (with no signs of illness)[36]. Human-to-mosquito dengue transmission may occur around 2 days earlier before the symptoms of the illness and could happen even after 2 days of the fever is subsided [37]. Risk of mosquito infection is positively associated with high viremia and high fever in the patient; conversely, high levels of DENV-specific antibodies are associated with a decreased risk of mosquito infection. Most people are viremic for about 4-5 days, but viremia can last as long as 12 days[38].

2.3.2.Mother to child transmission

The main mode of dengue transmission among people is the bite of *Aedes aegypti* mosquito. However, there is possibility of dengue transmission from a pregnant mother to her baby. In case of a pregnant mother is infected with dengue during her pregnancy, it may result in pre-term birth, low birthweight, and fetal distress[39].

2.3.3.Other transmission modes

Rare cases of transmission via blood products, organ donation and transfusions have been recorded.

2.4. Vector ecology

The mosquito *Aedes aegypti* is thought to be the key DENV vector. It used to breed in natural containers like tree holes and bromeliads, but it has now adapted to urban environments and now breeds primarily in man-made containers like discarded containers, mud pots, buckets, and used tyres as well as storm water drains. Hence making dengue a detrimental disease in heavily populated areas. *Aegypti* feeds during the day, with peak biting times are early in the morning and before the sunset. Female *Aedes aegypti* feed many times between egg-laying periods, resulting in infected individuals clustering together. When a female lays her eggs, the eggs can survive in dry conditions for several months until hatching when they come into contact with water.

The secondary dengue vector *Aedes albopictus* has expanded to more than 32 states in the United States and more than 25 nations in Europe because of international imports in old tyres and other items for instance the lucky bamboo. It breeds in locations where there is thick vegetation, such as plantations, which has been associated to an increased risk of exposure for rural workers in rubber and palm oil plantations. It has also been reported to be abundant in metropolitan areas. *Aedes albopictus* is a very adaptable species, which explains its global distribution. It also can tolerate cooler temperatures as an egg and adult.

2.5. Disease characteristics (signs and symptoms)

2.5.1.Dengue signs and symptoms

Majority of the dengue infections are asymptomatic with mild symptoms; however, it can be a severe, flu-like illness that can affect all ages including infants, children and adults. Symptoms usually last for 2–7 days, after an incubation period of 4–10 days after the bite from an infected mosquito [40]. Dengue should be suspected when a high fever (40°C/104°F) is accompanied by 2 of the following symptoms during the febrile phase (2-7 days):

If a high fever of 40°C/104°F includes 2 of the following symptoms during the febrile phase 2-7 days, a person can be diagnosed with dengue.

- Severe headache
- Pain behind the eyes
- Muscle and joint pains
- Nausea
- Vomiting
- Swollen glands
- Rashes

2.5.2.Severe Dengue

About 3-7 days following the onset of the illness, a patient reaches their critical phase. Some of the patients may experience a great deterioration of symptoms during the critical phase, which lasts 24-48 hours. When the patient's fever drops below 38 degrees Celsius (100 degrees Fahrenheit), warning indications of severe dengue can appear. Due to plasma spilling, fluid accumulation, respiratory distress, severe bleeding, or organ dysfunction, severe dengue becomes fatal. The danger signs for severe dengue include:

- Severe abdominal pain
- Persistent vomiting
- Rapid breathing

- Bleeding gums or nose
- Fatigue
- Restlessness
- Liver enlargement
- Blood in vomit or stool.

If patients are showing these symptoms during the critical phase, close observation for the next 24–48 hours are imperative so that exact medical care can be provided.

2.6. Diagnostics

The dengue (DENV) infection can be diagnosed using a variety of methods. Different diagnostic procedures may be more or less appropriate depending on the time of the patient's presentation. Both procedures should be used to test patient samples collected during the first week of illness:

2.6.1. Virus isolation methods

During the first several days after infection, the virus can be isolated from the blood. The gold standard is the reverse transcriptase–polymerase chain reaction (RT–PCR) method. They do, however, need specialized equipment and staff training in order to conduct these sophisticated tests. Testing for NS1, a viral-produced protein, may potentially be used to detect the infection. There are commercially accessible rapid diagnostic tests for this, which take only 20 minutes to complete and don't require any specific laboratory techniques or equipment.

2.6.2. Serological techniques

Anti-dengue antibodies can be detected using serological methods such as enzyme-linked immunosorbent assays (ELISA), which can establish the existence of a recent or past infection. IgM antibodies can be detected one week after infection and last for roughly three months. The presence of IgM

indicates that you have recently been infected with DENV. IgG antibody levels take longer to develop and might last for years in the body. The presence of IgG indicates that you have had a previous infection.

2.7. Dengue treatment

There is no specific treatment for dengue fever. Patients should rest, stay hydrated and seek medical advice. Depending on the clinical manifestations and other circumstances, patients may be sent home, be referred for in-hospital management, or require emergency treatment and urgent referral[40]. Supportive care such as fever reducers and pain killers can be taken to control the symptoms of muscle aches and pains, and fever.

To improve the symptoms such as fever, body/muscle aches and pains, painkillers medicines are prescribed for timely relief. Medicines such as Paracetamol or Acetaminophen would be the recommended pills for instant cure for such symptoms. However, patients must be conscious and avoid certain medicines too, including ibuprofen and aspirin which are NSAIDs (non-steroidal anti-inflammatory drugs), as they are anti-inflammatory drugs that cause blood-thinning. If a patient suffering severe dengue that could cause haemorrhage these blood thinners may worsen the situation. For the most critically severe cases of dengue, medical assistance by experienced nurses, doctors and physicians must be given which can save patient lives and consequently show a decrease in mortality rates to around 1% in the countries around the globe.

2.8. Dengue vaccine

The first vaccine made for the dengue disease, called the Dengvaxia® (CYD-TDV), that was developed Sanofi Pasteur and licensed in December 2015. This vaccine is currently approved in around 20 countries by concerned health authorities. In 2017, the findings of an additional investigation to identify serostatus at the time of immunization were published. When compared to unvaccinated participants, the subset of trial participants who were inferred to be seronegative at the time of initial immunization had a greater risk of more severe dengue and hospitalizations from

dengue. Hence, as a result, the CYD-TDV vaccination is intended for the age groups ranging from 9 to 45, who live in endemic areas and have had at least one episode of dengue virus illness. Several more dengue vaccine candidates are being tested.

2.9. Risk factors

The risk of an individual developing severe dengue increases if they have been previously affected by a DENV infection. Dengue transmission is linked to urbanization, mainly unplanned urbanization by a number of social and environmental factors, that include population density, access to a dependable water source, human mobility and community's water storage practices. The risk of dengue in certain communities dependent on their knowledge, attitude and practices regarding dengue prevention and control and their routine and sustainable vector control activities. As a result, disease risks in tropical and subtropical places may vary and shift because of climate change, and dengue vectors may consequently adapt to the changing environment and climate change.

2.10. Prevention and control

If you are experiencing dengue fever, make sure to avoid further mosquito bites, especially in the first week of illness as this is the time when the virus will be circulating in your blood, and hence if an uninfected mosquito bites, they will not only get infected themselves, but will carry the infection to other people. Dengue risk becomes manyfold if the breeding places are in abundance near the population settlements. At the moment, the primary technique for controlling or preventing dengue virus transmission is to remove the breeding places and combat the dengue vectors. This is accomplished by:

2.10.1. Prevention of mosquito breeding

- Using environmental management and modification to prevent mosquitos from accessing egg-laying environments.
- Removing artificial man-made habitats that can hold water and appropriately disposing of solid trash to avoid mosquito breeding

- Weekly covering, emptying, and cleaning of home water storage containers such as water tanks and containers
- Applying chemical insecticide to outdoor water storage tanks as needed

2.10.2. Personal protection from mosquito bites:

The personal protection measures include window screens, repellents, coils, and mosquito sprays to avoid the mosquito-human contact. As the dengue mosquito bites during the daytime, these personal protection measures should be observed during the day both inside and outside the home e.g., at work/school.

2.11. Global dengue situation

The dengue disease has emerged as a significant public health problem since the first dengue epidemic was recorded in Jakarta in 1779 [41]. Only 9 countries had experienced dengue epidemics before 1970; however, now, more than 100 countries in Southeast Asia, Western Pacific, Africa, the Eastern Mediterranean and the Americas are affected by the disease. Asia region is the most affected part which represents around 70% of the global burden of the dengue disease.

The cases of dengue have increased up to 30-times over the past 5 decades. An estimated 50-100 million dengue infections occur annually in more than 100 endemic countries, leaving half (50%) of the population of the world at dengue risk. There is no particular treatment for dengue infections and severe dengue infections, however, the early diagnosis and prompt health seeking to proper medical facilities reduces the morality rate keeping it under 1% (WHO).

2.12. Situation in Pakistan

2.12.1. Main dengue vectors in Pakistan

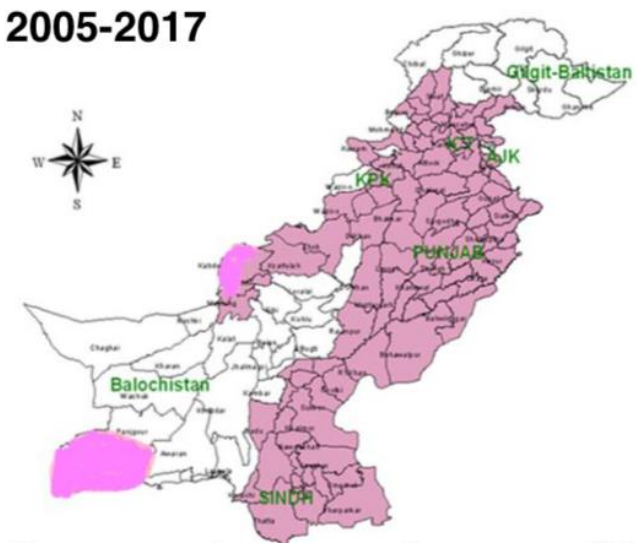
Dengue fever is becoming one of the rapidly emerging disease in Pakistan since its first outbreak occurred almost 20 years ago [18]. Aedes aegypti and A. albopictus are the dominantly prevalent vectors in Pakistan. Both species have been

closely associated with human dwellings due to their preference for clean water. In Pakistan, these vectors usually breed in man-made water containers used to store potable water where municipal water supplies are not reliable. Other breeding places include water containers, drinking water pots, water jars, plant bottles, flowerpots, plastic cups, empty tins and old tires.

2.12.2. Dengue outbreaks history

The dengue disease first time hit the largest city of Pakistan, Karachi in 1994 [19]. During the period of 1995-2004, only 699 dengue cases along-with 6 deaths were reported from 3 districts. However, the dengue infection alarmingly increased to 93,870 with 618 deaths from 105 districts during 2005-2016 (Ministry of Health Pakistan). Pakistan suffered the major dengue epidemics in 2008, 2010 and 2011 which affected thousands of people and claimed hundreds of deaths[20].

Figure 7. Map of dengue high risk areas of Pakistan



A high number of 27,000 dengue cases were reported in 2011. An estimated 24,938 dengue virus infections were recorded from fifteen districts of KPK in 2017 [21]. Dengue fever infections dramatically increases this year with an estimated 50,535 dengue cases and 83 deaths from various parts of Pakistan until November

2019. The overall case fatality rate reaches to 0.16% in 2019. The capital city of Islamabad was the most affected city with 13,320 dengue cases and 22 deaths, mostly from slums, by November 2019 (Sitrep Report, MoH).

2.13. Existing dengue control measures in Pakistan

2.13.1. Vector Control

Dengue Fever is transmitted by the bite of infected female mosquitoes of the Aedes (Stegomyia) group - primarily *Aedes aegypti*. These mosquitoes are silent, painless, and persistent feeders, which search for their victim during daylight hours, especially during early morning and the late afternoon. Aedes aegypti is the world's most domesticated mosquito; it breeds, feeds and lives its life in human habitations. In Pakistan, it is usually found breeding in any type of man-made water-holding containers, especially those used inside homes to store potable water where municipal water supplies are not reliable. *Aedes aegypti's* constant close contact with humans, preference for human blood, and ability to transmit dengue viruses, poses a serious long-term potential Dengue health threat in Pakistan. Over the past decade, Dengue interventions have largely remained knee-jerk reactions focused on controlling adult *Aedes aegypti* during dengue outbreaks. It is critical to institutionalize dengue control through proper surveillance, public education, solid waste disposal and community participation around the year wherever dengue could occur in order to prevent or contain outbreaks.

2.13.2. Larval control

Larval control of *Aedes aegypti* is considered to be the most feasible and cost-effective intervention for long term control of dengue outbreaks. It stops the mosquito before it can reach the adult stage to vector dengue viruses. It mainly consists of the following:

- Source reduction

Source reduction refers to any measure that prevents the breeding of mosquitoes or eliminates their breeding sites, and is a component of environmental

management which deprives the vector population of its survival requirements thus reducing human-vector contact and transmission risks. Source reduction is the cornerstone of *Aedes aegypti* control efforts, concentrating on control of the immature stages of the mosquito (larvae and pupae) by physical and chemical means. Physical, implies the straining of water stored in small (< 20 L) containers with fine wire screening or cloth material. The full container is poured into an empty container through the strainer. Larvae and pupae are taken outside and shaken loose of the strainer onto open dry ground where they die in 1-2 hours. This must be done by homeowners themselves. It is important that all small water containers are strained at 4 day-intervals to prevent immature larvae from reaching the adult stage. When not in use, openings to water containers must be covered with sheets or cloth material. The entire opening must be covered; any small cracks or crevices into the water container will be found by the mosquito and the container will then be used for breeding. Flower pots and vases should be emptied and rinsed out every 4 days. School children who have been taught dengue fever mosquito basics can perform, or help in these tasks. Home residents can also be trained using mass media and community volunteers. Electronic and print media should be encouraged to remind citizens to routinely strain water, especially during normal non-epidemic times.

- Larviciding

Larviciding implies the use of chemicals or toxins to kill the immature stage of vector mosquitoes, larvae and pupae. In Pakistan, particularly in mega-cities like Karachi, a large proportion of the population stores water in permanent and temporary water storage containers that are conducive to *Aedes aegypti* breeding. Large containers must be identified by Dengue control agencies and treated with insecticide on a permanent basis. Insecticides that can be used in drinking water include BT (Bacillus thuringiensis), an insect growth regulator. BT acts as a stomach poison and methoprene prevents adult emergence from pupae, and if made available to Dengue Control Units in Pakistan will substantially help in larval control without any adverse effects on human beings. Both are labeled for use in human drinking water supplies. Certain methoprene formulations such as XR briquets provide 5 months of protection before re-treatment is necessary. Dengue control teams will be trained in proper

application techniques. Mosquitoes found breeding in outdoor artificial containers can also be treated with either pesticide, however, container destruction or removal is a more desired technique. Sites with permanent water structures around Dengue cases and garbage collection sites, will be marked by the teams on maps, especially those with waste tyres. Tyres should either be destroyed (shredded/buried) or removed by city sanitation departments to areas away from human habitation.

2.13.3. Adult Aedes aegypti control

- Space spray

Area wide space spray is accomplished with thermal fogging for control of adult insects. Adulticides (insecticides that kill adults) are mixed with diesel fuel and dispersed from the truck bed. Truck-mounted machines provide rapid coverage of large areas. Fogging to control Aedes aegypti should only occur during dengue outbreaks, as it is not as effective as larval control. For effective vector control, three fogging machines and trucks are recommended for every 1,000,000 city residents. Each truck and machine can cover 1,500 to 2,000 homes a day. Spray is carried out only in outbreak foci and in areas of high Aedes aegypti populations and only during Dengue transmission periods. Neighborhoods should only be sprayed once a day, preferably in the early morning when adult Aedes aegypti are most active and climatic conditions are favorable for insecticide dispersal. Frequency of neighborhood spraying is dependent upon Dengue cases, homeowner complaints, and surveillance results. Routine fogging for adult Aedes aegypti control is not very effective, could strain resources and might lead to insecticide resistance. Deltamethrin, permethrin, or other suitable pyrethroid adulticides should be rotated fortnightly with malathion, an organophosphate adulticide. Records are kept of areas sprayed, vehicle speed, insecticide flow rate, insecticide type, and date of application.

2.13.4. Personal protection measures

Home residents, particularly patients, pregnant women and children, can help prevent dengue transmission by sleeping under Insecticide Treated or Impregnated Bed Nets (ITNs during daytime nap periods and at night. Aedes aegypti is a day biter

but will bite at night if disturbed. Insecticide treated nets are ideal as mosquitoes contacting them will receive lethal doses of insecticide, however, untreated net will also protect against biting mosquitoes. The community volunteers and mass media can create awareness among masses on how to properly use bed nets. Instructions for correct bed net use may also be posted on Pakistani public health or mosquito control web sites. Screening should be added to windows and curtains in doorways, where Dengue-infected patients reside to prevent infection of mosquitoes. Use of coils, other mosquito repellents and protective clothing is also recommended personal protection measures.

2.13.5. Environmental management

Following are considered the environmental management practices which are being carried out in Pakistan:

- Cleaning the large water contains frequently to prevent mosquitoes from breeding
- Cover the water containers to avoid mosquitoes to enter and lay eggs and breed
- Removing empty shells, bottles, cans to avoid mosquito to breed
- Using chemicals or insecticides such as temephos in the large water containers
- Applying fogging sprays during outbreaks for vector control

2.14. What is community engagement?

Community engagement is a capacity building process for community members, civil society, opinion leaders to engage them as active partners and address the health and development issues using that affect their lives. The community engagement process empowers communities and social groups about their basic rights, issues and improves the responsiveness of the government and development actors [34]. In order to contain and prevent the disease and avoid recurrence of DF and DHF, a sustained level of social mobilization is needed. Community participation

is of essence to the entire effort. Accordingly, communities are to be mobilized to undertake effective vector control measures, especially in the areas from where the cases are being reported. In this regard, mass awareness campaigns and interpersonal communication activities are to be carried out to make the community realize the importance of eliminating mosquito breeding sites inside their homes, adopt safe water storage practices for personal protection and acknowledge the relevance of using indoor sprays.

Involving community volunteers such as Lady Health Workers (LHWs) to create awareness on dengue during their regular home visits for service delivery at the community level. Lady Health Workers (LHWs) can impart the necessary knowledge and skills related to the prevention of Dengue fever to the households of their catchment areas with focus on water storage practices. In areas, where the LHWs are not present, community volunteers may be assigned to promote personal protection and essential vector control measures.

School-based community awareness programs can be initiated by local health departments in collaboration with their education counterparts. Children may be acquainted with the basic skills relevant to the elimination of vector breeding in and around their homes and mobilize them to create awareness among their families and communities. Mosques can also be used for awareness creation during Friday prayer sermons. Health authorities should launch large scale media campaign for public education. Both electronic and print media can play a vital role in achieving tangible successes in control of this rapidly spreading viral disease.

2.14.1. Fundamental standards of community engagement

The UNICEF framework, Minimum Quality Standards on Community Engagement, defines the following fundamental standards that should be integrated at all levels of implementations.

2.14.2. Community participation

Community participation is a key in the decision-making of issues and problems that affect them. Participatory techniques and methods should be employed to ensure the involvement of communities including gender, disenfranchised and marginalized groups such as ethnicity, caste and disability in identifying their priorities and needs and defining the means to materialize those needs. It is important for the implementing organizations, to actively listen to the communities, learn to understand the local culture and context, provide lead to the communities and use innovative and creative approaches to ensure their participation.

2.14.3. Empowerment and ownership

Empowerment and ownership ranges beyond simple participation and demonstrate how much decision-making power and control of resources and processes are in the hands of community members. Community ownership thrives when community members are considered active partners and have an active role and responsibilities in the implementation. Empowered communities demonstrate strong sense of ownership and commitment and firm belief in collective self-efficacy that together they can make a difference.

2.14.4. Inclusion

The community engagement methods are used to ensure the inclusion of all segments of the communities including disenfranchised and marginalized groups, in identifying their special needs and devising means of realizing those needs.

2.14.5. Communication

Communication requires the context specific and culturally appropriate information sharing in local language through appropriate channels of communications to help communities to identify appropriate actions and solutions to the problems they face.

2.14.6. Adaptability and localization

Adaptable, context specific and well-informed community engagement approaches develop strong ownership and acceptance of the communities in the health and development programmes. Community engagement approaches needs to be culturally appropriate, flexible and responsive to local conditions, needs and concerns in order to develop ownership and foster sustainability.

2.14.7. Building local capacities

Capacity building is one of the key goals of community engagement. Providing essential knowledge and skills to communities and frontline workers or volunteers facilitate them to play an active role in the community engagement activities. Community engagement is effective and sustainable when it is built on the existing resources and community-based structures.

2.15. Theoretical underpinning

Adopting a positive deviance approach to dengue prevention will result in increased community participation and improved dengue prevention behaviours in intervention slums.

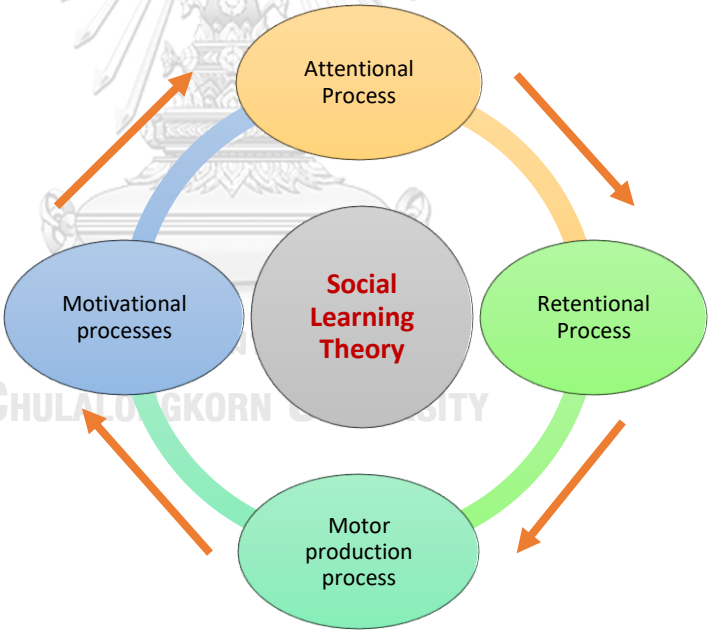
The Positive Deviance approach employs Social Learning Theory to guide the strategic thinking in order to influence the behaviors of the target communities. Social Cognitive Learning Theory of Bandura emphasizes that people learn via observation, imitation, and modeling of other behaviors. It also emphasizes on the role of self-efficacy which is required to perform a behavior [42]. The Social Cognitive Learning theory of Bandura suggest that learning process occurs through observation and imitation. He suggested that imitation of role models occurs in 3 parts i.e. behavioral models, behavior of the model influences and the internal processes of learning [42, 43]. Bandura suggests that individuals construct the learning process to recognize the role model or imitated behavior, then plan to emulate or imitate and become their personal behavior. If the action or behavior of role model synchronizes with the individuals' personal circumstances or situation (interests, experiences, objectives or

goals), then he/she will imitate, emulate or adopt the behavior of the model. In the following figure, Bandura suggests four interrelated elements that construct the learning process.

2.15.1. Attentional processes:

This is the first social and cognitive learning stage. At this step, the person focuses to the modeled behavior. The person carefully attends to and perceive the model's behaviours. This stage defines what is observed and what is expected from the model's influence. Therefore, it includes the observer's personal characteristics, the actions of the model itself, mutual interaction, and types of experiences in the observation.

Figure 8. Social Cognitive Learning Processes



2.15.2. Retention processes

This is the second stage of cognitive learning. At this phase, if the person is influenced by the model behavior, he will imitate the demonstrated behavior of the model. The individual retains the information from the displayed behavior so that he/she could adopt and practice the model behavior. Individuals will only be

influenced by the model's behavior, if remember it. Therefore, the modeling behaviors can be retained in the memory of the observing person permanently through symbols.

2.15.3. Motor reproduction processes

At this phase, individuals demonstrate motoric or cognitive abilities in order to perform the learned behavior. Motoric capabilities help transform the memory-imbedded signs or symbols that are transformed into appropriate behaviors or actions. The individuals carefully retain and maintain a mental image of the models' action, practice many times the model's behavior in order to perform the action or behavior in a correct way.

2.15.4. Motivational processes

This is the fourth social and cognitive learning phase. This phase defines the success of the social and cognitive learning process. This stage suggests that an individual mimic or imitate a behavior of a model successfully and accurately if he/she has stored the information in the memory, possess the skills to perform the behavior and has the motivation and willingness to perform the behavior. Bandura suggests that despite carefully observing the behavior and retaining the messages in memory, he/she will not be able to perform the behavior unless he/she has enough motivation or given a booster or incentive to do so. He suggests 4 types of boosters that can support if a person do not imitate the model behavior, namely (1) giving rewards or awards to the model, (2) giving rewards or awards to the individual, (3) making self-reinforcing statements, (4) explain how the modeled behavior came up with reinforced results.

2.16. Previous studies on behavior change and community engagement on dengue

The following studies conducted in various parts of the world demonstrate the effectiveness of community participation in dengue prevention and control:

Communication for Behavioral Impact (COMBI) is a behavior change approach that has been conducted on dengue control in various parts of the world. World Health Organization (WHO) has pioneered the use of COMBI to design and implement the behavior change communication interventions for dengue prevention and control in Malaysia[44]. A study was conducted to assess the effectiveness of COMBI program in Selangor, Malaysia on prevention and control of dengue. The study revealed that COMBI has a significant impact on the knowledge, attitude and practices of the participants but only during the intervention period. Lack of community engagement and availability of funds was the major bottleneck which significantly affected the sustainability of the COMBI intervention.

A cluster randomized controlled trial evaluated the eco-health method in Chennai, India [45]. The study randomly assigned 10 intervention and 10 control clusters for the study. In the intervention clusters, a community-driven environment management approach was carried out which included provision of covers of the water containers, environmental cleaning activities and sharing of dengue information through school children to control *Aedes*. The intervention clusters received the intervention while the control clusters only received the usual services and communication materials. The follow-up assessments demonstrated that there was a significant increase in dengue knowledge in the intervention cluster while only minimal knowledge changes in the control group. Community involvement using women's group was very effective. After 10 months of the intervention, the house index was reduced to 4·2%, the container index to 1·05%, and the Breteau index to 4·3 from the baseline values of 19·6, 8·91, and 30·8 in the intervention arm.

In another study in Indonesia, a community-led approach was implemented in 6 randomly assigned communities in Yogyakarta [46]. After 6 months, the follow up surveys were carried out. Qualitative methods including focus groups and key informant interviews were carried out to assess the community engagement aspects of the intervention. The key outcomes included: improved knowledge, attitude and practices in dengue prevention and control; higher community engagement; enhanced stakeholders' involvement with prospects for sustainability; enhanced community ownership in the dengue vector management. The results demonstrated that despite

some challenges and extra efforts in the beginning, the community-led participatory approach promises great prospects for sustainability.

A study assessed the implementation of a novel community-led intervention to improve the dengue control in Ouagadougou, Burkina Faso [47]. In this assessment, 64 observations and 18 in-depth interviews with community stakeholders were conducted. The intervention was built on 4 components: mobilization, operational planning, community action, and monitoring/evaluation. The coordination among these elements were aimed to improve community's knowledge about dengue and improve their self-efficacy for vector control in order to reduce the disease. The study successfully demonstrated the significance and feasibility of community-based interventions for dengue in Africa.

A study described the outcomes of health promotion intervention on a community-driven vector control programme in Mae Sot, Thailand [48]. Health promotion on dengue prevention and larval control through household visits, health education sessions and mass media lowered the *Aedes* Breteau index from 241 to 126. *Aedes* larval indices were lowered far more in the outbreak of 1990 than in 1989. The decrease of *Aedes* larvae in the containers was credited to a variety of community-based vector control activities. The study validated those changes in preventive and control behaviors were translated into the reduction of extra domestic water containers.

Another participatory research was carried out in 2 communities to determine the effectiveness of a community-led study in Mueang District [49]. Community's knowledge, attitude, perceived susceptibility and larval behavior were evaluated. The entomological aspects such as Container Index, House Index, and Breteau Index were carried out to validate the study results. The community stakeholders were engaged through various learning activities in the experimental village. The program resulted in positive outcomes. Community's knowledge, attitude, perception, self-efficacy, and larval practices were significantly higher in the experimental village before the experiment, and higher than the comparison village. The study suggest that active community engagement should be emphasized at village level.

A quasi-experiment was conducted in two groups to assess the effectiveness of intervention on dengue prevention in rural communities in Thailand [50]. The intervention community received 5-week intervention including sharing of dengue knowledge, health education, model house competition and health education sessions. The control community received the routine health education and care from the health promoting hospitals. The primary outcomes of the intervention were changes in knowledge, perceived susceptibility, perceived severity, perceived benefit, perceived barriers and dengue preventive measure. The secondary outcomes were changes in house index from baseline to post-intervention survey and at the three month follow up survey between intervention and control villages. The evaluation revealed significant changes in knowledge and preventive practices in the intervention community at the end of 5-weeks intervention and at three-month follow-up. The study revealed that the community participation resulted in improved knowledge, attitude, perceptions and preventive behaviors as well as reduced the house index.

Another study provided great insights on the community engagement on dengue. A cluster randomized trial was conducted on twenty randomly identified ‘clusters’ in Salto, Uruguay [51]. Entomological assessments were conducted to evaluate the outcome of the intervention on vector densities. An ecosystem management intervention was designed with active participation of all stakeholders. The community members destroyed or buried the small water holding containers and handed over to Municipality of Salto to eliminate them. The other breeding places such as large water containers were covered to avoid the mosquitoes breeding. The study resulted in strong partnership between the community and the decision makers at the national programme level. The study demonstrated reduction in dengue vector densities though it was not statistically significant level.

A qualitative study was conducted to define the existing social structures in a community and the way the social capital was utilized to address dengue fever [52]. In-depth interviews were carried out with 13 participants. The study was carried out in a dengue endemic area Surabaya, Indonesia. The results demonstrated that community-based structure or social capital provides the main foundation of joint

community action. The community-based social groups strengthened the intersectoral collaboration in order to perform the environmental management which improved the prevention and control of DHF. This study showed that community groups or social capital was an important structure, which could play, if engaged properly, an important role for solving community problems.

A similar qualitative study revealed that social capital or the relationship and existing networks of the community are important features and if properly engaged and build on in the dengue prevention and control programs, would be very effective to ensure community participation and solving dengue and other health related problems[53].

A study in Singapore revealed that to ensure dengue prevention and control, a strong intersectoral collaboration is required. The community participation to support house to house visits to monitor the mosquito breeding places coupled with the legislated framework including penalties can ensure compliance and adherence to the desired vector control behaviors and have strong impact on the dengue disease. The Singapore dengue prevention model is very successful in the country and can be adopted in other contexts as well[54].

A study conducted in Mexico highlighted the importance of community participation and Integrated Vector Management (IVM) Strategy in dengue prevention and control programs. The study stresses that community's role is very important to keep their environment clean. In order to achieve sustainable dengue prevention and control program, community need to be engaged to destroy the breeding places and ensure the environmental cleaning to have a mosquito free community [55].

A KAP survey was conducted in Cambodia revealed that a dengue awareness campaign disseminating dengue related knowledge and information is unlikely to ensure changes in the dengue related practices unless it is incorporated a well-informed strategy for behavior change such as Communication for Behavioral Impact which not only provides information but also creates as enabling environment for communities to follow those practices [56].

The qualitative study revealed that there is a lack of community participation and engagement in dengue at the community level. The community volunteers mentioned during interviews that community participation on dengue vector control has not been effortlessly executed at the bottom level. There is a dire need to engage the community in the vector control programs[57].

The study in Thailand revealed that community engagement is the main factor that help communities prevent the dengue outbreaks. If the community is engaged in removing outdoor mosquito breeding sites and collectively involved in the disposal of solid waste, it is likely to be a great achievement to prevent dengue outbreaks in the community[58].

A study applied Risk communication (RC) on dengue prevention and control. RC is an important approach to increase awareness and improve the risk perception of dengue prevention and control. The RC is a timely exchange of information between the community members and dengue experts to take collective and timely decisions to address dengue prevention and control[59].

A study conducted in India revealed that despite the community members in slums has sufficient knowledge about dengue prevention and control, but it was not reflected in the desired preventive measures such as removing breeding sites to avoid mosquitoes. There was a huge gap between the knowledge and practice. Community participation needs to be enhanced in all dengue prevention and control programs in order to control the dengue[60].

Community involvement is of the essence in dengue prevention and control. The study revealed that community engagement has a strong role for effective vector control at the community level. Communities should be engaged as partners and involved in the planning and implementation of the dengue prevention and control activities[61].

Another quasi experiment was conducted to assess the effectiveness of audiovisual media to improve family knowledge in order to prevent dengue fever in Indonesia [62]. The study was carried out with a sample size of 40 people (twenty for intervention and twenty people for control group). The purposive sampling method

was applied to identify the participants. The study demonstrated a significant increase in the knowledge, attitudes and behaviors of the families in the prevention of dengue fever by using audiovisual media, (p=0.000), (p=0.000). The study suggested that the community-based health workers should be equipped with audiovisual media to conduct health education for dengue control.

A school-based study assessed the effectiveness of health education interventions to improve knowledge, attitude and practices regarding dengue fever in private schools in Jeddah [63]. A pre-evaluation was conducted before the start and a post-evaluation was carried out after 3 months of the implementation to evaluate the outcomes. A multistage stratified random sampling was carried out to identify the schools and school children. The study revealed a significant difference in mean score in the knowledge, attitude, and behaviors of the study participants. The study demonstrated that health promotion interventions are imperative for dengue prevention and control.

2.17. Studies from Pakistan

There is a dearth of community engagement experimental studies on dengue control in Pakistan. Mostly cross-section surveys or pre-post studies were conducted to assess some community engagement and behavior change approaches in Pakistan. There is a dire need to implement and evaluate the effective community engagement approaches to inform the national dengue programme to adopt and implement these approaches at scale in order to promote the preventive behaviors among the at-risk communities.

A cross-sectional study was conducted to assess the effectiveness of community engagement in improving the preventive and control behaviors regarding dengue fever in district Swat, Pakistan [64]. A random sampling was used to select 354 respondents. The association of community involvement and community's behaviors for dengue control were tested using Chi Square test. The findings revealed that there is a strong association between community participation and dengue control behaviors to eradicate dengue mosquitoes (p=0.00), community leaders (p=0.04), community efforts ($p \leq 0.01$), use of insecticides by community people (p=0.00) and

community participation in dengue awareness campaign (p=0.00). Similarly, significant associations were found between dengue control and health promotion messages disseminated during dengue outbreak (p=0.00), community's linkages with department of health and non-governmental organizations (p=0.02). The study recommended that community participation and intersectoral collaboration between the health and other sectors is key to improve dengue outbreaks.

Another cross-sectional study assessed awareness and dengue preventive and control practices in Karachi, Pakistan [65]. In this study, 6 randomly selected communities were visited, 608 residents (2 persons per household) were interviewed, and dengue related practices were observed. The dengue related information was shared with the community members through a brochure. Multivariate logistic regression analysis of variables associated with dengue knowledge and practices was conducted. The study revealed that dengue awareness, disease threat perception, and self-efficacy are key predictors of appropriate dengue control behaviors. The study revealed that dengue prevention and control strategies should be focused on health promotion and building skills and self-efficacy of community members to perform the desired dengue behaviors.

A cross-section study was conducted to assess the dengue knowledge and awareness among school children in the model schools of Islamabad during Sep-Oct 2017. The school children between grades 9 and 10 were involved in the study. The self-administered questionnaire was used to collect the data. Total 601 participants, 345 (57.4%) were males and 256 (42.6%) were female students. Majority of the students (67.2%) demonstrated poor knowledge of the disease. The study showed high score in participants' knowledge of prevention of the dengue while showed the lowest score in the knowledge of transmission of dengue. Most of the participants (72.9%) mentioned television and radio as key information sources whereas 44.60% revealed that they learned about dengue fever through health education campaigns conducted by the school. However, it was found that despite the school-based awareness campaign, the knowledge of the students was sub-optimal. The study

suggested to revisit the existing behavior change strategies as they were unable to meet the desired objectives [66].

2.18. Positive deviance on dengue prevention and control

This study first time applied the Positive Deviance (PD), an asset-based community engagement approach to improve dengue prevention practices in Pakistan. There is no previous study that provides a comprehensive framework for the Positive Deviance application to dengue prevention and control; therefore, this literature review explained theoretical concepts and share some previous PD studies to elucidate the context of the Positive Deviance approach. The focus was on the major PD studies conducted on various health and social issues to explain its use in various contexts and settings. The PD approach is a paradigm shift from the traditional Standard Model Development or 'Top Down' approach to the more effective and desirable 'Bottom Up' or asset based development models [32]. The Standard Model of Development focuses on "the 'needs or problems' rather than on existing 'strengths' and 'capacities [67]. From the standpoint of PD, lack of consideration to assets or capacities suggests that there is likelihood of ignoring the existing, local and therefore sustainable solutions. In the need-based models, outsiders or external experts decide what kind of help the people requires and then plan and implement the plans accordingly. With decisions taken by the external experts, the implementers may design and implement the inappropriate activities at the inappropriate time or in the inappropriate manner [67]. In case of provision of materials services form outsiders, there are chances that these supplies will not sustain when the outsides stop delivery, therefore, eventually the supplies will stop. The Standard Development or top-down approach considers beneficiaries as passive, recipients who are receiving services without playing a role in development, ignorant of their own capacities, challenges, and opportunities. As a result, community who is receiving services or benefits does not play any active role in the design, planning or decision making of the interventions. In the absence of community involvement, the projects will lack the community ownership and will be unable to touch the community members at the grassroot level. In PD, the projects are bottom up, designed and led by community because local knowledge is more appropriate, context specific than foreign

knowledge. PD also validates the vision of the Alma Ata Declaration held in 1978 which consider community participation as a core value of all health programme [7]. The Positive deviance has been applied on a number of health and social issues in various contexts. Followings are some successful examples of PD projects:

2.18.1. Nutrition in Vietnam

The PD approach was first time operationalized on nutrition in Viet Nam with excellent measurables results. The PD approach on nutrition successfully identified the simple, local and replicable nutrition behaviors from within the community [31, 32]. This was one of main success stories which improved the nutrition outcomes of the children in Vietnam [33, 68]. This model has been replicated in more than 40 countries all over the world.

2.18.2. New-born health in Pakistan

The Positive deviance was applied in district Haripur to reduce infant mortality through newborn care practices in Pakistan. The project successfully identified the model PD practices improving newborn health. This PD project helped demonstrate the key steps in applying PD to an area outside of nutrition and came up with excellent results in antenatal care, delivery preparedness, clean delivery and postnatal care [69].

2.18.3. Female genital mutilation

The Positive Deviance approach was successfully applied against Female Genital Mutilation (FGM) in Egypt in 1997. The PD found local role models who despite living in the same culture and context did not circumcise their girls. Their stories and behaviors were shared with other community members during the study. In the following year of PD intervention, there was not a single girl circumcised in two communities out of total 8 communities. The Egyptian Government adopted the strategy in 2007 in collaboration with UNICEG and found more than a thousand role models who reached out to more than 1500 families. Studies revealed that there were 4% reduction in the female circumcision from 1997 and 2000.

2.18.4. Positive deviance on malaria

The PD was applied on malaria to address the artemisinin resistance among the migrant population in northwestern Cambodia [70]. The PD process was carried out to sensitize and mobilize the community and establish normative behaviors and identify the PD role models in relation to malaria control and prevention. The village health volunteers were trained to conduct the PD sessions for one year. After one year of implementation, focus groups and in-depth interviews were carried out with 3 communities to assess community acceptance and ownership of the PD intervention, signs of behavior changes, and the key project outcomes. The qualitative data revealed that the PD approach created a strong sense of ownership, engagement and belonging. The PD project was able to influence the key behaviors, including better use of insecticide bed nets by mobile and migrant workers, and use of public health centres for early diagnosis and treatment of malaria. After one year of the completion of the intervention, PD volunteers were still carrying out health education sessions in their concerned communities. This malaria study successfully refined the PD tools and process and improved the key outcomes on malaria which paved way for applying this innovative community engagement approach on dengue prevention and control in Pakistan.

2.18.5. PD theoretical concepts

The following concepts are imbedded in positive deviance approach:

i. Community mobilization

PD approach builds on the assets or strength of the community which creates strong ownership. The PD's engaging process mobilizes communities for social and behavior change [69]. According to Yankelovich, in the Standard Development Model, it is "the right of the leader or expert to disseminate the message and the task of the follower recipients of the message to understand and absorb it, not to contribute to its content," which results in a "dangerous wedge" between leaders and the public. In opposite, PD approach is rooted in uniting and connecting, and not separating, people. In community engagement, community members have to make their personal

decisions and the external experts or outsiders cannot ignore the experience of the local people. PD focuses on engaging and empowering communities to undertake the behavior change themselves.

ii. Social proof

Social proof means that community members follow the behaviors of a fellow community members to be relevant, desirable and fit into any given social situation. In PD malaria project, the forest workers adopted preventive behaviors of their fellow migrants saying, *"If he (my co-worker migrant who share similar occupation, resources, risks) can do it, why can't I."* [70].

iii. Indigenous knowledge

Mostly Top-Down approach devalues local or indigenous knowledge and encourages the outsider or experts driven knowledge and solutions. PD supersedes the external knowledge with the local knowledge and indigenous solutions. "PD is very context-appropriate and builds on the sociocultural context of the community. PD is always bottom up, inside out and context appropriate and acknowledges the local wisdom.

iv. Benefits of the study

The study will help explore the effectiveness of the Positive Deviance in dengue context. The study will provide a new community engagement tool to the program managers to reach out the high-risk populations. The study will further refine the tools and processes for future community engagement studies in the dengue context in Pakistan and worldwide.

CHAPTER 3

METHODOLOGY

This chapter explains various steps that were carried out in the study. It describes the research design, study sites and population, sample calculations, inclusion and exclusion criteria, study instruments, statistical tests and the overall detailed implementation plan.

3.1. Research design

The study applied the mixed method research design. Two slums were purposively selected base on the dengue incidence. The researcher ensured that the selected slums had similar characteristics in terms of socio-economic status, occupation, religion, ethnicity, dengue risks, and access to health care resources. The experimental group had received the positive deviance intervention using interactive sessions, community-based competitions and role plays. The control group did not receive any intervention. However, both groups equally received a brochure on dengue prevention and control developed by the Directorate of Malaria Programme Pakistan.

3.2. Study timeline

The study was conducted over a period of 8 weeks from June to October 2020. In the total 4 months period, PD intervention was conducted in the first two months whereas the other two months were given the participant to carry out the activities without any external support. The PD intervention was conducted during first two months. The first follow ups were done after 2 months of the study. The second follow up was carried out after 4 months of the study to see if there were any signs of sustainability of the intervention.

3.3. Study site and population

In Pakistan and other parts of the world, slums had been the key feature of the urban part. Mostly the slums existed on the outskirts of the cities, however, Islamabad was an exception. Islamabad was the first planned city in Pakistan which was architected in 1970s. The construction of a new city from scratch invited millions of people to Islamabad to find work. These laborers travelled from all parts of the

country. Christians community members were in the majority to seek the odd jobs such as cleaners, maids, daily wage workers in the Capital city. After the Christian communities settled in, most of their friends and family members started to migrate to Islamabad to enjoy extended work opportunities in the new city. In Islamabad, slums are situated on the brink of urban nullahs, right in the centre of urban sectors. People started to dwell in these slums from early 1960s. The study was carried out in the slums which were already approved by Capital Development Authority (CDA). The CDA approved slum's dwellers have the right to construct homes and reside as legitimate member of the slum community. The environmental conditions in the slums were conducive to dengue transmission. Plastic bags, empty bottles, tins, and used packages, had been indiscriminately scattered in the streets of most of the slums which provided ideal conditions for the breeding of Aedes vector. They had bored wells which were linked with households through pipes to distribute water on regular intervals. The community members store water in water tanks, buckets, and small water holding containers which helped create a conducive environment for the breeding of dengue mosquitoes.

The study participants were community members of age 18 years and above in the selected slums in Islamabad. Two slums, Faisal Colony situated in Sector G-7/1 and France Colony were purposively selected for the study. Faisal colony is comprised of 450 households while the France colony had a total of 500 households. The populations of both slums shared similar socio-economic status, occupations, and dengue risk factors. Most of the male community members were working odd jobs such as janitors, daily laborers, small vendors while the majority of working women worked as housemaids in different sectors of the Islamabad city.

3.4. Sampling technique and sample size calculation

Convenient sampling technique was used to recruit 112 respondents, 56 were assigned to intervention and 56 were assigned to control group. One participant was identified from one conveniently selected household. The estimated sample size had been calculated using power analysis with G*Power 3.1 (Faul, Erdfelder, Lang and Buchner, 2007). The effect size was calculated using a previous study [34]. A power

of 0.8 based on the effect size of 0.59 for the difference in dengue knowledge between groups, which is the primary outcome. Power analysis contained four independent variables:

β	Beta error, where power = (1-Beta error): 0.8
α	Alfa error rate: 0.05
E	Effect size: 0.59
N	Sample size: 92

The total sample size included 92 participants, where 46 participants were divided into two group. After calculating the drop out at 20%, the total sample size was 112 which meant 56 participants per group. ANOVA: repeated measures, between–within interactions. Sample size calculation:

Effect size

$$f = \frac{\sigma_\mu}{\sigma}$$

$$\lambda = f^2 \mu N_\varepsilon$$

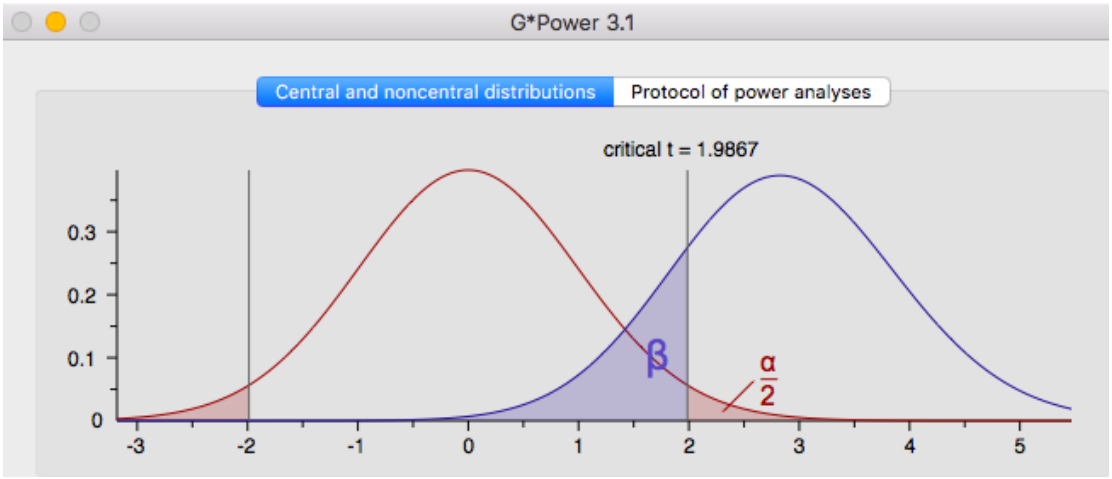
when

$$\mu = \frac{m}{1-\rho}$$

$$df_1 = (k-1)(m-1)\varepsilon$$

$$df_2 = (N-1)(m-1)\varepsilon$$

Figure 9. Sample size



3.5. Inclusion and exclusion criteria

3.5.1.Inclusion criteria

The study population comprised of community members who met the stated inclusion criteria:

- Male or female over 18 years of age
- Willing to take part in the research and able to provide the informed consent
- Permanent resident of the selected slum
- Can speak and understand Urdu language

3.5.2.Exclusion criteria:

- Mentally ill
- Infected with COVID-19
- Someone who leaves the slum for one month

3.6. Study instruments

In the beginning Knowledge, Attitude and Practices (KAP) survey was conducted to establish the benchmark. At the end of the two-month intervention, the KAP survey was repeated. After four months from the beginning, KAP was repeated the third time to assess the changes in knowledge, attitude, and practices among study participants. The survey tool included questions about;1) demographic and socio-economic information which included age, gender, religion, marital status, education level, and family's monthly income of the respondents; 2) knowledge about dengue transmission and symptoms; 3) health-seeking behaviors 4) attitude towards dengue; 5) personal protection measures and methods to avoid breeding sites; and 6) preferred channels of communication. The questionnaire was pretested with 30 participants for internal consistency and finalization of the tool. The questionnaire formerly used in Cambodia was modified for this study [35]. Face-to-face interviews were conducted in the Urdu language.

3.6.1.Content validity of the questionnaire

The content validity of survey questionnaire was verified by the review of 3 dengue experts. They assessed if the instruments were measuring the intended variables of the study. Three dengue experts were requested to review, assess, and validate the contents of the questionnaire. The Item-Objective Congruence (IOC) was used to evaluate the items of the questionnaire based on the score range from -1 to +1.

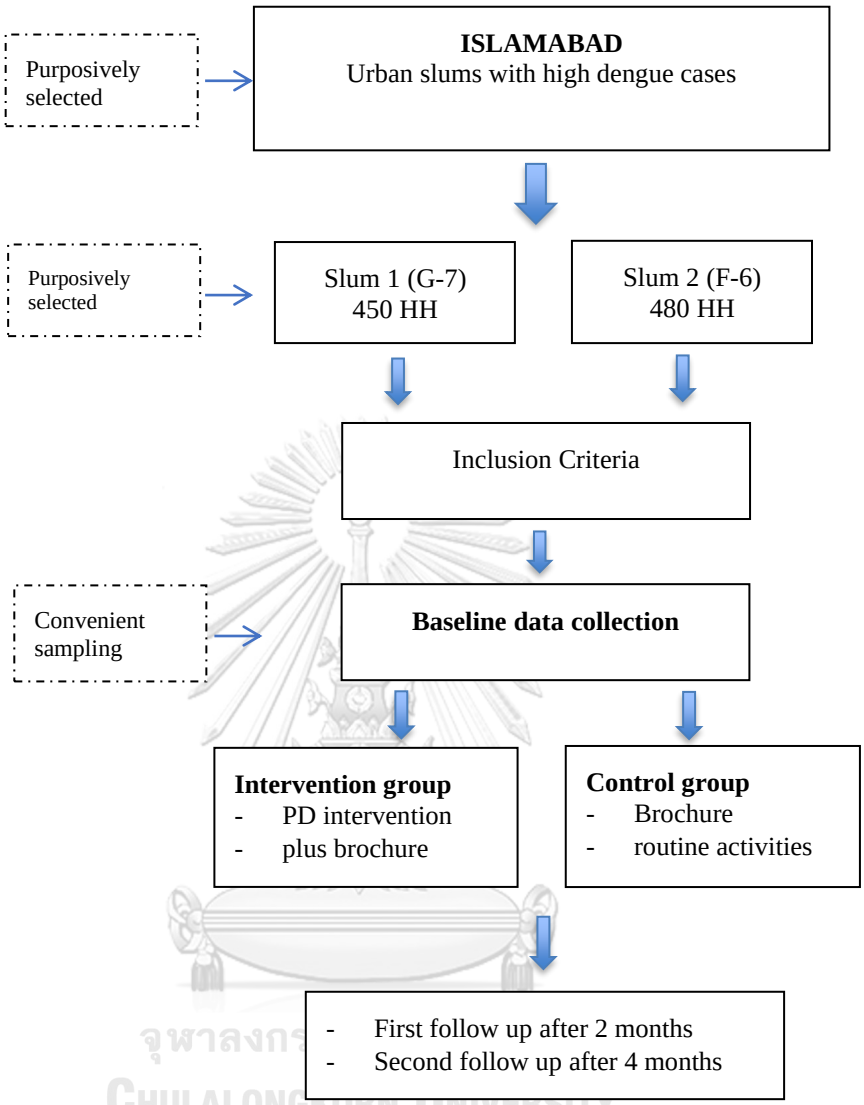
- Congruent = + 1
- Questionable = 0
- Incongruent = -1

The items that had scores lower than 0.5 were revised. On the other hand, the items that had scores higher than or equal to 0.5 were reserved.

3.6.2.Reliability of the instrument

To determine whether the questions were phrased appropriately and whether the response option was also appropriate, a pre-test was carried out with the similar population (30 persons) outside the selected study area/slums. The pre-test presented valuable feedback of the participants on how they comprehended the questions and whether there was a need to modify or correct the questions. The reliability value was measured using the Cronbach's alpha to ensure the internal consistency within the items. George and Mallery (2010) explained the value of Coefficient Cronbach's Alpha as the following≥ 0.9= Excellent, ≥ 0.8= Good, ≥ 0.7= Acceptable, ≥ 0.6= Questionable, ≥ 0.5= Poor, and ≤ 0.5=Unacceptable. Therefore, to ensure the reliability of the research tool, the Coefficient Cronbach's Alpha must be at least 0.7. According to the pre-test, the Cronbach's Alpha was 0.805, so the questionnaire's reliability good.

Figure 10. Flow diagram



3.7. Study variables

Independent variables

The key independent variables of the study were:

i. Socio-demographic factors (age, gender, education, marital status, occupation, income)

Dependent variables

i. Dengue knowledge, and attitude; knowledge of causes of dengue, knowledge of sign and symptoms of dengue, knowledge of preventive measures, knowledge of mosquito breeding places
ii. Dengue Practices i.e. covering of water containers, cleaning of water tanks, removing cans, shells, bed net use, and use of repellents

3.8. Quantitative data collection

3.8.1. Baseline and follow up surveys

The data was collected at the baseline (before the start of intervention), after two month of intervention and after 4 months to assess the changes in knowledge, attitude and practices and sustainability of the intervention. We lost only two participants in the second and third follow ups from the control group. Ten data collectors had received two days training to collect the data from the intervention and control slums. The data collectors visited the selected households to collect data from the study participants through face-to-face interviews using the questionnaire. Data was collected related to socio-demographics (age, gender, marital status, education and occupation), knowledge and causes of dengue, prevention measures i.e. cleaning environment, cleaning and covering water jars, use of bed nets, and use of repellents.

3.8.2. Training of data collectors

The data collectors participated in a two-day training to familiarize themselves with the methods and tools used in the field. The training comprised of; rapport building, interviewing skills, research ethics and review of the survey questionnaire.

3.9. Qualitative data collection

For the qualitative component, 8 Focus Group Discussions (FGDs) were carried out with male and female community members to explore their knowledge, perceptions, and practices regarding dengue. The participants were selected based on their convenience, interest, and willingness to participate in the focus group

discussions and the PD study. The head of the slum helped identified the potential participants for the FGDs. The FGDs were homogenized regarding gender and age to ensure quality discussions. For the FGD, participants were contacted one day before the actual FGD to get their informed consent and check their convenient times to schedule the FGDs. Separate FGDs with male and females were conducted at their convenient places to ensure the cultural appropriateness and facilitate a healthy discussion among the participants. Ten In-depth Interviews (IDIs) were conducted to identify the positive deviance role model behaviors from the community. The participants for IDIs were selected from the FGDs. When a potential role model was identified during the FGDs, he/she was asked for a separate detailed interview after the FGD to further explore his/her role model behaviors and strategies. Topic guides were developed in the local language URDU to conduct face-to-face interviews with the participants. The findings of the qualitative component formed the basis of the PD-informed intervention. The key themes in the qualitative topic guides pertained to; knowledge of dengue, causes of dengue, perception of the high-risk group, prevention of dengue, personal protection measures (use of repellents, bed nets), water jars and environmental cleaning. The qualitative component helped identified the positive deviant role models for intervention community. The Framework Approach was used to conduct the data analysis.

Table 1: No of focus group discussions and in-depth interview

Target Group	FGDs	IDIs	participants
Community members male	• 4 FGD	• 5 IDI	24
Community members female	• 4 FGD	• 5 IDI	24
Total	8 FGDs	10 IDIs	48

3.10. Intervention Details

The two affected slums were selected based on the dengue data. A meeting was organized with the National Malaria Directorate to access the recent dengue data

and get their permission to conduct the study in the most dengue affected slums in Islamabad. Two lists of households were collected from the head of the Faisal colony and France colony slums to select the participants for the study. An orientation meeting with the key stakeholders with each slum was organized to inform them about the study, participation and get their permission and support in the study. Convenient sampling technique was used to select the participants for the study. The baseline KAP survey was used to screen the participants for the study. In the baseline survey, participants were asked if they would like to participate in 4-month PD study in the two slums. The study participants were chosen based on the inclusion criteria as per the required sample size. One person per selected household was identified for the study. There was flexibility to include more participants who seemed interested and willing to participate in the dengue intervention.

A two-month intervention was carried out in the selected slum. After the intervention, two more months were given to the communities to practice these behaviors without researcher's involvement. The first follow-up was done after two months and second follow up was carried out after 4 months of the intervention to assess the sustainability of the approach. The PD intervention included 5 main activities:

Activity 1 - Two-day Training on Dengue

Objectives:

- To improve the knowledge on dengue, causes of dengue, sign and symptoms of dengue fever and severe dengue fever
- To improve the dengue control practices i.e., personal, and environmental protection measures

Two research assistants, a male and a female were hired for four months to support the researcher in the training and field implementation. They helped establish the links with the local communities, organized training and provided support in the PD sessions. A two-day training of study participants was conducted in two batches covering 30 persons per batch. The key topics of the training had been:

Day 1:

- Dengue situation in Pakistan?
- Who is at risk?
- Dengue transmission, causes of dengue, types of dengue mosquito, biting time,
- Mosquito life cycle
- Sign and symptoms of dengue fever
- Health seeking behaviors, what to do when we get dengue

Day 2

- What are the key preventive measures being used to control mosquito bite?
- Personal protection measures i.e., use of repellents, bed net,
- Environmental management i.e., clearing household surroundings, cleaning water jars, covering water containers, removing empty shells and cans etc.
- Roles and responsibilities of community members in the dengue intervention
- Communication on dengue with neighbors

Activity 2 - Identification of the positive deviance role models

Objectives

- To identify potential positive deviance role models, who are already performing dengue prevention and control behaviors, based on the household observations
- To conduct in-depth interviews with these potential role models to understand their dengue practices, motivations and local strategies to prevent dengue

- To share these local, simple and accessible role model behaviors in the coming health education sessions through these actual “role models”

During the dengue training, the researcher and research assistants assessed the participants to identify potential PD role models. After the training, they visited the houses of these potential role models and observed the dengue preventive behaviors and further explored their uncommon PD strategies through in-depth interviews. Following are the criteria that helped identify PD role models from the community:

Positive Deviants selection criteria:

The household has no dengue case. The household carry out the following preventive behaviors:

- Apply the preventive measures i.e., use of bed nets, use of repellents or other method to prevent mosquito bite
- Clean the household environment, disposal of cans, tires, empty bottles to avoid mosquito breeding etc.
- Cover and clean water containers, clean jars, change water on regular basis
- When suspect dengue, go to the health clinic within 24 hours for proper diagnosis and treatment

Activity 3: Booster training and material design

Objectives

- To refresh knowledge on the sign and symptoms of dengue fever, and severe dengue fever and preventive behaviors
- To share the behaviors of PD role models
- To design communication materials based on sketches or pictorials to reinforce PD role models behaviors

After two weeks of the first training, a one-day training booster had been conducted with the study participants to refresh their knowledge on disease severity and dengue prevention and control. The identified role models shared their local

behaviors which enabled them to prevent dengue. The second half of the training engaged the participants in designing the local Information, Education and Communication (IEC) materials that were used during the health education sessions. The training mainly centered on:

Morning session – refresh dengue knowledge and share PD behaviors

- Dengue transmission, causes of dengue
- Severity of dengue disease, sign and symptoms of dengue fever and severe dengue fever
- Prevention measures
- Environmental management i.e. clearing of rubbish, disposing of the empty cans, shells, tires and cleaning or covering water jars
- Sharing of PD role models behaviors and stories

Afternoon session – Designing of IEC materials

- The community members were divided in small group (6-8 person per group) to develop sketches or pictures of the dengue behaviors they learned from the identified PD role models living in their community. These community-made sketches and pictures ensured the ownership and acceptance of the community. These materials were used during PD sessions to provide consistent knowledge and information to the community The participants were divided in 5 small groups to develop following sketches:

    - Dengue mosquito
    - Transmission of dengue (Aedes mosquito)
    - Key preventive measures i.e., cleaning environment, covering water jars, cleaning water containers
    - Personal protection measures i.e., use of bed nets, repellents
    - Sign and symptoms of dengue and severe dengue
    - Health seeking behaviors

Activity 4: PD health education session

Objectives

- To share the local knowledge and practices of identified role models on dengue prevention and control to improve dengue knowledge and behaviors

Interactive health education session had been organized to share the dengue prevention and control behaviors of the identified role models. The actual role models shared their stories that how despite living in the at-risk community and sharing similar resource or risk factors with others, they managed to avoid dengue. They spoke of their experience with the help of locally made colorful pictures which were pasted on large size flip chart along-with the key messages. These role models continued sharing their behaviors with other community members informally after the intervention as well (see table 2).

Table 2. Schedule of PD sessions

Message	Methodology	Schedule
Dengue knowledge - Dengue transmission - Dengue vector - Mosquito breeding places - Dengue signs symptoms	Role plays Story telling	Weekly PD sessions
Dengue practices - How to prevent dengue - Environmental cleaning - Personal protection - Covering water containers	Story telling PD role models	Weekly PD sessions
Health seeking behaviors - What to do if suspect dengue - Where to go for dengue diagnosis	Story telling PD role models	Weekly PD sessions
- Dengue knowledge - Dengue practices - Dengue pictorial competition	Sketch competition Song competition	Last week (7-8th week)

- Dengue seminar

Activity 5: Community Seminar

At the 6th week of the intervention, a community seminar (community campaign) took place to reinforce the dengue messages and behaviors through various fun and interactive community-based competitions i.e. poster competition, dengue song competition, role play competition. The research assistants facilitated these competitions at the community level so community members could be prepared for the event. These helped amplify interest and enthusiasm among the community members to compete and win prices in the actual seminar. Following activities were to take place in the community one-week prior to the seminar.

Dengue sketch competition: The dengue sketch competition was conducted to augment interest and disseminate the key messages in the community. The research assistants informed the communities one week prior to the seminar to prepare colorful drawings on any dengue message that they heard during the intervention. The research assistants then collected the drawing/illustrations one day prior to the event and displayed these art pieces on the walls of the seminar venue. During the event, the audience looked through all the pictures and voted for the best illustrations. They selected the three best illustrations for the prices.

Dengue song competition: The communities of the intervention slum were involved in the song competitions as well. The research assistants informed the people for the competition a week in advance. The participants sang songs they wrote about dengue during the event and the best performers won prices.

Question/answer competition: A dengue related question/answers session was organized during the event. The dengue related questions were written on small pieces of papers, mixed and put in a small container. The researcher then asked the questions to the participants of the seminar. The participant who answered correctly received a gift of worth 1 US dollar as a token of appreciation and participation. The main objective of the quiz was to reinforce the dengue preventive messages and

clarify different issues related with dengue prevention and control. At the end successful participants received prizes.

Handing over: At the end a symbolic handing over ceremony took place to deliver the project to community. The community was informed that as they had started the dengue prevention control activities in the last few weeks, now there was no need for outsider researchers to facilitate the process. It was now the community's responsibility to continue the PD activities without any external support. Roles and responsibilities of the PD role models were developed on how to continue sharing this information onward.

Activity 6: Special PD session in the control group

A special PD interactive session was organized in the control group at the end of the intervention, after the second follow up was completed. The identified PD role model behaviors were shared with the control group using interactive techniques. All the sketches developed by the intervention community were shared with the control group. As part of the research ethics, the main purpose of the session was to share all the positive behaviors and clarify the misperceptions of the control community before phasing out of the project. Almost 40 community members from the control group participated in this session and appreciated the research team for sharing the information.

Figure 11. Timeline

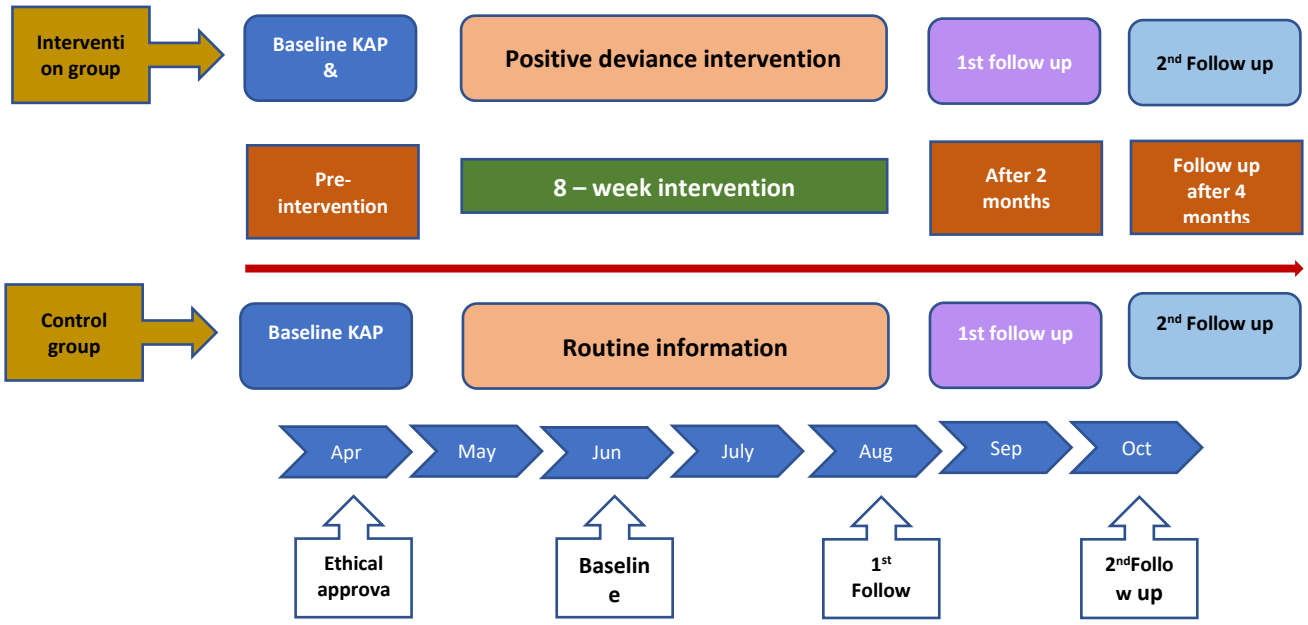
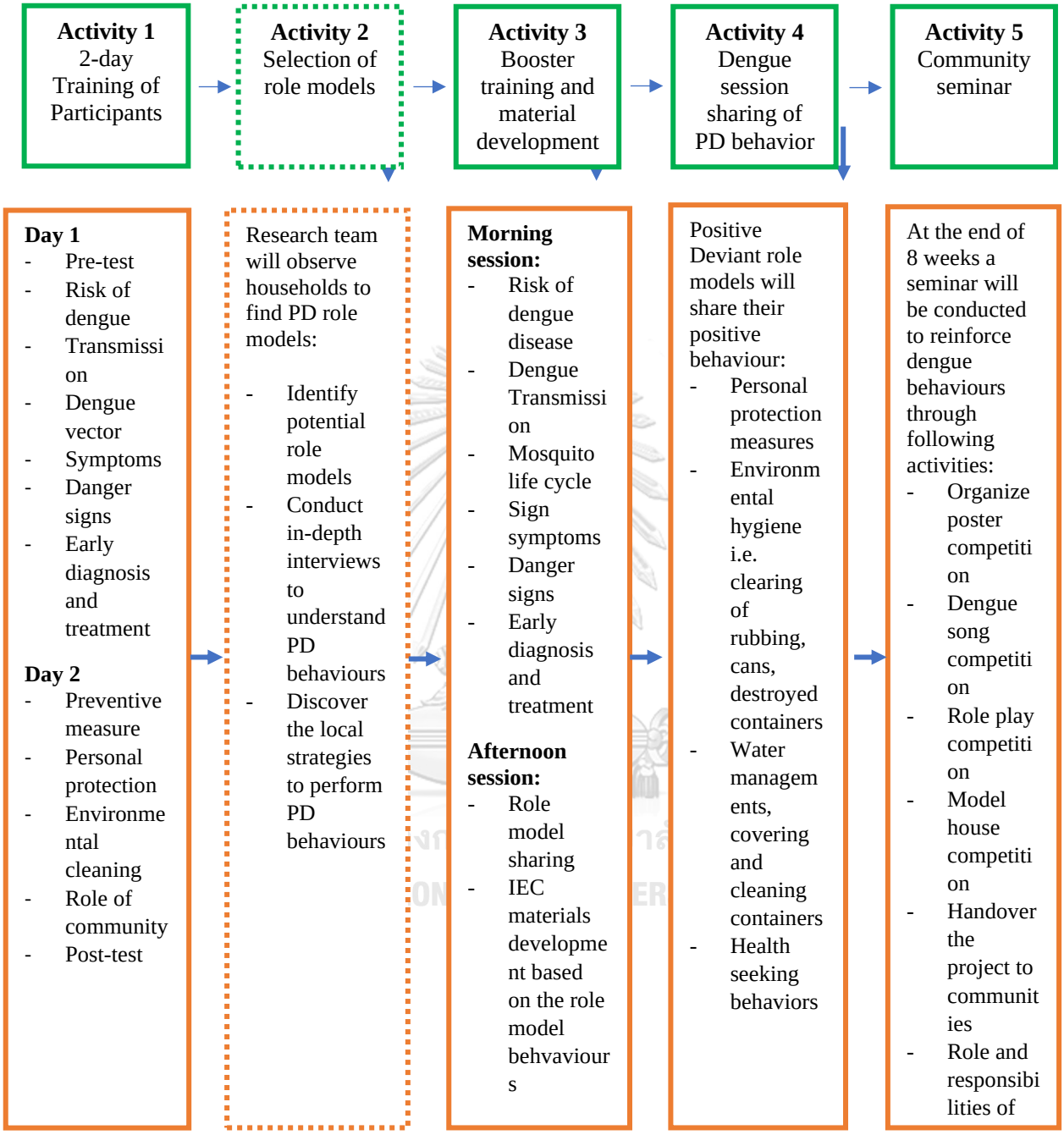


Figure 12. Flow chart of intervention



Activity 7: Monthly meetings

3.11. Data Analysis

The data were entered in the Epi Data 3.1 software (Epi Data Association, Denmark), cleaned, and then exported to the Statistical Package for Social Science

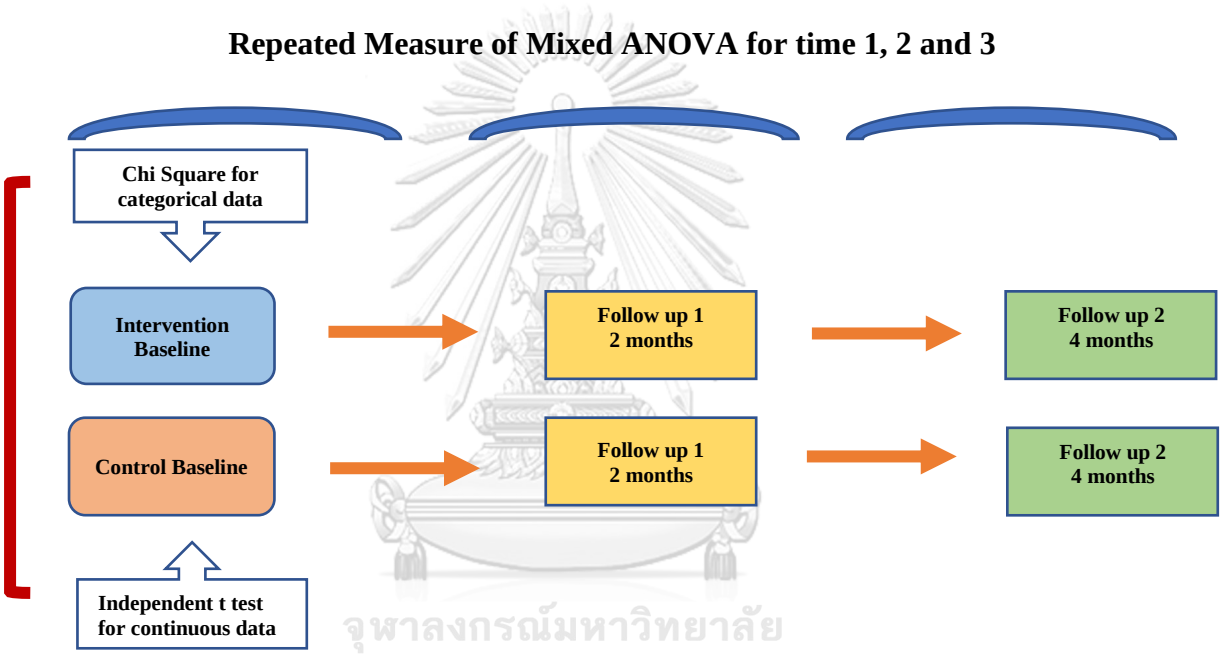
(IBM SPSS Statistics 25) for the detailed analysis. During the statistical processing of data, standard methods of descriptive statistics were used. Mean and median were used to describe continuous data and frequencies and percentages to describe categorical data. Chi square ($\chi 2$) tests were performed to examine differences in categorical data between intervention and control group at the baseline. Independent samples t-test were used to examine the differences between the intervention and control groups in the total knowledge score, total attitude, and total practice scores at the baseline. Based on total number of correct answers, new variables were created to examine dengue knowledge (0-48), attitude (0-32) and practice (0-24). To the options for the attitude statement answers, 'Strongly agree', 'Agree', 'Disagree' and 'Strongly disagree' were assigned points of 4, 3, 2, and 1, respectively. For scoring purposes, negatively worded items were reverse coded. For the purposes of descriptive analysis, the answers to the statements related to dengue attitudes were collapsed into a 3-point scale ('Agree', 'Don't know' and 'Disagree'). Repeated measures Mixed ANOVA with one within-subjects factor (time) and one between-subjects factor (group) was conducted to compare the mean differences in total dengue knowledge, attitude, and practice scores between the intervention and control group over time: baseline, midline after two months and endline after another two months. All results with $p<0.05$ were reckoned statistically significant.

Table 3. Statistics for data analysis

Types of variables	Variables	Statistics
Descriptive statistics		
Categorical data	Education level, Occupation, Marital status, Gender	Frequency and percentage
Continuous data	Age, Income, Score of Knowledge, score of behaviors	Frequency, percentage, mean, Min-Max, standard deviation
Baseline characteristics, between-group differences		
Categorical data	Education level, Occupation, Marital status, Gender	Chi-Square
Continuous data	Age, Income, Score of dengue knowledge, the score of dengue behaviors	Independent t-test
Effectiveness of positive deviance intervention		

Continuous data	Dengue knowledge and attitude	Repeated measures Mixed ANOVA with one within-subjects factor (time) and one between-subjects factor (group)
Continuous data	Dengue preventive practices	Repeated measures Mixed ANOVA with one within-subjects factor (time) and one between-subjects factor (group)

Figure 13. Statistical test



3.12. Ethical approval and consent

The ethical approval of the study was received by the National Bioethics Committee, Pakistan in April 2020 (Ref: No.4-87/NBC-451/20/ 2037). The study participants were briefed about the potential risks and benefits of the study. They were informed that the participation in the study is voluntary, and they are free to leave the intervention anytime without any consequences. The participants were also informed about the length of the intervention and number of surveys to be conducted during the intervention. All the participants were requested to provide a written informed consent where one copy of the consent with contact details of the lead researcher was given to each participant for any further details and clarifications. The

researcher carefully followed the Standard Operation Procedures (SOPs) of the Government of Pakistan regarding the COVID-19 to ensure the safety of the participants and the data collectors.

Informed consent

All persons selected for the study were briefed about the objectives of the study. Their informed consent was sought before the initiation of the study. They were also briefed on the duration, potential risks and benefits of the study. The participants were requested to provide a written informed consent. One copy of informed consent was handed over to the participants for their information.

Maximum benefit - Minimum harm

Since this is an intervention and evaluation relying on interviews, questionnaires, and focus group discussions, with questions that were not of a nature to present any known risks to subjects, there was little to no potential for harm to the participants. There were no human samples taken either: blood, urine, stool, etc.

Incentives

The participants were given 2 bars of soap as a token of their participation in the surveys and focus group discussions. Small prizes (USD 1 each) were given to the best sketch artists during the seminar as a token of appreciation.

Confidentiality

None of the information registered was sensitive. Upon entry of data into the computer database, all names had been omitted and each household was only identified by the ID number. The questionnaires with their identifying information were discarded once the study was completed. All results of the study were reported anonymously in an aggregated format. In the case of identified positive deviants, the purpose of the intervention was to share their stories and behaviors. All positive deviants had been requested permission for dissemination of their information.

CHAPTER 4

RESULTS

4.1. Socio-demographics at the baseline

A total of 112 respondents participated in the study, 56 in the intervention group and 56 in the control group at the baseline. At the midline and endline the number of respondents in the control group decreased by two respondents (Table 3).

Table 4. Sample size of intervention and control groups surveyed at baseline, midline and endline

n (%)	**Baseline**	**Midline** 1st follow up (after 2 months)	**Endline** 2nd follow up (after 4 months)
Intervention group	56 (100)	56 (100)	56 (100)
Control group	56 (100)	54 (96.4)	54 (96.4)
Total	112 (100)	110 (98.2)	110 (98.2)

When compared, groups are quite similar and there are no statistically significant differences in socio-demographic characteristics such as sex, age, marital status, religion, education, occupation and average monthly income between intervention and control groups.

Table 5. Socio-demographic characteristic of the intervention and control groups surveyed (baseline)

Characteristics (N=112)	**Intervention group** n **(%)**	**Median (range)**	**Control group** n **(%)**	**Median (range)**	**p-value***
Sex					
Female	47 (83.9)	-	42 (75.0)	-	1.000
Male	9 (16.1)	-	14 (25.0)	-	
Age		31.0 (18–58)		30.0 (18–55)	
<30	24 (42.9)	24.0 (18–28)	25 (44.6)	21.0 (18–29)	0.789
≥30	32 (57.1)	35.5 (30–58)	31 (55.4)	37.0 (30–55)	
Marital status					
Single	15	-	13	-	1.000

Characteristics (N=112)	Intervention group n (%)	Intervention group Median (range)	Control group n (%)	Control group Median (range)	p-value*
	(26.8)		(23.2)		
Married	41 (73.2)	-	43 (76.8)	-	
Religion					
Christian	56 (100)	-	56 (100)	-	
Education					
Primary school (1-5)	5 (8.9)	-	7 (12.5)	-	
Secondary school (5-9)	6 (10.7)	-	11 (19.6)	-	
High school (10)	14 (25.0)	-	19 (33.9)	-	0.285
Intermediate-FA	5 (8.9)	-	3 (5.4)	-	
Bachelor-BA	1 (1.8)	-	1 (1.8)	-	
Masters-MA	0 (0)	-	2 (3.6)	-	
No formal education	25 (44.6)	-	13 (23.2)	-	
Occupation					
Unemployed	15 (26.8)	-	15 (26.8)	-	
Government job	3 (5.4)	-	1 (1.8)	-	
Private job	11 (19.6)	-	14 (25.0)	-	0.114
Street vendor	1 (1.8)	-	2 (3.6)	-	
Housewife	24 (42.9)	-	24 (42.9)	-	
Others	2 (3.6)	-	0 (0)	-	
Average monthly income (Rupees)					
<25,000	36 (64.3)	-	31 (55.4)	-	
25,000-50,000	11 (19.6)	-	16 (28.6)	-	0.896
50,000-75,000	4 (7.1)	-	2 (3.6)	-	
>100,000	1 (1.8)	-	0 (0)	-	
Don't know	4 (7.1)	-	7 (12.5)	-	

** χ^2 test/Fisher's Exact test*

4.2. Dengue knowledge, attitude, and practices at the baseline

An equal number of participants in the intervention and control group knew that dengue infection is caused by mosquito bite (67.9%). Statistically significant difference was found in the knowledge of three or more dengue related symptoms where 53.6% respondents from the intervention group knew three or more symptoms compared to 19.6% respondents from the control group. However, there were no statistically significant differences found in terms of knowing about mosquito breeding sites and mosquito and dengue prevention methods. Independent samples t-test revealed that there were no statistically significant differences between intervention and control group at the baseline in the total knowledge score as well as in the total attitude and practice scores (Table 5.).

Table 6. Dengue knowledge, attitudes and practice based on intervention and control groups (baseline)

Baseline	n	%	n	%	p-value
	Intervention group (n=56)		Control group (n=56)		
Knowledge					
Dengue is mosquito transmitted	38	67.9	38	67.9	1.000*
Knows 3 or more dengue symptoms	30	53.6	11	19.6	p<0.001 *
Knows 1 or more mosquito breeding sites inside the house	47	83.9	44	78.6	0.629*
Knows 1 or more mosquito breeding sites outside the house	45	80.4	44	78.6	1.000*
Knows 1 or more mosquito breeding prevention methods	48	85.7	50	89.3	0.776*
Knows 1 or more dengue prevention methods	52	92.9	52	92.9	1.000*
Total knowledge score (0–48)	**Mean** 10.09	**SD** 3.549	**Mean** 8.91	**SD** 3.053	0.062**
Attitude					
Total attitude score (0-32)	**Mean** 24.21	**SD** 3.329	**Mean** 24.55	**SD** 4.004	0.627**
Practice					
Total practice score (0-24)	**Mean** 10.21	**SD** 1.615	**Mean** 10.63	**SD** 1.169	0.156**

χ^2 test

Baseline	n	%	n	%	p-value
	Intervention group (n=56)		Control group (n=56)		

***Independent samples t-test*

4.3. Knowledge comparison

An improvement in knowledge over time was observed for almost all examined variables even in the control group. The following table presents knowledge about dengue transmission, prevention practice and symptoms at the baseline, midline and endline between intervention and control group.

Table 7. Knowledge about dengue at the baseline, midline and endline

Knowledge	Baseline n (%)		Midline n (%)		Endline n (%)	
	I group	C group	I group	C group	I group	C group
How is dengue transmitted?						
Mosquito	38 (67.9)	38 (67.9)	56 (100)	44 (81.5)	56 (100)	45 (83.3)
What is the type of mosquito that cause dengue fever?						
Aedes	5 (8.9)	6 (10.7)	38 (67.9)	20 (37)	50 (89.3)	31 (57.4)
When do dengue mosquito most often bite?						
Bite during the day	15 (26.8)	10 (17.9)	49 (87.5)	19 (35.2)	54 (96.4)	35 (64.8)
Bite during the night time	25 (44.6)	34 (60.7)	7 (12.5)	29 (53.7)	2 (3.6)	19 (35.2)
Other	2 (3.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Don't know	14 (25)	12 (21.4)	0 (0)	6 (11.1)	0 (0)	0 (0)
Where *Aedes* mosquito usually breed inside the house?						
In the trays under the fridge	3 (5.4)	1 (1.8)	6 (10.7)	3 (5.6)	8 (14.3)	5 (9.3)
In the flower pot trays	2 (3.6)	1 (1.8)	7 (12.5)	2 (3.7)	9 (16.1)	2 (3.7)
In the water containers	35 (62.5)	22 (39.3)	30 (53.6)	35 (64.8)	31 (55.4)	18 (33.3)
In the open water tanks	8 (14.3)	22 (39.3)	30 (53.6)	16 (29.6)	34 (60.7)	34 (63)
Dirty environment	2 (3.6)	1 (1.8)	1 (1.8	0 (0)	0 (0)	0 (0)
Don't know	6 (10.7)	11 (19.6)	0 (0)	7 (13)	0 (0)	3 (5.6)
Knows 1 or more	47	44	54	47 (87)	55	51

Knowledge	Baseline n (%)		Midline n (%)		Endline n (%)	
	I group	C group	I group	C group	I group	C group
breeding sites inside the house	(83.9)	(78.6)	(96.4)		(98.2)	(94.4)
Where *Aedes* mosquito usually breed outside the house?						
In the flower leaves	9 (16.1)	15 (26.8)	14 (25)	12 (22.2)	19 (33.9)	8 (14.8)
In the old tires	6 (10.7)	1 (1.8)	13 (23.2)	4 (7.4)	20 (35.7)	1 (1.9)
In the roof gutter	12 (21.4)	5 (8.9)	17 (30.4)	10 (18.5)	11 (19.6)	3 (5.6)
In the empty cans, shells	22 (39.3)	27 (48.2)	38 (67.9)	23 (42.6)	51 (91.1)	43 (79.6)
Dirty water	2 (3.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Don't know	9 (16.1)	11 (19.6)	1 (1.8)	14 (25.9)	0 (0)	3 (5.6)
Knows 1 or more breeding sites outside the house	45 (80.4)	44 (78.6)	54 (96.4)	40 (74.1)	56 (100)	51 (94.4)
How can you prevent mosquitoes from breeding?						
Using insecticide in water	9 (16.1)	12 (21.4)	31 (55.4)	14 (25.9)	35 (62.5)	16 (29.6)
Changing stored water frequently	7 (12.5)	11 (19.6)	24 (42.9)	15 (27.8)	28 (50)	13 (24.1)
Turning containers upside down	10 (17.9)	21 (37.5)	31 (55.4)	20 (37)	40 (71.4)	17 (31.5)
Putting covers on water jars	27 (48.2)	20 (35.7)	45 (80.4)	28 (51.9)	34 (60.7)	22 (40.7)
Burn or burry empty cans, shells	3 (5.4)	3 (5.4)	14 (25)	7 (13)	23 (41.1)	10 (18.5)
Spraying insecticide	14 (25)	11 (19.6)	15 (26.8)	10 (18.5)	33 (58.9)	20 (37)
Clean the household	7 (12.5)	3 (5.4)	0 (0)	0 (0)	0 (0)	0 (0)
Don't know	3 (5.4)	2 (3.6)	2 (3.6)	3 (5.6)	0 (0)	0 (0)
Knows 1 or more mosquito breeding prevention methods	48 (85.7)	50 (89.3)	55 (98.2)	51 (94.4)	56 (100)	54 (100)
How can you prevent dengue?						
Use mosquito net during the day	5 (8.9)	9 (16.1)	15 (26.8)	14 (25.9)	22 (39.3)	9 (16.7)
Wear long sleeves/long pants	23 (41.1)	22 (39.3)	48 (85.7)	37 (68.5)	52 (92.9)	42 (77.8)
Use mosquito repellent	15 (26.8)	22 (39.3)	22 (39.3)	26 (48.1)	33 (58.9)	22 (40.7)
Use insecticide spray	34	36	27	31	41	32

Knowledge	Baseline n (%)		Midline n (%)		Endline n (%)	
	I group	C group	I group	C group	I group	C group
	(60.7)	(64.3)	(48.2)	(57.4)	(73.2)	(59.3)
Cut down bushes near the house	1 (1.8)	1 (1.8)	6 (10.7)	2 (3.7)	14 (25)	6 (11.1)
Have children play far from mosquito breeding area	3 (5.4)	0 (0)	3 (5.4)	0 (0)	14 (25)	1 (1.9)
Use mosquito coils during the day	4 (7.1)	3 (5.4)	9 (16.1)	2 (3.7)	21 (37.5)	3 (5.6)
Keep household environment clean	4 (7.1)	0 (0)	4 (7.1)	4 (7.4)	26 (46.4)	12 (22.2)
Installed screens on windows/doors	1 (1.8)	0 (0)	1 (1.8)	0 (0)	16 (28.6)	1 (1.9)
Keep clothes tidy	0 (0)	0 (0)	0 (0)	0 (0)	18 (32.1)	2 (3.7)
Use fan	0 (0)	0 (0)	0 (0)	0 (0)	2 (3.6)	1 (1.9)
Don't know	4 (7.1)	2 (3.6)	1 (1.8)	2 (3.7)	0 (0)	1 (1.9)
Knows 1 or more dengue prevention methods	52 (92.9)	52 (92.9)	55 (98.2)	52 (96.3)	56 (100)	53 (98.1)
What are the symptoms of dengue?						
High fever	40 (70.1)	37 (66.1)	52 (92.9)	42 (77.8)	55 (98.2)	45 (83.3)
Headache	16 (28.6)	12 (21.4)	34 (60.7)	26 (48.1)	45 (80.4)	29 (53.7)
Chills	5 (8.9)	0 (0)	24 (42.9)	14 (25.9)	35 (62.5)	17 (31.5)
Nausea/Vomiting	12 (21.4)	4 (7.1)	31 (55.4)	17 (31.5)	36 (64.3)	19 (35.2)
Rash	13 (23.2)	3 (5.4)	24 (42.9)	9 (16.7)	22 (39.3)	7 (13)
Muscle and joint pain	11 (19.6)	11 (19.6)	26 (46.4)	16 (29.6)	37 (66.1)	15 (27.8)
Bleeding	6 (10.7)	2 (3.6)	25 (44.6)	7 (13)	35 (62.5)	12 (22.2)
Diarrhea	0 (0)	0 (0)	5 (8.9)	1 (1.9)	1 (1.8)	0 (0)
Eye pain	3 (5.4)	0 (0)	12 (21.4)	2 (3.7)	25 (44.6)	1 (1.9)
Don't know	12 (21.4)	18 (32.1)	3 (5.4)	9 (16.7)	0 (0)	7 (13)
What signs and symptoms make you decide the illness is serious?						
Severe abdominal pain	9 (16.1)	4 (7.1)	20 (35.7)	15 (27.8)	28 (50)	11 (20.4)
Persistent vomiting	7 (12.5)	2 (3.6)	35	23	43	19

Knowledge	Baseline n (%)		Midline n (%)		Endline n (%)	
	I group	C group	I group	C group	I group	C group
Difficult or fast breathing	5 (8.9)	2 (3.6)	13 (23.2)	11 (20.4)	20 (35.7)	5 (9.3)
Bleeding from gums or nose	9 (16.1)	4 (7.1)	22 (39.3)	10 (18.5)	31 (55.4)	3 (5.6)
Very pale skin	5 (8.9)	0 (0)	10 (17.9)	6 (11.1)	20 (35.7)	9 (16.7)
Feeling tired or restless	7 (12.5)	4 (7.1)	9 (16.1)	7 (13)	23 (41.1)	7 (13)
Vomiting blood	6 (10.7)	1 (1.8)	18 (32.1)	3 (5.6)	34 (60.7)	20 (37)
Blood in stool	0 (0)	0 (0)	1 (1.8)	1 (1.9)	5 (8.9)	0 (0)
Don't know	26 (46.4)	46 (82.1)	7 (12.5)	25 (46.3)	0 (0)	17 (31.5)
Knows 3 or more dengue symptoms	30 (53.6)	11 (19.6)	52 (92.9)	34 (63)	54 (96.4)	38 (70.4)

At the baseline, 67.9% of respondents from the intervention and control group knew that dengue is mosquito transmitted compared to 100% of respondents from the intervention group and 83.3% of respondents from the control group at the endline. At the endline, 96.4% of respondents from the intervention and 64.8% of respondents from the control group knew that dengue mosquito most often bites during the day compared to 26.8% of respondents from the intervention group and 17.9% of respondents from the control group at the baseline. Furthermore, 53.6% of respondents from the intervention and 19.6% of respondents from the control group knew 3 or more dengue symptoms at the baseline compared to 96.4% of respondents from the intervention group and 70.4% of respondents from the control group at the endline.

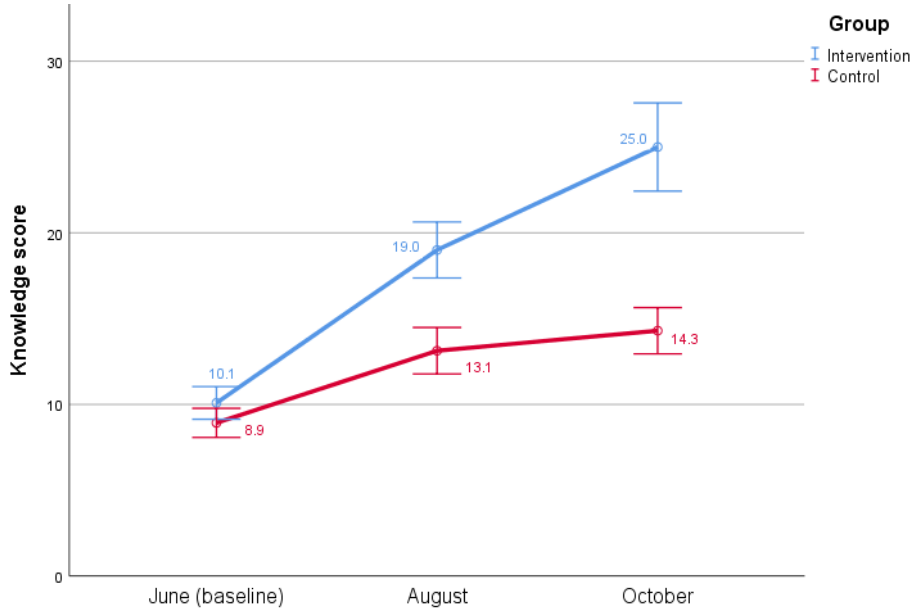
Table 8. Descriptive statistics of total knowledge scores at three time points according to the group

	Group	Mean	SD	N
KNOWLEDGE (baseline)	Intervention	10.09	3.549	56
	Control	8.93	3.107	54
	Total	9.52	3.375	110
KNOWLEDGE (midline)	Intervention	19.00	6.093	56

	Control	13.13	4.953	54
	Total	16.12	6.273	110
KNOWLEDGE (endline)	Intervention	25.00	9.607	56
	Control	14.30	4.944	54
	Total	19.75	9.346	110

To examine the mean differences in total dengue knowledge scores between the intervention and control group over time repeated measures Mixed ANOVA was performed. Mauchley's test of sphericity was violated so the Huynh-Feldt correction was used. Levene's Test of Equality of Error Variances was also performed to check homogeneity of variance. Results showed that there was significant main effect of time ($F(1.74,187.94)=88.492$, $p<0.001$, $\eta p2=0.450$) and group ($F(1,108)=81.518$, $p<0.001$, $\eta p2=0.430$), on knowledge scores. In addition, there was a significant interaction between group and time ($F(1.74,187.94)=19.037$, $p<0.001$, $\eta p2=0.150$). For the pairwise comparisons Bonferroni adjusted paired t-tests were performed. Statistically significant differences in dengue knowledge between control (M=8.93, SD=3.107) and intervention (M=10.09 , SD=3.549) group were not found at the baseline ($p=0.071$). After two months and Positive deviance intervention, intervention group (M=19.00, SD=6.093) had better statistically significant improvement regarding dengue knowledge compared to control group (M=13.13, SD=4.953) ($p<0.001$). Furthermore, after another two months at the endline, knowledge regarding dengue transmission, prevention practice and symptoms not only persisted but continued to improve with statistically significant difference between control (M=14.30, SD=4.944) and intervention group (M=25.00, SD=9.607) ($p<0.001$). Estimated marginal means are visualized in the profile plot where an increase in knowledge over time can be seen in both groups, especially in the intervention group (Figure 9.).

Figure 14. Change in mean dengue knowledge scores during three different times in 2020 in two low-income communities in Islamabad. Maximum knowledge score was 48.



4.4. Attitude

Attitude towards dengue disease was good overall among the respondents from the intervention and control group. Most respondents from both groups agreed that dengue is a serious and transmissible illness, that removing empty containers can protect from dengue infection, that using bed nets, repellents and long sleeves can protect from mosquito bite and that communities should participate in controlling dengue. Interestingly, at the endline, 32.1% of respondents from the intervention and 40.7% of respondents from the control group still thought that dengue control is only government responsibility compared to 50% of respondents from the intervention group and 51.8% of respondents from the control group at the baseline. These percentages were even higher at the midline (Table 8.).

Table 9. Attitude towards dengue disease at the baseline, midline and endline

Attitude	Agree n (%)		Don't know n (%)		Disagree n (%)	
	I group	C group	I group	C group	I group	C group
Dengue is a serious illness?						
Baseline	56 (100)	53 (94.6)	0 (0)	0 (0)	0 (0)	3 (5.4)
Midline	55 (98.2)	54 (100)	0 (0)	0 (0)	1 (1.8)	0 (0)

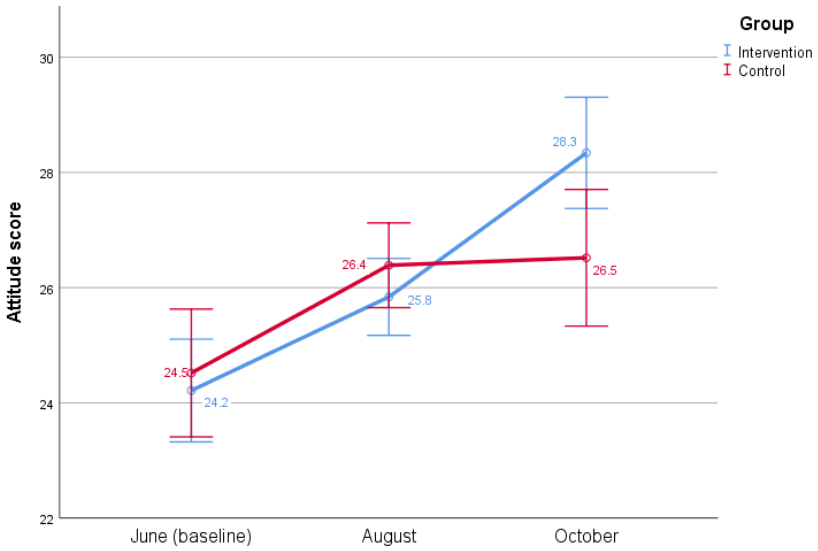
Attitude	Agree n (%)		Don't know n (%)		Disagree n (%)	
	I group	C group	I group	C group	I group	C group
Endline	56 (100)	51 (94.4)	0 (0)	1 (1.9)	0 (0)	2 (3.7)
Dengue is transmissible disease?						
Baseline	47 (83.9)	39 (69.6)	0 (0)	2 (3.6)	9 (16.1)	15 (26.8)
Midline	50 (89.3)	46 (85.2)	0 (0)	1 (1.9)	6 (10.7)	7 (13)
Endline	51 (91.1)	44 (81.5)	0 (0)	0 (0)	5 (8.9)	10 (18.5)
You are at risk of getting dengue?						
Baseline	37 (66.1)	40 (71.4)	7 (12.5)	6 (10.7)	12 (21.4)	10 (17.9)
Midline	49 (87.5)	37 (68.5)	2 (3.6)	3 (5.6)	5 (8.9)	14 (25.9)
Endline	46 (82.1)	38 (70.4)	4 (7.1)	5 (9.3)	6 (10.7)	11 (20.4)
Dengue fever can be prevented easily?						
Baseline	34 (60.7)	39 (69.6)	1 (1.8)	0 (0)	21 (37.5)	17 (30.4)
Midline	44 (78.6)	40 (74.1)	0 (0)	2 (3.7)	12 (21.4)	12 (22.2)
Endline	47 (83.9)	34 (63)	0 (0)	0 (0)	9 (16.1)	20 (37)
Can removing empty containers protect you from dengue infection?						
Baseline	49 (87.5)	48 (85.7)	0 (0)	1 (1.8)	7 (12.5)	7 (12.5)
Midline	56 (100)	54 (100)	0 (0)	0 (0)	0 (0)	0 (0)
Endline	55 (98.2)	52 (96.3)	0 (0)	0 (0)	1 (1.8)	2 (3.7)
Using bed nets, repellents and long sleeves can protect from mosquito bite?						
Baseline	55 (98.2)	54 (96.4)	0 (0)	0 (0)	1 (1.8)	2 (3.6)
Midline	56 (100)	53 (98.1)	0 (0)	0 (0)	0 (0)	1 (1.9)
Endline	56 (100)	52 (96.3)	0 (0)	0 (0)	0 (0)	2 (3.7)
Do you think dengue control is only government responsibility?						
Baseline	28 (50)	29 (51.8)	0 (0)	0 (0)	28 (50)	27 (48.2)
Midline	32 (57.1)	40 (74.1)	0 (0)	0 (0)	24 (42.9)	14 (25.9)
Endline	18 (32.1)	22 (40.7)	1 (1.8)	0 (0)	37 (66.1)	32 (59.3)
Do you think communities should participate in controlling dengue?						
Baseline	54 (96.4)	52 (92.9)	1 (1.8)	2 (3.6)	1 (1.8)	2 (3.6)
Midline	56 (100)	51 (94.4)	0 (0)	0 (0)	0 (0)	3 (5.6)
Endline	54 (96.4)	52 (96.3)	2 (3.6)	1 (1.9)	0 (0)	1 (1.9)

Table 10. Descriptive statistics of total attitude scores at three time points according to the group

	Group	Mean	SD	N
ATTITUDE (baseline)	Intervention	24.21	3.329	56
	Control	24.52	4.064	54
	Total	24.36	3.694	110
ATTITUDE (midline)	Intervention	25.84	2.492	56
	Control	26.39	2.695	54
	Total	26.11	2.596	110
ATTITUDE (endline)	Intervention	28.34	3.604	56
	Control	26.52	4.343	54
	Total	27.45	4.070	110

To examine the mean differences in total dengue attitude scores between the intervention and control group over time repeated measures Mixed ANOVA was performed, with sphericity assumed. Levene's Test of Equality of Error Variances was also performed to check homogeneity of variance. Results showed that there was significant main effect of time ($F(2,216)=25.431$, $p<0.001$, $\eta p2=0.191$) and non-significant main effect of group ($F(1,108)=0.538$, $p=0.465$, $\eta p2=0.005$), on attitude scores. There was a significant interaction between group and time ($F(2,216)=4.577$, $p=0.011$, $\eta p2=0.041$). For the pairwise comparisons Bonferroni adjusted paired t-tests were performed. Statistically significant differences in dengue attitude between control ($M=24.52$, $SD=4.064$) and intervention ($M=24.21$, $SD=3.329$) group were not found at the baseline ($p=0.668$). Furthermore, at the midline, after two months and Positive deviance intervention, statistically significant differences in dengue attitude between control ($M=26.39$, $SD=2.695$) and intervention ($M=25.84$, $SD=2.492$) group were also not found ($p=0.269$). Interestingly, after another two months at the endline, attitude towards dengue disease improved significantly in the intervention group ($M=28.34$, $SD=3.604$) compared to control group ($M=26.52$, $SD=4.343$) ($p=0.018$). Estimated marginal means of dengue attitude are visualized in the profile plot where an increase in dengue attitude between baseline and midline for the intervention and control group is quite similar, but between midline and endline control group attitude remains almost horizontal compared to increased intervention group attitude (Figure 15.).

Figure 15. Change in mean dengue attitude scores during three different times in 2020 in two low-income communities in Islamabad. Maximum attitude score was 32.



4.5. Practices

At the endline, an improvement in practice was observed related to dengue preventive methods especially in the intervention group, like sleeping under bed net during the day, using insecticide spray, repellent, mosquito coil and smoke to drive away mosquitoes. At the endline, 53.6% of respondents from the intervention group were covering all water containers compared to 10.7% at the baseline. At the endline, 55.4% of respondents from the intervention group were changing the storage water one a week compared to 25% at the baseline. Interestingly, an improvement in practice was observed not only in the intervention group but also in the control group.

Table 11. Dengue practice at the baseline, midline and endline

Practice	Baseline n (%)		Midline n (%)		Endline n (%)	
	I group	C group	I group	C group	I group	C group
What do you do to prevent dengue?						
Nothing	2 (3.6)	7 (12.5)	3 (5.4)	2 (3.7)	4 (7.1)	0 (0)
Sleep under bed net during the day	9 (16.1)	16 (28.6)	15 (26.8)	22 (40.7)	29 (51.8)	18 (33.3)
Use fan to prevent mosquito bites	9 (16.1)	17 (30.4)	10 (17.9)	22 (40.7)	17 (30.4)	10 (18.5)
Use insecticide spray	40 (71.4)	41 (73.2)	47 (83.9)	41 (75.9)	53 (94.6)	49 (90.7)
Use repellent	30 (53.6)	26 (46.4)	47 (83.9)	38 (70.4)	51 (91.1)	32 (59.3)

Practice	Baseline n (%)		Midline n (%)		Endline n (%)	
	I group	C group	I group	C group	I group	C group
Use mosquito coil	25 (44.6)	22 (39.3)	42 (75)	28 (51.9)	51 (91.1)	30 (55.6)
Use smoke to drive away mosquito	5 (8.9)	1 (1.8)	8 (14.3)	5 (9.3)	13 (23.2)	2 (3.7)
Cover all water containers	6 (10.7)	3 (5.4)	21 (37.5)	6 (11.1)	30 (53.6)	15 (27.8)
Change water in trays under the fridge	0 (0)	0 (0)	7 (12.5)	0 (0)	11 (19.6)	2 (3.7)
Destroy or burn unused containers	1 (1.8)	0 (0)	3 (5.4)	0 (0)	18 (32.1)	2 (3.7)
Do you keep covers on the water containers in the home?						
Yes	55 (98.2)	54 (96.4)	56 (100)	53 (98.1)	56 (100)	54 (100)
How often do you change the storage water?						
Once a week	14 (25)	18 (32.1)	21 (37.5)	20 (37)	31 (55.4)	30 (55.6)
More than once a week	34 (60.7)	37 (66.1)	31 (55.4)	34 (63)	24 (42.9)	22 (40.7)
Twice per month	2 (3.6)	0 (0)	2 (3.6)	0 (0)	0 (0)	0 (0)
Once a month	0 (0)	1 (1.8)	2 (3.6)	0 (0)	1 (1.8)	2 (3.7)
Never	4 (7.1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Don't know	2 (3.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
How often do you clean the water containers?						
Every day	43 (76.8)	44 (78.6)	45 (80.4)	43 (79.6)	35 (62.5)	36 (66.7)
Once a week	8 (14.3)	9 (16.1)	10 (17.9)	11 (20.4)	20 (35.7)	10 (18.5)
Once a month	4 (7.1)	2 (3.6)	0 (0)	0 (0)	0 (0)	8 (14.8)
Occasionally	1 (1.8)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Never	0 (0)	1 (1.8)	0 (0)	0 (0)	1 (1.8)	0 (0)
Don't know	0 (0)	0 (0)	1 (1.8)	0 (0)	0 (0)	0 (0)
Observe water containers						
Containers look very clean	50 (89.3)	48 (85.7)	56 (100)	51 (94.4)	56 (100)	52 (96.3)
Containers do not look very clean	6 (10.7)	8 (14.3)	0 (0)	3 (5.6)	0 (0)	2 (3.7)
What do you do with containers you are not currently using?						
Leave them empty as they are	4 (7.1)	3 (5.4)	3 (5.4)	6 (11.1)	2 (3.6)	0 (0)
Turn them upside down	13 (23.2)	13 (23.2)	29 (51.8)	21 (38.9)	33 (58.9)	26 (48.1)
Move them inside	12 (21.4)	23 (41.1)	17 (30.4)	12 (22.2)	15 (26.8)	12 (22.2)

Practice	Baseline n (%)		Midline n (%)		Endline n (%)	
	I group	C group	I group	C group	I group	C group
Move them outside	26 (46.4)	18 (32.1)	12 (21.4)	20 (37)	10 (17.9)	16 (29.6)
Don't have extra containers/Sell	2 (3.6)	1 (1.8)	0 (0)	1 (1.9)	0 (0)	0 (0)
What do you do with waste such as old shells, cans, tires, plastic bottles and other small containers?						
Bury them	1 (1.8)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Turn them upside down	2 (3.6)	0 (0)	1 (1.8)	2 (3.7)	3 (5.4)	1 (1.9)
Burn them	0 (0)	0 (0)	1 (1.8)	0 (0)	2 (3.6)	1 (1.9)
Move them outside	52 (92.9)	54 (96.4)	55 (98.2)	52 (96.3)	52 (92.9)	52 (96.3)
Sell/Recycle	6 (10.7)	3 (5.4)	0 (0)	0 (0)	1 (1.8)	0 (0)
Do you think your household's environment keep clean?						
No	29 (51.8)	14 (25)	24 (42.9)	20 (37)	5 (8.9)	19 (35.2)
Yes	27 (48.2)	42 (75)	32 (57.1)	32 (59.3)	51 (91.1)	35 (64.8)
Don't know	0 (0)	0 (0)	0 (0)	2 (3.7)	0 (0)	0 (0)
Do you think the clothes in your household keep tidy?						
No	4 (7.1)	0 (0)	1 (1.8)	2 (3.7)	3 (5.4)	2 (3.7)
Yes	52 (92.9)	56 (100)	55 (98.2)	52 (96.3)	53 (94.6)	52 (96.3)
Don't know	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

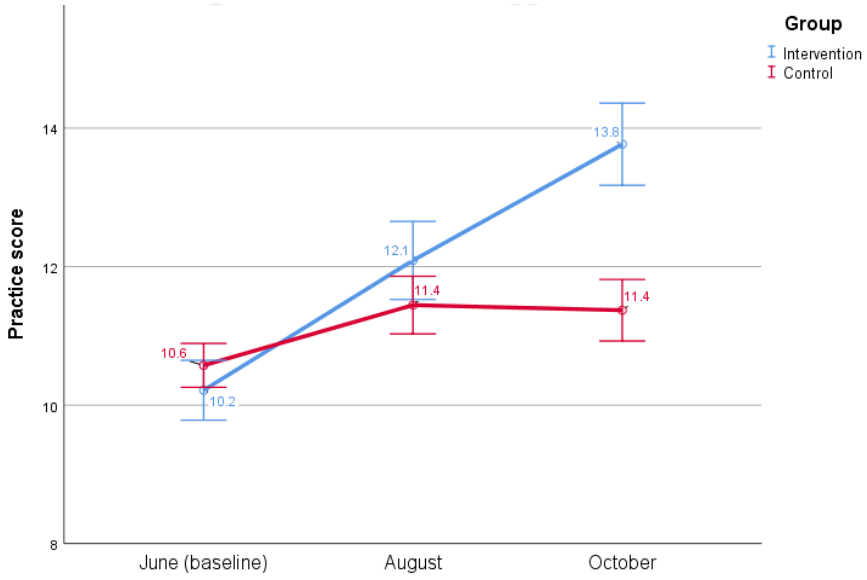
Table 12. Descriptive statistics of total practice scores at three time points according to the group

	Group	Mean	SD	N
PRACTICE (baseline)	Intervention	10.21	1.615	56
	Control	10.57	1.159	54
	Total	10.39	1.415	110
PRACTICE (midline)	Intervention	12.09	2.109	56
	Control	11.44	1.525	54
	Total	11.77	1.865	110
PRACTICE (endline)	Intervention	13.77	2.216	56
	Control	11.37	1.629	54
	Total	12.59	2.284	110

To examine the mean differences in total dengue practice scores between the intervention and control group over time repeated measures Mixed ANOVA was performed, with sphericity assumed. Levene's Test of Equality of Error Variances was

also performed to check homogeneity of variance. Results showed that there was significant main effect of time ($F(2,216)=45.019$, $p<0.001$, $\eta p2=0.294$) and group ($F(1,108)=20.070$, $p<0.001$, $\eta p2=0.157$), on practice scores. In addition, there was a significant interaction between group and time ($F(2,216)=18.117$, $p<0.001$, $\eta p2=0.144$). For the pairwise comparisons Bonferroni adjusted paired t-tests were performed. Statistically significant differences in dengue practice between control ($M=10.57$, $SD=1.159$) and intervention ($M=10.21$, $SD=1.615$) group were not found at the baseline ($p=0.184$). Furthermore, at the midline, after two months and Positive deviance intervention, statistically significant differences in dengue practice between control ($M=11.44$, $SD=1.525$) and intervention ($M=12.09$, $SD=2.109$) group were also not found ($p=0.070$). Interestingly, after another two months at the endline, practice regarding dengue disease improved significantly in the intervention group ($M=13.77$, $SD=2.216$) compared to control group ($M=11.37$, $SD=1.629$) ($p<0.001$). Estimated marginal means of dengue practice are visualized in the profile plot where an increase in dengue practice between baseline and midline is quite similar for the intervention and control group, but between midline and endline control group practice remains almost horizontal compared to increased intervention group practice.

Figure 16. Change in mean dengue practice scores during three different times in 2020. Maximum practice score was 24.



4.6. Qualitative assessment

The main objective of the qualitative assessment was to understand the perceptions of the community members about dengue infection and to inform the PD behavior change intervention and messages based on the qualitative findings. A total of 8 gender-balanced, 4 with males and 4 with females, Focus Group Discussions (FGDs) and 10 in-depth interviews were conducted in the Intervention community (see table 1). Six community members participated in each focus group discussion to get the quality discussion. Separate focus group discussions were conducted with males and females to ensure open and quality discussion in the focus groups. The focus groups were homogenized with gender and age groups to ensure open and quality discussions. During the FGDs, potential role models were identified and separately interviewed to understand the determinants and motivators of their role model behaviors. These role model behaviors were shared during the PD-informed intervention. The participants were selected based on their interest, convenience, and availability for participation in the focus groups and in the four-month PD intervention. Mostly the selected participants for the intervention group participated in the focus group discussions.

The head of the slum helped identified the potential participants for the FGDs. The FGDs were homogenized regarding gender and age to ensure quality discussions. For the FGD, participants were contacted one day before the actual FGD to get their informed consent and check their convenient times to schedule the FGDs. Separate FGDs with male and females were conducted at their convenient places to ensure the cultural appropriateness and facilitate a healthy discussion among the participants. Ten In-depth Interviews (IDIs) were conducted to identify the positive deviance role model behaviors from the community. The participants for IDIs were selected from the FGDs. When a potential role model was identified during the FGDs, he/she was asked for a separate detailed interview after the FGD to further explore his/her role model behaviors and strategies. Topic guides were developed in the local language URDU to conduct face-to-face interviews with the participants. The findings of the qualitative component formed the basis of the PD-informed intervention. The key themes in the qualitative topic guides pertained to; knowledge of dengue, causes of

dengue, perception of the high-risk group, prevention of dengue, personal protection measures (use of repellents, bed nets), water jars and environmental cleaning. The qualitative component helped identified the positive deviant role models for intervention community. The Framework Approach was used to conduct the data analysis.

Table 13: No of focus group discussions and in-depth interview

Target Group	FGDs	IDIs	participants
Community members male	• 4 FGD	• 5 IDI	24
Community members female	• 4 FGD	• 5 IDI	24
Total	8 FGDs	10 IDIs	48

4.6.1.Training of the data collectors

Six data collectors with previous experience in qualitative research were hired for the qualitative study. The training was organized in a local church in the Faisal Colony. SOPs of COVID-19 were ensured during the training. The training covered the positive deviance orientation, interviewing and facilitation, probing skills, note taking skills, methods of data collection, topic guides, research ethics and informed consent. The data collectors were oriented in the key themes of the topic guides such as dengue transmission, signs and symptoms of dengue, preventive measures and preferred channel of communication.

4.6.2.Pre-test

Topic guides for FGDs and IDIs were developed in Urdu language to facilitate the local interviewers in data collection. A pre-test was carried out in the nearby community to assess the tools and communication and facilitation skills of the data collectors. At the end of the pre-test, a feedback meeting was organized with the team to discuss the pre-test findings in order to finalize the topic guides.

4.6.3.Data collection

FGDs and in-depth interviews were conducted by three teams of two data collectors (one facilitator and one note taker). FGDs were conducted at neutral common places such as church, and volunteer's houses. The in-depth interviews were conducted at the respondent's house. An average focus group discussion engaged 6 participants. A total of 48 persons participated in the qualitative study. FGD roughly took around 1 and half hour while an IDI last for 1 hour on average. The field team spent 4 days to conduct 8 FGDs, 10 IDIs and completed the transcriptions.

4.6.4.Data management and transcription

Each FGD and IDI were carried out by one facilitator and one notetaker. Digital voice recorders were used during FGDs and IDIs to capture the complete discussion. A daily feedback session was held with the field team to discuss the process, issues, gaps, emerging themes and potential positive deviant cases. The FGDs and IDIs were transcribed 'verbatim' in Urdu language by the study team as early as possible to avoid any information loss or recall bias. Each transcript was separately stapled and handed over to the lead researcher on the same or next day.

4.6.5.Qualitative data management and analysis

The FGDs, and IDIs were carried out by three teams of one facilitator and one notetaker in the intervention slums only. After permission, digital voice recorders were used during FGDs and interviews to capture the complete discussions. The transcriptions of FGDs and IDIs were done 'verbatim' in Urdu language in the same evening or next day to avoid recall bias. Each transcript was separately stapled and handed over to the lead researcher on the same or next day. All the writing pads were handed over to the researcher after the transcription is done. The data analysis was conducted by the lead researcher using the thematic framework approach[71] using the following steps:

Familiarization – first of all themes were identified by carefully reading the Urdu transcripts; Thematic framework construction – A coding or thematic

framework was developed based on the themes that emerged from the data; Indexing - the data were coded according to the thematic framework by target group and re-organized into sections under each themes; Interpretation - each thematic area was compared between respondents, similarities and associations between themes were identified and findings were interpreted accordingly. The quotes of the respondents were selected and organized under each theme to validate and support the findings.

4.6.6.Qualitative findings

4.6.6.1. Knowledge about dengue, vector and causes of dengue

Most of the community members use the term ‘dengue’ for dengue fever and consider it a dangerous disease. Most respondents were aware that mosquito bite causes dengue. The qualitative findings were consistent with the KAP baseline survey which also shows that 67.9% at the baseline knew that mosquito bite is the main cause of dengue. However, very few were aware of the mosquito/vector i.e., Aedes aegypti that causes dengue which was also validated by the KAP survey which revealed that only 8.9% knew that Aedes causes dengue. Most of the participants did not know the correct biting time of the dengue mosquito and mentioned that dengue mosquito bites at night which was also consistent with the KAP survey which confirms that 44.6% incorrectly mentioned that dengue bite during the night.

“We don’t know, maybe the dengue mosquito bites during the night-time.” FGD, Male, Intervention group

“It does not bite in the daytime due to sunlight, so it might bite us during the night when we are asleep”. FGD, females, Intervention group

Some mentioned that dengue is caused by drinking dirty water. A very few participants mentioned that dengue is a punishment from God for their misdeeds.

“Dengue is caused by drinking dirty or un-boiled water.” IDI, Male, Intervention group

"Dengue is a punishment from God, and we should collectively pray to prevent it". FGD, female, Intervention group

4.6.6.2. Perceived causes of dengue

Many community members revealed during the focus group discussions that dengue is a punishment from God for their misdeeds. They reveal that God is angry on them that's why they face dengue outbreaks. The community members mentioned that they are collectively praying in the church to avoid this punishment.

Some community members believed that dengue is causes by ingestion of dirty or contaminated water. They perceive that when they drink the dirty water, it causes dengue. Some community members linked the causes of diarrhea with dengue such as drinking un-boiled water and contaminated water may cause dengue disease.

4.6.6.3. Breeding places of the dengue mosquito

Most participants mentioned that dengue mosquito breeds in the water containers which was also consistent with the KAP baseline survey which revealed that 62.5% knew that dengue mosquito breeds in water containers. They knew that dengue mosquito breeds in the surroundings of their household, especially in the clean water.

"The dengue mosquito breeds in the clean water and lays their eggs which leads to mosquito breeding." FGD, female, Intervention group

"The mosquito comes around clean water, lays eggs, breeds and bite which causes dengue". IDI, female, Intervention group

Many participants reported that they cover their water containers and water tanks to avoid mosquito breeding which was also validated by the KAP survey which shows that 48.2% cover the water containers to avoid mosquito breeding. The participants also reported that they clean the water tanks regularly to avoid mosquito breeding. Many mentioned that they remove the water from the water buckets and put it upside down to avoid mosquitos.

"My water tank is placed up at the roof and is covered all the time to avoid mosquito breeding inside the tank". FGD, female, intervention group

"We cover the water tanks and also check on a daily basis to avoid mosquito breeding." FGD, Male, Intervention group

"If the water tank does not have a lid, we cover it with a plastic sheet to avoid mosquitoes to enter and lay eggs in the water". IDI, female role model, Intervention group

"We should not store water in buckets and water tanks as it may breed mosquitos, therefore, I always remove the water and put the containers upside down to avoid mosquito breeding". IDI, female, role model

Many participants also mentioned that they clean the water container or water storage tanks regularly to avoid the breeding of dengue mosquitoes.

"I clean the water containers, and roof tanks once a week to remove any mosquito eggs and avoid the mosquito breeding in the water tanks." IDI, female, role model

"I scrub the water tanks, clean with the empty buckets with soap to avoid mosquito breeding inside the house." IDI, female role model,

Many participants mentioned that mosquito breeds in the plants, empty cans, plastic bottles, and old tires out of the house. According the KAP survey 39.3% mentioned that empty cans, shells, bottles breed mosquitos out of the house which were very consistent with the qualitative findings.

"The mosquito breeds in the water puddles, plants, empty bottles, and tins." FGD, female, Intervention group

"The mosquito grows in the plants near the households." IDI, male, Intervention group

The participants mentioned that they collect all the water bottles and tins and keep them in a plastic bag to avoid mosquito breeding inside. Most mentioned that they properly dispose of these plastic bottles and cans to avoid mosquito breeding inside or outside the households.

"I always collect all the tins, bottles and dispose of them out to avoid mosquito breeding in them." FGD, female, intervention group

4.6.6.4. Dengue prevention/personal protection

The majority of the participants revealed in the focus group discussions that they use mosquito sprays, wear full sleeve clothes, and mosquito repellents to avoid mosquito bites. These findings were very consistent with the KAP survey which mentions that 60.7% use insecticide sprays, 41.1% wear full sleeved clothes and 26.8% use mosquito repellents to avoid mosquito bites and protect themselves from dengue. Few community members also mentioned that they use mosquito coils and use bed nets to avoid mosquito bites.

"We use mosquito sprays, repellents, and keep our home clean to avoid mosquitos." FGD, female, Intervention group

"We use mosquito spray, repellents, and mosquito coils to avoid mosquitos from our house." FGD, Male, Intervention group

"There are a lot of mosquitos around, so we wear full-sleeved clothes, use repellants, and use a mosquito spray as well." FGD, female, Intervention group

"I wear long-sleeved clothes during the day to avoid mosquito bites and prevent dengue." IDI, role model, Intervention group

"We burn mosquito coils as soon as evening sets and use bed nets to sleep in. FGD, female, Intervention group

"I use a mosquito repellent as well as mosquito coils. I also use Mortein sprays for my house to avoid mosquitos." FGD, Male, Intervention group

4.6.6.5. Knowledge of Signs and symptoms

Most participants mentioned fever as the major sign and symptom for dengue which was consistent with the KAP survey which showed that 70.1% said fever as a sign and symptom of dengue. Headache, chills, vomiting, body aches, loss of appetite, and bleeding from the ear and eyes were the other signs and symptoms mentioned by both male and female community members. A few participants, especially those who themselves or their family members have experienced dengue, mentioned that white blood cells decrease during dengue infection.

"Fever, chills, body aches, vomiting are the key signs and symptoms of dengue." FGD, female, Intervention group

"High fever, body aches, rashes, and vomiting are the major signs and symptoms of the dengue disease." FGD, Male, Intervention group

"My brother who had dengue last year was admitted to the hospital as his white blood cells were decreased due to the disease." FGD, female, Intervention area

"Bleeding from ears and nose and eye pain are the danger signs for dengue." IDI, female, Intervention

4.6.6.6. Home based remedies for dengue fever

Majority of the community members mentioned that they first try home based remedies to treat dengue. Majority boils papaya leaves and mix it with tea and give to the patient. Lemonade, green apple and guava is recommended for the dengue patient.

"In order to cure dengue, papaya leave's soup and lemonade should be given to the patients." FGD, female, Intervention area.

"Papaya leaves are put into tea, mint tea with some lemon and are given to the patient to treat dengue. Papaya leaves increases the white blood cell count." FGD male, intervention

"Papaya leaves have great potential to cure the disease, my son-in-law was infected with dengue and felt better after the use of papaya leaves." FGD female, Intervention.

4.6.6.7. Health seeking behaviors

Majority of the community members adopt a wait-and-see strategy when getting a fever and take paracetamol or home-based remedies first. If they don't get better after two days, they go to the nearby hospital for a check-up. If they do not feel better, they go to the government hospital for dengue diagnosis and treatment.

"We take Panadol first and then wait for a couple of days, if there is no improvement then we go to the private clinic or government hospital for treatment." FGD, female,

"We go to the government hospital if we suspect dengue". FGD, male, Intervention

The majority mentioned that they start with home-based remedies if suspect dengue. Most mentioned that they give papaya leaves' tea to the patient to cure the dengue. Lemonade, sugarcane juice, and green apple juice were mentioned as effective home-based remedies for the dengue disease.

"I gave tea of papaya leaves which is very effective to cure dengue. My son-in-law was infected and felt better after taking the papaya leave tea." FGD, female, Intervention

"Papaya leave tea is very effective in dengue as it increases the white blood cell count and cures the disease." FGD, male, intervention group

"When I had dengue, I was given papaya leaves tea along with the medical treatment and I got well in one week." IDI, male, Intervention group

"We use a lot of home remedies, such as tea with papaya leaves and apple juice to cure the dengue disease". FDG, male, intervention group

"We drink lemonade and green apple juice when we get dengue." IDI, male, Intervention

The participants noted that the government hospitals are very crowded, Lack of transportation, long waiting time at the hospital, attitude of the health care workers and lack of financial resources to buy medicines are the key barriers to seek treatment at the government hospitals.

"Going to government hospitals is very difficult, the tests are expensive, and the hospitals are very crowded as well.

The qualitative assessment helped identified the positive deviant role model behaviors which were shared with other community members to inspire and motivate them to follow the same behaviors to avoid dengue. Following are some examples of the PD role model behaviors identified during the intervention:

Table 14. Positive deviant behaviors identified during the PD process in Islamabad 3.

Desired behaviors	**Positive Deviance Behaviors**
Knowledge	Correct knowledge of the dengue vector and mosquito biting time
	Knowledge of dengue mosquito's breeding places inside and outside the house
Avoid water storage	A housewife does not store water. She uses it immediately so that the dengue mosquitoes do not breed in the clean water
Change the water in plants	A housewife changes the water in her plants every day to ensure no mosquitoes breed inside the plants
Cover the water containers	A housewife covers all the water tanks and water containers to avoid mosquito breeding
Clean the water tank	A male community member covers his water tank and cleans it on regular basis to avoid any mosquito breeding
	A female community member cleans her water tank with a brush and soap twice a week to avoid mosquito breeding
Bury the old bottles and tins	A housewife collects the old bottles and tins and buries them outside the house to avoid mosquitoes breeding in them
Clean the tray under refrigerator	A female community member cleans the tray which lies under the refrigerators to avoid the breeding of mosquitoes in it

Change the water in the water cooler fan	A female community member changes the water in her watercooler fan on daily basis to avoid mosquito growth inside it
Healthcare seeking	A female community member knows the signs and symptoms of dengue fever and seeks treatment as soon as she suspects dengue
Personal protection	A mother ensures that her children wear full-sleeved clothes during the day to avoid mosquito bites
	A mother keeps her children sleeping under bed net during the day to avoid mosquito bites
	A father ensures that his children wear long-sleeved clothes to avoid mosquito bites during the day

4.6.6.8. Preferred channels of communication

Majority of the respondents noted that they prefer the face-to-face interaction or in-person meetings on health issues. Many mentioned that they get information from TV and brochures, but they prefer the interpersonal communication through community volunteers or health workers to clarify things on the spots.

"We prefer in-person meetings since we can ask questions and understand the information better." FGD, female, intervention group

Many participants mentioned that they cannot read the posters or brochures therefore, they prefer the health workers to provide them health education during a face-to-face meeting. During the PD process, the community members mentioned that no one comes here to provide us any health information. They mostly rely on the TV and health education materials displayed at the health facilities to get information.

"No one comes along to disseminate any information or give us posters/brochures. We don't really listen to news, so were happy that you are here to educate us today." FGD, male community members

A few community members mentioned that they preferred the face-to-face meetings as they cannot read and write so it is difficult for them to get information from posters and flyers.

"We would like a direct meeting since most of us cannot read the newspapers or brochure and understand them." FGD, female, Intervention community

4.6.7.Positive deviant role models and their strategies

4.6.7.1. PD role model, Shamim

Shamim is a 27-year-old housewife. She is well aware that one can be infected with Dengue fever due to a mosquito, that usually bites during the day. She can distinguish that a dengue mosquito is larger than the other mosquitos, has longer legs and white spots all over its body. The mosquito breeds over clean water, hence she ensures that water doesn't keep stored in her house, instead fills fresh water and uses it up immediately so the mosquitos don't gather, breed and contaminate. She also knows that the mosquito ambushes in plants therefore she makes sure none of them are placed in her house. Shamim also regularly gets rid of any old waste and containers that could keep water collected in them and invite mosquitos. She ensures that any collected water is covered, and all the utensils are cleaned and covered so they do not get contaminated. Even the tray under refrigerators can attract and cause the breeding of mosquitos, in order to avoid that she cleans it regularly. The clothes are folded, and everything else is kept in place so no clutters can hide mosquitos in them. Over to personal protection she uses mosquito repellent and coil. Since she knows that Dengue is a deadly disease which can cause fever, vomiting, bleeding and decrease in the white blood cell count, the moment she suspects any such symptoms in any family member Shamim approaches the hospitals immediately. She believes that implementation is key and until or unless she has not implemented the necessary behaviors, she would not be able to educate others over the same.

4.6.7.2. PD role model, Niba

Niba is a 30-year-old woman who resides in the slums of Faisal Colony, Islamabad. *"The dengue mosquito is a different kind, slightly bigger than the normal one with longer legs and white spots over its body. It bites either at early morning or in the evening",* she says. Niba keeps her curtains drawn till its noon and closes them back as soon as its evening since the mosquitos are most likely to bite at these times.

She ensures the cleanliness of both her house and her lanes because her children play around. Niba mentions “I cannot be dependent on other people for cleanliness, so I just do my part”. Niba says that during the months of June, July and August when it’s hot, rainy and humid really causes puddles to contain collected rainwater that attracts mosquitos. Niba deems Dengue a very contagious disease, she says that even if a normal mosquito bites a person already infected with dengue, it will get the potential to infect anyone it now bites with dengue as well. She puts forth some treatments for a person diagnosed with dengue, she says “we keep them isolated and feed them liquid food”. Niba also makes sure her kids are dressed in full sleeved garments and that they do not go out in the day. She shares that she has a water tank placed up on the roof which is covered at all times and a cooler fan which she checks in on and changes the water daily. Niba does not keep water stored anywhere and also discards any containers that may be able to keep water collected in them.

4.6.7.3. PD role model, Shamshad

Shamshad says that the fever is called Dengue and that it breeds over stored water and bites either early in the morning or as soon as evening arrives, when it bites a person can be diagnosed with dengue. She shares that when a person is bitten it leaves a red rash over their body, they vomit, their ears bleed and legs ache, it may even result in death. Shamsaad mentions that the mosquitos can gather at many places such as under the beds, in tires, in pipes and sewers or anywhere that water is left collected. Which is why she ensures that her house is clean at all times and that trash or things out of use are thrown away and any water that she fills up and stores is covered. The mosquito coils are used in the evening and bed nets to sleep in. Shamshaad believes in prayers and precaution equally which is why she does not keep medicines at home but leaves to the hospital immediately if she suspects symptoms.

4.6.7.4. PD role model, Najma

Najma says that this disease is called Dengue and some of its symptoms are loss of appetite and feeling excessively drowsy. She’s unsure of what time the mosquito bites but it gathers most around wet and slippery places. They keep the

patient isolated since she believes that Dengue is highly contagious and may even result in death. She ensures her family uses repellent, wears full sleeves clothes, throws any old and broken containers and checks if there is water collected anywhere. She is aware that littering invites mosquitos which is why she keeps her home and lanes clean. If Najma suspects any symptoms, she first takes a Panadol, try some home remedies but then leave for the hospital in case she does not feel better.

4.6.7.5. PD role model, Kesar

Kesar works in the army and one of his relatives was infected with the dengue fever which is how he is quite aware over the subject of Dengue Fever. He has a water tank placed on the roof that he checks regularly and cleans thoroughly every 3 months. Kesar makes sure his tank is covered and his home is sprayed with a mosquito repellent. He has also taken out any plants inside the house since mosquitos gather there most, he shares that his neighborhood does not maintain cleanliness at all and that some people in the colony do not even regard the existence of the dengue mosquito.

4.6.7.6. PD role model, Nijad

Nijad says that as soon as it gets dark, she puts on the mosquito coil, wears full sleeved clothes and has her family do the same. She fills fresh water every day and uses it up immediately, so it doesn't stay stored. She lives by a sewer and that's why is extremely particular about cleanliness, does not let any leakage fill up water in her house or any clutters hide mosquitos in them. If she stores water in her house, she ensures it is covered at all times. Nijad also throws away any waste and old materials from her house, takes out the trash and washes the bin clean on a daily basis, meanwhile cleans the cooler fan's water storage every three days as well. Nijad strongly believes that cleanliness should not only be maintained within the homes but even outside in the lanes since that is where kids play around most, and so she and her neighbor both wipe the lanes clean every day.

CHAPTER 5

DISCUSSIONS

This chapter explains the findings of the effectiveness of positive deviance approach to improve knowledge, attitude and practices on dengue prevention and control in selected slums in Islamabad, Pakistan. To our best knowledge, this is the first application of the positive deviance approach on dengue prevention and control. The main objective of the study was to assess the effectiveness of positive deviance approach on dengue prevention and control in the low-income urban slums in Islamabad. The intervention aimed to gain experience of a new behavior change approach 'positive deviance' on communities on dengue prevention and control. The qualitative assessment helped design and implement the PD process in the community. The in-depth interviews helped identify uncommon positive dengue practices from within the community which were further shared with other community members to improve their behaviors.

The PD approach is multi-dimensional which achieve a lot i.e., initiates successful community dialogue that generates community interest and ownership, sparks community mobilization, generates quality information (formative research) and ensures behavior change. It sensitizes communities to find viable solutions (role models) from within their own communities. Following topics will be discussed in this chapter:

- Research methodology
- Baseline characteristics
- Dengue knowledge, attitude, and practices at baseline
- Dengue knowledge comparison at baseline, midline and end line
- Dengue attitude comparison at baseline, midline and end line
- Dengue practices comparison at baseline, midline and end line
- Key recommendations
- Lessons learned
- Limitation

- Conclusion

5.1. Research design

The study applied the mixed method quasi experimental research design. Two slums, intervention, and control arms were purposively selected base on the dengue cases in these community. The experimental group received the positive deviance intervention using interactive sessions, community-based competitions, and role plays. The control group did not receive any intervention. However, both groups equally received a brochure on dengue prevention and control developed by the Directorate of Malaria Programme Pakistan. At the end of the intervention a two-hour session was organized in the control community to share the positive deviant role model behaviors identified in the intervention group.

5.2. Study population

The study participants were community members of age 18 years and above in the selected slums in Islamabad. Two slums, Faisal Colony situated in Sector G-7/1 and France Colony were purposively selected for the study. Faisal colony is comprised of 450 households while the France colony had a total of 500 households. The populations of both slums shared similar socio-economic status, occupations, and dengue risk factors.

5.3. Sampling technique and sample size calculation

Convenient sampling technique was used to recruit 112 respondents, 56 were assigned to intervention and 56 were assigned to control group. One participant was identified from one conveniently selected household. The estimated sample size had been calculated using power analysis with G*Power 3.1 (Faul, Erdfelder, Lang and Buchner, 2007). The effect size was calculated using a previous study. A power of 0.8 based on the effect size of 0.59 for the difference in dengue knowledge between groups, which is the primary outcome. The total sample size included 92 participants, where 46 participants were divided into two group. After calculating the drop out at 20%, the total sample size was 112 which meant 56 participants per group.

5.4. Study instruments

In the beginning Knowledge, Attitude and Practices (KAP) survey was conducted to establish the benchmark. At the end of the two-month intervention, the KAP survey was repeated. After four months from the beginning, KAP was repeated the third time to assess the changes in knowledge, attitude, and practices among study participants. The survey tool included questions about;1) demographic and socio-economic information which included age, gender, religion, marital status, education level, and family's monthly income of the respondents; 2) knowledge about dengue transmission and symptoms; 3) health-seeking behaviors 4) attitude towards dengue; 5) personal protection measures and methods to avoid breeding sites; and 6) preferred channels of communication. The questionnaire was pretested with 30 participants for internal consistency and finalization of the tool. Face-to-face interviews were conducted in the Urdu language.

5.5. Data collection (quantitative and qualitative)

The data was collected at the baseline (before the start of intervention), after two month of intervention and after 4 months to assess the changes in knowledge, attitude and practices and sustainability of the intervention. The data collectors visited the selected households to collect data from the study participants through face-to-face interviews using the questionnaire. Data was collected related to socio-demographics (age, gender, marital status, education and occupation), knowledge and causes of dengue, prevention measures i.e., cleaning environment, cleaning and covering water jars, use of bed nets, and use of repellents.

For the qualitative component, 8 Focus Group Discussions (FGDs) were carried out with male and female community members to explore their knowledge, perceptions, and practices regarding dengue. The participants were selected based on their convenience, interest, and willingness to participate in the focus group discussions and the PD study. Separate FGDs with male and females were conducted at their convenient places to ensure the cultural appropriateness and facilitate a healthy discussion among the participants. Ten In-depth Interviews (IDIs) were

conducted to identify the positive deviance role model behaviors from the community. The participants for IDIs were selected from the FGDs. The findings of the qualitative component formed the basis of the PD-informed intervention.

5.6. Data Analysis

During the statistical processing of data, standard methods of descriptive statistics were used. Mean and median were used to describe continuous data and frequencies and percentages to describe categorical data. Chi square ($\chi 2$) tests were performed to examine differences in categorical data between intervention and control group at the baseline. Independent samples t-test were used to examine the differences between the intervention and control groups in the total knowledge score, total attitude, and total practice scores at the baseline. Based on total number of correct answers, new variables were created to examine dengue knowledge (0-48), attitude (0-32) and practice (0-24). Repeated measures Mixed ANOVA with one within-subjects factor (time) and one between-subjects factor (group) was conducted to compare the mean differences in total dengue knowledge, attitude, and practice scores between the intervention and control group over time: baseline, midline after two months and end line after another two months. All results with $p<0.05$ were reckoned statistically significant.

5.6.1.Baseline characteristics

A total of 112 respondents participated in the study, 56 in the intervention group and 56 in the control group at the baseline. At the midline and end line the number of respondents in the control group decreased by two respondents. When compared, groups are quite similar and there are no statistically significant differences in socio-demographic characteristics such as sex, age, marital status, religion, education, occupation and average monthly income between intervention and control groups. This shows that the groups were selected very carefully to understand the effectiveness of the PD approach.

5.6.2. Dengue knowledge, attitude, and practices at baseline

An equal number of participants in the intervention and control group knew that dengue infection is caused by mosquito bite (67.9%). However, statistically significant difference was found in the knowledge of three or more dengue related symptoms where 53.6% respondents from the intervention group knew three or more symptoms compared to 19.6% respondents from the control group. However, there were no statistically significant differences found in terms of knowing about mosquito breeding sites and mosquito and dengue prevention methods. Independent samples t-test revealed that there were no statistically significant differences between intervention and control group at the baseline in the total knowledge score as well as in the total attitude and practice scores.

The main difference of knowledge of three dengue related symptoms in the intervention group could be due to the high cases of dengue in the intervention group during the dengue outbreak of 2019. Due to the personal experience, community members of the intervention group were more sensitized on the signs and symptoms than the control group. Two studies conducted in Malaysia validates our findings that there is an association between personal experience and dengue knowledge[72, 73]. However, there were no statistically significant differences in any other variable found between the intervention and control group at the baseline.

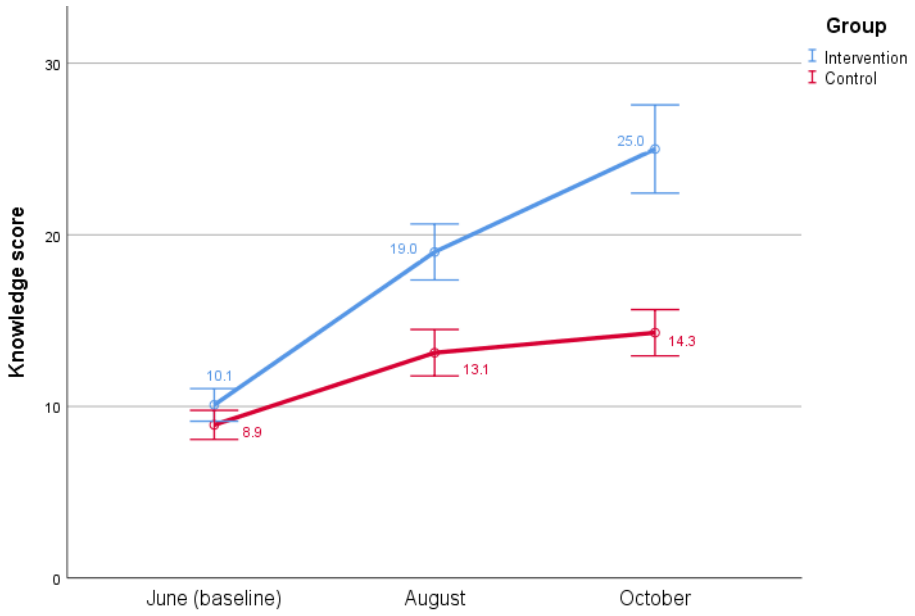
5.6.3.Dengue knowledge at baseline, midline, and end line

An improvement in knowledge over time was observed for almost all examined variables even in the control group. At the baseline, 67.9% of respondents from the intervention and control group knew that dengue is mosquito transmitted compared to 100% of respondents from the intervention group and 83.3% of respondents from the control group at the end line. At the end line, 96.4% of respondents from the intervention and 64.8% of respondents from the control group knew that dengue mosquito most often bites during the day compared to 26.8% of respondents from the intervention group and 17.9% of respondents from the control group at the baseline. Furthermore, 53.6% of respondents from the intervention and

19.6% of respondents from the control group knew 3 or more dengue symptoms at the baseline compared to 96.4% of respondents from the intervention group and 70.4% of respondents from the control group at the endline.

The findings of the PD study demonstrated statistically significant changes in the dengue knowledge in the intervention arm as compared to the control arm. After completion of two months of the PD intervention, the intervention group revealed statistically significant improvements in the knowledge of dengue prevention and control than the control group. Moreover, after another two months (without the researcher's support) at the end-line, the knowledge of dengue transmission, preventive and control behaviors and signs and symptoms not only sustained in the intervention group but further improved with statistically significant differences between the intervention and control groups. The improvements in knowledge were also observed in the control group as well which could be credited to the health promotion activities of the Directorate of Malaria Control Pakistan conducted in all vulnerable communities to prevent the further outbreaks. The Malaria Control programme conducted household visits with community volunteers to disseminate the dengue related information and distributed the brochures as well. They also conducted fogging sprays in the communities frequently after the dengue outbreak which sensitized the communities about dengue infection. Another factor could be the contamination due to the frequent visits of some of the community members from the intervention group to the control group and vice versa to see their relatives.

Figure 17. Change in mean dengue knowledge scores during three different times in 2020 in two low-income communities in Islamabad. Maximum knowledge score was 48.



The figure 12 shows that after two months of the intervention, there was statistically significant improvement in knowledge in the intervention group than the control group. However, after four months the knowledge not only sustained but further improved in the intervention group than the control group. It means if the knowledge is disseminated through the appropriate and trusted channels of communication it persists even when the external support is withdrawn. The qualitative assessment revealed that interpersonal communication is most preferred and trusted communication channel in these communities. Therefore, the PD approach which is a strong interpersonal communication tool was very successful in creating and sustaining the awareness among community members on dengue prevention and control. Previous studies also verified that cultural appropriate and trusted communication channels improve awareness on dengue in the community[74].

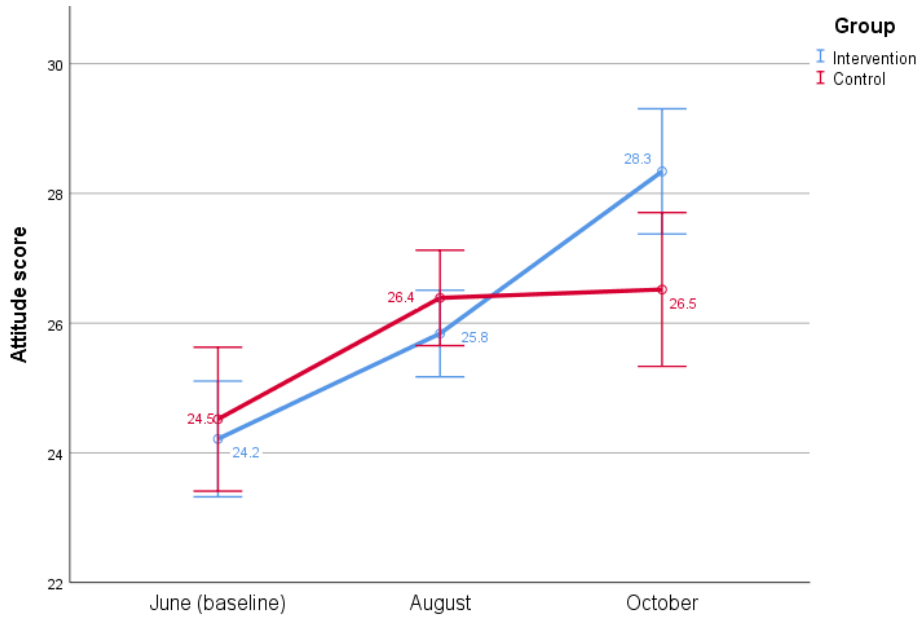
5.6.4.Dengue Attitude score at baseline, midline, and end line

Attitude towards dengue disease was good overall among the respondents from the intervention and control group. Another study on dengue also found similar findings regarding the attitude on dengue[75]. Most respondents from both groups agreed that dengue is a serious and transmissible illness, that removing empty containers can protect from dengue infection, that using bed nets, repellents and long

sleeves can protect from mosquito bite and that communities should participate in controlling dengue. Interestingly, at the endline, 32.1% of respondents from the intervention and 40.7% of respondents from the control group still thought that dengue control is only government responsibility compared to 50% of respondents from the intervention group and 51.8% of respondents from the control group at the baseline. It reveals the community's perception that dengue is only government responsibility as they never been actively engaged in the dengue prevention and control activities. The community is always considered as a passive recipient. There is a strong need to engage the community members in the dengue prevention and control with clear roles and responsibilities to successfully combat the dengue. The PD interventions successfully demonstrated that if communities are actively engaged in the planning and decision making, it develops strong acceptance and ownership which foster the sustainability of the program. Studies conducted in various countries validate that community engagement should be ensured to guarantee the positive changes in attitude and practices on dengue prevention and control[15, 60].

Statistically significant differences in dengue attitude between control and intervention group were not found at the baseline. Furthermore, at the midline, after two months and Positive deviance intervention, statistically significant differences in dengue attitude between control and intervention group were also not found. However, after another two months at the endline, attitude towards dengue disease improved significantly in the intervention group compared to control group. Estimated marginal means of dengue attitude are visualized in the profile plot where an increase in dengue attitude between baseline and midline for the intervention and control group is quite similar, but between midline and endline control group attitude remains almost horizontal compared to increased intervention group attitude (Fig18). The findings of a study conducted in Thailand suggest that it takes time to bring changes in the attitude of the community members[76]. Therefore, it took time to improve the community attitude regarding dengue. In order to bring changes in community attitude, key community leaders and influences should be engaged in the intervention to bring positive changes in knowledge and attitude.

Figure 18. Change in mean dengue attitude scores during three different times in 2020 in two low-income communities in Islamabad. Maximum attitude score was 32.

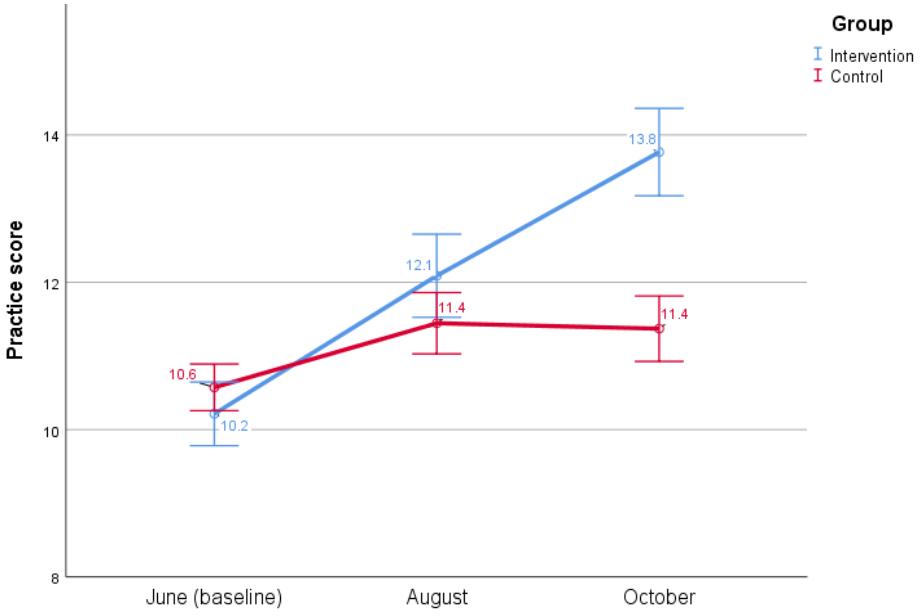


5.6.5.Dengue practices score at baseline, midline and endline

At the end line, an improvement in practice was observed related to dengue preventive methods especially in the intervention group, like sleeping under bed net during the day, using insecticide spray, repellent, mosquito coil and smoke to drive away mosquitoes. At the endline, 53.6% of respondents from the intervention group were covering all water containers compared to 10.7% at the baseline. At the endline, 55.4% of respondents from the intervention group were changing the storage water one a week compared to 25% at the baseline. Interestingly, an improvement in practice was observed not only in the intervention group but also in the control group. Statistically significant differences in dengue practice between control and intervention group were not found at the baseline. Furthermore, at the midline, after two months and Positive deviance intervention, statistically significant differences in dengue practice between control and intervention group were also not found. However, after another two months at the endline, practice regarding dengue disease improved significantly in the intervention group compared to control group.

Estimated marginal means of dengue practice are visualized in the profile plot where an increase in dengue practice between baseline and midline is quite similar for the intervention and control group, but between midline and endline control group practice remains almost horizontal compared to increased intervention group practice (Figure 19)

Figure 19. Change in mean dengue practice scores during three different times in 2020 in two low-income communities in Islamabad. Maximum practice score was 24.



These improvements in dengue practices and behaviours in the intervention group can be attributed to the positive deviance interactive intervention which facilitated the behavior change process and transformed the knowledge into practices in the PD intervention group which is validated by a similar behavior change intervention carried out in Cambodia[77]. Study revealed that changes in knowledge is easier than bringing the changes in attitude and practices.

The study confirms that findings of the author Park Lloyd's study that only knowledge does not guarantee the desirable positive changes in the practices[78]. Another study conducted in Malaysia verified that good knowledge does not necessarily lead to good practice[75].

Despite some improvements in the dengue knowledge in the control group, no statistically significant changes were detected in the dengue attitude and behaviors in the control group at the end line. This further strengthens the notion that creating awareness alone is not sufficient unless the enabling environment is created through community participation at the household and community level for effective prevention and control of dengue [10].

As per the key recommendations of the Alma Ata conference, the community engagement has been considered as a crucial component of the primary health care programs by the world health organization [79, 80]. However, unfortunately, in most cases, the community participation remained top-down or expert driven where outsiders or experts planned and instructed on how to solve the health or vector control problems [80]. It is still very unusual that the community is regarded as an active partner and involved in the design, planning, implementation, monitoring and evaluation of the health programs.

In the positive deviance study, the community was considered as an active partner where they actually took lead in the study design and played an active role in decision making regarding the intervention which helped generate interest, community acceptance, and sustained community participation (not a single person left the intervention group) throughout the PD intervention which is consistent with the previous studies [20–22]. Equity and equality of participation were also considered seriously ensuring that people from all segments of the community have equal opportunity to participate in the intervention.

The PD intervention was informed by the qualitative or formative research which helped understand the routine or normative behaviors around dengue prevention and control. The PD inquiry through in-depth interviews helped identify the already existent accessible and local solutions which were disseminated to other community members through the actual role models during the two months of PD intervention. These local PD behaviors and messages were promoted by the role models through storytelling. These role models served as social proof for the other community members who believed, *"if he/she can do it, why can't I".*

The community members were also involved in the development of the local Information, Education, and Communication (IEC) materials using their own colorful sketches and pictorials on the flip charts (large paper) which were used in the IEC materials. These local sketches and messages had strong ownership of the communities. The previous studies also validated that culturally appropriate and context-specific messages and behavior change communication tools were very effective to improve community knowledge and behaviors on dengue [6, 78, 81]. Similarly, many randomized controlled trials also showed encouraging outcomes in reducing entomological indicators as the interventions were contextually appropriate and the community was actively engaged in the project [15, 45, 82, 83]. The PD intervention was community led, culturally appropriate, and tailored to the context. A similar study validated that well-informed and context-appropriate intervention guarantees behavior changes. [84].

The positive deviance approach has a great potential as an effective behavior change and community participation tool for the dengue prevention and control. The PD approach has been successfully used on malaria and received positive feedback from the small-scale evaluation of the malaria study conducted in Cambodia [70].

In this study, the PD approach produced a significant amount of interest, enthusiasm, and empowerment among the study participants which resulted in the improved community participation and dengue outcomes in the intervention community. The real promise of the approach is the signs of sustainability of the intervention, with the dengue prevention and control behaviors sustained after two months of the end of the intervention (in the intervention group).

Another interesting aspect of the active community engagement in the study was the community-led interactive competitions that were organized during the study. For example, the community members were actively involved in the sketch or songs competitions based on the messages or behaviors they heard in the previous months. This activity created tremendous interest among the community members as they involved their friends, family members and neighbors in the sketch competition to come up with good drawings and songs which in turn reinforced the dengue behaviors

at the community level. The successful participants were given away small gifts as a token of appreciation for their outstanding sketches and dengue songs in the presence of the large community which enhanced their confidence and sustained their motivation throughout the intervention. Hence, as Atkinson's highlighted in her study, small gifts or incentives should be considered to acknowledge and encourage the community participants and volunteers to enhance their motivation in the vector control programs [85].

PD's strength is that it engages communities in the change process by understanding their context and identifying positive role model behaviors from within the community to encourage behavior change. It also creates an enabling environment for others to follow and adopt the models' simple, doable and local behaviors to improve their health outcomes. As positive deviance behaviors and strategies are local, they are easily accepted by their fellow community members, which speeds up behavior change.

The additional value of PD is that it increases the sustainability of behavior change. The presence of the role model in the communities serves as a continuous, unspoken, reminder to village residents of the importance of maintaining practices to remain dengue free. It rests on the premise that "If he/she can do it, why can't I?" Further, the involvement of the community at every step of the intervention establishes a successful community dialogue and strong community ownership in dengue prevention and control activities. In this way, the intervention sustains itself at no cost.

Majority of the community members mentioned in the qualitative research that interpersonal or face to face communication is their most preferred channel of communication. They believe that face to face communication from health workers or volunteers are more effective as they can clarify information on the spot. Many mentioned that they cannot read or understand the pamphlets or posters, therefore they like to receive information from face-to-face health education sessions. As positive deviance a strong interpersonal communication approach therefore, it fits very well in the similar culture or context. As many also mentioned that they receive

information from TV and social media, therefore, if the messages are harmonized and synchronized across TV, local media and interpersonal communication it will have a strong reinforcing effect on the community members. When people hear similar messages from different media, it validates and authenticate the information.

The qualitative component complemented the quantitative component to better understand the quantitative results. The qualitative findings validated and better understand the quantitative findings. Majority of the community members in qualitative research mentioned that mosquito bite is the main cause of dengue which was validated by the quantitative survey that 67.9% respondents knew that mosquito bite is main cause of dengue. Majority of the community members did not know the correct biting time of dengue which was reflected in the quantitative component as well that only 8.9% people knew that day biter Aedes causes dengue. Similarly, most of the findings of the quantitative KAP surveys were triangulated by the qualitative component.

The main purpose of the qualitative assessment was to understand the context and normative behaviors around dengue to develop a well-informed behavior change communication intervention for dengue. One of the main reasons of the success of the positive deviance intervention was its well-informed and context appropriated dengue intervention. Various studies highlighted that if an intervention is developed based on the understanding of the community and context, target audiences, priority behaviors, trusted and preferred channels of communication, it will be successful in achieving its objectives i.e., desired behavioral changes of the target community[70, 86].

5.7. Positive deviance vs. other approaches

Positive deviance is an organic, simple, and bottom-up behavior change approach which builds on the existing community-based structures and promote the local and accessible behaviors which are already being practiced by some of the community members. As the approach utilizes the community-based structures i.e., volunteers and identify and promote the already existing behaviors, it has strong

acceptance and ownership of the community which ensures the sustainability. The study practically demonstrated this that the PD knowledge and behaviors were not only improved during the intervention period but persisted and improved (specially dengue preventive practices) after even the two months of PD intervention which reflects the signs of sustainability of the approach.

This aspect is a big challenge with many behaviors change communication approaches where people stop practicing the desired behaviors as soon as the external support for intervention is withdrawn. For example, an evaluation of a COMBI study in malaria revealed that there were no further improvement in knowledge and behaviors as soon as the COMBI intervention completed[44]

The strength of the PD approach is that it engages communities as 'active partners' than passive recipients and gives them clear roles and responsibilities in the program which develops strong ownership from the very inception of the project. When communities are engaged as partners, they believe that this is their responsibility to make it successful. The PD approach encourages community by highlighting their strengths, assets, and positive behaviors which further build the confidence and trust in them. The locally made information, education and communication materials by the local community members and volunteers ensures the acceptance and ownership of the simple materials among community members. These local materials and messages are more relatable to the communities and their context than an expert made high resolution IEC material. These context specific and culturally appropriate messages and materials are easy accepted and followed[83].

Positive deviance approach is very appropriate for the hard to reach and difficult to access communities as it identifies the role models from within the communities and share these behaviors with wider communities through interpersonal communication. Therefore, to strengthen the existing volunteers' strategy, PD approach could be incorporated to ensure the community interest and ownership in the process.

5.8. Policy implications

5.8.1.Individual level

The PD approach works very well on the individual level as it identifies the local role models from the community which serve as a social proof from other individuals and facilitates them to change their behaviors. It engages community members from the beginning and provide them key roles and responsibilities in the program which develops their self-efficacy to perform and sustain the behaviors.

5.8.2.Social level

Positive deviance approach not only improve the behaviors of the individual community members but also bring social changes such as changes in social norms in the community. For example, the role model behaviors are easily adoptable and accessible for other community members. When majority of the community members follow the preventive behaviors of the role model individuals it become social norms which lead to social changes in the community.

5.8.3.Policy level

The PD study demonstrated that well-informed and community-led behavior change strategies ensure community ownership, acceptance and guarantee the behavioral changes in the target communities. The positive deviance approach was first time applied on the dengue prevention and control in the selected slums which yielded excellent measurable results in short implementation period. The PD is an excellent interpersonal communication tool which ensure community participation hence very effective for vector control interventions.

In Pakistan, there is a strong community-based structure exist in the shape of Lady Health Workers and volunteers which could be further strengthened by equipping them with the PD approach. There is a need to orient the national program on the PD approach and trained the LHWs or volunteers on this very effective interpersonal communication approach for scaling it up at the larger level.

5.9. Key Recommendations

Following are the key recommendation of the study for future implications:

- The study indicates that the community's knowledge on the mode of transmission, and dengue biting time is sub-optimal. Therefore, there is dire need to review and revise the existing messages and Information, Education and Communication (IEC) materials.
- Culturally appropriate and well-informed behavior change communication strategy on dengue prevention and control needs to be developed to improve the dengue prevention and control behaviors at the community level
- Formative research needs to be conducted to better understand the barriers, enablers and drivers of the behavior changes in order to develop a well-informed and context specific behavior change communication strategy for the high-risk slums population.
- The study demonstrated that interpersonal or face to face communication is the most trusted sources of dengue information in these communities. Therefore, capacity of the volunteers should be developed in communication and facilitation skills in order to improve their community-based interactions. Focused IEC materials such as flip charts or story cards using tailored messages should be developed in order to provide consistent and standardized messages during the household visits.
- The misconception about dengue biting time and dengue transmission should be addressed through focused health education by volunteers and health staff. This could be due to the mixed health education activities on malaria and dengue. The health volunteers should avoid mixed messaging on malaria and dengue and should conduct focused and separate health education sessions (one session per disease) on these diseases to avoid the confusion. Focus flip charts should be developed and handed over to these volunteers to ensure the standardized and consistent messages on dengue prevention and control.

- Positive deviance is a strong community engagement approach which should be adopted for the vector control to improve preventive behaviors of the community
- The Communities should be given a lead role in the community-based health interventions in order to build capacity and ensure the sustainability of the interventions
- Culturally appropriate and context specific behavior change approaches are highly accepted in communities and ensure positive changes in the behaviors of target audiences
- Local and community-made Information, Education and Communication materials are more effective as people strongly relate to those messages and sketches made by their own community members
- The PD approach should be further replicated at a larger scale to better assess its effectiveness for the dengue and vector control programs

5.10. Lessons Learned

Followings are some key lessons learned for the PD implementation on dengue and other health issues:

- Try to grasp the social, political, and cultural context and perceive the nature of the community thoroughly before you plan to work in a community
- Engaging with a community is a treat, it is always a good opportunity to gain indigenous knowledge, therefore, make the most of the opportunity and learn as much as possible from the interaction
- Always be willing to learn from the community and go as a learner rather than as an expert to develop a strong rapport with them
- Try to be a good observer and learn about their culture, traditions, behaviors and the overall context to develop a solid foundation of your work
- Respect the culture and values of the community and try to incorporate their cultural festivals and events in your health education strategies to spread the positive behaviors of the community

- Always reckon the community as the expert; they are aware of their matters, issues, problems, and what add up to these issues. Hence, always consider them as vibrant partner to address the problems together
- Be inclusive and engage all the segments of the community in the PD process. Preclude any inequality and discrimination in terms of gender, ethnicity, social class, religion or geographical distance. Give everyone a fair chance to be a member of the project to develop their sense of belonging and ownership
- Positive deviance approach builds the self-efficacy of the community members so that they could gradually take the lead to solve their own problems without any external support. Therefore, develop their confidence, capacity, and skills so that they could take responsibility and solve their own issues independently
- The PD process takes up a few weeks to perceive the context of the community, therefore, explore the locality with local leaders, work in the community in a harmless way, for instance, do not walk around the community holding cameras or notebooks, it will make the community feel uncomfortable and suspicious. Always walk empty handed and try to observe things in the environment in your head, do not make physical notes. When you are completed the community walk, take a seat, and then complete your notes
- Respect community's time and routines and always plan out your work when the community is available. If you plan your work according to their convenience, they will give you quality time and you will acquire better information. However, if you go at your own convenience, they will want to end it abruptly or will not give you thorough responses.
- When you have identified a positive deviant individual, make sure that there is no cultural sensitivity to share their stories using their identity. In case of a sensitive topics, always ask for their consent to know if they would be comfortable to show their identity or names to share their positive behaviors with other community members
- Always keep community’s expectations controlled and avoid making any promises you can't keep or avoid giving incentives. This will bring their

hopes up and raise their expectation and they will expect the same treatment in the future or without incentive they might stop taking part in the intervention

- Always wear culturally appropriate dresses and prevent wearing branded clothes or ornaments as it creates social distance and considered rude in the community
- Apply story telling methods during the PD process and training of facilitators as it generates interest in the community and help them better grasp the information

5.11. Limitation

The positive deviance study was carried out on a small scale due to the limited financial resources. As the study applied quasi-experiment using convenience sampling technique, hence, the results cannot be generalized, nevertheless, the study still offers some rich and excellent insights on the process and evaluation of the new approach on dengue. As the PD study was implemented in low-income slums, the study findings may be more relevant to a similar context only. As the study was conducted in the peak time of COVID-19 pandemic, it might have hampered community participation in the PD intervention.

5.12. Conclusion

The study findings demonstrated that the positive deviance approach exerted a significant impact on the dengue knowledge, attitudes, and behaviors in the target communities even during a shorter period of the study implementation. The study suggests that context appropriate and well-informed behavior change approaches are required to ensure community engagement and sustained knowledge and behavioral changes in dengue prevention and control programs.

The study highlighted the importance of formative research to develop well-informed and culturally appropriate behavior change communication strategies to improve the dengue prevention and control behaviors. Simple and locally made IEC materials are more relatable to the community. The study revealed that indigenous, local, and already existent solutions and community-made communication materials

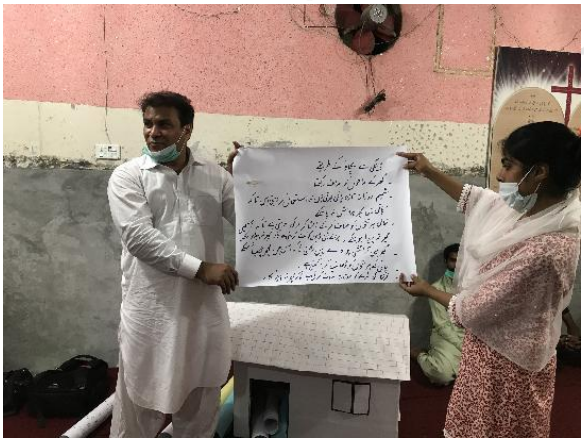
had strong acceptance and ownership of the community. PD is a community driven behavior change approach that engages the community as active partner throughout the process which is a key requirement of the vector control programs. PD emphasized on the active role of community in the dengue prevention and control. The community should be considered as active partners with clear roles and responsibilities in the programs.

PD is an interpersonal communication tool which is very suitable for the hard to reach and vulnerable communities. The volunteers should be trained in the interpersonal communication skills to improve their interaction with the community. The study revealed that timely appreciation and acknowledge of the volunteers can boost their confidence and commitment in the community-based interventions. The study also highlighted the importance of approaching communities at their convenient timings to ensure their participation in the intervention. There PD approach should be further explored at a larger scale to better assess the effectiveness of the approach. Positive deviance could be a potential behavior change tool to be adopted for dengue prevention and control in Pakistan and elsewhere.

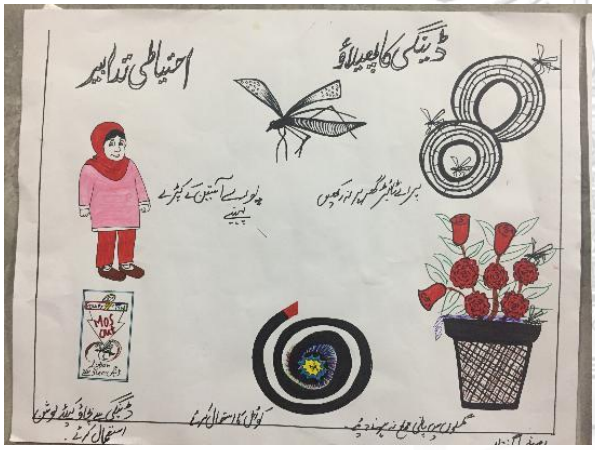
Intervention pictures - Surveyor's training and data collection

Focus group discussions pictures

Role model sharing their behaviours



Community competition and seminar



Appendix 1.

Information sheet

Assalam o Alaikum. Thank you for agreeing to participate in this research which is part of a doctoral research study at the School of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand. My name ----------is and we are conducting a household survey about dengue in your community. This survey is part of our community engagement intervention *'positive deviant or role model approach'* to control dengue with active community participation. We are conducting this survey with the permission of the National Dengue Control Programme, Pakistan to better understand the community's perception, knowledge, preventive, and health-seeking behaviors about dengue fever. We hope the information you and other people in your community provide us will help us understand the best way to control dengue outbreaks in the future. The information you provide will also help the government to develop well-informed behavior change communication strategies to reach out to the population at risk.

The survey questionnaire will take about 20 to 25 minutes on average. All the information will be kept private and confidential and will not be shared with other persons. We would very much appreciate your participation in this survey.

At this time, do you want to ask me anything about the survey?

May I begin the interview now?

Signature of Interviewer: _____ Date: _____

Signature of Interviewee: _____ Date: _____

RESPONDENT AGREES TO BE INTERVIEWED	☐
	☐

RESPONDENT DOES NOT AGREE TO BE INTERVIEWED

Appendix 2.

Dengue Survey Questionnaire

IDENTIFICATION

Name:_____ نام	HH ID no. |__|__|__| گھر کا نمبر
Area code_____ |__|__|	Interviewer's code |__|

Section 1: Socio-demographics

NO.	QUESTION	CODING CATEGORIES		SKIP
Q 1	How old are you? آپ کی عمر کیا ہے؟	(Age): |__|__| عمر سالوں میں		
Q 2	What is your gender? جنس؟	Male مرد	1	
		Female عورت	2	
Q 3	Your marital status? کیا آپ شادی شدہ ہیں؟	Single غیرشادی شدہ	1	
	(Only 1 answer)	Married شادی شدہ	2	
		Divorced طلاق یافتہ	3	
		Widow بیوہ	4	
Q 4	Religion? مذہب	Muslim اسلام	1	
	(Only 1 answer)	Christian مسیح	2	
		Other (specify):_____ کچھ اور	98	

NO.	QUESTION	CODING CATEGORIES		SKIP
Q 5	Highest level of school attended? آپکی تعلیم؟ (Only 1 answer)	Primary school (1-5) پرائمری	1	
		Secondary school(5-9) مڈل	2	
		High school (10) میٹرک	3	
		Intermediate – FA ایف اے	4	
		Bachelor -BA بی اے	5	
		Masters – MA ایم اے	6	
		No formal education غیر تعلیم یافتہ	7	
Q 6	What is your main occupation? (Only 1 answer) آپکا پیشہ کیا ہے؟	Unemployed بے روزگار	1	
		Government job سرکاری ملازم	2	
		Daily laborer دیہاڑی دار مزدور	3	
		Private job غیر سرکاری ملازمت	4	
		Street vendor چھابڑی فروش	5	
		Other_____ کچھ اور	98	
Q 7	How many people live in the house? اس گھر میں کتنے افراد رہتے ہیں؟	|___|___| افراد کی تعداد لکھیں		
Q 8	What is your average monthly income? آپکی أوسط ماہانہ آمدن کیا ہے؟	Less than 25000 Rupees پچیس ہزار سے کم	1	
		25,000 –50,000 پچیس اورپچاس کے درمیان	2	

NO.	QUESTION	CODING CATEGORIES		SKIP
		پچاس اور پچھتر کے 50,000 – 75,000 درمیان	3	
		پچھتر اور لاکھ کے 75,000 – 100,000 درمیان	4	
		ایک لاکھ سے زائد More than 100,000	5	
		کچھ اور Other specify_____	98	
		معلوم نہیں Don’t Know	99	

Section 2: Knowledge about dengue ڈینگی کے متعلق معلومات

No.	QUESTION	CODING CATEGORIES		Skips
Q 9	Have you heard of an illness called dengue? کیا آپ نے ڈینگی کےبارے ہیں سنا ہے؟	ہاں Yes	1	If NO go to Q 11
		نہیں No	0	
Q 10	Have you or any of your relatives had dengue this year? کیا خدانخواسطہ اس سال آپ یا آپکے کسی رشتہ دار کو ڈینگی بخار ہوا ہے ؟	ہاں Yes	1	
		نہیں No	0	
Q 11	How is dengue transmitted? Multiple Responses possible circle all mentioned Probe once: Anything else آپکے خیال میں ڈینگی وائرس انسان میں کیسے منتقل ہوتا ہے؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	مچھر کے کاٹنے سے Mosquito bite	1	
		خون کو انتقال سے Blood transfusion	2	
		گندہ پانئ پینے سے Drinking unclean water	3	
		غیرہاضم خوراک سے Eating indigestible food	4	
		کچھ اور Other specify_____	98	
		معلوم نہیں Don’t Know	99	

No.	QUESTION	CODING CATEGORIES		Skips
Q 12	What is the type of mosquito that cause dengue fever? Only 1 answer کس قسم کے مچھر کے کاٹنے سے ڈینگی بخار پھیلتا ہے؟	Aedes ایڈیز	1	
		Anopheles اینوفلیس	2	
		Culex کیولکس	3	
		Don't Know معلوم نہیں	99	
Q 13	When do dengue mosquito most often bite? Only 1 answer ڈینگی مچھر عموما کس وقت کاٹتا ہے؟	Bite during the day دن کے وقت	1	
		Bite during the night time رات کے وقت	2	
		Other specify_____ کچھ اور	3	
		Don't Know معلوم نہیں	99	
Q 14	Where do you think *aedes* mosquito usually breed inside the house? Multiple Responses possible ڈینگی مچھر گھر کے اندر کہاں پرورش پاتا ہے؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	In the trays under the fridge فرج کے نیچے ٹرے میں	1	
		In the flower pot trays گلدان کی تھالی میں	2	
		In the water containers پانی کے برتنوں میں	3	
		In the open water tanks پانی کے حوض میں	4	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	
Q 15	Where you think aedes mosquito usually breeds outside the house? **Do not prompt**	In the flower leaves پھول کے پتوں میں	1	
		In the old tires پرانے ٹائروں میں	2	

No.	QUESTION	CODING CATEGORIES		Skips
	Multiple response possible, circle all mentioned. Probe once, anything else? ڈینگی مچھر گھر کےباہرکہاں پرورش پاتا ہے؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	In the roof gutter چھت کی ٹینکی میں	3	
		In the garbage, empty cans, shells کوڑے میں، پلاسٹک کی خالی بوتلوں اور ڈبوں میں	4	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	
Q 16	How can you prevent mosquitos from breeding? **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything else? آپ مچھروں کو پرورش پانے سے کیسے روک سکتے ہیں؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Using insecticide in water پانی میں مچھر مار دوا ڈالنے سے	1	
		Changing stored water frequently جمع شدہ پانی کو مسلسل تبدیل کرنے سے	2	
		Turning containers upside down پانی کے برتن الٹے رکھنے سے	3	
		Putting covers on water jars پانی کے برتنوں کو ڈھانکنے سے	4	
		Burn or Burry empty cans, shells خالی بوتلوں، ڈبوں کو جلانے یا زمیں میں گاڑنے سے	5	
		Spraying insecticide مچھر مار ادویات کے سپرے کرنے سے	6	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	
Q 17	How can you prevent dengue? آپ ڈینگی سے کیسے محفوظ رہ سکتے ہیں؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،** **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything	Use mosquito net during the day دن میں سونے کے دوران مچھر دانی کا استعمال	1	
		Wear long sleeves/long pants لمبی آستینوں والے کپڑوں کا استعمال	2	
		Use mosquito repellent مچھر بھگانے والی کریم کا استعمال	3	
		Use insecticide spray مچھر مار دوا کا سپرے کرنا	4	

No.	QUESTION	CODING CATEGORIES		Skips
	else?	Cut down bushes near the house گھر کے قریب والی جھاڑیوں کا کاٹنا	5	
		Have children play far from mosquito breeding areas بچوں کو مچھروں والے علاقوں سے دور کھیلنے کو کہنا	6	
		Use mosquito coils during the day دن میں مچھر بھگانے والی جلیبی کا استعمال	7	
		Keep household environment clean اپنے گھر کو صاف رکھنا	8	
		Installed screens on windows/doors دروازوں اور کھڑکیوں پہ جالیاں لگانا	9	
		Keep cloths tidy کپڑوں کو ترتیب سے رکھنا	10	
		Use fan پنکھے کا استعمال	11	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	
Q 18	What are the symptoms of dengue? **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything else? ڈینگی بخار کی علامات کیا ہیں؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	High fever تیز بخار	1	
		Headache سر درد	2	
		Chills کپکپی طاری ہونا	3	
		Nausea/vomiting الٹی آنا	4	
		Rash جسم پہ سرخ نشانات	5	
		Muscle and joint pain جوڑوں میں درد	6	
		Bleeding خون کا جاری ہونا	7	

No.	QUESTION	CODING CATEGORIES		Skips
		Diarrhea پیچش لگنا	8	
		Eye pain آنکھوں کے گرد درد ہونا	9	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	
Q 19	What signs and symptoms make you decide the illness is serious? **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything else? وہ کونسی علامات ہیں جوظاہر کرتی ہیں کہ ڈینگی کا مرض بہت شدید ہے **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Severe abdominal pain پیٹ میں شدید درد	1	
		Persistent vomiting الٹی کا متواتر آنا	2	
		Difficult or fast breathing سانس میں تکلیف	3	
		Bleeding from gums or nose ناک اور مسوڑوں سے خون آنا	4	
		Very pale skin جلد کا پیلا ہو جانا	5	
		Feeling tired or restless شدید تھکاوٹ محسوس کرنا	6	
		Vomiting blood خون کی الٹی آنا	7	
		Blood in stool پاخانہ میں خون آنا	8	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	
Q 20	Are there certain times a year when you recognize that more people in your family/village get sick of dengue? کیا آپکے خیال میں سال میں کچھ خاص مہنے	Yes ہاں	1	
		No نہیں	0	

No.	QUESTION	CODING CATEGORIES		Skips
	ہوتے ہیں جب زیادہ لوگ ڈینگی بخار کا شکار ہوتے ہیں؟	Don't Know معلوم نہیں	99	
Q 21	If yes, when? اگر ہاں تو کونسے مہینے؟	From…….to……..		
		Don't Know معلوم نہیں	99	

Section 3: Health Seeking Behaviour

No.	QUESTION:	CODING CATEGORIES		Skips
Q 22	If you think you or someone in your family has fever, what would you do First? Only 1 answer اگر آپ یا آپ کےگھر میں کسی کو بخار ہو جائے تو آپ سب سے پہلے کیا کرتے ہیں؟	Go to govt. hospital سرکاری ہسپتال جاتے ہیں	1	
		Go to private provider پرائیویٹ ہسپتال جاتے ہیں	2	
		Go to Lady Health Worker لیڈی ہیلتھ ورکر کے پاس جاتے ہیں	3	
		Take drugs from pharmacy فارمیسی سے دوا لیتے ہیں	4	
		Stay at home/ wait for fever to go away گھر میں بخار اترنے کا انتظار کرتےہیں	5	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	
Q 23	If your family members gets fever, how many days do you wait to seek care after symptoms starts? اگر آپکے کسی رشتہ دار کو بخار ہو جائے تو آپ علامات ظاہر ہونے کے کتنے دن بعد علاج کیلئے رجوع کریں گے؟	|____|____| Record '0' if they respond in the same day Record '99' if they respond Don't know اگر اسی دن جائیں تو صفر لکھیں، اگر معلوم نہیں تو ننانوے لکھیں		
Q 24	If you suspect someone in your family has dengue, where would you go for advice/testing ?	Go to govt. hospital سرکاری ہسپتال جاتے ہیں	1	
		Go to private provider پرائیویٹ ہسپتال جاتے ہیں	2	

No.	QUESTION:	CODING CATEGORIES		Skips
	Only 1 answer اگر کسی کو ڈینگی ہو جائے تو آپ اسے تشخیص کیلئے کہاں لے کر جاتے ہیں؟ صرف ایک جواب ممکن ہے	Go to Lady Health Worker لیڈی ہیلتھ ورکر کے پاس جاتے ہیں	3	
		Go to pharmacy فارمیسی جاتےہیں	4	
		Other specify_____ کچھ اور	98	
		Don't Know معلوم نہیں	99	

Section 4: Attitude

No.	QUESTION:	CODING CATEGRIES		Skips
Q 25	Dengue is a serious illness? ڈینگی ایک خطرناک مرض ہے؟ کیا آپ اس سے----	Strongly agree بالکل متفق ہیں	1	
		Agree متفق ہیں	2	
		Disagree متفق نہیں ہیں	3	
		Strongly disagree بلکل متفق نہیں ہیں	4	
		Don't know معلوم نہیں	99	
Q 26	Dengue is transmissible disease? ڈینگی ایک پھیلنے والی بیماری ہے؟	Strongly agree بالکل متفق ہیں	1	
		Agree متفق ہیں	2	
		Disagree متفق نہیں ہیں	3	
		Strongly disagree بلکل متفق نہیں ہیں	4	
		Don't know معلوم نہیں	99	
Q 27	You are at risk of getting dengue? آپکو ڈینگی بخار کا خطرہ لاحق ہے	Strongly agree بالکل متفق ہیں	1	

No.	QUESTION:	CODING CATEGRIES		Skips
		Agree متفق ہیں	2	
		Disagree متفق نہیں ہیں	3	
		Strongly disagree بلکل متفق نہیں ہیں	4	
		Don’t know معلوم نہیں	99	
Q 28	Dengue fever can be prevented easily? ڈینگی سے باآسانی بچا جا سکتا ہے ؟	Very easy بہت آسانی سے	1	
		Easy آسانی سے	2	
		Difficult مشکل سے	3	
		Very difficult بہت مشکل سے	4	
		Don’t know معلوم نہیں	99	
Q 29	Is removing empty tins, bottles, pots, a good strategy to protect you from dengue infection? کیا پلاسٹک کی خالی بوتلیں،خالی ٹین ڈبے، اور ٹوٹے برتنوں کو تلف کرنا ڈینگی سے بچنے کی ایک اچھی حکمت عملی ہے؟	Strongly agree بالکل متفق ہیں	1	
		Agree متفق ہیں	2	
		Disagree متفق نہیں ہیں	3	
		Strongly disagree بلکل متفق نہیں ہیں	4	
		Don’t know معلوم نہیں	99	
Q 30	Do you think using bed nets, repellents and long sleeved can protect you from mosquito bite? کیا آپ کے خیال میں مچھر دانی، مچھر سے	Strongly agree بالکل متفق ہیں	1	
		Agree متفق ہیں	2	

No.	QUESTION:	CODING CATEGRIES		Skips
	بچنے کا لوشن اور پوری آستینوں والے کپڑے آپکو مچھر کے کاٹنے سے بچا سکتے ہیں؟	Disagree متفق نہیں ہیں	3	
		Strongly disagree بلکل متفق نہیں ہیں	4	
		Don't know معلوم نہیں	99	
Q 31	Do you think dengue control is only government responsibility? کیا آپکے خیال میں ڈینگی کو کنٹرول کرنا صرف محکمہ صحت کی ذمہ داری ہے؟	Strongly agree بالکل متفق ہیں	1	
		Agree متفق ہیں	2	
		Disagree متفق نہیں ہیں	3	
		Strongly disagree بلکل متفق نہیں ہیں	4	
		Don't know معلوم نہیں	99	
Q 32	Do you think communities should participate in controlling dengue? کیا آپکے خیال میں ڈینگی پہ قابو پانے والی سرگرمیوں میں کمیونٹی (محلے داروں) کی شمولیت ضروری ہے؟	Strongly agree بالکل متفق ہیں	1	
		Agree متفق ہیں	2	
		Disagree متفق نہیں ہیں	3	
		Strongly disagree بلکل متفق نہیں ہیں	4	
		Don't know معلوم نہیں	99	

Section 5: Practice

No	QUESTIONS	Coding Categories		Skips
Q 33	What do you do to prevent dengue?	Nothing کچھ بھی نہیں	1	

No	QUESTIONS	Coding Categories		Skips
	Do not prompt Multiple response possible, circle all mentioned. Probe once, anything else? ڈینگی سے بچاو کیلئے آپ کیا تدابیر اختیار کرتے ہیں؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Sleep under bed net during the day دن کے وقت سونے کے دوران مچھر دانی کا استعمال	2	
		Use fan to prevent mosquitoes bites پنکھے کےذریعے مچھر بھگانا	3	
		Use insecticide spray مچھر مار ادویات کا استعمال	4	
		Use repellent مچھر سے بچاو کا لوشن	5	
		Use mosquito coil مچھر سے بچاو کی جلیبی	6	
		Use smoke to drive away mosquito مچھر بھگانے کیلیے دھوویں کا استعمال	7	
		Cover all water containers پانی کے برتنوں کو ڈھانپنا	8	
		Change water in trays under the fridge فرج کے نیچے رکھی ٹرے کا پانی تبدیل کرنا	9	
		Destroy or burn unused containers غیر استعمال شدہ بوتلوں اور برتنوں کو تلف کرنا	10	
		Other specify_____ کچھ اور	98	
Q 34	Do you keep covers on the water containers in the home? کیا آپ پانی کے برتنوں کو ڈھانپ کے رکھتی ہیں؟	Yes ہاں	1	
		No نہیں	0	
Q 35	”Please can I observe some of the containers? کیا میں برتنوں کا معائنہ کر سکتا ہوں؟ *NOTE IF CONTAINERS HAVE*	Covers observed on all containers تمام برتن ڈھانپے ہوئے پائے گئے	1	
		Covers observed on some containers کچھ برتن ڈھانپے ہوئے پائے گئے	2	

No	QUESTIONS	Coding Categories		Skips
	COVERS	No covers observed کوئی برتن بھی ڈھانپا ہوا نہیں پایا گیا	3	
Q 36	How often do you change the storage water? (Only 1 answer) آپ جمع شدہ پانی کتنے عرصے بعد تبدیل کرتے ہیں؟	Once a week ہفتے ہیں ایک دفعہ	1	
		More than once a week ہفتے میں ایک سے زائد دفعہ	2	
		Twice per month مہینےمیں دو دفعہ	3	
		Once a month مہینے میں ایک دفعہ	4	
		Never کبھی نہیں	5	
		Don't know معلوم نہیں	99	
Q 37	How often do you clean the water containers? Only 1 answer آپ کتنے عرصے بعد پانی کے برتنوں کو صاف کرتے ہیں؟	Every day روزانہ	1	
		Once a week ہفتے ہیں ایک دفعہ	2	
		Once a month مہینے میں ایک دفعہ	3	
		Occasionally کبھی کبھار	4	
		Never کبھی نہیں	5	
		Don't know معلوم نہیں	99	
Q 38	*Observe water containers* پانی کے برتنوں کا معائینہ کریں *NOTE IF CONTAINERS LOOK CLEAN*	Containers look very clean پانی کے برتن بہت صاف ہیں	1	
		Containers do not look very clean پانی کے برتن صاف نہیں ہیں	2	
Q 39	What do you do with containers you are not currently using?	Leave them empty as they are انکو اسی طرح خالی چھوڑ دیتے ہیں	1	

No	QUESTIONS	Coding Categories		Skips
	Do not prompt Multiple response possible, circle all mentioned. Probe once, anything else? آپ ان پانی جمع کرنے والے برتنوں کا کیا کرتی ہیں جو روزمرہ استعمال میں نہیں آتے؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Turn them upside down ان کو الٹا کر کےرکھ دیتےہیں	2	
		Move them inside ان کو اندر رکھ دیتے ہیں	3	
		Move them outside ان کو گھر سے باہر نکال دیتے ہیں	4	
		Other specify_____ کچھ اور	98	
Q 40	What do you do with waste such as old shells, cans, tires, plastic bottles and other small containers? **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything else? اُپ پلاسٹک کی خالی بوتلوں، پرانے ٹائروں، اور پرانے ٹین ڈبوں کا کیا کرتے ہیں؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Bury them دفنا دیتے ہیں	1	
		Turn them upside down ان کو الٹا کر کےرکھ دیتےہیں	2	
		Burn them جلا دیتے ہیں	3	
		Move them outside ان کو گھر سے باہر نکال دیتے ہیں	4	
		Other specify_____ کچھ اور	98	
Q 41	Do you think your household's environment keep clean? کیا آپ سمجھتے ہیں کہ آپ کےگھر کے اردگرد کا ماحول صاف ہے تاکہ مچھروں سے بچا جا سکے؟	Yes ہاں	1	
		No نہیں	0	
		Don't know معلوم نہیں	99	
Q 42	Do you think the clothes in your household keep tidy? کیا آپ کے خیال میں آپکے گھر میں کپڑے ترتیب سے رکھے جاتے ہیں؟	Yes ہاں	1	
		No نہیں	0	
		Don't know معلوم نہیں	99	

Section 5. Health Education Exposure

No.	QUESTIONS	CODING CATEGORIES		Skips
Q 43	Do you get involved in health education activities on dengue in the last 3 months? کیا آپ ڈینگی کی گزشتہ تین ماہ کے دوران ہونے والی معلوماتی سرگرمیوں میں شریک ہوئے؟	Yes ہاں	1	
		No نہیں	0	
Q 44	What types of activities you get involved in during last 3 months? **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything else? آپ پچھلے تین ماہ کے دوران کس قسم کی معلوماتی سرگرمیوں میں شریک ہوئے؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Health education sessions ڈینگی کے بارے میں معلوماتی اجتماع	1	
		Dengue training ڈینگی کے بارے میں تربیت	2	
		Community competition ڈینگی کے بارے میں ہونے والے کمیونٹی کی سطح پہ معلوماتی مقابلے	3	
		Community seminar ڈینگی کے متعلق کمیونٹی سیمینار	4	
		Individual advice انفرادی طور پہ دی جانے والی معلومات	5	
		Other specify_____ کچھ اور	98	
		Don't know معلوم نہیں	99	
Q 45	In the past 3 months, have you heard or seen any messages or information about dengue? کیاآپ نے گزشتہ تین ماہ کے دوران ڈینگی سے بچاو کے متعلق کوئی پیغام یا معلومات سنی یا دیکھی ؟	Yes ہاں	1	اگر نہیں تو انٹرویو ختم کر دیں
		No نہیں	0	
Q 46	What messages or information related to dengue did you see or hear? **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything else?	Keep household environment clean prevent mosquito from breeding اپنے گھر کے اردگرد کا ماحول صاف رکھیں تاکہ مچھروں سے بچا جا سکے؟	1	
		Wearing long sleeved clothes avoids dengue پوری آستینوں والے کپڑے پہننا تاکہ مچھر کے کاٹنے سے بچا جا سکے؟	2	

No.	QUESTIONS	CODING CATEGORIES		Skips
	ڈینگی سے بچاو کےبارےمیں وہ کونسے پیغامات یا معلومات تھیں جوآپ تک پہچیں؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Putting covers of water jars avoids mosquito from breeding برتنوں کو ڈھانپ کر رکھنا تاکہ مچھر اس میں انڈے نہ دے سکیں اورمزید پرورش نہ پا سکیں	3	
		Use mosquito net during day to avoid dengue دن کے وقت سونے کے دوران مچھر دانی کا استعمال تاکہ مچھروں کے کاٹے سے بچا جا سکے؟	4	
		Use mosquito coils during the day دن کے وقت مچھروں سے بچنے کیلئے کوئیل یا جلیبی کا جلانا	5	
		Seek care for dengue promptly within 24 hours ڈینگی کے بخار کے چوبیس گھنٹوں کے اندر تشخیص و علاج کیلئے رجوع کرنا	6	
		Dengue is dangerous ڈینگی خطرناک مرض ہے	7	
		Dengue can kill ڈینگی سے موت واقع ہو سکتی ہے	8	
		Mosquito spread dengue ڈینگی مچھر سے پھیلتا ہے	9	
		Other specify_____ کچھ اور	98	
		Don’t know معلوم نہیں	99	
Q 4۷	Where or from whom did you see or hear these messages/information about dengue? **Do not prompt** Multiple response possible, circle all mentioned. Probe once, anything else?	Lady Health Worker لیڈی ہیلتھ ورکر سے	1	
		Health facility staff ہسپتال کے عملہ کے زریعے	2	
		Private health provider پرائیویٹ ہسپتال کے عملہ کے زریعے	3	
		Religious leader مزہبی رہنما کے زریعے	5	

No.	QUESTIONS	CODING CATEGORIES		Skips
	ڈینگی کے متعلق یہ معلومات آپ تک کس زریعے یا شخص سے پہنچیں؟ **ایک سے زیادہ جوابات ممکن ہیں، لقمہ نہ دیں، تمام دئے گئے جوابات کے گرد دائرہ لگا دیں،**	Health education session ڈینگی کے بارے میں معلوماتی میٹنگ کے زریعے	6	
		Friends/neighbors دوستوں یا پڑوسیوں سے	7	
		TV ٹی وی کے زریعے	9	
		Radio ریڈیو کے زریعے	10	
		Posters ڈینگی کے بارے میں پوسٹر سے	11	
		Leaflets ڈینگی کے بارے میں پمفلٹ سے	12	
		Role models مثالی کرداروں کے زریعے	13	
		Other specify_____ کچھ اور	98	
		Don't know معلوم نہیں	99	

END INTERVIEW

Appendix 3.

Topic Guide for Focus Group Discussion

Generic question Dengue Signs and Symptom of Dengue	1. What are the main health issues that you community suffers? Probe for dengue 2. What do you call dengue? Probe local dengue terms 3. Do you know the main symptoms of dengue? Please explain 4. Is dengue a serious illness? Why? Why not? 5. How do people get dengue? (cultural beliefs around dengue fever.) 6. When dengue is widespread in your community? Why? 7. When a person gets dengue, what do you do for treatment?

Causes of Dengue Healthcare Seeking Behavior: Preventive Measures	• Probe for home remedies and health seeking 8. How many days you wait before seeking care? 9. What are the main hurdles you face in receiving treatment for dengue? Probe for all barriers 10. What do you do to protect yourself from dengue? • Probes: for all personal protection measures 11. If no preventive behaviour, why? Probe for the reasons 12. How can we reduce dengue from your community? Probe for all suggestions

Appendix 4. Informed consent in Urdu

اجازت نامہ

Informed Consent

تحقیق کا عنوان: _مثالی کردار کے طریقہ کارکی ڈینگی کیلئیے افادیت معلوم کرنا، اس کے زریعے ڈینگی بخار کی روک تھام کےلئے، شعور اور آگاہی پھیلانا اور ڈینگی پہ قابو پانے والے طریقوں کو کمیونٹی کی شمولیت کے زریعے بہتر بنانا	پراجیکٹ نمبر:NBC-451
اخلاقیات کی تحقیقاتی کمیٹی کا نمبر:NBC-451	تحقیق کا ذمہ دار، سپانسر: محمد شفیق، پی ایچ ڈی مکمل کرنے کے لئے (ذاتی خرچہ)
مرکزی تحقیق کار: محمد شفیق	پی ایچ ڈی طالب علم، اپارٹمنٹ نمبر ۵۰۲، المصطفی ٹاور 0311 8308388فلور نمبر ، ایف ٹین ، اسلام آباد
شریک تحقیق کار: ڈاکٹر محمد مختار، ڈائریکٹر ویکٹر بورن ڈیزیز کنٹرول	نیشنل ڈینگی پروگرام، اسلام آباد، پاکستان

۱۔ تحقیق کا مقصد: آپ سے اس تحقیق میں شمولیت کی درخواست کی گئی ہے جسکا مقصد علاقے کے لوگوں کی بھر پور شمولیت کے ساتھ ڈینگی پہ قابو پانا ہے۔ اس ریسرچ میں ہم علاقے سے کچھ ایسے مثالی کرداروں کی نشاندہی کریں گے، جو اپنے مثبت رویوں کی بدولت ڈینگی سے بچاو کی بہترین تدابیر اختیار کیے ہوئے ہیں، جن کی وجہ سے وہ اور ان کے خاندان والے ڈینگی سے بہترطور پر نپٹ رہے ہیں، ہم ان کے اپنائے ہوئے مثبت رویے دوسرے لوگوں تک پہنچائیں گے تاکہ وہ بھی ان آسان رویوں کو اپنا کر صحت مند رہ سکیں۔ ہم اس سروے اور تحقیق کی بدولت ڈینگی کے موجودہ رویوں کو سمجھنے کی کوشش کریں گے تاکہ ہم ڈینگی پہ قابو پانے کے لئے بہتر حکمت عملی بنا سکیں۔

طریقہ کار: سروے کے دوران آپ سے انٹرویو کیا جائے گا جس کا دورانیہ تقریبا ۲۰ منٹ ہو گا۔
۲۔

۳۔ ممکنہ خطرات یا تکالیف: اس ریسرچ کے دوران ہم صرف ڈینگی کی بارے میں سوالات کریں گے، جس سے کسی قسم کا نفسیاتی، سماجی یا ثقافتی دباو ممکن نہیں، دوران انٹرویو ، کورونا وائرس سے بچاو کیلئے گورنمنٹ آف پاکستان کے جاری کردہ ایس او پیز کا مکمل خیال رکھا جائے گا، اور انٹرویوکے دوران فیس ماسک پیننا ضروری ہوگا۔ اور سماجی فاصلہ کو بھی ملحوظ خاطر رکھا جائے گا۔

۴۔ ممکنہ فوائد: اس ریسرچ سے آپ کو کوئی مالی فائدہ نہیں پہنچےگا، لیکن آپ کی شمولیت سے یہ ریسرچ ڈینگی سے بچاو کیلئے فائدہ مند ثابت ہوگی، اور اس سے حاصل کردہ تجربے سے قومی ڈینگی پروگرام کو آگاہ کیا جائے گا تاکہ وہ کمیونٹی کی شمولیت کیلئے بہتر حکمت عملی بنا سکیں

۵۔ معلومات کی پوشیدگی اُپ کی معلومات کو سیغیہ راز میں رکھا جائے گا، آپ کا نام کسی بھی رپورٹ کا حصہ نہیں بنے گا۔ تجزیہ کے دوران آپ کے نام کو کوڈ نمبر میں تبدیل کر دیا جائگا تاکہ آپ کی شناخت پوشیدہ رہے۔ تمام انٹرویوز صرف مرکزی تحقیق کار کی دسترس میں ہونگے۔

۶۔ شمولیت سے دستبرداری: آپ جب چاہیں اس ریسرچ سے دستبردار ہو سکتے ہیں، آپ پہ کسی قسم کا کوئی عذر نہیں آئے گا

۷۔ کسی انفارمیشن یا رابطہ کے لئے: اگر آپ کو کوئی سوال پوچھنا ہویا کسی بھی قسم کی ہنگامی صورت حال کے لئے آگاہ کرنا ہو تو آپ فون نمبر پر محمد شفیق سےرابطہ کر سکتے ہیں 0311 8308388

اجازت نامہ

میں نے اجازت نامہ اچھی طرح پڑھ اور سمجھ لیا ہے، یا مجھے پڑھ کر سمجھایا گیا ہے اور میں اس ریسرچ میں شمولیت کے لئے رضاکارانہ طور پہ تیار ہوں، مجھے علم ہے کہ اس اجزت نامے کی ایک نقل میرے پاس بھی رہے گی۔ مجھے اس بات کا بھی علم ہے کہ یہ اجازت نامہ میرے کسی قسم کے فیڈرل یا لوکل قوانیں یا حقوق کو تبدیل نہیں کر سکتا۔

شرکت کرنے والے کا نام: ----------

شرکت کرنے والے کے دستخط: ----------

تاریخ ----------

اجازت نامہ لینے والے کے دستخط: ----------

تاریخ ----------

مرکزی تحقیق کار کے دستخط: ----------

تاریخ ----------

Appendix 5: Ethical approval from National Bioethics Committee Pakistan

National Bioethics Committee (NBC) Pakistan

PHRC

Ref: No.4-87/NBC-451/20/ 2037 **Date: April 30, 2020.**

Mr. Muhammad Shafique
College of Public Health Sciences,
Chulalongkorn University
Institute building 3 (10th - 11th floor),
Chulalongkorn soi 62,
Phyathai Rd.,
Bangkok 10330, Thailand

Subject: **Effectiveness of the Positive Deviance, a community engagement approach, to improve knowledge, awareness and practices of dengue prevention among urban slums in Islamabad, Pakistan: A mixed methods study (NBC-451).**

Dear **Mr. Muhammad Shafique**

I am pleased to inform you that the above mentioned project has been cleared by the "Research Ethics Committee" of "National Bioethics Committee" **for a period of one year.**

For the continuation of project in the next years, you have to send a progress report and a formal request asking for continuation of projects (however, you do not need to submit REC application or pay any processing fee again).

Kindly keep the National Bioethics Committee, Secretariat updated about the progress of the project and submit the formal final report on completion.

Yours sincerely

(Prof. Dr. Saima Perwaiz Iqbal)
Chairperson
NBC-Research Ethics Committee

NBC Secretariat:
Pakistan Health Research Council, Shahrah-e-Jamhuriat, Off Constitution Avenue, Sector G-5/2, Islamabad
www.nbcpakistan.org.pk,e-mail: nbcpakistan.org@gmail.com Tel: 92-51-9224325, 9216793, Fax 9216774.

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VITA

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DATE OF BIRTH	04 October 1968
PLACE OF BIRTH	Khushab, Pakistan
INSTITUTIONS ATTENDED	College of Public Health Sciences, Chulalongkorn University, Bangkok, Thailand Punjab University Lahore, Pakistan
HOME ADDRESS	Apartment no. 502-B, Floor no. 5, F-10, Islamabad, Pakistan
PUBLICATION	1. Effectiveness of Positive Deviance, an asset-based behavior change approach, to improve knowledge, attitude, and practices regarding dengue in slums of Islamabad, Pakistan: A mixed-method study 2. Knowledge, Attitude and Practices towards Dengue Fever among the Communities Living in Slums of Islamabad, Pakistan; A Cross-sectional Survey
AWARD RECEIVED	No