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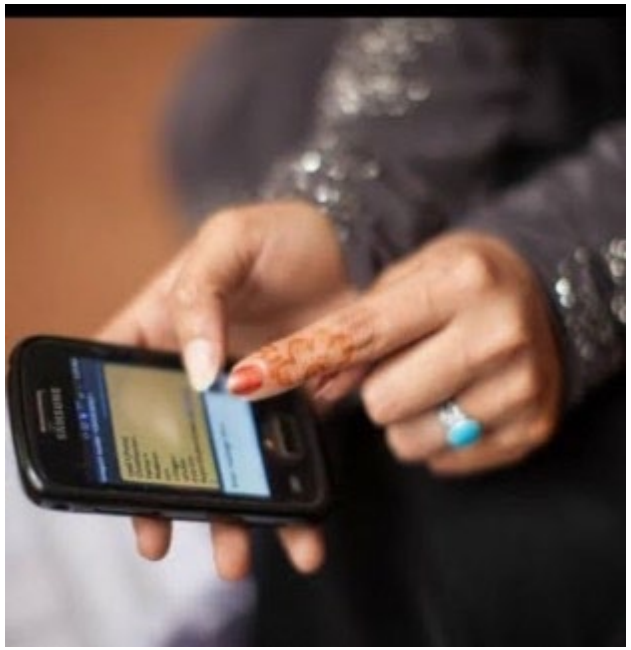
Using mHealth Interventions to Improve Vaccination Coverage



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Department of Pediatrics & Child Health
The Aga Khan University, Karachi, Pakistan

The New York Times

Opinion

We're Ignoring the Biggest Cause of the Measles Crisis

Text messages the Magic Pill

The New York Times

Slowing the Coronavirus Is Speeding the Spread of Other Diseases

Many mass immunization efforts worldwide were halted this spring to prevent spread of the virus at crowded inoculation sites. The consequences have been alarming.

INTERNATIONAL

THE NEWS

'Automated text, voice messages increase vaccine coverage in Sindh's underserved areas by 26pc'

News Desk

Customized e-health messages communicated to underserved areas of Sindh through Interactive Voice Response (IVR) system led to a 26 percent increase in vaccine uptake, revealed a study conducted by researchers of Aga Khan University.

According to the details issued by the AKU communication department, the exercise with the theme "Paigham-e-Sehat" comprised a randomised con-

The Paigham-e-Sehat study saw researchers from the AKU and the University of British Columbia partner with digital health and telecommunications specialists to develop a variety of mobile campaigns containing targeted

These messages were then delivered through four different mediums to generate evidence on the most effective means to boost demand for routine immunisation.

Participants in the study were also consequently divided into four different groups, one of which received a one-way series of SMS messages providing information on the benefits of immunisation.

The second group got an interactive sequence of SMS

minders and educational messages," Dr Momin Kazi, an assistant professor in paediatrics at child health at the AKU was quoted to have said.

According to Dr Kazi, the study has generated novel insights into the value of voice messages, which is an innovative medium for health awareness.

The study's findings, he said, were particularly useful in contexts where literacy is a challenge, where a variety of local languages and di-

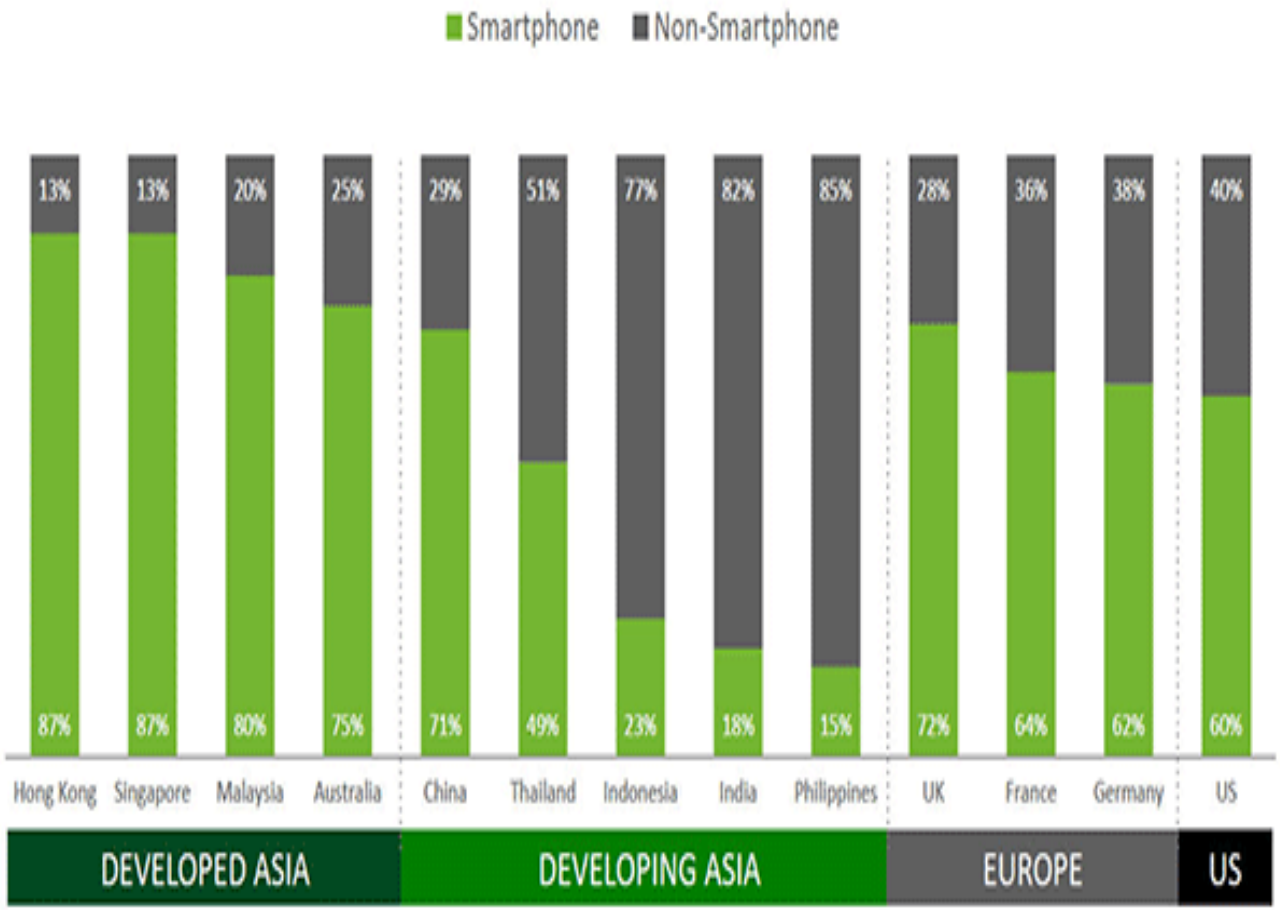
Mobile phone usage across the world

Dixon Jr JH. rext Messaging-The Dig: ai Evidence Revolutioi. Judges' Journal. 2022;61(4).

https://99firms.com/blog/texting-statistics/

SMARTPHONE PENETRATION

https://www.nielsen.com/bd/en/insights/article/2013/the-asian-mobile-consumer-decoded0/



https://www.brookings.edu/wp-content/uploads/2019/04/20190410_futuredevelopment_Mobile_ownership_2018.jpg

8.3 billion Mobile phone subscribers globally

People sent 18.7 billion texts to each other globally

Average 72 SMS per mobile phone on a daily basis

However less than 1/3 of the population use Smart phone and hence Interventions that can be used in simple function phone is recommended for generalizability

Textrequest reports USA,2018

Kazi et al JMIR 2018

mHealth Based Intervention- Requirement

Mobile Network's Accessibility or internet

- Mobile phone Coverage

Key Population access to mobile network

- Usage
- Literacy level
- Technology Savvy

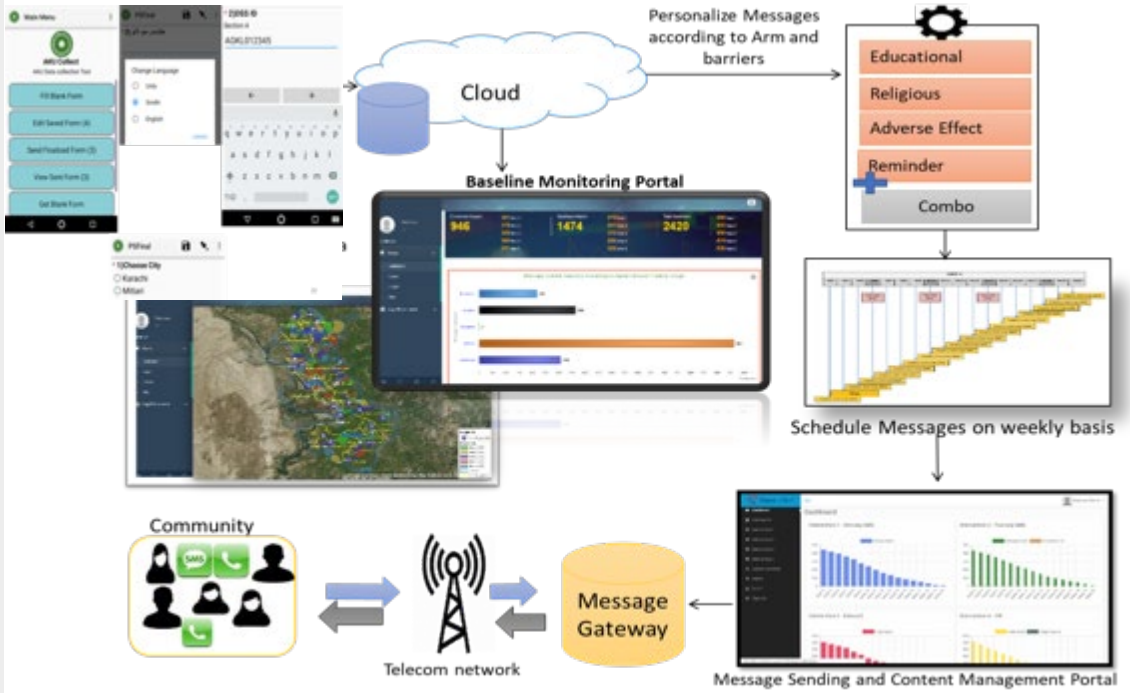
Availability of Electricity

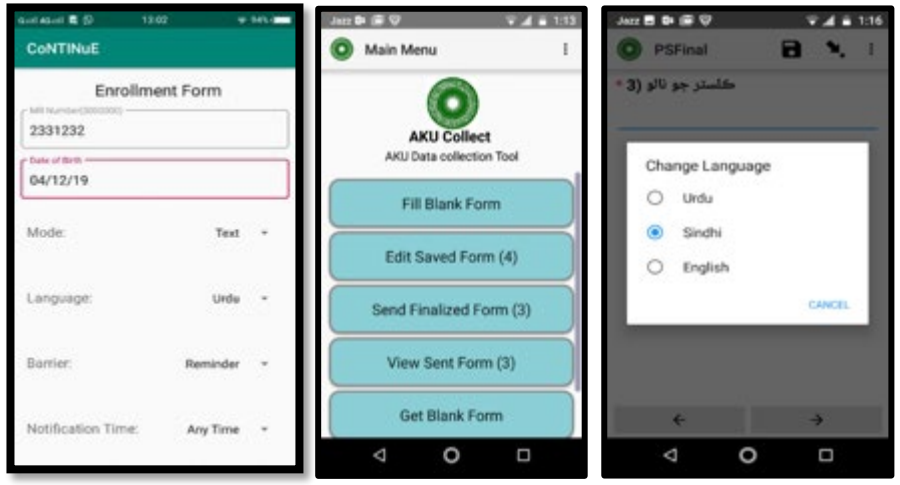
- Timely Charging of Mobile phones

Device Security

- Theft

Infrastructure and Applications





BARRIERS TO IMMUNIZATION

- Vaccine Hesitancy
- Lack of knowledge
- Lack of trust
- Adverse effects
- Religious and social barriers
- Forgetting due date

SMS

Text

Automated calls

Automated Text/Calls Message Categories

- **Registration/Reminder**
- **Educational**
- **Interactive**

"Your child [name] is due on [date] at [clinic] for vaccines."

Immunization protects your child against killer diseases such as polio, whooping cough, diphtheria, measles, pneumonia and tuberculosis.

Get your child vaccinated for 10 dangerous diseases: TB, Hepatitis B, Hepatitis C, measles, Pertusis, whooping cough, fever, Tetnus, pneumonia and polio. For more information on frequency of doses reply 1 and for importance of vaccination reply 2

Kazi et al JMIR 2018

Mobile phone based messages - Global data

9 USA and 3 LMIC (12 studies)

Type of Intervention	Details	Type of messages	Vaccines covered
SMS based	10	3 reminder messages only and 8 both reminder and educational messages	All childhood vaccinations, MMR, HPV, Influenza and MCV4 or TDAP
Emails	2	Both reminder and educational messages	Pneumococcal vaccine and HPV series

Increase in vaccine uptake and series completion – **1.18 (1.11-.125)**

For parents of children aged 18 and younger – **1.22 (1.15- 1.30)**

This study provided evidence that digital push technologies have a modest, positive impact on vaccine uptake and series

K.M. Atkinson et al. 2019

14 USA and 7 LMIC (21 studies)

Type of Intervention	Details	Type of messages	Vaccines covered
SMS based	18	14 studies one-way SMS reminders 1 on one-way SMS reminder plus monetary incentive , 1 on two-way SMS reminders	All childhood vaccinations, HPV, MMR, Influenza
SMS and Automated calls	3	combination of SMS and phone call reminders	HPV, MCV Tdap and Varicella, Influenza
Automated Call	1	Automated calls reminders	All childhood vaccinations

All types of messages as compared to control showed increase vaccine uptake - **1.23 (1.12-.136)**

Messages involving adolescents vaccine only - **2.05 (0.92 4.52)**

The review shows potential for mobile phone based interventions to improve immunization coverage for children and adolescents

Kazi et al personal communication

Systematic Review APPS for Vaccination Coverage

28 studies included

9: pre-post studies
6: cross sectional survey
4: Longitudinal
3: RCT
2: Non-RCT
2: Qualitative
1: Economic
1: Interrupted time series

1: Cost effectiveness outcomes

Usability and Acceptability outcomes

5: Usability
1:Acceptability
3:Both

Participant Perception studies outcomes

9=Perception of Parents
1=Teenagers
1=Mother and vaccination service provider

Primary Purpose of Apps

11: Education
8: Record Keeping
3: Reminders

25 Unique APPS

3: Immunize CA App
2: Morbiquiz
20: studies – different apps

The quality of the included studies was moderate to poor, with many aspects of the methodology being unclear

Uptake on Vaccination Outcomes

9: Vaccination uptake (9/28)
4: Showed significant Improvement in Vaccination coverage (Pre/post design)

1. 17% (*P*=.03)
2. 5% (*P*<.001),
3. 9.7% (*P*<.001), and
4. 17.9% (rural) and 16.4 (urban; *P*<.001 for both)

Vaccination Knowledge and Decision making outcomes

10: Impact of the vaccination apps on knowledge/learning

4: Showed statistically significant Improvements (*P*≤.05)
2:No Improvement
4:Improvement but not statistically significance

Caroline et at, 2020.

Effect of Mobile Phone Text Message Reminders on Uptake of Routine Immunization in Pakistan: A Randomized Controlled Clinical Trial

- Automated one way reminder messages were sent in the week child was due - 6,10, 14 weeks schedule
- The coverage was consistently higher at each visit
  - Both the ITT and PP analyses
  - Only the RI coverage scheduled at 6 weeks, according to PP analysis, was statistically significant

- 94% of the participants approached had a mobile phone(household), and out of them 99% were comfortable in using text messages

Table 3. Intention-to-treat and per protocol analyses of immunization rates at 6, 10, and 14 weeks.

Analysis and vaccination schedule	Intervention (n=150), n (%)	Control (n=150), n (%)	*P* value
Intention-to-treat			
Vaccination at 6 weeks	114 (76.0)	107 (71.3)	.36
Vaccination at 10 weeks	88 (58.7)	79 (52.7)	.30
Vaccination at 14 weeks	47 (31.3)	39 (26.0)	.31
Per protocol			
Vaccination at 6 weeks	86 (96)	102 (86.4)	.03
Vaccination at 10 weeks	67 (78)	77 (75.5)	.69
Vaccination at 14 weeks	36 (58)	39 (51)	.36

Kazi et al JMIR 2018

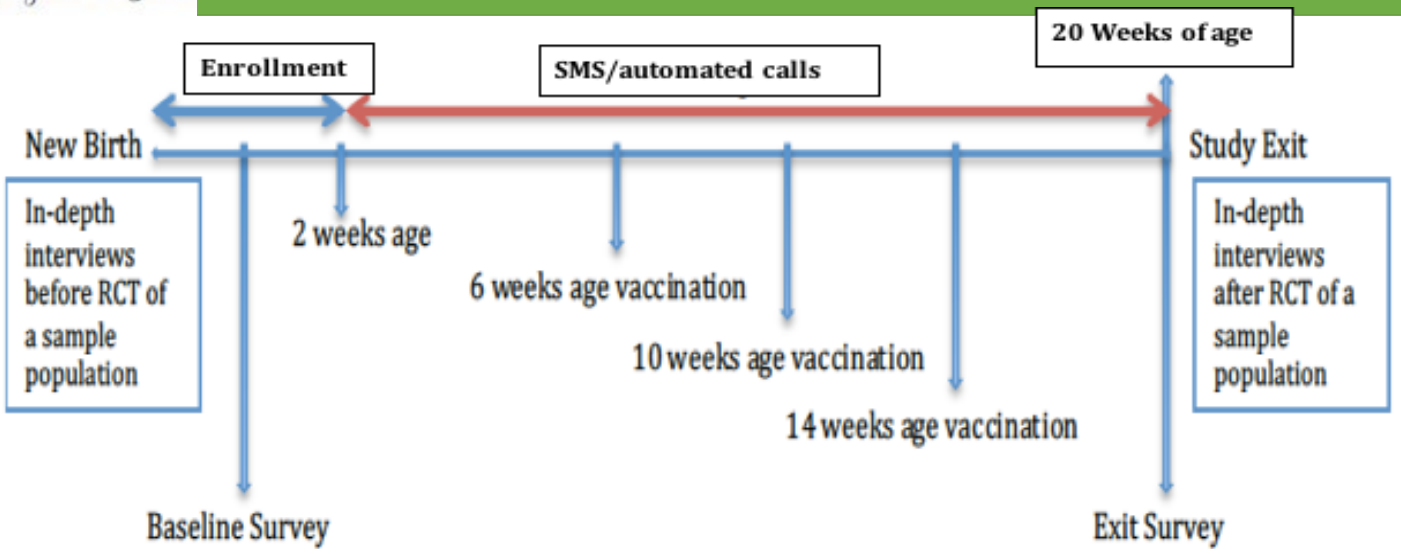
Key Findings

Automated simple one-way SMS reminders in local languages might be feasible for improving routine vaccination coverage

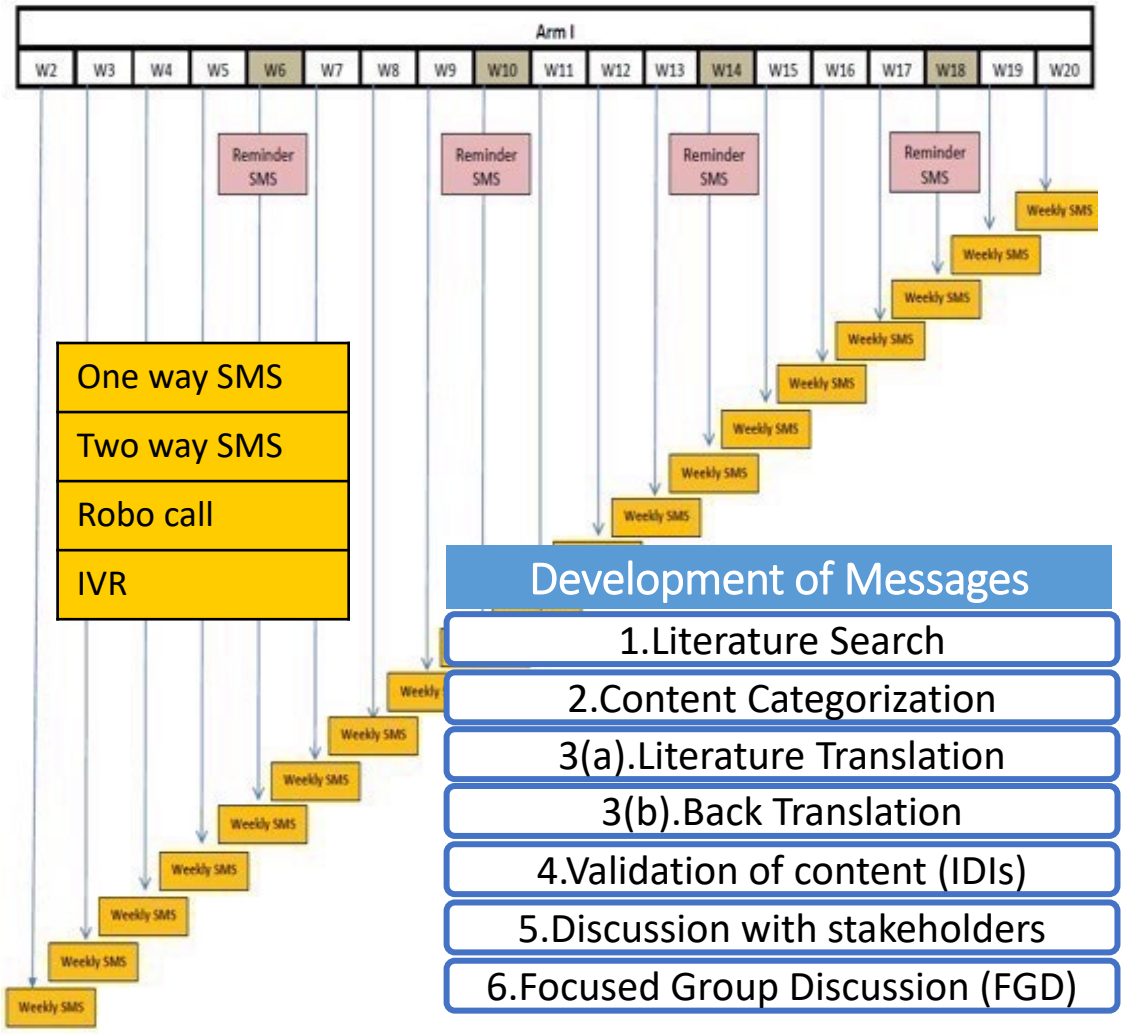
Whether SMS reminders alone alter parental attitudes and behavior needs to be evaluated by better-powered studies, comparing the different types and content of text messages

Information on perceptions, barriers, and text content according to the local settings that may affect SMS-based interventions should be assessed as well

To evaluate the role of mobile phone SMS messages and automated calls in improving vaccine coverage among children in urban and rural districts of Pakistan-Mixed method



INTERVENTION ARM	WEEKLY AUTOMATED SMS TEXT AND AUTOMATED CALLS FROM ENROLMENT TILL 20 WEEKS OF LIFE
ARM 1 (INTERVENTION)	Parents/caregivers will receive one way educational/ reminder/ proactive SMS messages related to routine immunization once a week till 20 weeks of age.
ARM 2 (INTERVENTION)	Parents/caregivers will receive two way (interactive) educational/ reminder/ proactive SMS messages related to routine immunization once a week till 20 weeks of age- parents will have the option to reply and receive more information related to immunization through text messages.
ARM 3 (INTERVENTION)	Parents/caregivers will receive one way educational/ reminder/ proactive automated phone call related to routine immunization once a week till 20 weeks of age.
ARM 4 (INTERVENTION)	Parents/caregivers will receive two way (interactive) educational/ reminder/ proactive automated phone call related to routine immunization once a week till 20 weeks of age- parents will have the option to reply and receive more information related to immunization through phone call.
CONTROL GROUP	NO INTERVENTION



- One way SMS
- Two way SMS
- Robo call
- IVR

Development of Messages

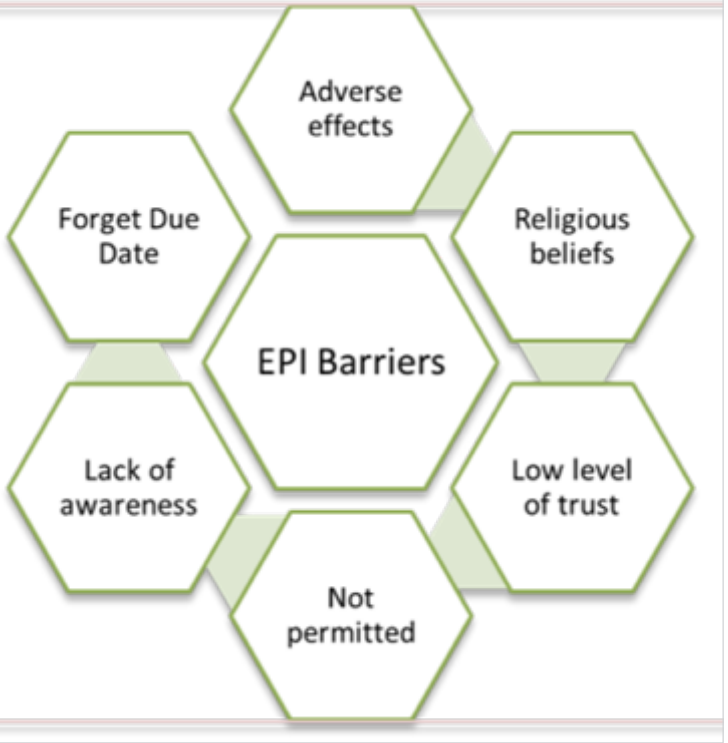
1. Literature Search
2. Content Categorization
3. (a). Literature Translation
   (b). Back Translation
4. Validation of content (IDIs)
5. Discussion with stakeholders
6. Focused Group Discussion (FGD)

General Education → Education Adverse → Education Religious → Reminders → Combo

English	Roman Urdu	Urdu	Roman Sindhi	Sindhi

Trial Findings

Barriers to Coverage



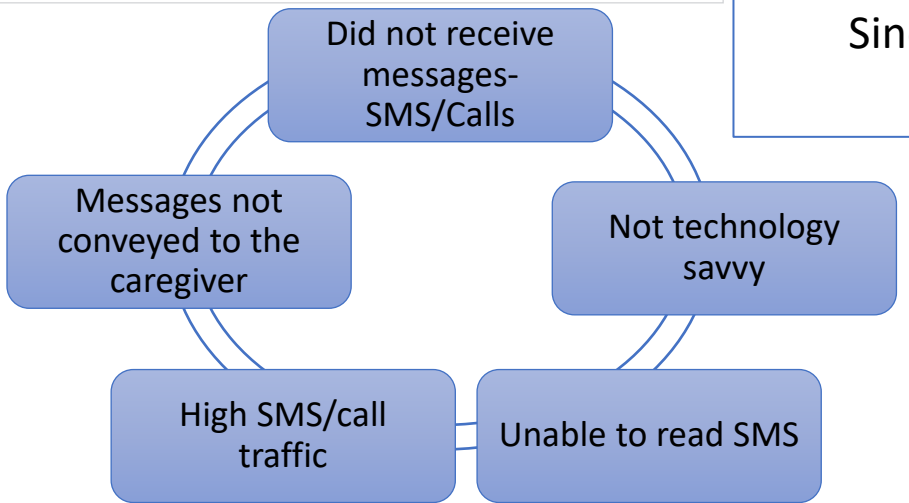
Messages

Preferred language for SMS

- Roman Urdu and plain Urdu for urban site
- Sindhi written in Sindhi script for rural site

Preferred language for automated calls

- Urdu for urban site and
- Sindhi for rural site



Post Trial

- 99% of the study participants had access to mobile phone
- 79.1% of the respondents used a simple function phone
- 50% of the mothers had no formal education and 54.5% of the fathers respectively owned a mobile phone
- In PP analysis, CRI at 14 weeks for Pentavalent 3 was 46% (142/309), 42% (96/227), 43% (182/419), 49% (156/321) respectively in arm 1,2,3 and 4 as compared with 39% (273/698) in the control group (P<0.05)
- **In the final PP model IVR risk ratio was 1.26 (p-Value 0.037) with (CI 1.01-1.52)**

Conclusion

- The **Intervention is useful** but too many families did not get the message
- Information regarding families' perceptions of vaccination and the daily life challenges helped to develop personalized mobile phone messages
- IVR based intervention personalized according to barriers for immunization should be scaled up

Perceptions and Barriers Related to Child Routine Immunization and COVID-19 Vaccine Hesitancy & Role of mHealth & Electronic Media, Social Media in Pakistan: Exploratory Study

Study Objectives

- To understand the **perceptions and barriers related to routine immunization** during COVID-19 pandemic
- To understand the **perceptions and barriers related to COVID-19 Vaccine** when it will be introduced separately or as a part of routine immunization
- To understand the **role of mHealth and social media in improving COVID-19 vaccination**

VACCINATION ACCEPTANCE RESEARCH NETWORK
SABIN VACCINE INSTITUTE

Study Design

- Qualitative Exploratory study design
- Purposive Sample techniques
- Semi-structured interviews guides

Study Participants

- **In-depth interviews:** caregivers of children under 1 year of age (N=60)
- **Focus-group discussions:** healthcare providers working in immunization (N=7 with 55 HCPs)

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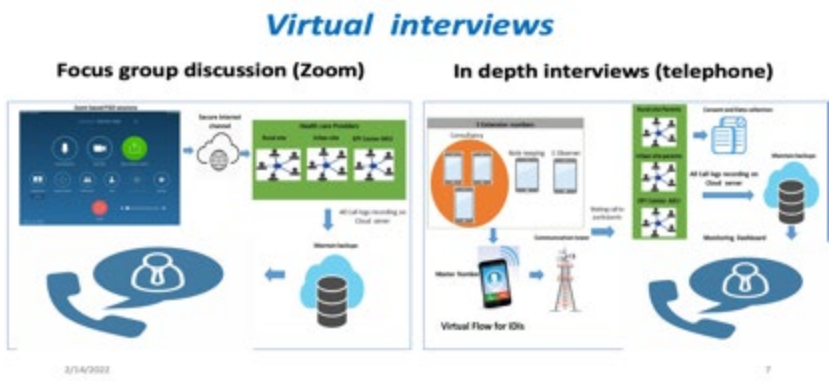


Study Analysis

- **Thematic analysis**
- Audio recordings were transcribed Urdu and Translated into English
- Formulation of free codes
- Merging codes into sub categories into themes

Yale University

1. **Electronic media was considered more reliable sources of information**

Caregivers /Parents

- *"I also get news and information about children's vaccines from TV. Programs should be aired regarding getting your child vaccinated on all channels. But as media is showing that COVID-19 cases are on a rise, they should give awareness, keep talk shows . Parent/caregiver from CHC)*

2. **Broad casting and news bulletin can create confusion**

Health Care Providers

- *"Media is like two faces of a coin...one side portrays COVID as something very dangerous and should be taken seriously. The other side of media makes fun and is suspicious and doubtful about the existence of COVID. (Healthcare providers from CHC, Karachi)*

3. **Fake videos, jokes about COVID-19, infertility, and death after COVID content on social media can contribute to vaccine apprehension**

Caregivers /Parents

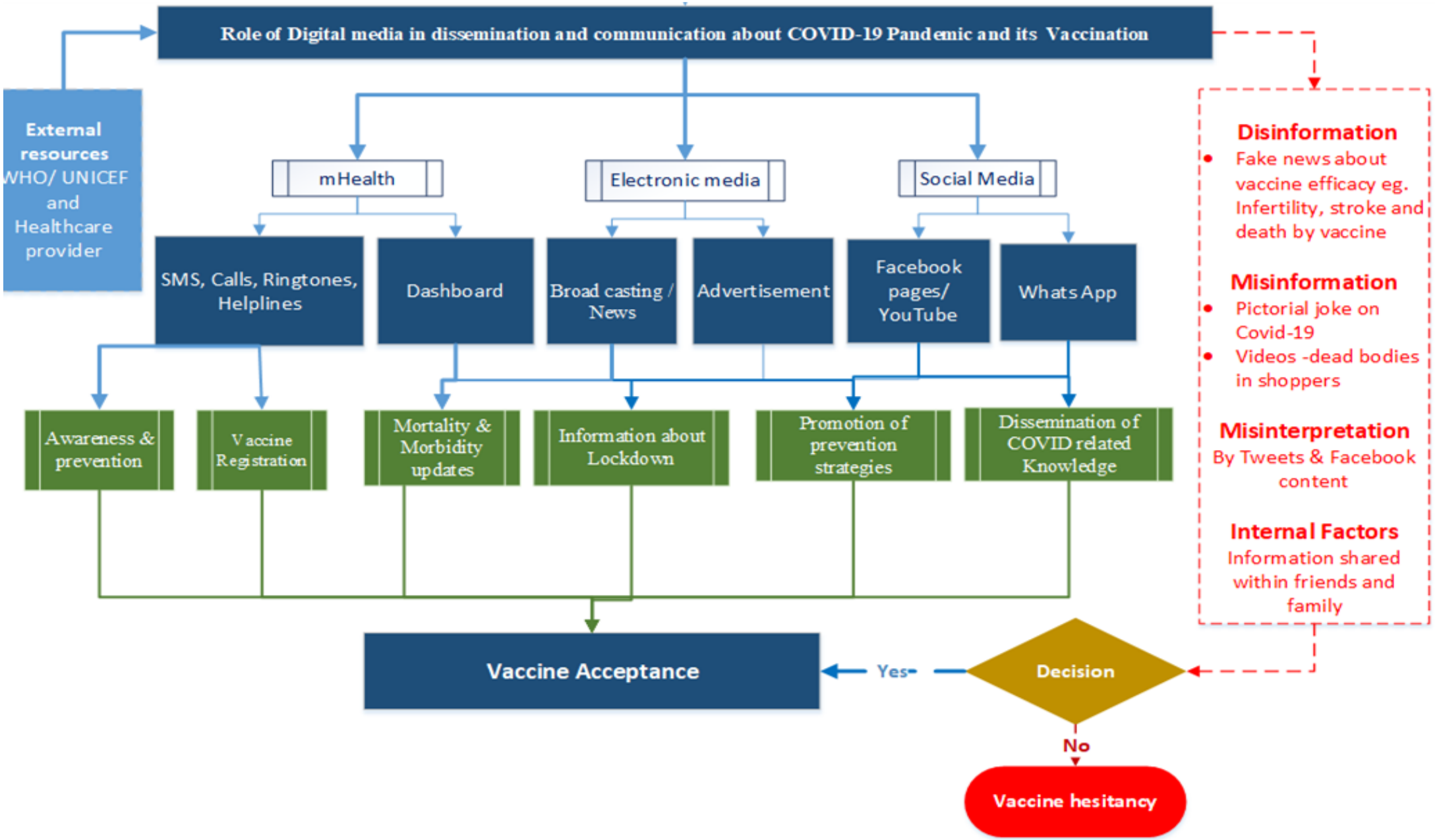
- *"They ask for your NIC number when u go to get your COVID test done. Your data will be sold to China or USA. There were such gossips making rounds too in twitter-like China and US will control the world (Parent/caregiver from CHC)*
- *"So women are not aware of what social media is." (Parent/caregiver from Matiari)*

4. **HCPs shared their concerns that sometimes people were not able to understand social political narratives and women had limited access of social media**

Health Care Providers

- *In the initial days of the pandemic, some people were following social media a lot regarding COVID. Even our PM Imran Khan tweeted as I can remember, don't need to worry about it, Its like a normal flu, but all need to stay at home and follow SOPs, he said that COVID is not serious. Many people didn't take the PM message seriously and started doubting the seriousness of the disease altogether(Healthcare providers from CHC, Karachi)*

Pathway of digital information and dissemination



Conclusion

- Personalized mobile phone messages (barrier based) interventions should be scaled up at the program level
- Need for well planned personalized and community-based knowledge translation interventions related to mobile phone and technology usage
- Automated calls or text helpline linked with electronic immunization registries and national immunization program having AI ML models incorporated

Digital future recommendation

- Design low-cost digital health interventions to identify & overcome barriers related to vaccine hesitancy and to reach zero dose children
- Invest in tailored training for local HCPs using digital health tools and interventions on how to create vaccine awareness and advocacy within rural and urban settings

Thank you

Study team and staff

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NIH Fogarty

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BILL & MELINDA GATES foundation

World Health Organization

UBC University Of British Columbia

Gavi The Vaccine Alliance

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