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University of Stirling

Division of Health Psychology

Professional Doctorate Health Psychology

**Cultural Adaptation of The 5C Scale Of Antecedents of
Vaccination To Assess Vaccination Behaviour In Pakistan.**

March 2024

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Abstract

This research study explored psychological factors that contribute to vaccine hesitancy among the Pakistani population, translating a standard vaccine hesitancy scale into Urdu language and utilizing it to examine its cultural adaptation and reception. The 5C scale is a validated tool to assess five psychological factors related to vaccination- Confidence, Complacency, Constraints, Calculation and Collective Responsibility.

A mixed-method approach was employed, which included population based quantitative surveys of the 5C Scale, Think-Aloud sessions to assess questionnaire usability and suitability, and focus group discussions to evaluate face validity and review of translated items within an expert group.

Age of questionnaire evaluation participants (n=26) ranged between 18 to 75 years; 61.5% were females, 38.5% were Government of Pakistan's employees and 26.9% were housewives. Descriptive results showed that 76.9% of participants received Covid-19 vaccine recently; 61.5% received it by choice and 15.4% reported they received the Covid-19 vaccine to avoid Government restrictions. 9 participants participated in the focus group due to their experience of the vaccination process in Pakistan.

Participants mean scores of 5C constructs align with their vaccination behaviour scores, it shows that the constructs effectively predict or explain participants' decisions to get vaccinated based on their attitudes and perceptions. Three of the five subscales in the 5C(PK) questionnaire, Confidence, Constraints, and Calculations, met the criterion for internal consistency (Cronbach's $\alpha \geq 0.7$) whereas, the Complacency and Collective Responsibility subscales did not meet this threshold in the population

sample. This suggests that the items within these sub-scales may not be consistently measuring the intended constructs. There may be variability in how participants interpret or respond to these items. This deviated from expectations in previous literature.

Correlation analysis of population data revealed the strength and direction of the linear relationships between five constructs of vaccination hesitancy using Pearson's correlation analysis in the sample. A strong negative correlation between Confidence and Complacency, aligning with previous research highlights the crucial role of Confidence in shaping vaccine attitudes.

Think-Aloud and qualitative study revealed challenges in comprehending questions, highlighting the importance of culturally sensitive survey design. Expert Focus group discussions indicated generally positive attitudes of vaccination acceptance in Pakistan during COVID-19, with suggestions for cultural adaptations to enhance the 5C Scale's relevance. Participants generally validated significance of 5C constructs Confidence, Complacency, Constraints, Calculation, and Collective Responsibility in shaping vaccination behaviour, emphasizing trust in the Pakistan healthcare system.

In conclusion, this study provides essential insights into the need for cultural adaptation of the 5C Scale for use in Pakistan. The study findings support the predictive capability of 5C constructs in determining vaccination behaviour among the Pakistani population. The knowledge gained opens avenues for further research and validation, potentially offering a tool to understand and address vaccine hesitancy in Pakistan in future.

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1 Introduction

Vaccinations are crucial in preventing and controlling infectious diseases, contributing significantly to public health outcomes worldwide (Greenwood, 2014). Vaccination has a pivotal role in human history, with its roots tracing back to "variolation" (The earliest method of inducing immunity against smallpox) in ancient China and India (Riedel, 2005). The development of modern vaccines in the 18th and 19th centuries, notably Edward Jenner's smallpox vaccine, marked a turning point in disease prevention (Riedel, 2005).

Vaccines have been developed for various diseases, from polio to hepatitis B, drastically reducing morbidity and mortality rates worldwide (Rodrigues & Plotkin, 2020). Vaccination provides individual protection and contributes to herd immunity (Kadkhoda, 2021). When a sufficiently high percentage of the population is immunised against a disease, the spread of that disease is significantly reduced, protecting vulnerable individuals who cannot be vaccinated for various reasons (Syal, 2020). Herd immunity is critical for preventing outbreaks and safeguarding public health, making vaccine uptake a collective responsibility (Kadkhoda, 2021).

The World Health Organization (WHO) is a key advocate for global vaccination efforts, emphasising vaccination as a fundamental strategy to prevent and control the transmission of various infectious diseases (World Health Organization, 2021). Their recommendations and guidelines, based on rigorous scientific research, highlight the vital role of vaccines in safeguarding individuals and communities (WHO, 2021). WHO conducts awareness campaigns on vaccination benefits and partners with governments, international organisations, and nonprofit organisations to ensure vaccine access and distribution globally (WHO, 2021).

1.1 Vaccination behaviour in Pakistan

In Pakistan, unique sociocultural, economic, and healthcare dynamics shape individuals' attitudes, beliefs, and practices related to vaccinations (Hussain et al., 2016). Vaccine hesitancy remains a challenge for vaccination behaviour in Pakistan. The Global Polio Eradication Initiative Programme (GPEI) started in 1988 in Pakistan (Hussain et al., 2016). Since then, it has continually faced accusations about vaccination quality and efficacy, ill-intents behind the vaccination program and refusal due to cultural/religious beliefs (Hussain et al., 2016). Similar perceptions are reported about COVID-19 vaccination (Chaudhary et al., 2021). The levels of vaccination hesitancy vary across time and place, depending on factors such as complacency and convenience (Chaudhary et al., 2021).

Understanding public perceptions and attitudes towards vaccination is essential in a diverse and populous country like Pakistan to design effective vaccination campaigns and public health strategies, especially now, as we build on experiences from the COVID-19 pandemic. This research seeks to identify and analyse cultural factors influencing vaccination decisions in Pakistan through a synthesis of literature and empirical studies.

1.2 Vaccine Hesitancy (VH)

Despite efforts, a significant number of individuals, including children and adults worldwide, remain unvaccinated, resulting in outbreaks of preventable diseases and unnecessary fatalities due to diseases like measles and pertussis worldwide (Omer et al., 2013). This issue, termed Vaccine Hesitancy (VH) is complex. , VH relates to delays in acceptance or refusal of vaccination despite the availability of vaccination services (MacDonald, 2015).

It extends beyond a mere choice not to vaccinate and encompasses various determinants influencing vaccination decisions. These determinants include vaccine accessibility, availability, affordability, and other socioeconomic and religious considerations. VH is complex and context-specific, varying by time, place and vaccine (MacDonald, 2015).

VH has recently gained widespread attention, specifically since the global landscape has been profoundly impacted by the Coronavirus 2019 (COVID-19) pandemic, witnessing a staggering 773,819,856 reported cases of infection and 7,010,568 deaths as of December 31, 2023, (Ivanković et al., 2023) While vaccination campaigns have been underway since December 2020 globally (Watson et al., 2022) and May 2021 in Pakistan (Unicef, 2021) the spectre of VH looms large.

VH, notably against COVID-19 vaccines, poses a major challenge to public health in Pakistan, fuelled by historical resistance to polio vaccination (Soofi et al., 2023) Influencing factors encompass safety concerns (Sheikh et al., 2023) efficacy doubts, fear of adverse effects, and distrust in vaccine-developing agencies (Perveen et al., 2022; Shahani et al., 2022) with economic disparities (Khan et al., 2021) amplifying hesitancy, especially among lower economic classes. Studies reveal a significant portion of the population expressing reluctance, citing concerns about side effects compounded by the spread of conspiracy theories among younger, less-educated, politically extreme individuals (Khan et al., 2021; Rasheed et al., 2022; Sheikh et al., 2023).

Despite initiating the Expanded Program of Immunization (EPI) in 1978, aiming to protect children from vaccine-preventable diseases, Pakistan struggles to meet global vaccination targets, ranking third globally for the most under-vaccinated children and one of two countries still reporting ongoing poliovirus cases (Soofi et al., 2023). A

consistently low immunization rate in Pakistan has been identified as a major contributor to 50% of neonatal deaths caused by vaccine-preventable diseases (Khattak et al., 2021). Challenges include hesitancy, religious misconceptions, and insufficient vaccination coverage (Khattak et al., 2021)

It underlines the pressing need for collaborative efforts among national and international health organisations and academia to delve into the origins of VH and devise strategies to mitigate its far-reaching impacts (Betsch et al., 2018; MacDonald, 2015). Understanding the factors influencing individuals' vaccination behaviour is essential for developing effective vaccination strategies and promoting higher vaccination rates within communities (Kadkhoda, 2021; Zampetakis & Melas, 2021).

1.2.1 Health Psychology Perspective on Vaccine Hesitancy

Vaccine hesitancy (VH), a nuanced health behaviour, is intricately linked to psychological factors, drawing insights from health psychology. The Health Belief Model (HBM) underscores that individuals are more likely to adopt vaccination if they perceive susceptibility to diseases, understand their severity, believe in the benefits, and encounter minimal barriers (Rosenstock, 1974). Applying this to hesitancy, concerns about vaccine safety, doubts about efficacy, and mistrust in vaccine-related information can deter acceptance (Champion & Skinner, 2008).

The Theory of Planned Behaviour (TPB) adds that attitudes, subjective norms, and perceived behavioural control shape health decisions, highlighting the impact of social influences and cultural factors on vaccination choices (Ajzen, 1991). Health psychology also delves into emotional and cognitive dimensions. Fear appeals, if perceived as excessive, can induce defensive reactions, while cognitive biases contribute to the prevalence of conspiracy theories (Witte & Allen, 2000).

Interventions addressing VH should thus tailor messages to individual perceptions, consider psychological barriers identified by models, and acknowledge emotional and cognitive influences (Betsch et al., 2015; Brewer et al., 2017). By applying health psychology principles, a comprehensive understanding emerges, paving the way for targeted strategies to promote vaccine acceptance.

Recognizing vaccination behaviour as a complex health phenomenon, this study utilizes a health psychology approach to explore the multifaceted determinants of VH. By anchoring our analysis in psychological theories, we aim to decipher the underlying cognitive, emotional, and social factors that contribute to individuals' vaccination behaviour. Through this lens, we endeavour to not only identify but also understand the psychological aspects influencing vaccination behaviour in the local context.

1.2.2 Measuring Vaccine Hesitancy

Establishing a widely accepted and rigorously validated measure is paramount in comprehending the intricacies of VH, laying the foundation for crafting effective interventions to bolster vaccine uptake (Betsch et al., 2015; Butler & MacDonald, 2015). The World Health Organization (WHO) encourages countries to track and report VH in their annual joint reporting form (JRF) to monitor trends and promptly identify concerns related to vaccines (Marti et al., 2017). However, in 2016, only approximately one-third of countries reported data evaluation, underscoring the necessity for a straightforward yet valid measure (Lane et al., 2018).

A widely agreed-upon measure is also essential to understand reasons for vaccination hesitancy for crafting effective interventions to enhance vaccine uptake (Betsch et al., 2015; Butler & MacDonald, 2015). The call for standardised and valid measures of VH is driven by the critical need to address gaps in public health research and intervention

strategies. Policymakers, healthcare practitioners, and researchers rely on these measures to gain accurate insights into the complex phenomenon of VH.

Valid measures ensure precise representation of intended constructs, providing an accurate understanding of individuals' attitudes and behaviours toward vaccination. Standardised measures, reflecting a consistent methodology across different populations and settings, enable comparability of data, allowing for the identification of patterns and trends in vaccine-related perceptions. Standardised measures not only ease future comparisons in research but also enhance data quality over time and facilitate the development of evidence-based interventions (Schmid et al., 2017).

In the context of this research exploring the antecedents of vaccination to assess vaccination behaviour in Pakistan, the need for standardised and valid measures becomes paramount. Culturally adapted measures ensure assessment tools align with the specific cultural nuances of the population under study (Alobwede et al., 2022). Standardisation is essential for cross-cultural comparisons and developing targeted interventions tailored to Pakistan's unique cultural context (Betsch et al., 2020; Hammoud et al., 2023). Ultimately, robust and validated measures are indispensable for informed decision-making, effective policy formulation, and successful public health interventions in addressing VH (Taherdoost, 2016) .

1.2.3 Different Vaccine Hesitancy Measures

To define and measure VH, various scales are available, including the Parent Attitudes about Childhood Vaccines survey (PACV)(Opel et al., 2011), the Vaccine Confidence Scale (VCS) (Gilkey et al., 2014), Global Vaccine Confidence Index (GVCI) (Larson et al., 2015), Vaccine Hesitancy Scale (VHS) (Shapiro et al., 2018) , Vaccine Acceptance

Scale (VAS) (Sarathchandra et al., 2018), and Vaccine Confidence Index (VCI) (Frew et al., 2019) . Some of these scales have been adapted and validated in Pakistan (Table1)

Table 1 Different Vaccine Hesitancy Measures, Their Determinants And Their Adaptation And Validation In Pakistan

Scale	Main Determinants	Validity/Reliability	Adapted and validated in Pakistan
GVCi <i>Global Vaccine Confidence Index</i> (Larson et al., 2015)	Vaccine Safety, Vaccine importance, Vaccine effectiveness, Vaccine compatibility with religious beliefs	Used in multiple countries, global monitoring tool	No Study Found
VHS Vaccine Hesitancy Scale (Shapiro et al., 2018)	Lack of confidence, risk due to vaccination	Valid and reliable, correlates with other measures of hesitancy	Development and validation of COVID-19 vaccine hesitancy scale for the general Pakistani population (Amin, 2022)
VAS Vaccine Acceptance Scale (Sarathchandra et al., 2018)	Perceived safety, effectiveness, necessity; acceptance of selection and scheduling; positive values and affect; perceived legitimacy of authorities	Strongly relates to theoretical concept of confidence, validation data available	No Study Found
VCI Vaccine Confidence Index (Frew et al., 2019)	Trust on vaccination providers, Vaccine importance confidence in vaccine	Scale in development, aims to track changes in parents' confidence	No Study Found
PACV <i>Parent Attitudes about Childhood Vaccines survey</i> (Opel et al., 2011)	Vaccination attitudes, beliefs about safety and effectiveness, behaviour	Good reliability, predicts under-immunization of children	No Study Found
VCS Vaccine Confidence Scale (Gilkey et al., 2014)	Vaccine Benefits, Vaccine harms, Vaccine trust	Low to acceptable internal consistency, predicts vaccine uptake and refusal	No Study Found
3C Scale of Vaccine Hesitancy (MacDonald, 2015)	Confidence, Convenience and Compliance)		Sheikh et al,(2023) used 3C Scale of vaccine hesitancy but study does not explain any adaptation and validation of scale in Urdu language
5C Scale of Vaccine Hesitancy (Betsch et al., 2018)	Confidence, Constraints, Complacency, Calculations, Collective Responsibility	Provides a comprehensive tool to monitor psychological antecedents of vaccination, facilitating diagnosis, intervention design and evaluation	No Study Found

Most measures stated in Table 1 predominantly focus on confidence-related aspects of VH. In contrast the 5C Scale offers a more comprehensive approach by assessing

five distinct psychological determinants: confidence, complacency, constraints, calculation, and collective responsibility (Betsch et al, 2020). This multidimensional framework provides a deeper understanding of individual mental representations, attitudes, and behavioural tendencies related to vaccination, drawing upon established theoretical models explaining health behaviour (Betsch et al., 2018; Larson et al., 2015).

Brewer's (2021) review underscores the importance of considering complacency, constraints/convenience, calculations, and collective responsibility as crucial predictors of vaccination intention and behaviour (Brewer et al., 2017). By encompassing these additional dimensions beyond mere confidence, the 5C Scale offers a more nuanced and holistic assessment of VH, capturing various psychological factors that influence individuals' vaccination decisions.

Moreover, empirical evidence suggests that these additional dimensions of VH play significant roles in shaping vaccination behaviour. Studies utilizing the 5C Scale have demonstrated its effectiveness in identifying key determinants of vaccine hesitancy and predicting vaccination behaviour outcomes (Schmid et al., 2017). Therefore, by incorporating a broader range of psychological determinants, the 5C Scale provides a more robust and comprehensive tool for understanding vaccine hesitancy, offering valuable insights that may not be captured by measures focusing solely on confidence-related aspects.

The 5C Scale has been developed in Germany and then translated and adopted in USA (English version), representing WEIRD societies (Western, Educated, Industrialised, Rich and Democratic) (Betsch et al., 2018). 5C has also been translated into Arabic by the block of ten Arab countries (Ghazy et al., 2021), Japan (Machida et al., 2021) and Nigeria (Adeyanju et al., 2022). This Scale has shown efficacy in various

cultural contexts globally. However, to ensure its applicability and relevance in a diverse and culturally distinct setting such as Pakistan, it is imperative to adapt and validate the Scale culturally.

The 5C scale is considered a validated and effective tool for assessing psychological antecedents of vaccination, outperforming other scales in explaining self-reported vaccination behaviour (Betsch et al. 2020). It is economically viable, allowing for efficient assessment in large-scale studies. While the 5C Scale has not been tested in a Pakistani context, the proposed research endeavour seeks to thoroughly explore the relevance and adaptation of the 5C Scale within the unique cultural context of Pakistan.

A careful evaluation of available measures underpinned the selection of the 5C Scale for this research. Considering its robust theoretical framework, broad applicability, and established effectiveness, the 5C Scale emerged as the most suitable choice for cultural adaptation to assess vaccination behaviour in the specific context of Pakistan. According to Betsch et al., (2018) a tool that can assist in designing campaigns and interventions for vaccination behaviour should also assess complacency, constraints, calculation, and collective responsibility along with confidence factor.

1.2.4 Psychological antecedents of vaccine hesitancy and the 5C scale

The 5C Scale captures a broad range of antecedents by systematically examining various psychological factors that influence individuals' attitudes and behaviours related to vaccination (Schmid et al., 2017) It provides a comprehensive understanding of the multifaceted nature of VH while simultaneously providing the possibility to assess it briefly and economically (Betsch et al., 2018)

The first construct of the 5C Scale is Confidence, which reflects trust in vaccine effectiveness, safety, the healthcare system, and policymakers. Lack of confidence is linked to negative vaccination attitudes and misinformation, fostering doubts about medicine and healthcare (Betsch et al., 2018).

5C Scale's second construct is Complacency, which arises when vaccine-preventable diseases are perceived as low risk, undermining the urgency for vaccination (Betsch et al., 2018). High complacency correlates with lower disease risk perception and a lack of social norms favouring vaccination, leading to a focus on immediate outcomes and risk-seeking behaviour by staying unvaccinated (Betsch et al., 2018).

The third construct, Constraints, represents barriers hindering the transition from vaccination intent to action, encompassing access and self-control limitations. Elevated constraint scores correlate with reduced perceived control, self-efficacy, and healthcare access, often compounded by time pressures and daily challenges (Betsch et al., 2018).

Calculation, the fourth construct of the 5C Scale, involves thoughtful risk-benefit analysis of infections and vaccination indicates a deliberative decision-making style (Betsch et al., 2018). Those scoring high in calculation exhibit risk aversion, perceiving higher vaccination risks, but this does not necessarily translate to better numeracy skills (Betsch et al., 2018).

The last construct is Collective Responsibility, which manifests as the willingness to protect others through personal vaccination for herd immunity. Conversely, it also involves a free-riding tendency when others are sufficiently vaccinated. High collective responsibility is positively correlated with collectivism, communal orientation, and empathy, promoting the collective benefit of vaccination (Betsch et al., 2018).

Adapting this Scale to specific cultural contexts is pivotal for its practical application and meaningful assessment of vaccination behaviour (Betsch et al., 2020). While the 5 constructs (Confidence, Constraints, Complacency, Calculations, and Collective Responsibility) may appear universal, the nuances of cultural contexts can introduce variables that influence individuals' perceptions and responses to vaccination. Successful adaptation goes beyond mere translation and involves meticulously aligning the questionnaire with the cultural beliefs, norms, and contextual factors prevalent in the target population.

This is essential to ensure the Scale's relevance and reliability in capturing the intricacies of vaccination behaviour specific to the cultural landscape of Pakistan (Betsch et al., 2020). Without this adaptation, certain cultural factors affecting vaccination decisions may be overlooked or inaccurately assessed (Larson et al., 2015).

1.2.5 Culture-Specific Adaptation of Vaccine Hesitancy Measure

Cultural adaptation involves modifying an instrument to be culturally appropriate, sensitive, and valid within a specific population (Betsch et al., 2020). Cultural adaptations enhance the tool's comprehensibility, acceptability, and effectiveness, enabling accurate assessment of the factors influencing vaccination behaviour in a given cultural milieu (Guruge et al., 2018).

In Pakistan, a nation with unique sociocultural and religious dynamics, understanding vaccination behaviour is crucial for successful public health interventions. With over 220 million people (Statistics, 2017) and a rich tapestry of cultures and traditions, Pakistan presents a useful context for studying vaccination behaviour and VH.

Vaccination programs in the country have progressed over the years, yet challenges related to misinformation, mistrust, and healthcare accessibility persist (Butt et al., 2020)

1.3 Literature Review

To inform the research on the 'Cultural adaptation of the 5C Scale in Pakistani population,' an exploration of relevant literature was conducted. The review investigated into critical aspects such as VH, vaccine acceptance, and the influence of cultural factors on vaccination in Pakistan. To ensure a methodical approach, the literature search was guided by specific questions framing the research inquiry, such as the psychological determinants of vaccination behaviour in Pakistan.

The specific objectives of the literature search included

- considering the cultural, social, and contextual factors that influence individuals' decisions regarding vaccination,
- exploring the applicability and relevance of the 5C constructs (Confidence, Complacency, Constraints, Calculations and Collective Responsibility) within the unique Pakistani context and
- understanding existing research gaps.

The search strategy for the literature review, as outlined in Table 2, was designed to systematically examine essential concepts relevant to the research inquiry. The primary search terms included "Cultural adaptation," "5C Scale," "Antecedents of Vaccination," and "Vaccination Behaviour in Pakistan." To develop a comprehensive search strategy, synonyms and related terms for each concept were identified. For psychological determinants, terms such as "factors influencing," "barriers and facilitators," "antecedents," and "determinants" were selected, while "immunisation" and "inoculation" were recognized as terms associated with vaccination.

The search strategy utilized logical operators (OR and AND) to combine relevant terms, adhering to key principles of systematic searching. A comprehensive search was conducted across academic databases such as PubMed, ScienceDirect, JSTOR, CINAHL, and PsycINFO, University of Stirling Library resources and Google Scholar. Studies published within the past 20 years were included, specifically those examining the determinants of vaccination behaviour in the Pakistani population.

Table 2 *Search Strategy of the Present Study*

Search Strategy	Execution
Defined Key Concepts <i>Identified main concepts to be searched.</i>	Psychological determinants, Vaccination, Pakistan, Cultural adaptation
Identified Synonyms	Cultural adaptation: cross-cultural adaptation, cultural modification, cultural validation. 5C Scale: Confidence, Constraints, Complacency, Calculations, Collective Responsibility Scale. Psychological determinants: factors influencing, barriers and facilitators, antecedents, determinants Vaccination: immunisation, inoculation Measuring vaccination behaviour: Assessing vaccination manners, determining vaccination conduct, calculating vaccination behaviour, evaluating vaccination actions
Developed Search Strings <i>Created search strings for each concept using identified terms</i>	Cultural adaptation: ("cultural adaptation" OR "cross-cultural adaptation" OR "cultural modification" OR "cultural validation"); 5C Scale: ("5C Scale" OR "Confidence Constraints Complacency Calculations Collective Responsibility Scale"); Psychological determinants: ("factors influencing" OR "barriers and facilitators" OR "antecedents" OR "determinants"); Vaccination: ("Vaccination" OR "immunisation" OR "inoculation") Measuring Vaccination behaviour in Pakistan: "Assessing vaccination manners" OR "determining vaccination conduct" OR calculating vaccination behaviour" OR" evaluating vaccination actions"
Combined Concepts <i>Used logical operators (e.g., AND) to combine search strings for comprehensive searches.</i>	("Cultural adaptation" AND "Psychological determinants" AND "Vaccination") ("Confidence Constraints Complacency Calculations Collective Responsibility" AND "Vaccination") ("measuring Vaccination behaviour" AND "Pakistan")
Applied Filters	Limit to articles published in the last 20 years. Excluded any studies not related to Pakistani population and their vaccination behaviour
Select Databases for Search	PubMed, PsycINFO, Scopus, Web of Science, etc.
Executed the Search	Execute searches in PubMed using the identified strings.
Reviewed Search Results	Assessed if articles address the research questions.

12 studies were identified (Table 3) that focused on vaccination, psychological determinants of vaccination behaviour, and the cultural adaptation of vaccination behaviour measures within the Pakistani population. Through a detailed analysis of these studies, we aimed to identify patterns, gaps, and cultural nuances influencing vaccination behaviour in Pakistan, as presented in peer-reviewed journals written in both English and Urdu. Exclusion criteria were applied to filter out sources not directly related to vaccination behaviour. Additionally, a snowball technique was used, reviewing the reference lists of the identified articles to discover further relevant sources. The RefWorks citation management tool was utilized to organize and format the references.

Table 3 Literature Review of Vaccine Hesitancy in Pakistani Population

Study ID	Study Title	Study Question	Study Design	Study Measure	Study Result	Study Limitations
1	COVID-19 vaccine hesitancy and social contact patterns in Pakistan: results from a national cross-sectional survey (Quaife et al., 2023)	To measure vaccination perceptions and social contacts in the context of COVID-19 control measures and vaccination programmes.	Cross-sectional survey with 3,658 respondents across five provinces in Pakistan between 31 May and 29 June 2021	perception and social contact survey	The perceived risk of COVID-19 in Pakistan is low in the general population; around half of the participants in this survey indicated they would get vaccinated if offered.	Vaccine impact studies which do not account for the correlation between social contacts and vaccine hesitancy may incorrectly estimate the impact of vaccines, for example, if unvaccinated people have more contacts.
2	Understanding COVID-19 vaccine hesitancy in Pakistan: The paradigm of confidence, convenience, and complacency (Sheikh et al., 2023)	Aimed to explore the determinants of vaccine hesitancy amongst the Pakistani population.	A cross-sectional study was carried out from November 2020 to March 2021	The google-forms-based questionnaire was disseminated amongst the general population	Campaigning and communication strategies to reaffirm confidence in the COVID-19 vaccine and educating the general population about the vaccine could lead to an increased perception of vaccine safety and effectiveness, thereby restoring confidence in the vaccine and decreasing vaccine hesitancy	Generalisability is difficult as social media is used, and the questionnaire was in the English language literacy rate is 60% Access to cell phones is more than 50% among youth, access to the Internet is only 15%
3	An Insight into the Acceptance and Hesitancy of COVID-19 Vaccines in Pakistan: A Cross-Sectional Survey (Rasheed et al., 2022)	This study highlights the opinion of the general population in Pakistan regarding the acceptance and hesitancy of COVID-19 vaccination.	A descriptive cross-sectional survey was conducted among Pakistanis from December 2021 to January 2022.	333 respondents completed the questionnaire	Most Pakistanis agreed that vaccines could manage the pandemic. The awareness and belief regarding the protective effects of vaccines contributed to vaccine acceptance. In contrast, vaccine hesitancy was due to the public's doubt about the vaccines' side effects and testing.	Small sample size Did not assess the results based on geographical representation of participants

4	COVID-19 Vaccine Hesitancy in Pakistan: A Mini Review of the Published Discourse (Khalid et al., 2022)	provides a summary of the main findings, features, limitations, and gaps in the current epidemiologic research on COVID-19 vaccine hesitancy (VH) in the Pakistani population.	Mini Literature Review Out of 323, 10 studies were selected. For this purpose, data on VH studies were extracted from January 2020 to October 2021	Mini Literature Review	An in-depth analysis of COVID-19 vaccine hesitancy in a representative sample of Pakistani population is crucial to measure the magnitude of VH as well to explore and identify the determinants of VH in Pakistani population. This is an important step toward informing intervention and policy design and to address this issue at its root cause.	
5	Development and validation of COVID-19 vaccine hesitancy scale for the general Pakistani population (Amin, 2022)	To develop and validate the COVID-19 Vaccine Hesitancy Scale through Exploratory Factor Analysis (EFA) and the resulting factors confirmed through Confirmatory Factor Analysis (CFA)	Survey questionnaire 311 participants	Google forms Manual questionnaire Vaccine Hesitancy Scale (VHS)	Overall, the COVID-19 Vaccine Hesitancy Scale developed for the population is a reliable and valid measure of COVID-19 vaccination hesitancy in Pakistani culture.	The measure is only relevant for COVID-19 vaccination; the study does not discuss the generalisability of the measure to assess vaccination hesitancy behaviour towards other vaccines.
6	Understanding the Role of Psychosocial Factors in Pakistani Parents' Hesitancy to Vaccinate Their Kids: The Mediating Role of Knowledge and Mistrust of Science about the COVID-19 Vaccine (Shahani et al., 2022b)	Developed a model with psychosocial factors serving as the predictor and mistrust in science and vaccine knowledge serving as the mediator.	Online Questionnaire 454 Parents completed	The parents' intentions regarding their children's vaccination with COVID-19 were	A correlation exists between risk perception and vaccination intentions, followed by parental self-efficacy. Vaccine knowledge mediated conspiracy beliefs, risk perceptions, and intentions fully but partially mediated parental self-efficacy. A mistrust of science-mediated conspiracy theories, while perceptions of risk and vaccine safety were partially mediated.	Public health messages based on the perspectives of individuals, families, and communities may be necessary as complementary treatments to improve risk perception and vaccination intentions. Customized messages are the most effective.

7	Vaccination-hesitancy and vaccination-inequality as challenges in Pakistan's COVID-19 response (Perveen et al., 2022)	Examines the factors that support and/or impede peoples' access and response towards COVID-19 vaccination in Pakistan.	The study uses a literature synthesis approach to examine and analyze the situation of the COVID-19 vaccination in Pakistan.	literature synthesis approach	The research results show "hesitancy" and "inequality" as two fundamental challenges that hinder the successful delivery of COVID-19 vaccination in Pakistan. People are reluctant to use vaccines due to conspiracy theories and religious beliefs. However, inequality, especially unequal accessibility to all social groups, appears to be a more significant barrier to getting a vaccine.	The area of this study is underdeveloped
8	Acceptance of COVID-19 vaccine in Pakistan among healthcare workers (Malik et al., 2021)	This study aimed at the level of acceptance of the COVID-19 vaccine and predictors of non-acceptance in Health Care Workers	cross-sectional study Out of 5,237 responses, 3,679 (70.2%) accepted	An English questionnaire was distributed through social media platforms and the administration of affiliate hospitals, along with snowball sampling for private hospitals	Most HCWs in Pakistan are willing to be vaccinated, and only a few participants would reject being vaccinated.	A snowball sampling method could have created a selection and social desirability bias among HCWs. Furthermore, English questionnaires can produce a selection bias towards English-literate HCWs, particularly those active on social media.
9	Assessment of attitude and hesitancy toward a vaccine against COVID-19 in a Pakistani population (Khan et al., 2021)	To assess the attitude and hesitancy toward a vaccine against COVID-19 in a Pakistani Population	A mixed methods survey 1033 participants' responses were analyzed in the final analysis	The questionnaire was prepared, hosted in Google Forms and circulated through electronic platforms and was also available to be done in in-person.	Most of the participants showed a positive attitude toward considering the COVID-19 vaccine. However, awareness with informed knowledge of efficacy, possible adverse effects and cost would be of added significant value to increase the honest response of the Pakistani population toward COVID-19 vaccination	participants have a preference to account for socially acceptable responses. This study did not outline any other key factors that could have influenced the willingness of participants to vaccinate Did not mention financial implications on the potential vaccine-eligible population. The issue of availability of vaccines. The study should have reported the confidence and preference of the study sample locally or internationally.

10	Factors affecting Pakistani young adults' intentions to uptake COVID-19 vaccination: An extension of the theory of planned behaviour (Ullah et al., 2021)	Young adults' intention to uptake the COVID-19 vaccine can be influenced by their fear of COVID-19 and perceived infectability of COVID-19.	A cross-sectional study 1034 Pakistani Social Media users	Incorporated fear of COVID-19 and perceived infectability with the theory of planned behaviour (TPB) to form an expanded TPB to analyze factors affecting Pakistani young adults' intentions to uptake the COVID-vaccine in Pakistan	Perceived infectability was positively related to the participants' intentions to uptake COVID-19 vaccination, and perceived behavioural control was the strongest mediator.	The study participants were recruited via the Internet and were younger than the mean age of the Pakistan population. The proportion of female participants was much higher than the proportion of men. The participants in the present study were younger and more educated than the average of the national Pakistani population. Therefore, the results cannot be generalized to older and lower-educated populations in Pakistan
11	Factors influencing COVID-19 vaccine hesitancy and acceptance among the Pakistani population (Chaudhary et al., 2021)	Examined the factors associated with acceptance of the COVID-19 vaccine compared to hesitance in the Pakistani population and explicitly focusing on the perceived beliefs, knowledge, concerns, risks, and safety perceptions relating to the COVID-19 vaccine.	A cross-sectional study 423 subjects of Pakistan Institute of Medical Sciences, Islamabad, Pakistan	A 27-item valid and reliable questionnaire was used to assess socio-demographic characteristics, acceptance, and hesitance toward the COVID-19 vaccine, perceived beliefs, knowledge, perceived concerns, risk, and safety of COVID-19 vaccines and its source of information.	The lack of knowledge, understanding, and perception of risk safety partly explains the low vaccine acceptance rate in the Pakistani population.	The participant sample was recruited from a single institution using a convenient sampling technique, creating inherent bias, thus limiting the generalizability of the findings.
12	Population preferences and attitudes towards COVID-19 vaccination: a cross-sectional study from Pakistan (Tahir et al., 2021)	Aimed to assess the Pakistani population's attitude and preferences towards the vaccine of the Coronavirus disease 2019 (COVID-19).	cross-sectional study 883 participants	An online self-administered questionnaire from 27 September 2020 to 11 October 2020	Most respondents (70.8%) will accept the COVID-19 vaccine if available, and 66.8% showed a positive attitude towards vaccination.	Online questionnaire distribution results cannot be generalized to the whole Pakistani nation.

The literature search aimed to provide an understanding of VH in Pakistan by compiling a diverse range of studies. Of the 12 identified studies, seven were cross-sectional surveys, two were literature reviews, and the remaining three were descriptive studies. These studies encompassed various sample populations, with eight focusing on the general population, two targeting healthcare professionals, and two specifically examining young adults.

In terms of key findings, the compiled literature highlighted several determinants of vaccination behaviour in Pakistan. The studies collectively emphasized the significant influence of vaccination perceptions, social contact patterns, and psychosocial factors such as misinformation, cultural beliefs, and healthcare accessibility on VH levels. Notably, Quaife et al.'s (2023) nationwide survey shed light on prevalent vaccination perceptions, while Sheikh et al. (2023) emphasized the role of confidence, convenience, and complacency in driving VH.

A research study work on developing a COVID-19 Vaccine Hesitancy Scale presented five determinants named, Belief in myths & conspiracy theories, Perceived effectiveness, Religiosity, Social and Media Influence, and Misinformation for assessing hesitancy levels in the Pakistani population (Amin, 2022). Additionally, Khalid et al.'s (2022) literature review synthesized existing epidemiologic research, identifying key features, limitations, and gaps in the discourse, thereby informing future research directions.

Lack of knowledge, understanding, and awareness contributed to low vaccine acceptance rates among the Pakistani population Chaudhary et al. (2021). Perveen et al. (2022) highlighted hesitancy and inequality as challenges in Pakistan's COVID-19 response. Hesitancy stemmed from conspiracy theories

and religious beliefs, while inequality in vaccine accessibility hindered successful vaccination efforts. Psychosocial factors such as risk perception, parental self-efficacy, and fear of COVID-19 influenced vaccination intentions. Tailored public health messages were recommended to address these factors (Ullah et al. (2021).

1.3.1 Critique of Literature

Despite the abundance of literature on vaccine hesitancy and associated psychological factors in Pakistan, a research gap exists regarding the specific culturally adapted Scale for assessing vaccination behaviour. Most studies focus on identifying the factors influencing intentions to vaccinate rather than vaccination behaviour itself (Bilal et al., 2021; Chaudhary et al., 2021b; Khattak et al., 2021; Shahani et al., 2022; Tahir et al., 2021).

While it is acknowledged that intentions can often serve as a reliable proxy for actual behaviour (Ajzen, 1991) , the choice of focusing on intentions rather than directly observing behaviour might introduce a potential gap or limitation in capturing the factors influencing the actual behaviour of individuals, which may be different from those influencing intentions(Ajzen & Fishbein, ; Ajzen, 1991). This approach assumes that stated intentions align with subsequent actions but does not provide direct evidence of the behaviour.

Considerations should be made regarding how intentions accurately reflect vaccination behaviour, recognising that intentions might not always translate into actions (Sheeran, 2002; Webb & Sheeran, 2006). This underscores the need for research that directly observes and measures vaccination behaviour. Our study aims to address this gap by culturally adapting the 5C Scale to provide a comprehensive and validated tool for assessing vaccination behaviour among the Pakistani population.

Studies by Bilal et al. (2021), Chaudhary et al. (2021b), Khattak et al. (2021), Shahani et al. (2022), and Tahir et al. (2021) primarily utilised social media for data collection, potentially limiting the generalizability of findings to diverse Pakistani populations. This methodological bias may result in an incomplete understanding of the complex factors influencing vaccination behaviour in real-world contexts and poses a challenge in developing targeted psychological and behavioural interventions for vaccination.

The reliance on online platforms may introduce biases, impacting the representativeness of the sampled population. This emphasises the need for more inclusive research methodologies to comprehensively understand vaccination behaviour across various demographic and socioeconomic groups in Pakistan. Our approach seeks to mitigate sampling bias by employing rigorous sampling techniques and ensuring diverse representation across demographics in our study population. Moreover, the culturally adapted 5C Scale will facilitate standardized measurement across diverse populations, enhancing the validity and reliability of our findings.

Research studies in Table 2 explained different factors influencing hesitancy, including misinformation, socioeconomic status, cultural beliefs, and healthcare

accessibility and their effect on vaccine behaviour of the population. There is also a need for research to understand the relationship between vaccine hesitancy and healthcare infrastructure in Pakistan. It is crucial to devise strategies to improve vaccine uptake nationwide in deprived areas with poor infrastructure.

In summary, our research endeavours to overcome the limitations identified in existing literature by introducing culturally adapted 5C scale to directly assess vaccination behaviour which will facilitate standardized measurement across diverse populations, enhancing the validity and reliability of research findings.

1.4 Aims and objectives

Given the critical need to enhance vaccination uptake and ensure public health preparedness, this multi-method study aims to develop an Urdu translation of the 5C Scale and gain insights into Pakistani people's views and thoughts about this measure which can be used to inform the future cultural adaptation of the 5C Scale to comprehensively evaluate the factors influencing vaccination behaviour among the Pakistani population in the post Covid-19 context. Tailoring the 5C Scale to Pakistan's cultural and social context can provide a tool to help policymakers, healthcare practitioners, and researchers design targeted interventions to improve vaccine acceptance and coverage.

This will contribute to a more nuanced understanding of the complexities surrounding vaccination behaviour and enable the development of strategies that resonate with the Pakistani context, fostering a healthier and more protected society.

Objectives

1. To translate the 5C Scale into Urdu
2. To understand the interpretations, thought processes and views of the general Pakistani population about the translated 5C scale items.
3. To explore the face validity, acceptability, and adequacy of the translated 5C scale in the Pakistani cultural context from the perspectives of the general public and expert stakeholders.
4. To make recommendations for adaptation of the 5C Scale based on empirical data gathered for objectives 2 and 3.

2 Methodology

This chapter describes the methods used in this study to culturally adapt and assess the face validity of the 5C(PK) scale for vaccine hesitancy in Pakistan. First, an overview of the methodological approach is provided, outlining both the recommended protocol by Betsch et al. (2020) for adapting and validating the scale in different contexts and the adaptations made to fit the scope of this study. Subsequently, the methods used in each step are discussed, detailing the steps followed and justifications for decisions made throughout the process.

2.1 Methodological Approach

The 5C scale, developed by Betsch, provides a comprehensive framework for understanding vaccine hesitancy. Betsch also recommends a systematic methodological process for the translation, adaptation, and validation of the 5C scale when used in other cultural contexts (Betsch et al., 2020). Below, I first outline the recommended approach and then describe how it was adapted and implemented in this study.

2.1.1 Recommended Approach by Betsch (2020)

The recommended process by Betsch is divided into two main phases (Figure 1):

Phase 1: Translation and Adaptation

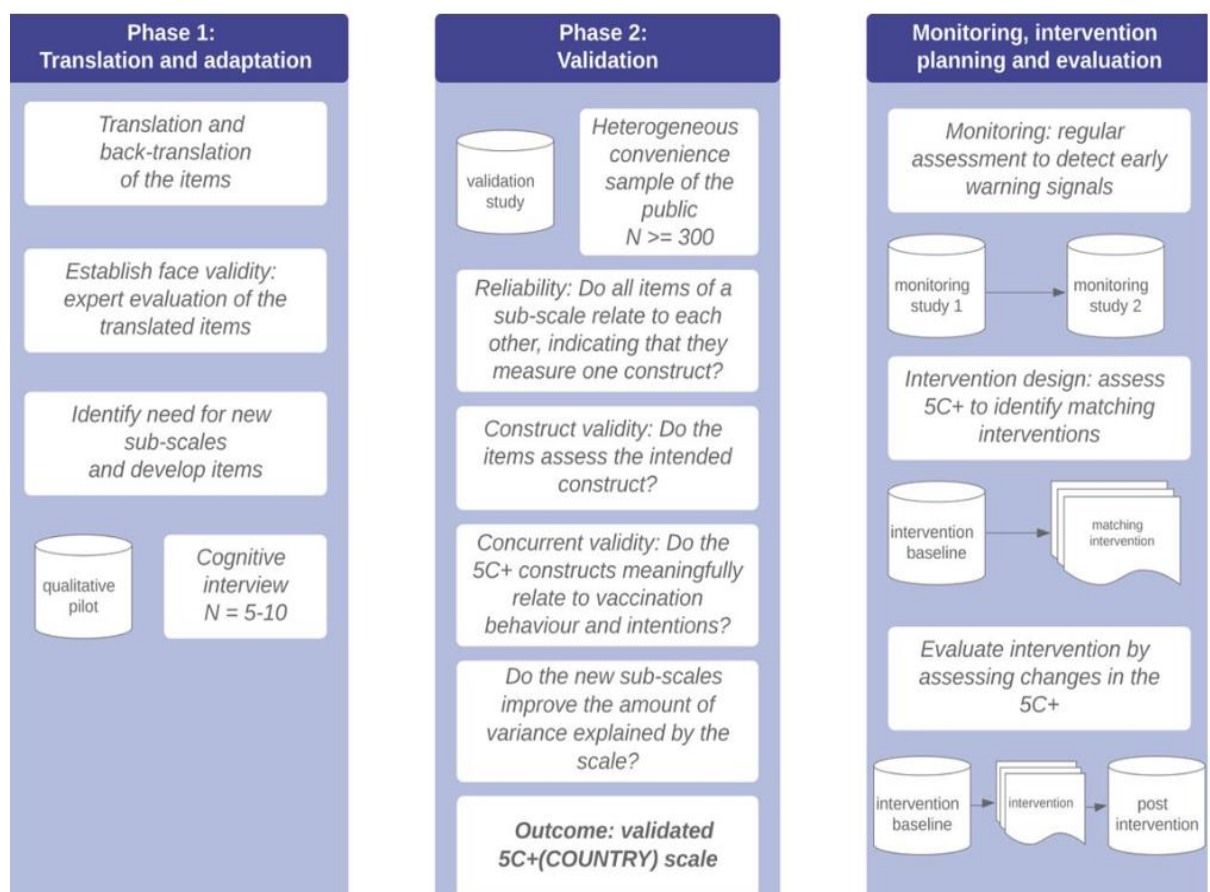
- **Translation and Back Translation:** Ensures the scale is linguistically appropriate for the new population.
- **Expert Evaluation:** Engages stakeholders and experts to evaluate the content for cultural and contextual relevance.

- **Pretest (Cognitive Interviews):** Assesses the comprehensibility of the scale in the target population using methods such as cognitive interviews.
- **Identification of New Antecedents:** Based on expert evaluation and pretest data, the potential need for additional context-specific items is considered.

Phase 2: Validation

- **Assessment of Reliability and Validity:** A large-scale study is conducted to assess internal consistency, construct validity, and concurrent validity of the translated scale.

Figure 1 Betsch Et Al. (2020)'S Methodology For Validating Psychological Measures, 5C Scale For Vaccine Hesitancy



2.1.2 Adaptation of Betsch's Protocol in the Current Study

In this study, we focused primarily on Phase 1 of Betsch (2020) protocols to ensure a thorough cultural adaptation and an initial assessment of the scale's reliability. We adapted Betsch's approach to accommodate the resource and time constraints, as well as the cultural context of Pakistan. Below is an outline of how the phases and steps were implemented and modified.

Phase 1: Translation and Adaptation

1. **Translation and Back Translation:** This step followed Betsch's protocol directly. The 5C scale was first translated into Urdu by bilingual experts, followed by a back-translation process to ensure accuracy and retain the original meaning of the items.
2. **Expert Evaluation:** Following Betsch's guidelines, a focus group was conducted with expert stakeholders, including psychologists, public health professionals, and vaccine hesitancy researchers. This evaluation ensured that the scale was culturally relevant and understandable. The expert group discussed the translation, phrasing, and appropriateness of the items in the Pakistani context, helping ensure face and content validity.
3. **Pretest (Cognitive Interviews):** Unlike Betsch's protocol, we employed the Think-Aloud technique for cognitive interviews. Participants were asked to verbalize their thoughts while completing the scale. Both **Concurrent** and **Retrospective** Think-Aloud methods were used to assess the comprehensibility of the items and identify potential difficulties. This method provided deeper insight into how participants interpreted the items, allowing us to refine the scale. The choice of Think-Aloud was

justified by its ability to capture real-time cognitive processing and improve face validity (Ericsson & Simon, 1993).

- **Assessment of Reliability:** In addition to the cognitive interviews, we conducted a preliminary **assessment of internal reliability** using the quantitative data collected. 26 Participants completed the translated scale, and the resulting quantitative data were used to calculate Cronbach's alpha to evaluate the internal consistency of the subscales. While this small-scale analysis does not provide full validation, it offers an initial indication of the scale's reliability in this context.

4. Review of 5C(PK) and Identification of New Antecedents

Identification: Based on feedback from the expert evaluation and cognitive interviews, we assessed the need for new antecedents. While no major new antecedents were added, minor adjustments were made to ensure the scale captured relevant cultural factors related to vaccine hesitancy.

By adapting the phase 1 of Betsch (2020) protocol, the current study provides a more detailed and culturally sensitive adaptation process, especially focusing on ensuring face validity and cultural appropriateness before full psychometric validation is conducted. Face validity involves evaluating whether the items on the scale appear to be appropriate and relevant to the respondents, a critical first step in any psychological measure validation process. In the context of this study, the goal was to ensure that the 5C scale, after translation and adaptation, appeared understandable and culturally

appropriate to the Pakistani population. Table 4 details the differences in Betsch protocols and current study.

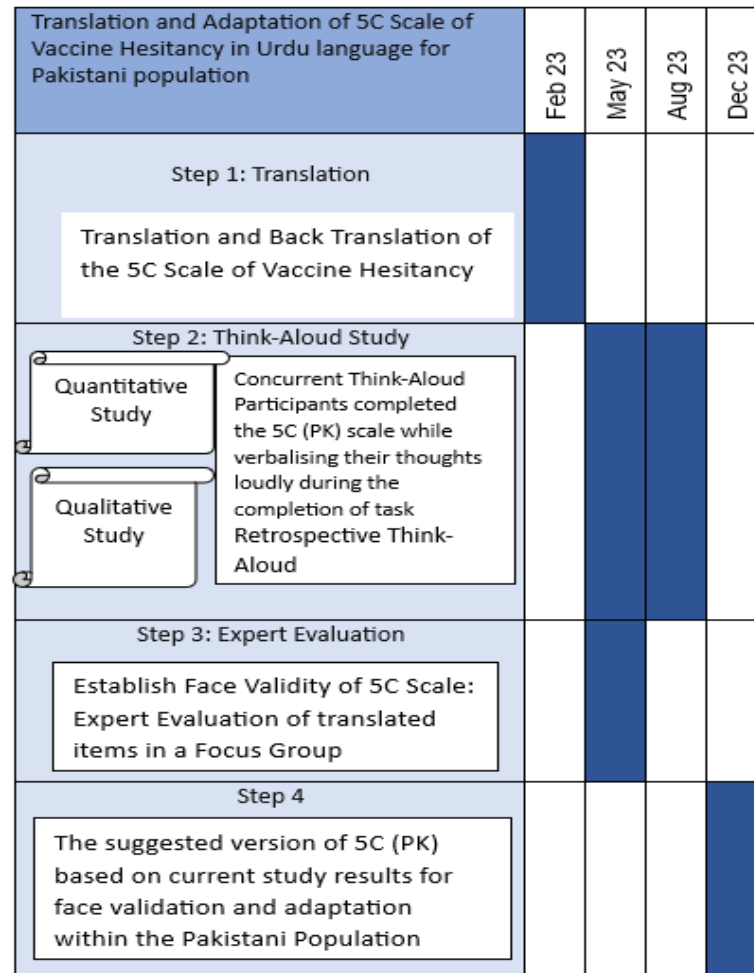
Table 4 Difference in Betsch (2020) and current study scope and methodology

Betsch's Protocol (Two Phases)	Current Study (One phase Four steps)	Extension of current study methodology/Justification
Study scope: 5C Translation, adaptation and validation	Study Scope: Translation, adaptation and face validity	
Phase 1: Translation and Adaptation Phase 1 involves formal translation of the 5C scale followed by back-translation to ensure linguistic accuracy.	Phase 1: Translation, adaptation and face validity Step 1: Translation Translation by bilingual experts and back-translation by separate bilinguals for cultural relevance.	Cultural adaptation was a priority in this phase to ensure language and context fit the Pakistani population.
Cognitive Interviews Pretest using cognitive interviews with 5–10 participants to assess comprehensibility.	Step 2: Think-Aloud Quantitative and Qualitative study Used Concurrent Think-Aloud (CTA) and Retrospective Think-Aloud (RTA) methods to assess face validity. 26 participants completed the 5C(PK) survey measure and we carried out reliability and validity analysis on their quantitative data.	This step corresponds to Step 3 of Phase 1 in Betsch's study but forms Phase 2 in the current study. Our use of the Think-Aloud method during cognitive interviews allowed for a more in-depth assessment of participants' interpretations of the scale's items, beyond what Betsch's original protocol recommended. This extension was vital for ensuring that the adapted scale was not only linguistically accurate but also resonated with the local population's understanding of vaccination behavior.
Expert Evaluation Experts evaluate the validity of translated items and consider if new antecedents are necessary for local context.	Step 3: Focus Group Conducted a focus group with expert stakeholders from public health, psychology, and healthcare to evaluate the scale.	This step 2 of Phase 1 in Betsch's study. However, in the current study, Think-Aloud study (phase 2) and the focus group (phase 3) were conducted concurrently. This approach allowed for the integration of public opinion into the focus group discussions while simultaneously incorporating expert insights, ensuring a more comprehensive evaluation (Betsch et al., 2018).
Identification of New Antecedents New antecedents are considered and identified based on expert evaluations if needed.	Step 4: Review of the scale Based on findings from the qualitative (Think-Aloud), quantitative, and expert focus group phases.	Betsch's protocols recommend identifying new antecedents through expert evaluation. In contrast, the current study conducted a comprehensive review, integrating findings from all prior phases to ensure the scale's cultural appropriateness before moving to the validation phase. While this is Step 3 of Phase 1 in Betsch's study, it serves as the final phase in the current study, reflecting a thorough pre-validation process.
Phase 2: Validation Phase 2 involves a full psychometric validation to assess internal consistency and construct validity of the scale.	During Step 2 (Think Aloud Study) 26 participants completed the 5C(PK) survey measure and we carried out reliability and validity analysis on their quantitative data. Betsch protocol suggests 300 participants to attain the scale psychometric validation.	Betsch(2020) recommends assessing reliability and validity on a large sample size; however, due to the scope and resource limitations of this study, we were only able to conduct a preliminary assessment of internal consistency. Participants completed the translated scale, and their resulting quantitative data were used to calculate Cronbach's alpha to evaluate the internal consistency of the subscales. While this small-scale analysis does not constitute full validation, it offers an initial indication of the scale's reliability in this context. This decision was justified by the need to create a culturally appropriate instrument that would later undergo a rigorous validation process.

2.2 Methods

There are 4 different steps of this multimethod study. Figure 2 details the different steps of current study and Gantt chart of their timeline

Figure 2 Different Steps of Current Study and its Timeline



Betsch's (2020) protocols primarily utilized expert evaluation for the translated scale and subsequent pretesting for scale validation. However, we expanded the methodology by incorporating a qualitative study to assess the face validity of 5C of Urdu translated scale by conducting a think-aloud study. This qualitative approach aimed to evaluate the suitability of the 5C(PK) constructs for the Pakistani population before progressing to the validation and adaptation phases of the 5C measure.

2.2.1 Step 1. Translation into Urdu Language of 5C Vaccine Hesitancy Scale

In multilingual societies like Pakistan, where Urdu is one of the official languages, it is crucial to have validated assessment tools in local languages to understand and address vaccine hesitancy effectively (Abd ElHafeez et al., 2021). This involved the "Translation" of the 5C Scale (Betsch et al., 2020) into Urdu language. The research team followed a systematic approach provided by The World Health Organization (WHO) guidelines to translate instruments of measurements (WHODAS 2.0,)2016) to ensure the accuracy and validity of the Urdu translation of the 5C construct questionnaire.

2.2.1.1 Translation Process

Translating a questionnaire from one language to another is a complex process that involves linguistic, cultural, and contextual considerations (Hall et al., 2018)). The Betsch, 2020 sample study protocol provides a step-by-step guidance for the process of translating and adapting the 5C scale to any country, language or cultural context.

2.2.1.2 Procedure

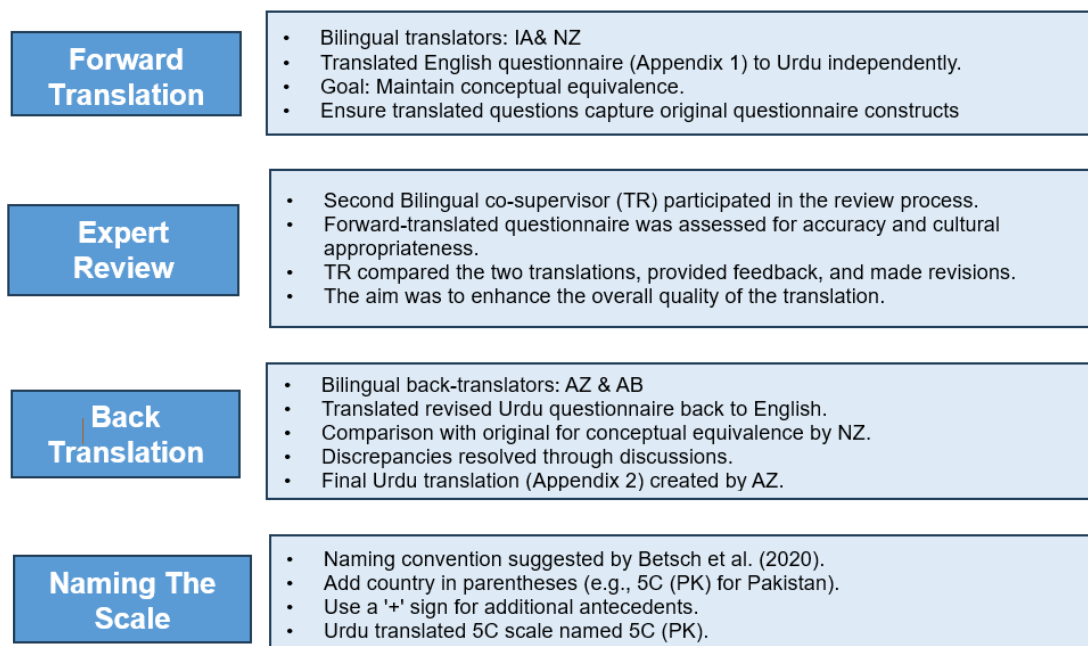
During Step 1 the 5C Scale of psychological antecedents of vaccine hesitancy was translated to identify whether the items capture the definitions of their respective antecedents (discussions, face validity). This step was performed by the principal researcher (NZ) and four bilingual translators (IA, TR, AZ, AB).

Principal researcher and Co-supervisor in Pakistan first translated the 5C Scale (Appendix 3) into Urdu (IA& NZ) (Appendix 4). After the translation was completed, we highlighted, discussed, and shared the difficulty of translating

different constructs of the Scale and their response choices for our individual translated versions with the second Bilingual co-supervisor (TR). TR compared the two translations and reconciled the discrepancies with mutual agreement. Then, the questionnaire was translated back into English by two additional Bilingual translators (AZ & AB).

After back translations, the first author (NZ) compared their translations with the original English version; discrepancies were resolved through discussions between the researchers, and the final version of the Urdu translation (Appendix 4) was created by the bilingual translator (AZ). In naming the translated Scale, it is suggested by (Betsch et al., 2020) to add the country in parentheses in which the translation took place so after translating in Urdu, 5C would be 5C(PK) and a '+' sign when an additional antecedent is added. (PK=Pakistan.). Figure 3 explains the different steps of 5C Scale translation in Urdu language.

Figure 3 Translation Process of 5C Scale of Vaccine Hesitancy in Urdu



2.2.2 Step2. Think-Aloud Study

This step involved completion of the 5C(PK) in a Think Aloud study with a sample of the Pakistani population to determine usability and suitability. The study was carried out in Attock, Pakistan. The primary reasons for selecting this region were practicality and resource limitations. I was fortunate to have a pre-existing network of colleagues who could assist in facilitating the research. They are affiliated or have connections and resources in various sectors in Attock, including education, healthcare, vaccination teams for rural areas, and with distinct members of civil society. This diverse composition ensured that the research was carried out efficiently and effectively in Pakistan. Moreover, Attock, is a unique border city connecting Khyber Pakhtunkhwa and Punjab provinces and serves as a microcosm reflecting Pakistan's sociocultural diversity (*District, pakistan. (2023). asia: Population statistics, charts, map and location. .)* . It encompasses both urban and rural communities, has nearly equal distribution of males and females, and a diverse population with varied ethnicities (*Statistics. (2017). brief on the census. .)*). Attock's strong family bonds, adherence to traditional values, and regional healthcare disparities make it a relevant microcosm for broader insights into vaccine hesitancy in Pakistan.

2.2.2.1 Think Aloud Study Design

This Step aimed to understand the interpretations, thought processes and views of the general Pakistani population in relation to the constructs represented in the translated 5C Scale. Participants were asked to report their thoughts once while completing the 5C (PK) (concurrently) and then again immediately after completing it (retrospectively).

Why a Think-Aloud Study?

Think-aloud is a qualitative research strategy that aims to explore an individual's thought processes and decision-making by asking them to verbalize their thoughts as they perform a task or solve a problem (Güss, 2018). Think-Aloud gives valuable information about the cognitive processes from reading a question to writing down the answer (Nielsen et al., 2002).

Thinking aloud as a scientific method has been used in many other disciplines, showing the relevance and applicability of this method such as cognition (Ben Malek et al., 2017), psychology and law (Santtila et al., 2004), for analysis of cultural perspective (Smagorinsky, 2001) and in health-related resource-use research (Janssen et al., 2023)

There are two main techniques in Think-Aloud method, *Concurrent think-aloud* and *Retrospective think-aloud* (Ericsson & Simon, 1998). Respondents can be instructed to report their thinking concurrently (i.e., while answering the question), or retrospectively (i.e., immediately after answering the question or finishing the questionnaire).

Several researchers in the think-aloud literature have not solely relied on *Concurrent* think-aloud transcripts for data gathering. As emphasized by Ericsson and Simon (1980), think-aloud data derived from working memory inherently tends to be incomplete, omitting various thought processes that are not verbally expressed due to their brief duration in working memory. Additionally, the quantity and quality of think-aloud utterances may vary.

In response to these challenges, the most adopted follow-up strategy is retrospective questioning. Despite involving the retrieval of information from long-term memory and being susceptible to biases introduced by researcher questioning, these issues are mitigated when combined with concurrent data from working memory (Nunan, 1992). When retrospective questioning is utilized solely to elucidate and enhance think-aloud results, it has the potential to provide a deeper understanding of the participant's thought processes.

TA (Think-Aloud) is an economical qualitative research technique which provides insight to real life experience with low numbers of participants, but it also runs the risk of telling the observer what they want to hear (social desirability bias), disruption of natural task performance, inconsistent verbalization, and the observer effect, where participants alter their behavior due to being observed (Ericsson & Simon, 1993; Nielsen et al., 2002). Additionally, it only captures conscious thoughts, missing subconscious processes (Nielsen et al., 2002).

To minimize these issues during this study we provided participants with an explanation and a brief demonstration of TA session to improve their understanding and verbalization. Participants were given an opportunity to ask questions about the TA study process if they were unclear. In the present study, a combination of the concurrent and retrospective methods of TA was used, a technique that has been suggested for producing optimal data quality (Janssen et al., 2023).

By limiting the study to the translation, adaptation, and face validity assessment phase, and by adding the think-aloud protocol, I ensured a thorough initial examination of the scale's appropriateness for the target population. This

approach aligns with best practices in cross-cultural validation studies, which often recommend an iterative process of adaptation and testing to achieve a valid and reliable measure (Hambleton et al., 2004).

2.2.2.2 Study Sample

Recruitment

Participants were recruited from one local community centre, two private schools, three public schools (parents of pupils) and two religious organisations in Attock City, Pakistan. Research activities organiser AZ (District Education officer, Attock District) acquired permission from different organisation heads to conduct research activities at their venue.

The principal researcher attended all organisations in person after attaining permission from their management/head to attend and recruit the participants. A convenience sampling model was used for participants' recruitment. The principal researcher attended each organisation for two consecutive days and distributed the study flyers (Appendix 5) with brief information about the study rationale and researcher contact information (In-person/email/by post) on day one. All participants agreed in person to participate when they met the principal researcher the next day in the respective organisation, completed demographic forms and provided their contact details to the principal researcher.

Inclusion criteria

Table 5 describes the inclusion and exclusion criteria for study participants. Participants completed a questionnaire (Demographic Details Form, Appendix 6) to assess their eligibility and collect demographic data, including age, gender, education, employment, income, and prior participation in vaccination studies..

Identifiable data were only accessed by the principal researcher for interview scheduling and were stored securely. Active research data were stored in password-protected folders on a Stirling University server (Sharepoint).

Table 5 Inclusion and Exclusion Criteria for Think Aloud Study

Inclusion criteria	Exclusion criteria
18 years or older	Under 18 years
Able to provide consent	Not able to provide consent
Able to read and write in the Urdu language.	Not able to comprehend the Urdu language
Able to comprehend Urdu if cannot read or write	

Invitation to the session

Participants meeting the inclusion criteria were invited to attend an individual (1:1) session (From May 2023 – July 2023) in their respective organisations where they received the information about the study. Participants recruited from schools were invited at Government High School No. 2 Attock Cantt, as school was observing exams. Their science lab was offered (by the school Principal) to use after 11:30 a.m. during weekdays. 12 Think Aloud interviews were held in Government High School No. 2 Attock Cantt, eight at Attock City Community Centre, and six at two different religious organisations in Attock City.

Participants

In total, 40 participants were approached and invited to participate; 10 declined, three did not meet the inclusion criteria as they needed help to read, and 27 were recruited to the study. One subsequently withdrew due to feeling uncomfortable while verbalising their thoughts. Twenty-six participants attended the research interview 10 males and 16 females, with a mean age of 56.64 years (s.d.= 17.53, range – 20-77) and completed the study.

Measures

The think-aloud procedure (Appendix 7) was conducted with 5C psychological antecedents of Vaccine Hesitancy, a 15-question scale (Urdu language translated). This step resulted in three types of data – quantitative data from participants' numerical responses to the 5C scale items: qualitative data from the concurrent think aloud technique and qualitative data from the retrospective think aloud interviews. Questions were presented as statements, for instance: "I am completely confident that vaccines are safe" (*Confidence*) and "Vaccination is a collective action to prevent the spread of diseases" (*Collective Responsibility*). Responses were made on a 7-point Likert scale from 'strongly disagree' to 'strongly agree'.

For the retrospective Think-Aloud study researcher asked participants a set of questions and recorded their responses for analysis.

Process of Think Aloud session

The Think Aloud study followed a process involving several distinct steps. The purpose was to gain insights into participants' cognitive processes while completing the 5C(PK) questionnaire. The following detailed explanation outlines the various steps involved:

1. Participant Welcome and Informed Consent

On the scheduled day, the main researcher, NZ, warmly welcomed participants to the designated venue at their scheduled time slot. Participants were provided with an information sheet (Appendix 8) outlining the study's details and were asked to provide written informed consent (Appendix 9) to ensure ethical considerations.

Principal researcher emphasized the creation of a comfortable and private environment, offering participants their choice of hot/cold beverages. Additionally, participants were reassured of their right to withdraw from the study at any time without needing to provide an explanation.

2. Introduction of Think Aloud Method

NZ delivered an explanation of the Think Aloud method, elucidating its purpose and the crucial role participants would play in articulating their thoughts during the study. Participants were oriented to the study's objectives, with an emphasis on the importance of verbalizing thoughts throughout the process.

3. Demonstration of Think Aloud (Concurrent study)

A practical demonstration of the Think Aloud method was conducted with the assistance of another member of the research team for each participant. NZ facilitated the demonstration, providing prompts and encouragement while the team member performed the task. This practical example lasted approximately 10 minutes, serving to familiarize participants with the approach.

4. Participant Preparation and Understanding

Participant was given an opportunity to seek clarification and ask questions regarding the study method. Once participant confirmed their understanding, other members of the research team exited the venue, leaving only the main researcher and participant. This same process was repeated for all participants.

5. *Think-Aloud Task Execution*

Participants commenced the main task, which involved completing the 5C(PK) questionnaire while articulating their thoughts on each construct. To detail the think-aloud procedure, participants instructions were adapted from Green and Gilhooly (1996) and French et al. (2007). A short script was provided to explain the study and task (Appendix 10) to ensure the smooth running of each think-aloud session. We took notes on comment sheets created for each session. As recommended (Van Someren et al., 1994), we created a list of questions to prompt continued vocalisation should a participant remain quiet. Observation notes were composed to address questions expected to be useful in the ordinary course of the session (Charters, 2003).

The researchers referred to a list of prompts and provided the *non-verbal neutral acknowledgement throughout the session to show that the researcher is attentive and listening, like "uhu uhu" or "Humm"*. Participants were only interrupted while thinking aloud if they fell silent for 10 seconds, so they were asked to 'keep talking'. Different *prompts were used (e.g., "What are you thinking now?" and "Tell me what is on your mind")*. *Aside from reminders, all interaction between participant and researcher was minimal*. As each participant proceeded through the 5C questionnaire, any area of text that they read twice or stumbled upon was noted by the researcher. Each participant was explicitly informed that the questionnaire was under scrutiny and not their knowledge and beliefs. Any queries were dealt with at this point, and misunderstandings were corrected.

This process took approximately 12-15 minutes per participant, ensuring ample time for thoughtful responses.

6. *Follow-up Interview (Retrospective Think-Aloud)*

After completing the 5C questionnaire, a short follow-up session was conducted to discuss any notes the researcher had made during the review. It formed the retrospective stage of the Think-Aloud sessions and was guided by a question guide (Appendix 11). During the retrospective stage, we directly asked each participant whether the questions made sense to them and whether they found any grammar, wording, or language strange.

The questions in this part of the session were more probing than the prompting questions asked during the concurrent stage, e.g. ., *"What are you thinking now?"* and *"Tell me what is on your mind."* Any questions arising from researcher notes taken during the concurrent stage such as misreading a question, stumbling over it, or experiencing confusion, were addressed. This process took approximately 15-20 minutes for each participant.

This step aimed to gain deeper insights into the cognitive processes and potential barriers encountered during the task. This step integrated both quantitative and qualitative approaches to provide a comprehensive evaluation of the scale's comprehensibility and cultural relevance.

2.2.2.3 Data Analysis of Think- Aloud Study

2.2.2.3.1 Quantitative Data Analysis

Participants completed the 5C questionnaire while verbalizing their thoughts, allowing for real-time insights into their interpretation of the items. The questionnaire responses were analysed quantitatively to generate descriptive statistics, assess the scale's reliability, and explore correlations among variables.

The main steps involved in this process are presented in Table 6.

Table 6 Quantitative Study Steps, Their description and Selection Rationale

Step	Description	Rationale
Sample Selection	Convenience sampling was utilized to recruit participants from various demographic backgrounds within Pakistan.	Although this method has its limitations, it was chosen due to time and resource constraints (Hammarberg et al., 2016)
Data Collection	Participants were asked to complete the 5C(PK) scale (Betsch et al., 2020). Data was collected in a controlled environment to reduce external influences and ensure consistency.	Ensured that the data collected was relevant and reliable, facilitating accurate assessment of the adapted scale.
Reliability Testing	Internal consistency of the scale was assessed using Cronbach's alpha.	This helped determine whether the items on the adapted scale were consistently measuring the same underlying construct (Tavakol & Dennick, 2011)
Correlation Analysis	Correlations between the 5C(PK) scale psychological constructs and participants vaccination behaviour were examined to assess criterion validity (Boateng et al., 2018)	This step was crucial to understand if the adapted scale's constructs were relevant to the Pakistani context.

Data cleaning was completed before the analysis to ensure the data's accuracy, reliability, and validity for meaningful analysis (Pallant, 2020).

Data Cleaning

Firstly, Descriptive analysis was run to determine the missing values, outliers in data using SPSS involves combining statistical techniques, graphical visualisation techniques, and domain knowledge.

Descriptive statistics (mean, standard deviation and frequencies) were employed in SPSS to analyse the central tendency and spread of the data (Pallant, 2020). Outliers were identified by comparing individual values to the mean or median, with Z-scores calculated for each construct of the 5C Scale. Z-scores exceeding

three were considered outliers, with positive scores indicating values above the mean and negative scores indicating values below the mean (Pallant, 2020)

Box Plots were created for each variable in SPSS to visualise the distribution and identify outliers. Boxplots help to visually identify the observations falling far outside the interquartile range, indicating potential outliers (Field, 2013). The Confidence construct of the 5c (Urdu translated) Scale observed one outlier,. The calculation variable observed one outlier and four true outliers.

Score interpretation of Urdu 5C Scale

For quantitative data analysis, all data was derived from Urdu-translated 5c Scale (Appendix 17) forms completed by participants. All data was imported to SPSS, and statistical analysis was conducted using IBM SPSS Statistics version 29.0 (241).

The mean scores of items for each subscale were computed, with higher mean score indicating stronger agreement of the corresponding subscale. Using the 5C scale does not lead to a total score, rather, allows for a valid assessment of the different psychological antecedents. For descriptive statistics, measures of central tendency, (mean and median), and variability, (standard deviation), were calculated to summarize the ordinal data from the 5c Scale (Pallant, 2020)

Reliability

Reliability Analysis was conducted to assess the internal consistency (correlation of subscale items with each other) of the Urdu 5C scale constructs using the reliability coefficient Cronbach's alpha. The analysis included all three items from each of five

constructs (Pallant, 2020). Before calculating Cronbach's alpha, reverse-coded items were calculated for analysis.

Correlation

Correlation analysis was conducted to explore the relationships between the ordinal construct variables of the Urdu 5c Scale. Given the nature of Likert scale ordinal data, Pearson correlation coefficient and the two-tailed significance levels 0.01 and 0.05 were used to assess the strength and direction of the relationship (Jamieson 2010).

2.2.2.3.2 Qualitative Data Analysis

In this study I selected a combination of qualitative methodologies to address different aspects of the research. Each method was chosen for its specific strengths and was employed to enhance the depth and relevance of the findings. To establish face and content validity of 5C(PK) translated items required a method that allows to assess people's understanding and interpretation of items, the cultural appropriateness of items, and their views on whether the items accurately represent all reasons/determinants of vaccination behaviour that are relevant to the Pakistani context and culture. I used Think-Aloud concurrent and retrospective methods to help elicit people's interpretations and thought processes at the time of responding to 5C questionnaire (to mimic real-world use of the scale) as well as elicit their consolidated views on cultural sensitivity and appropriateness of items once they had experience of the scale. This approach provides real-time insights into how respondents interpret and react to survey items (Ericsson & Simon, 1993), which is essential for identifying issues related to item clarity and relevance.

Content Analysis for Concurrent Data

For the concurrent study, where participants verbalize their thoughts while engaging with a survey, Content analysis was chosen to systematically code and quantify the verbal data collected (Krippendorff, 2018). Content analysis can handle large volumes of data and provides a systematic approach to identifying patterns (Krippendorff, 2018). It quantifies qualitative data, facilitating a structured evaluation of face validity by identifying recurring themes and patterns in participants' responses. Content analysis may overlook context and deeper meanings of data and can be basic if not applied rigorously (Krippendorff, 2018). Therefore, careful coding and categorization were necessary to ensure that the context and nuances of participants' feedback were adequately captured.

Each interview was transcribed verbatim. Transcripts were segmented into verbalisations relating to each of the 15 questions of the 5C vaccine hesitancy questionnaire. Segments were examined alongside the completed questionnaire and coded according to whether any difficulties or comments were articulated with the questions. Initially, coding categories were based on 5C constructs of vaccine hesitancy and then those of French et al. (2007) to find the usability of the 5C scale in the population. These categories were:

- No significant problems were identified.
- Text segments suggesting that participants re-read, misread, or significantly struggled in answering a question. Participants were indicating that they needed help understanding the question.
- Text segments suggesting that participants questioned sensibleness of question. The respondent identified a problem with how the question was worded.

- Text segments suggesting that participants answered different questions from the one asked or gave reasoning inconsistent with the answer given. Participants had problems comprehending/answering the questions but needed to be made aware of this.

In addition, one code from McCorry et al. (2013) was used:

- A participant expressed that question or response options did not apply to their circumstances.

All transcripts were coded by the principal researcher for TA data from 15 questionnaires; each question was coded (0,1) as to whether each type of problem was present. The total number of problems experienced by all participants was calculated for each question. The number of participants having problems (as opposed to no problems) with each question was also calculated, and the number of problems experienced by each participant was calculated.

These analyses helped identify the questions that caused difficulty or clarity issues for participants, and pinpoint areas for improvement to enhance clarity, comprehension, and overall quality of the survey instrument. Participants' views about the usability of the questionnaire (from spontaneous verbalisations) and rationales given for selecting strongly disagree, neutral, and strongly agree responses were coded under theme "questionnaire face validity" and sub themes "Content validity", "Layman Language", "Complex/confusing language" and "response options".

Thematic Analysis for Retrospective Data

For the retrospective think Aloud study, where participants reflect on their past experiences and attitudes toward vaccines, thematic analysis was employed to analyse the data. This method is well-suited for exploring complex and nuanced

experiences by identifying and analysing patterns within qualitative data (Braun & Clarke, 2006).

Thematic analysis provides rich, detailed data and is flexible and adaptable to various research questions (Braun & Clarke, 2006). It allows for an in-depth understanding of participants' perspectives on vaccine hesitancy, capturing subtle aspects of their historical attitudes and experiences. Thematic analysis can be subjective if not rigorously applied, and it requires a clear process for coding and theme development to ensure consistency and reliability (Braun & Clarke, 2006). Thus, a structured approach was employed to maintain rigor and reduce subjectivity.

The principal researcher carried out data analysis thematically through a multi-stage process following the deductive thematic analysis process (Clarke & Braun, 2017). The deductive approach is explicitly researcher-driven, allowing the researchers to analyse the data about their theoretical interest in the issues being investigated (Braun & Clarke, 2022). We adopt the six-phase process of thematic analysis (Dawadi, 2021), familiarising with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes and writing reports (Braun & Clarke, 2022). Using the deductive approach, we began the analysis with themes based on the 5C construct of vaccine hesitancy and interview guide questions (Appendix 11). Table 7 describes the layout of each stage of thematic analysis.

Table 7 Stages of Thematic Analysis and its implication to Current Study

Stages of Thematic Analysis	Implication in current study
Familiarization	In phase one, the principal researcher became familiar with the data through interviewing, transcribing, translating transcripts in English, reading and re-reading transcripts and performing the above content analyses.
Generating initial codes	In phase two, initial codes were developed to reflect exciting aspects of the most basic raw data segments. Example codes are: 'disease severity'; "
Searching for themes	In phase three, themes were identified from the codes, and, in an iterative process, themes were considered and reconsidered in relation to emerging themes and all relevant codes were collated into the themes.
Reviewing themes	These themes were refined in phase four. All coded extracts about each theme were reviewed; based on coherence within the theme, the themes were then reviewed in relation to the entire data set. This step determined whether the themes appropriately represented the data and searched for coding additional data within the themes
Defining and naming themes	. In phase 5, the themes were defined in terms of what aspects of data they represent, and a name was selected to capture the 'essence' of the theme.
Writing reports	In Phase 6, the analysis results were reported in 'Results'.

This iterative process began with an open, axial coding exercise of all the transcripts. The principal researcher was familiar with the data as they carried out verbatim transcription of Urdu and completed the English translation of the data.

After developing a coding framework for content analysis (for spontaneous verbalisation about questionnaire face validity) and thematic analysis (for verbalisation about 5c constructs of vaccine hesitancy during TA and in follow-up retrospective study), four randomly selected transcripts were independently coded by the independent reader (RS, peer) and principal researcher to ensure rigour, trustworthiness, and consistency.

Discrepancies were resolved through discussion and mutual agreement between main researcher (NZ) and peer (RS). After that, the principal researcher coded all transcripts using the coding framework and added emergent codes until no new codes emerged. Codes were then sorted, collated, and categorised into themes and subthemes. Codes were captured using NVivo 12 data analysis software, and a comprehensive codebook was developed.

2.2.3 Step 3 Focus Group

To establish cultural appropriateness and whether it accurately represents all determinants of vaccination prevalent in Pakistan I consulted a group of experts (public health experts, policy makers and organise a Focus group. Focus Group allows for in-depth exploration of social issues through participants' opinions, attitudes, and experiences (DeCarlo, 2018). It encourages interaction and diverse perspectives (DeCarlo, 2018; Nibbeling et al., 2021). However during Focus Group participants can conform to dominant views, and the possibility of some individuals dominating the discussion (Leung & Savithiri, 2009). Additionally, focus group findings may lack generalizability, and moderator bias can influence responses (Plummer-D'Amato, 2008). To mitigate these issues, we encouraged equal participation, ensured diverse sampling, followed a structured discussion guide, and employed skilled moderators to maintain neutrality (Leung & Savithiri, 2009)

2.2.3.1 Study Design

A focus group was organised to facilitate expert evaluation. These participants are purposively chosen, due to their interest or experience in relation to vaccination.

2.2.3.2 Study Sample

Recruitment

The research team sent an invitation email (Appendix 12) to different stakeholder organisations in District Attock, Pakistan, to nominate a colleague who fulfilled the inclusion criteria to contribute to the focus group and share their expert views about the psychological constructs of 5C(PK) questionnaire, along with an invitation letter (Appendix 13) and research study information sheet (Appendix

14). This included relevance of questionnaire in evaluating the vaccination behaviour in Pakistani population and their views on the language and layout of 5C Scale being understood by most people in Pakistan.

Inclusion Criteria

Table 8 Inclusion Criteria For Participation In The Focus Group

Inclusion criteria	Exclusion criteria
Over 18	Under 18 years
Provide consent to attend the focus group	Not able to provide consent
Read and write Urdu	Not able to comprehend the Urdu language
Self-identify as someone from the key stakeholder roles or nominated by a stakeholder organization.	No experience of vaccination, public interaction

Participants

9 participants participated in the focus group, Table 9 provides details of all departments invited and attended the focus group and their relevance to the vaccination process in Pakistan.

Table 9 Different Stakeholder Organisations And Their Role In Pakistan Vaccination Drive

Department	Their role in Pakistan Vaccination Drive	No. of experts attended Focus Group
District Health authorities	Responsible for organizing, and managing vaccination drives according to the national health policy implementation programme.	2
Government Healthcare professionals	Involved in administering vaccines and providing education about vaccination, facilitating, and distributing vaccine	1
District Education Department	Collaborate with the government and other stakeholders to support vaccination drives, community education, and outreach activities and provided their premises to facilitate vaccination.	3
Private hospitals healthcare professionals	Collaborate with the government and other stakeholders to support vaccination drives, community education, and outreach activities	1
Civil Society Community leaders and influencers	Advocate for vaccination, dispel myths, and encourage community participation in vaccination programs	2

Procedure Focus Group

Once the organization nominated the expert, an individual email was sent to them to explain the rationale/purpose of the study, the focus group information sheet

(Appendix 14), and consent form (Appendix 15) and to inform them about the time and venue of the focus group (Local community centre). The research moderator (AZ) organized the focus group in the local community centre, Attock, Pakistan, on 14/05/2023 for the current study.

Focus Group participants met for a one-and-a-half-hour session; the Focus Group was conducted in Urdu Language. A bilingual translator (AZ) led the session and requested all attendees to introduce themselves to the group. Principal researcher explained the study and shared the 5C questionnaire (both English and Urdu version) with the group. NZ explained the rationale of the “adaptation of 5C scale in the Pakistani population” to the group and elaborated on the structure and conduct of the Focus group (guide to conduct focus group) to the participants. The standardised focus group guide (Appendix 16) was drawn from Betsch et al. (2020).

Participants were requested to share their opinions about the 5C questionnaire and discuss whether its constructs are relevant to assessing Pakistani population vaccination behaviour and suggest additional items for the existing 5C Scale if necessary. For example, in case of thoughts that service delivery may pose a problem, the stakeholders may wish to add an item to assess the antecedent 'constraints' that pertain more explicitly to this aspect (e.g., 'How vaccines are offered keeps me from being vaccinated'). The Focus group was audio recorded, and notes were taken. Tea and snacks were offered to the group at the end of the discussion. NZ extended gratitude to thank the group for their participation.

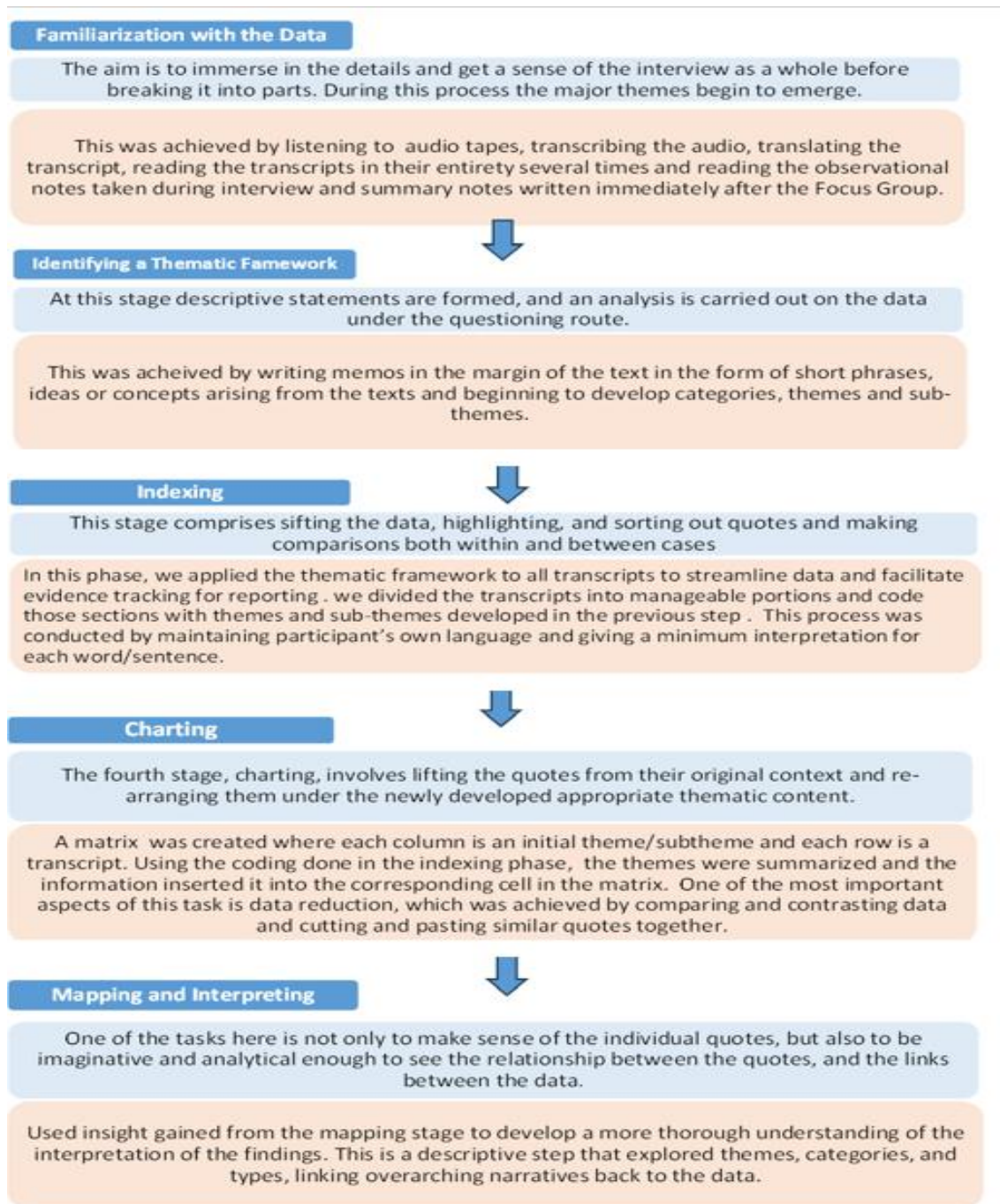
2.2.3.3 Data Analysis Focus Group

For analysing focus group data, framework analysis was chosen. This method offers a structured approach to organizing and interpreting data according to predefined themes and research questions (Ritchie et al., 2013). This method is particularly useful for managing complex data from group discussions and ensuring thorough exploration of key themes. Framework analysis can be less flexible and requires a pre-existing framework for analysis, which may limit its adaptability to emerging themes not initially anticipated (Ritchie & Spencer, 1994). Despite this, the structured approach was essential for aligning findings with practical implications and policy development.

Framework analysis involves several interconnected stages in the analysis process, (DeCarlo, 2018). The five steps of the framework approach are (1) familiarization, (2) identifying a thematic framework, (3) indexing, (4) charting, and (5) mapping and interpretation (Nibbeling et al., 2021), allowing the researcher to move forward and backward across the data until the final themes are developed. . Figure 4 explains the stages of Framework analysis and how these stages were implied for current focus group data analysis.

The audio recorded data of the focus group were transcribed verbatim in Urdu and then translated into English by Principal researcher, AI (Co-supervisor in Pakistan) cross-checked the audio recording – Urdu transcript – English translation to rule out errors and missing data. The data were coded and analysed with Nvivo12. (Dhakal, 2022). The focus group interview was 90 minutes long and field notes were taken immediately after the interview session to reflect the participants' emotions and non-verbal communications.

Figure 4 Framework analysis Key Stages and their implication for Current study



2.2.4 Step 4 Review of 5C(PK) and Identification of New Antecedents

In step 4, the findings of public sessions (Step 2) and expert panel sessions (Step 3) were used by the researcher to produce a draft version which modified and adapted the Urdu language version of the 5C measure to the Pakistani context. Table 10 describes all steps involved to complete this research.

Table 10 Different Methods involved to complete this research study

Steps	Methodology	Data Collection	Analysis Techniques	Participants	Purpose/Objective
1	Translation of 5C Scale to Urdu	Translation of 5C Questionnaire	-	Urdu-speaking participants who completed the 5C questionnaire	Adapting the 5C questionnaire to the Urdu language for cultural relevance and linguistic appropriateness in Pakistan
2	Quantitative Descriptive	5C Questionnaire (Urdu)	Descriptive Analysis, Reliability, Correlation	Participants who completed the Urdu-translated 5C questionnaire	Assessing the baseline characteristics and relationships among variables using quantitative measures
3	Qualitative Concurrent	Think-Aloud Sessions (Urdu)	Content Analysis	Participants engaging in concurrent thinking sessions with the Urdu-translated questionnaire	Exploring participants' immediate thoughts and insights during Urdu-translated questionnaire completion using qualitative analysis
4	Qualitative Retrospective	Think-Aloud Sessions (Urdu)	Thematic Analysis	Participants engaging in retrospective thinking sessions with the Urdu-translated questionnaire	Exploring participants' reflections on past experiences with the Urdu-translated 5C questionnaire using thematic analysis
5	Mixed-Methods Integration	Combining Quantitative and Qualitative Data	Integration of findings from both phases	Cross-analysis of quantitative and qualitative results from the Urdu-translated questionnaire	Synthesizing insights from both phases to provide a comprehensive understanding of the study phenomenon
6	Focus Group	Expert Evaluation	Qualitative Framework Analysis	Knowledgeable and experienced individuals	Obtaining expert opinions on the usability and suitability of the Urdu-translated 5C scale in the context of Pakistan, informing further refinement
7	Overall Findings	Study Integration of All Phases	Comprehensive Analysis	All study participants	Drawing conclusions and making recommendations based on the integrated findings from quantitative and qualitative phases

2.2.5 Integration of Findings

In tandem with mixed methods, our research methodology incorporated triangulation, employing diverse approaches to address our research question. Triangulation, as defined by (Heale & Forbes, 2013), involves utilizing multiple theories, data sources, methods, or investigators within the study of a single phenomenon. While mixed methods combine quantitative and qualitative approaches, triangulation describes how researchers use multiple approaches to extract necessary information and critically analyse findings, thereby enhancing validity and credibility.

Quantitative and qualitative results were combined to provide a comprehensive understanding of participants' experiences with the 5C questionnaire. Triangulation was used to compare and contrast findings from both steps, looking for convergent, divergent, or complementary patterns to enhance the overall interpretation of the research question.

2.2.6 Rationale and Reflection

I chose these qualitative methodologies for their distinct strengths in addressing the complexities of validating and culturally adapting measures of vaccine hesitancy. Thematic analysis was selected for its depth and flexibility in exploring participants' experiences, while content analysis was chosen for its systematic approach to handling large volumes of data. Framework analysis was employed for its structured approach to organizing and interpreting focus group data, which was crucial for aligning findings with policy and practice-related outcomes. These choices were made to ensure a comprehensive exploration of vaccine hesitancy, capturing both immediate perceptions and historical attitudes while providing structured insights into group dynamics and policy implications.

This methodological choice aligns with the need to capture and understand culturally specific manifestations of psychological constructs, supporting the validity and relevance of measures across diverse global settings (Braun & Clarke, 2006). These choices were made to ensure a comprehensive exploration of vaccine hesitancy, capturing both immediate perceptions and historical attitudes while providing structured insights into group dynamics and policy implications.

2.2.7 Ethical Considerations

The study acquired Ethics Approval (Appendix 1) from the University of Stirling General University Ethics Panel, with application approval number 10684 Dated. 24/04/2023 for steps 2 and 3, which involve data collection from people in Pakistan.

A thorough risk assessment (Appendix 2) for Step 2 and Step 3 research activities was conducted to identify potential hazards and establish measures to mitigate risks for the research activities in the study. Various aspects, including travel, driving, physical violence, excessive working hours, emergency arrangements, and participant welfare, were carefully evaluated. Appropriate controls were already in place, and additional controls were proposed to further reduce risks. The resulting residual risks were generally deemed to be low. The primary objective of the risk assessment was to guarantee the safety and well-being of both the researcher and the participants.

2.2.7.1 Data Storage

The principal researcher, NZ, recorded the Think-Aloud sessions and Focus group, and all recordings were stored in encrypted storage on the University of Stirling One-Drive. The demographic forms and Urdu-translated 5C scale completed by

participants remained with NZ only and were stored in locked bags for travelling purposes.

Following the principles of Good Clinical Practice, all active research data was stored in password-protected folders on the University of Stirling Server (Sharepoint). The data was only accessible to the researcher and her supervisors at the University of Stirling (VS and PA). The data are stored in DataSTORRE for a minimum of 10 years. Any personal data (names, contact details) is stored in password-protected files on Sharepoint, is accessible to the researcher (NZ), and will be destroyed once the study is completed. All audio recordings were stored in password-protected folders on Sharepoint and destroyed once transcribed.

2.2.7.2 Informed Consent

Participants were fully informed about the nature of the study, the purpose of the study, how the findings will be used, and any benefits of the study through the study flyer and information sheet (Appendix 5, Appendix 8). Informed consent was obtained from participants for both quantitative and qualitative components, and for focus group study.

Right to withdraw

Taking part in the study was voluntary. If participants would prefer not to participate, they did not have to give a reason. If participants first took part but later changed their mind, they could withdraw at any time (up to the time analysis was completed).

Do no harm

Harm can be both physical and/or psychological and, therefore, can be in the form of stress, pain, anxiety, diminishing self-esteem or an invasion of privacy. We did not

anticipate any significant ethical issues during qualitative interviews. However, we acknowledge that asking people about vaccination might remind them of any unpleasant memories. If a participant becomes distressed or upset during the interview, the principal interviewer immediately followed the procedure below:

- The recording stopped immediately, and participant were asked if they want to take a break/end the interview/continue talking.
- when participant decided to take a break and continue with the interview, researcher confirmed with participants that they are comfortable continuing and reassured them that there is no penalty for withdrawing.
- when participants wished to continue but remain distressed, the interviewer made decisions to end the interview for wellbeing of participants. Interviewer also provided participant with an opportunity to talk and ensure that they were not visibly distressed when leaving the interview.
- The interviewer also offered to provide participant with a list of local contacts (e.g., counselling services, psychology services).

Confidentiality

To safeguard confidentiality, we did not collect identifiable information in the Think-Aloud session questionnaires. Only the main researcher, NZ, accessed identifiable data solely for interview scheduling. This data was stored separately, linked only by a unique identifier, and will not use in reports or publications. Following Good Clinical Practice principles, all survey, contact, and interview data were securely stored in an encrypted, password-protected Excel sheet on the University of Stirling Server and will be deleted after study completion.

Anonymity

Only study-relevant information was used by main researcher, NZ. All data were securely stored on The University of Stirling server for ten years, accessible through encrypted password-protected files. Access is restricted to NZ for scientific data analysis and interpretation.

3Results/Discussion

3.1 *Think Aloud Study Results*

3.1.1 Quantitative Results

3.1.1.1 Descriptive Statistics

We recruited 26 participants (16 female, 10 male) with convenience sampling. Table 11 describes the characteristics of the study participants. Age ranged between 18 to 75 years; with mean age of 56.4 year. More than half were females, one third were Government of Pakistan's employees and a quarter were housewives.

One-third were earning Rs 100.000/month (Approximately £286/month) and more than one third were educated to undergraduate level, and a few only had early secondary school education. Most reported that they have received vaccine recently (Covid-19)- two thirds of them received it with their free will whereas some reported that they received the vaccination to avoid government restrictions (not able to receive salary, suspension of mobile phone account, or not able to travel on motorways). A quarter did not receive any vaccination at all. None had any prior experience of completing questionnaires related to vaccination behaviour.

Table 11 Sociodemographic Characteristics of Participants

Participants' Characteristic		N	%
Gender			
	Female	16	61.5
	Male	10	38.5
Educational level			
	Metric/GCSE	3	11.5
	Diploma/some college	4	15.4
	University Graduation	10	38.5
	MSC	6	23.1
	PHD	1	3.8
	Others	2	7.7
Employment			
	Govt. Employee	10	38.5
	Non-Govt Employee	4	15.4
	Businessman/woman	3	11.5
	Unemployed	1	3.8
	Student	1	3.8
	Household	7	26.9
Age			
	(18-24)	3	11.5
	(25-35)	4	15.4
	(36-45)	8	30.8
	(46-55)	5	19.2
	(56 – 75)	6	23.1
	(75 +)	0	
Income			
	Under Rs 100,000/m	15	33.3
	100,000 – 250,000/m	9	30.8
	More than 250,000/m	1	7.7
	Not Applicable	1	3.8
Any Vaccination received ^a			
	YES, (with own will)	16	61.5
	NO, (with own will)	6	23.1
	YES (To avoid government	4	15.4
restrictions)			
<i>Most answers were based on COVID-19 vaccination experience</i>			

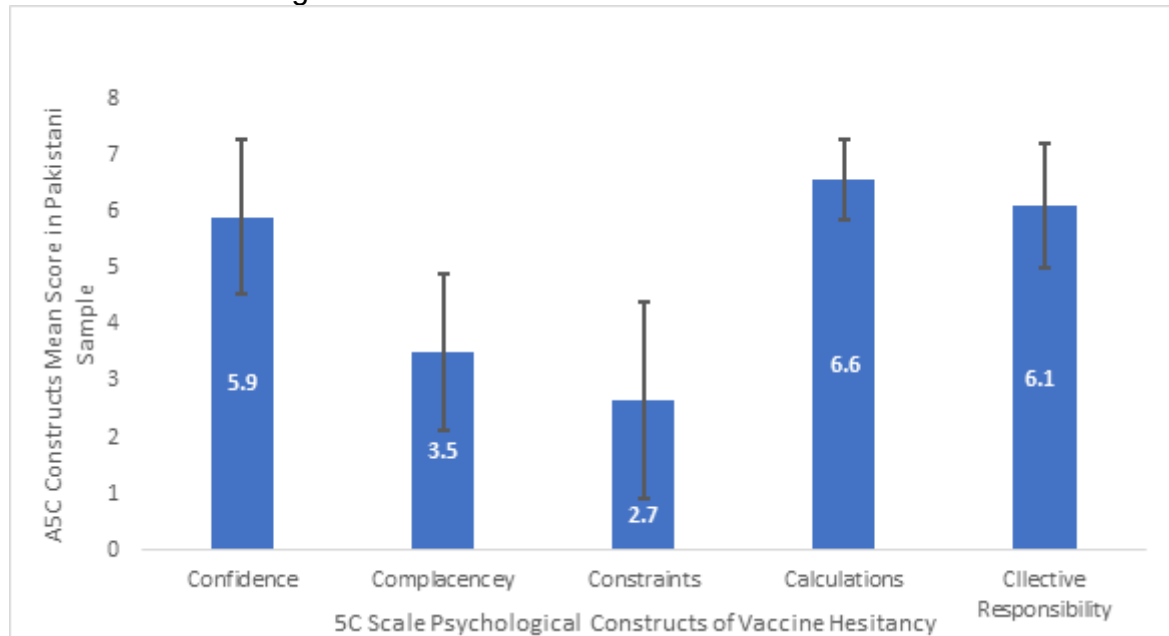
Table 12 describes the mean scores of all items of the 5c Scale of psychological antecedents of vaccination hesitancy and their dispersion for this study.

Table 12 Mean Scores Of All Items Of The 5c Scale Of Psychological Antecedents Of Vaccination Hesitancy

Participants N=26	Mean	SD
Confidence		
I am entirely confident that vaccines are safe.	6.04	1.28
Vaccinations are effective.	5.77	1.48
Regarding vaccines, I am confident that public authorities decide in the best interest of the community.	5.77	1.70
Complacency		
Vaccination is unnecessary because vaccine-preventable diseases are not common anymore.	2.85	2.11
My immune system is so strong that it also protects me against diseases.	4.77	2.25
Vaccine-preventable diseases are not so severe that I should get vaccinated.	2.85	2.07
Constraints		
Everyday stress prevents me from getting vaccinated.	2.54	1.88
For me, it is inconvenient to receive vaccinations.	2.58	2.16
Visiting the doctor makes me uncomfortable; this keeps me from getting vaccinated.	2.69	2.33
Calculation		
When I think about getting vaccinated, I weigh the benefits and risks to make the best decision possible.	6.35	1.441
For each vaccination, I closely consider whether it is helpful for me.	6.31	1.463
It is important for me to fully understand the topic of vaccination before I get vaccinated.	6.38	1.416
Collective Responsibility		
When everyone is receiving vaccination, then I do not have to get vaccinated (Reverse Coded)	5.88	1.583
I get vaccinated because I can protect people with weaker immune systems.	5.65	1.853
Vaccination is a collective action to prevent the spread of diseases.	6.73	0.604

Figure 5. illustrates the mean scores of 5C scale constructs for this study in the Pakistani sample.

Figure 5 Mean Scores Of 5C Scale Constructs



Each item score reflects the degree of C assessed (Figure 4), with a higher score indicating a higher degree (Betsch et al., 2018). Table 13 presents comparison of 5C constructs mean score of current studies with other studies.

Table 13 Mean Score Comparison Of Current Study With Other Studies

5C Scale Studies in Different Languages		Mean Scores of 5C Scale Psychological Constructs for Different Studies				
Numbers of Participants =N		Confidence	Complacency	Constraints	Calculations	Collective Responsibility
Arabic	<i>N=350</i>					
(Abd ElHafeez et al., 2021)		4.9	3.0	2.9	5.8	5.8
Arabic	<i>N=1340</i>					
(Alenezi et al., 2022)		4.7	3.5	2.6	5.3	5.3
Nigerian	<i>N=255</i>					
(Adeyanju et al., 2022)		4.2	1.9	1.6	3.8	3.1
T1	<i>N=93</i>	4.8	2.3	1.4	3.7	3.3
Urdu	<i>N=26</i>	5.9	3.5	2.7	6.6	6.1
Current Study ^d						

^a = 5C Vaccine hesitancy Scale study in block of 14 Arab countries (Egypt, Sudan, Libya, Tunisia, Morocco, Mauritania, Jordan, Palestine, Lebanon, United Arab of Emirates (UAE), Saudi Arabia, Oman, Kuwait, and Yemen)

^b = 5C Vaccine hesitancy Scale study in Kingdom of Saudi Arab

^c = 5C Vaccine hesitancy Scale study in Nigeria T1, Prenatal Study, T2 = Postnatal study

^d = 5C Vaccine hesitancy Scale study in Pakistan

3.1.1.2 Reliability Statistics

The coefficient of reliability Cronbach alpha scores of Urdu 5C scale for this study and their comparison with Cronbach alpha scores of 5C scale in other languages are presented in Table 14.

Table 14 Reliability Coefficient Scores Of Urdu 5C Scale And Comparison With Other Language Versions.

5C Scale Studies in different languages	Confidence α	Complacency α	Constraints α	Calculations α	Collective Responsibility α
English/German (Betsch et al., 2018)	0.88	0.77	0.67	0.75	0.71
Arabic (Abd ElHafeez et al., 2021)	0.829	0.712	0.71	0.773	0.829
Nigerian (Adeyanju et al., 2022)	0.41	0.32	0.45	0.51	0.26
Urdu (Current Study)	0.90	0.29	0.69 = 0.7	0.75	0.53

Note α = Reliability coefficient Cronbach alpha

The confidence construct demonstrates high reliability across studies. There is high consistency and stability in measuring confidence in this study. The reliability scores for complacency are relatively low in Nigerian and Pakistani participants. Low reliability suggests that the responses to the complacency questions lack consistency or stability within the given dataset.

The internal consistency indicators were low for complacency and below the acceptable threshold (≥ 0.7) for collective responsibility as compared to reliability indicators obtained in Western samples (Betsch et al., 2018) and Arabic samples (Abd ElHafeez et al., 2021).

3.1.1.3 Inter-relationship Correlation between 5c constructs

Table 15 Correlation between 5C(PK) constructs

Correlation Coefficient = r							Collective
Sig. (2-tailed) = p			Confidence	Complacency	Constraints	Calculation	Responsibility
Pearsons correlation N=26	Confidence	r	1	-.503**	-.098	-.153	.084
		p		.009	.633	.456	.683
	Complacency	r		1	.171	.244	-.265
		p			.404	.230	.192
	Constraints	r			1	-.484*	-.253
		p				.012	.213
	Calculation	r				1	.249
		p					.220
	Collective Responsibility	r					1
		p					

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

A Pearson's's correlation (ordinal data with Likert scale = Interval data) was calculated to determine the relationship between the 5C Scale of vaccination hesitancy constructs (i.e., *Confidence*, *Complacency*, *Constraints*, *Calculation* and *Collective Responsibility*) in the current Pakistani sample. Table 15 shows a significant negative correlation is observed of Complacency with Confidence, indicating that as confidence in vaccination increases, complacency tends to decrease. However, Confidence does not show a significant correlation with Constraints, Calculation, or Collective Responsibility.

Complacency, on the other hand, exhibits no significant correlation with Collective Responsibility or Calculation, but a positive correlation with Constraints ($r = .171$, $p = .404$). This suggests a weak positive relationship between complacency and Constraints. Constraints show a significant negative correlation with Calculations signifying that as perceived Constraints increase, Calculations of risks and benefits of vaccination tends to decrease.

3.1.1.4 Relationship between demographic characteristics and the 5C constructs of vaccine hesitancy

Table 16 explains the correlation between population sample demographic characteristics and 5C constructs of vaccine hesitancy.

Table 16 Correlation Between Demographic Characteristics And The 5C Constructs

Pearson Correlation = r													
Sig. (2-tailed) = p		Gender	Age	Profession	Education	Income	Vaccination Behaviour	Confidence	Complacency	Constraints	Calculation	Collective R	
Pearson Correlatio N=26	Gender	r	1	.449*	-.495*	.087	.123	-.041	-.356	-.090	-.001	-.046	.131
		p		.022	.010	.672	.550	.843	.075	.662	.995	.824	.523
	Age	r		1	-.086	.154	.074	-.151	-.018	-.016	.095	.089	.026
		p			.675	.454	.720	.462	.931	.937	.643	.666	.899
	Profession	r			1	-.169	.047	.422*	.028	-.005	-.192	-.088	-.037
		p				.409	.821	.032	.894	.982	.347	.671	.856
	Education	r				1	.001	-.142	-.241	.193	-.095	.127	.007
		p					.995	.488	.235	.345	.645	.537	.973
	Income	r					1	.060	-.028	-.071	.027	.032	-.479*
		p						.771	.891	.731	.894	.876	.013
	Vaccination Behaviour	r						1	-.215	-.247	-.477*	.075	.031
		p							.291	.223	.014	.716	.881

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

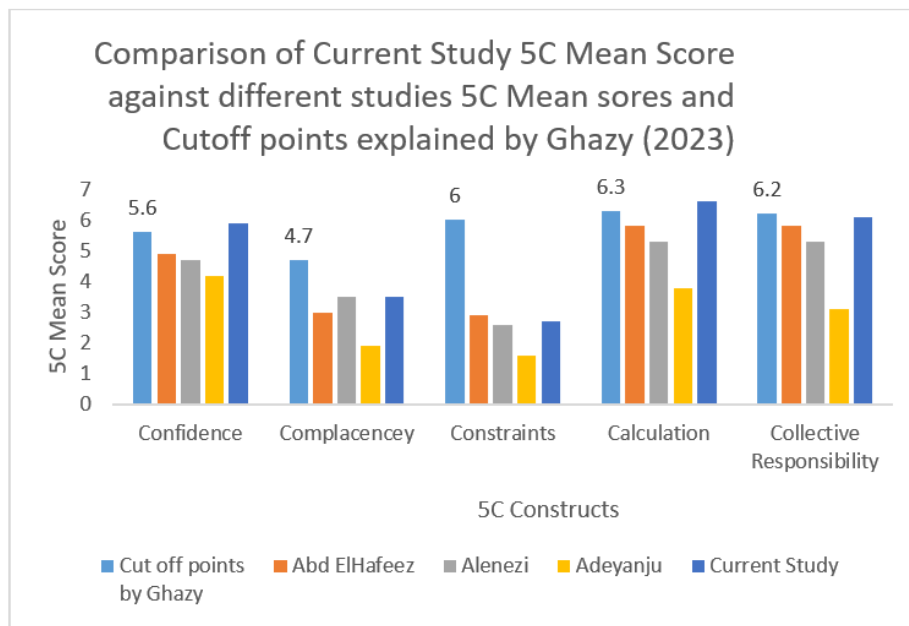
Pearson correlation observed significant negative correlation between income and Collective Responsibility, which suggest that as income increased the sense of Collective Responsibility decreased within the population set. The vaccination behaviour in our sample was significantly negative related with Constraints. It suggest that those who received the vaccination perceived fewer constraints to vaccination.

3.1.2 Discussion Quantitative Analysis

This study aimed to investigate the psychological antecedents of vaccine hesitancy using the 5C scale in the Pakistani population. The quantitative analysis found high Calculation scores and low Complacency and Constraint scores among respondents, aligning with similar findings in the Arab population during the COVID-19 pandemic (Abdou et al., 2021). The high Calculation score suggests a desire for informed decision-making and a sense of societal responsibility towards vaccination, contrasting with previous research where Calculation negatively impacted vaccine acceptance (Alenezi et al., 2022). Notably, participants reported fewer barriers or obstacles that would hinder their decision to get vaccinated. Additionally, they demonstrated a higher level of confidence in vaccines, indicating trust in the effectiveness and safety of vaccination. This finding is consistent with previous research conducted by (Gerretsen et al., 2021).

Our sample result resonate with (Abd ElHafeez et al., 2021) results in 5C adaptation study in Arab countries (Block of 4 countries) that stronger confidence and collective responsibility, lower constraints, and weaker complacency were associated with stronger intention to get COVID-19 vaccine. The religion is common ground for study for Arab countries and our study for Pakistani population. Figure 6a presents the comparison of 5C construct mean score in our sample with Arab and Nigerian 5C studies and their comparison with Ghazy's cut-offs (2023). Ghazy (2023) calculated categorical cutoff points for 5C constructs (Figure 6b) in investigating vaccination behaviour in the Arab population.

Figure 6a Comparison of 5C Mean Scores



Note. Explanation of our study 5C Mean scores

- *High Calculation scores: It suggest that individuals who engage in extensive calculations are more inclined to make informed vaccination decisions, weighing benefits against risks (Larson, 2014).*
- *High Confidence levels: They are linked with greater vaccine acceptance (Larson et al., 2014),*
- *High Collective Responsibility: It can foster acceptance by framing vaccination as a social norm communal effort (Betsch et al., 2018).*
- *Low Complacency scores: These indicate that individuals are less likely to underestimate disease severity, maintaining vaccination motivation (Brewer et al., 2007).*
- *Low Constraints scores: it imply fewer barriers to accessing vaccines (Gerretsen et al., 2021).*

Figure 6b Cut-off points for 5C Construct Arabic version

- *Not confident: when confidence subscale score was <5.6, and confident when subscale score was ≥5.6.*
- *Not complacent: when complacency score was <4.7, and complacent when subscale score was ≥4.7.*
- *Do not have constraints against vaccine when the subscale score was <6.0, and had constraints when the sub-scale score was ≥6.0*
- *Do not assess different calculation for receiving vaccine when the sub-scale score was <6.3 and assessed calculation when the subscale score was ≥6.3.*
- *Lacking collective responsibility when the sub-score was <6.2 and having (feeling) collective responsibility when the subscale score was ≥6.2. (Ghazy, 2023)*

Our study results contrast with the findings of Wismans et al. (2021), they used the 5C Scale to examine vaccination behaviour among university students from the Netherlands, Belgium, and Portugal. Their study found that confidence and collective responsibility were the strongest predictors of students' intention to receive the COVID-19 vaccine. Study in Japan demonstrated that increased vaccine acceptance

was linked to the need for personal and public protection and a sense of collective responsibility (Roberts et al., 2021).

Both studies were carried out in developed countries and western culture which is very different from Pakistan SES (Socio Economic Status), culture and religion. A 5C adaptation study in Nigeria (Adehaynju, 2022) found a higher level of everyday constraints was related to less vaccination behaviour which corresponds with our sample results. Nigeria and Pakistan are different in culture and religion but share similarities in their SES, and both are developing countries (Arisman et al., 2021). We could infer that SES are also very important to shape people's vaccination behaviour.

The reliability analysis showed mixed results, indicating that while the 5C constructs were more reliable in the Pakistani sample compared to the Nigerian sample (Adeyanju et al., 2022), further qualitative analysis is needed to assess their suitability for the population. The correlation analysis revealed significant negative correlations between Confidence and Complacency, and Constraints and Calculation, highlighting the importance of addressing complacency and promoting a sense of collective responsibility to increase vaccine acceptance (Betsch et al., 2018; Ghazy et al., 2021).

Interestingly, no significant correlations were found between demographic variables such as age, gender, and education level, and the 5C constructs associated with vaccine hesitancy except significantly negative relationship between income and Collective Responsibility, contrasting with findings in Arab countries (Abdou et al., 2022). This suggests that factors beyond demographics may play a more significant role in shaping attitudes towards vaccination in Pakistan, warranting further investigation into psychological, cultural, socioeconomic, and contextual factors through qualitative studies (Abdou et al., 2022). Overall, these findings underscore the

complexity of vaccine hesitancy and the need for tailored interventions to address its underlying causes effectively.

Limitations of quantitative study

While the quantitative study provides initial insights into the face validity of the adapted 5C scale, several limitations need to be acknowledged:

Sampling Method: The use of convenience sampling limits the generalizability of the findings. This method tends to include participants who are easily accessible, which may not represent the broader population, thus introducing potential bias in the results (Hammarberg et al., 2016). In contrast, probabilistic sampling methods, such as random sampling, are more robust as they give each member of the target population an equal chance of being selected, which enhances the representativeness of the sample and reduces bias (Etikan et al., 2016).

However, probabilistic sampling requires more time, resources, and logistical planning, which were beyond the scope of this study. Due to resource constraints, including limited access to a larger and diverse sample population, convenience sampling was chosen as a pragmatic approach for this initial phase of research. Future research should aim to use probabilistic sampling methods to enhance the representativeness of the sample and reduce sampling bias (Hammarberg et al., 2016).

Scope of Validation: This study primarily focused on face validity, consistent with Phase 1 of Betsch et al.'s (2020) protocol, which includes translation, adaptation, and pretesting. Although full psychometric validation (Phase 2) was not conducted, we did perform preliminary reliability and correlation analyses. These additional tests were included to gain an early indication of the scale's internal consistency and to ensure

that the adapted version functioned appropriately in the local context. However, the study was limited by resource constraints, specifically the time and funding available, which prevented the recruitment of a larger sample size necessary for comprehensive validation. As a result, we were unable to conduct an in-depth psychometric evaluation, which typically requires a larger and more diverse sample for thorough testing of content, construct, and criterion validity..

Future research should aim to recruit larger, representative samples as recommended by Betsch et al. (2020), to enhance the robustness of these statistical analyses. The larger sample size is essential for improving the generalizability and stability of the reliability estimates and for accurately assessing the scale's factor structure and concurrent validity across different subgroups (Boateng et al., 2018). Although this study laid the groundwork by ensuring that the scale was contextually appropriate, full-scale validation requires a larger participant pool to meet established psychometric standards.

Cultural Bias: Despite efforts to adapt the scale culturally, some biases may remain unaddressed. Additional qualitative research could help identify and mitigate these biases, ensuring a more accurate cultural adaptation (Van de Vijver & Leung, 2000).

Self-Report Measures: The reliance on self-report measures can introduce social desirability bias, where participants may answer in a way they believe is socially acceptable rather than reflecting their true beliefs or behaviours (Podsakoff et al., 2003). For example, in surveys about vaccination hesitancy, participants might underreport their reluctance to vaccinate due to social pressure to conform to pro-vaccine norms (Rasheed et al., 2022). To address this bias, future studies could use

more objective measures, such as analysing vaccination records or conducting behavioural observations (Larson et al., 2015). These methods can provide more accurate insights into vaccination attitudes by minimizing the impact of participants' desire to present themselves in a favourable light.

Cross-Sectional Design: The cross-sectional nature of this study limits the ability to make causal inferences. Longitudinal studies would be beneficial to examine the stability of the adapted 5C scale over time (Wang & Cheng, 2020).

Conclusion: Quantitative Study

The quantitative study represents an initial effort to explore the face validity of the 5C scale for assessing vaccine hesitancy in the Pakistani population. By employing convenience sampling and conducting reliability and correlation analyses, we aimed to determine if the adapted scale's constructs were relevant and applicable within this cultural context. The findings suggest that the adapted 5C scale holds promise for further validation work. However, this study only marks the beginning of a more extensive validation process. Future research should address the limitations identified, particularly by employing more rigorous sampling methods, incorporating longitudinal designs, and advancing through additional stages of validation, such as predictive validity (Boateng et al., 2018).

The primary purpose of the quantitative data collection in this study was to assist in exploring the face validity of the adapted 5C scale. This preliminary step was crucial to assess whether the scale's constructs were culturally relevant to the Pakistani population and to justify the need for further, more detailed validation efforts. By situating this research within the broader context of validation study methodology, we

aim to inform and guide subsequent efforts to refine and validate this important tool for use in diverse cultural settings.

Quantitative data collection, such as participant ratings and structured feedback, enables researchers to systematically assess respondents' initial impressions of each item in a measure. This approach helps to identify items that may be confusing, irrelevant, or poorly understood, which allows for targeted revisions before the measure undergoes more rigorous validation stages (Fink, 2003). By quantifying this feedback, researchers can make informed decisions about which items require refinement, thereby enhancing the measure's clarity and appropriateness (Polit & Beck, 2006). This level of transparency ensures a thorough evaluation of whether the items effectively measure the intended construct and maintain consistency in their application, ultimately supporting the measure's validity and reliability.

3.1.3 Concurrent Study Content Analysis Results

Distribution of problems across the questions in Table 3 demonstrates the number of participants who showed/expressed having any type of problem for each question. It should be noted that participants may have been observed or expressed as having more than one problem with each question. 6 questions appeared completely unproblematic; within the 9 problematic questions some questions were more problematic than others.

The most problematic was question “Everyday stress prevents me from getting vaccinated” 16/26 (61.5 %) of participants were observed/ had expressed as having problems with this question. Question 4 “Vaccination is unnecessary because vaccine-preventable diseases are not common anymore” and Question 13 “When everyone is vaccinated, I do not have to get vaccinated, too” were the second most problematic questions; each evidenced by difficulties in 10/26 (38.5%) of participants. Approximately 4% to 31% of participants (1 – 8 /26) encountering difficulties with remaining questions.

More problems were experienced with the construct *Constraints* (17/26 participants), then *Collective responsibility* (13/26), followed by *Confidence* and *Complacency* (11/26 participants) and least number of participants observed/expressed having problems with 5C construct *Calculations* (2/26) (Table 17).

Table 17 Number of Participants Coded as Having Any Type of Problem for Each Question

Number of participants expressed as having any type of problem for each question (Q1-Q15)															
5C(PK) Constructs	Confidence			Complacency			Constraints			Calculations			Collective Responsibility		
Question No.	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
No. of problems	8	3	0	10	0	1	16	1	0	2	0	0	10	3	0

The most common problem was observed 1) re-reading, misreading, or floundering in answering (comprising 33 of the 66 problems) and 2) problems with the answering scale (24/66problems). The least frequent issue was 'question not deemed applicable to their circumstances' (1/66 problems). Verbalizations are quoted to exemplify problems (Table 18).

Table 18 Content Analysis of Think-Aloud Study

Problem	Frequency	Example Quotes
Re-read, mis-read, or significantly stumble in answering question	33	Everyday stress prevents me from getting vaccinated ... [Reread] Everyday stress [pauses] I'm not sure I get this one. How does stress have anything to do with getting vaccinated? [misreads] "When everyone is vaccinated, I have to get vaccinated, too." Oh, so I still <u>have to</u> get vaccinated even if everyone else does? "[stumbling] I'm not sure if I understand. If everyone is protected, why wouldn't I need to be vaccinated? [confused] Wait, so if everyone else gets vaccinated, I don't have to?"
Questioned sensibleness of question	8	"How does stress have anything to do with getting vaccinated?"
Answered different question from the one that was asked, or gave inconsistent reasoning	0	
Question deemed not applicable to their circumstances	1	"[Laugh] How come vaccination is inconvenient and painful it's just a small injection, no <u>its</u> not right"
Problems with the response-scale	24	"Too many answer options, <u>its</u> confusing" "Moderately is not easily understood by common people, you should change it"

The nature of the problems varied between the questions. Notably, re-reading, misreading, or stumbling in answering, constituted the most frequent difficulties; 15 with the Constraints question, "Everyday stress prevents me from getting vaccinated" and 7 with Collective Responsibility question, 'When everyone is vaccinated, I do not have to get vaccinated, too' (Table 19).

Participants also struggled with the response-scale (Table 18) mostly for Confidence construct questions. This may be because these were the first questions and participants might have stumbled despite prior explanation.

Table 19 Frequency Of Each Type Of Problem Coded For Each Question On The 5C Vaccine Hesitancy Scale

	Number of times each problem type was coded as present for each question (Q1-Q15)														
	Confidence			Complacency			Constraints			Calculations			Collective Responsibility		
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
Re-read, mis-read or stumble in answering Question	–	–	–	6	–	–	15	–	–	2	–	–	7	3	–
sensibleness of question	–	1	–	–	1	–	5	–	–	–	–	–	1	–	–
Answered different question or gave inconsistent reasoning	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Not applicable to their circumstances	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Struggle with scale	8	3	–	6	–	–	–	–	–	–	–	–	7	–	–
Total number of problems	8	4	–	12	–	1	20	1	–	2	–	–	15	3	–

3.1.4 Discussion Content Analysis

The results from Table 15-17 indicate that the most problematic question in the 5C(PK) Scale pertained to Constraints, specifically, "Everyday stress prevents me from getting vaccinated, it was not well received due to confusion regarding the real perspective of the daily stress restrain people from vaccine uptake. These qualitative results are consistent with the Arab study by Adu Elhafeezi (2021).

Collective Responsibility question, "When everyone is vaccinated, I do not have to get vaccinated, too" appeared hard to comprehend by the participants. These findings suggest potential challenges in interpretation and response, which could affect the reliability and validity of the scale (Stefan, 2018).

Addressing these issues is crucial to ensure the scale effectively measures the intended constructs and accurately reflects participant attitudes (French et al., 2007). The observed difficulties with comprehension highlight the importance of question clarity and cultural sensitivity in survey design (Phillips, 2014). Negative themes, particularly in Collective Responsibility and Complacency questions, presented challenges, indicating the need for careful adaptation to cultural norms to improve engagement (McCorry et al., 2013).

While participants generally perceived the 5C(PK) Scale as thorough and well-designed, some expressed difficulty with certain answer options. However, complaints were scattered, suggesting no systematic issues with the measure. Notably, participants attempted to answer all questions, regardless of difficulty, which is consistent with previous research (Bainbridge, 1993).

Addressing comprehension and presentation challenges in the 5C(PK) Scale requires a multidimensional approach involving careful survey design, pilot testing, and ongoing evaluation to ensure cultural appropriateness and clarity. Continuous refinement of survey instruments is essential for maintaining validity and reliability in public health research.

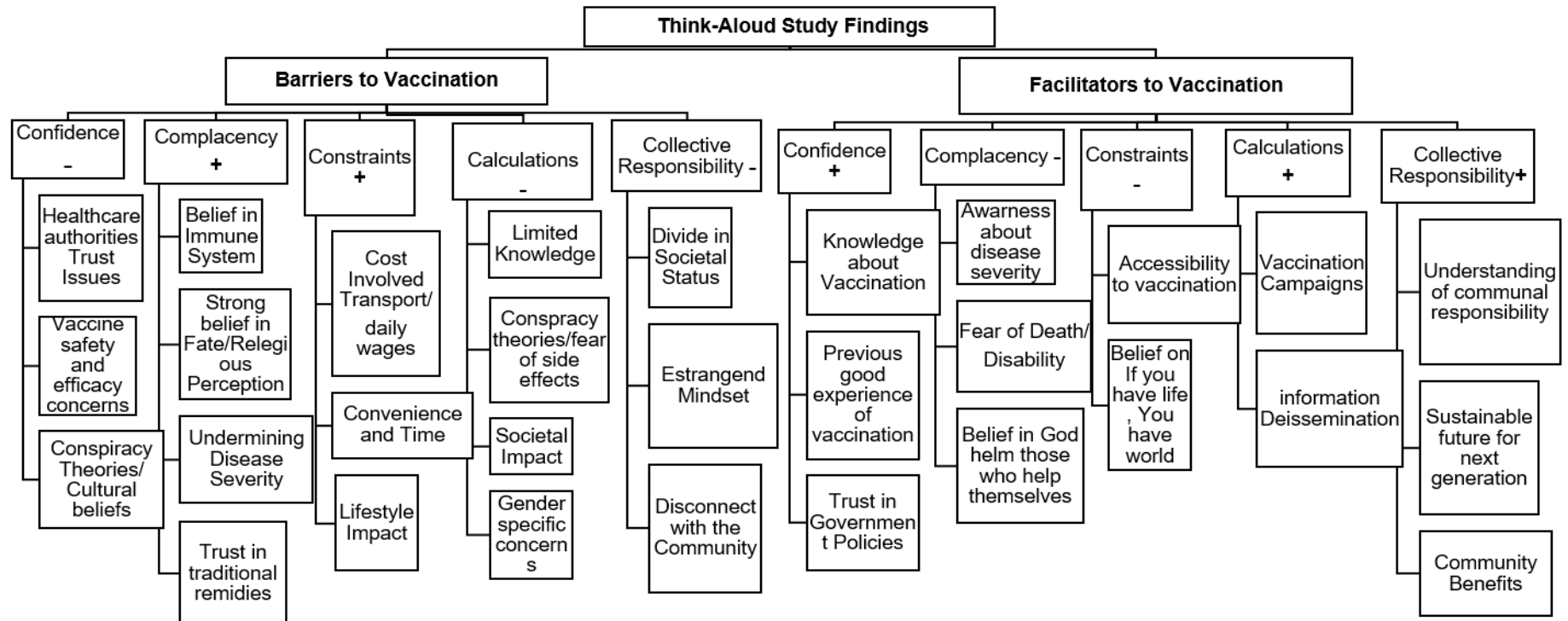
3.1.5 Qualitative Analysis (Concurrent and Retrospective study)

We adopted the six-phase process of thematic analysis (Dawadi, 2021) familiarizing with the data, generating initial codes, searching for themes, reviewing themes, defining, and naming themes and writing reports (Braun & Clarke, 2022). We categorised the initial codes into 2 main sets of attitudes towards the 5C constructs, one as barrier to vaccination behaviour and second as facilitator of vaccination behaviour in the population. We used (+) and (-) sign to explain the direction of 5C psychological constructs (Table 20 defines the high (+) and low (-) levels of 5C Constructs of vaccine hesitancy) in determining the vaccination behaviour and linked them with initially derived codes to elaborate thought process and opinions of participants about their vaccination behaviour. Figure 7 explains the basic thematic framework of the study.

Table 20 High (+) And Low (-) Levels Of 5C Constructs Of Vaccine Hesitancy

5C Construct	High Levels	Low Levels
Confidence	Strong trust in vaccine and healthcare system	Doubts, concerns, mistrust in vaccine and healthcare system
Complacency	Perceive low risk of vaccine-preventable diseases	Perceive high risk of vaccine-preventable diseases
Constraints	Few practical or logistical barriers to vaccination	Practical barriers to vaccination (e.g., access, cost)
Calculation	Actively seek and critically evaluate information about vaccines	May not actively seek or critically evaluate vaccine information
Collective Responsibility	Belief in societal benefits of vaccination and herd immunity	Prioritize individual choice over collective benefits

Figure 7 Summary of themes : Thematic Analysis of Barriers and Facilitators of 5C Constructs from Think-Aloud Study



3.1.5.1 Thematic Analysis of 5C Scale Constructs

3.1.5.1.1 Confidence

Low Confidence as Vaccination Barrier

Participants highlighted low confidence in vaccination as a significant barrier to vaccine uptake, expressing scepticism about government motives for vaccination campaigns and concerns about vaccine safety and efficacy. One participant criticized the government, stating,

"The Pakistan government does not think about the common man, the powerful people running it to look good in international community, and they must have found their commission in it" (AM, T-A)

Participants also voiced distrust in the healthcare system, with one stating,

"Pakistan health system is so corrupt; healthcare personnel sell the real vaccinations and provide expired or fake vaccination to the public" (MS, T-A).

Another participant expressed doubts about the COVID-19 vaccine provided by the government, accusing authorities of using the population as "lab-rats" and stopping essential services until vaccination is obtained. Regarding vaccine quality, a participant mentioned,

"The rich people and authorities keep the best for themselves and give compromised, expired items to the common man" (SI, T-A)

Some participants mentioned adverse reactions to COVID-19 vaccination, linking it to fatal heart attacks. Conspiracy theories further eroded public trust, with one participant mentioning fears of vaccines being used for harmful purposes. Another participant expressed concerns about the Polio vaccination program, stating,

"People in Khyber Pakhtunkhwa hide their kids and do not let them take Polio vaccination as they are afraid that national and international political powers are trying to eliminate Pashtuns." (NP, T-A)

Individuals subscribing to conspiracy theories appeared more inclined to reject vaccination, with one stating,

"I did not get vaccinated as I want to extend my family, and I don't want them to be disabled." (MD, T-A)

Confidence as Vaccination Facilitator

Most participants strongly assent that when people are confident that vaccines are safe and effective, they are more likely to choose vaccination as a preventive measure against infectious diseases. This can lead to higher vaccination rates across the population.

"In general, the vaccinations for epidemic diseases are introduced after worldwide campaigns. Developed countries and NGOs introduce these vaccines after thorough research.....so it is in our best interest" (MS, T-A).

The participants recognized the importance of knowledge about vaccination in shaping vaccination behaviour. Access to accurate and comprehensive information about vaccines empowers individuals to make informed decisions about their health. This includes understanding the benefits of vaccination in preventing diseases and potential risks.

"We need to gather full information about vaccine and then go for it" (TS, T-A)

"Pakistani Government and healthcare authorities should create effective vaccine information campaigns for all parts of country, even they should use mosques and schools to disseminate the information" (KA, T-A).

Positive experiences with previous vaccinations were identified as significant factors in building trust in vaccines. Participants cited examples such as the swift containment of measles outbreaks and the reduction in COVID-19 deaths and symptoms post-vaccination. These positive outcomes contribute to increased confidence in the efficacy and universality of vaccines.

Moreover, participants expressed trust in government policies and healthcare systems, particularly when vaccination information originates from trusted government sources. Those involved in the vaccination process and government employees spoke positively about the Pakistan healthcare system and vaccination efforts. They emphasized the importance of government-led vaccination drives and infrastructure for administering vaccines in preventing disease transmission,

“The authorities make the right decision. They are doing a good job. If authorities do not launch these vaccination drives and do not make an infrastructure to administer these vaccinations, many diseases can be transmitted to humans” (NB, T-A).

3.1.5.1.2 Complacency

High Complacency as Vaccination Barrier

High complacency emerged as a significant barrier to vaccination in Pakistan, impacting vaccination behaviour in the population. Participants expressed a lack of perceived risk or necessity for vaccinations due to various factors, including a strong belief in the immune system, fate/religious perceptions, undermining disease severity and reliance on herbal medications.

Participants highlighted their trust in their immune system, viewing it as a powerful defence against diseases and questioning the need for vaccines when immunity is strong.

“I believe that immunity is your biggest weapon, which is given by Allah, it supports us” (SA, T-A).

Additionally, there was a prevalent belief in fate, with some participants attributing diseases to Allah and relying on faith for protection rather than vaccines.

"As Muslims, we believe that whatever disease comes to us it's from Allah." (MS,SA,TH,MM, T-A)

"(Prophet Jacob)Yaqoob (AS) despite the disease being so severe, he survived, we do learn from history that no vaccination or medication cured him, Allah healed him" (TH, T-A).

"As Allah says (interpretation of the meaning): "I send a disease and then I cure it." (SA,RA,AB,MM, T-A)

Concerns about disease severity were undermined by a belief that epidemics were not severe, leading some individuals to disregard vaccination mandates. Participants reported that,

"People were not worried about Covid and just wanted to get vaccinated because Government made it mandatory. People found a way out and they are getting vaccination card by paying some money to the officials and not getting the vaccination done" (AM, T-A).

Trust in herbal remedies also played a significant role, with participants opting for traditional remedies over vaccinations based on ancestral practices and religious beliefs.

"We use mixture of honey and ginger juice and use it during the winters. We also take ginger and fennel seed tea with honey to avoid flu and sore throat. Allah says in Quran that "Honey Heals" (AB, T-A).

"... AS Prophet Muhammed (Peace Be Upon Him) decreed that "Nigella seeds cures every disease except death". My father- in- law is 105 years old he never had vaccine for anything in his life, he uses nigella seeds, honey, nuts and many herbal medicines on regular basis and he is completely fit and healthy" (MM, T-A).

Low Complacency as Vaccination Facilitator

Conversely, low complacency was associated with awareness of disease severity and fear of death or disability resulting from certain illnesses. Participants emphasized the importance of vaccination for preventing severe diseases such as COVID-19 and polio, citing personal experiences and the need to protect oneself and others.

"My sister-in-law is disabled as she was not given vaccination against polio, I made sure that my kids get their vaccination at right time and age, Alhamdulillah my kids are healthy and normal" (ZB, T-A).

The belief in "God helps those who help themselves" underscored personal responsibility and proactive behaviour in seeking vaccination as a means of protection. Participants expressed their belief in accessing available resources for disease prevention and following prophetic teachings as a religious obligation.

"Getting treatment for disease is Sunnah, the first thing is that healing is given by Allah, the treatment is Sunnah, Follow the ways of the Prophet (peace and blessings of Allah be upon him) as mentioned in the Sunnah" (TH, T-A).

3.1.5.1.3 Constraints

High Constraints as Vaccination Barrier

Our transcripts highlight that high constraints serve as a significant barrier to vaccination in Pakistan, limiting access to vaccination services due to geographical, financial, and logistical obstacles. Participants highlighted the cost involved in accessing vaccinations, including transportation expenses and loss of daily wages, as major factors contributing to vaccine hesitancy.

"Most of the population in our country are below the extremes of poverty, they cannot afford to lose their daily wages and transport cost to go to vaccination centres and wait in long ques for hours, so people do not consider it necessary to go for vaccination..."(MS, T-A).

The inconvenience and time-consuming nature of the vaccination process, particularly for individuals with busy work schedules or small businesses, further deterred people from seeking vaccination.

Low Constraints as Vaccination facilitators

In contrast some participants associated low constraints with improved accessibility to vaccination services and a strong belief in the value of life and health. Participants emphasized the importance of easy access to vaccination canters and the

convenience of vaccinators coming to their doorstep, which facilitated greater vaccine uptake.

The belief that "If you have life, you have the world" underscored the prioritization of health and the willingness to overcome barriers to vaccination for the sake of one's well-being.

"Everyday stress prevents me from getting vaccinated. Strongly Disagree, because vaccines have their own importance, "If there is life, then there is the world". So, we need to prefer health over other engagements and it's not forever, just one day even for few hours" (AI, T-A).

3.1.5.1.4 Calculations

The concept of calculations plays a significant role in shaping vaccination behavior in Pakistan, with both negative and positive calculations influencing individuals' decisions regarding vaccination.

Negative Calculation as Vaccination Barrier

Negative calculation, characterized by a lack of understanding or misconceptions about vaccines, contributes to vaccine hesitancy. Limited knowledge about vaccine safety and effectiveness, fueled by misinformation and conspiracy theories, leads individuals to perceive vaccines as risky or unnecessary.

"Due to their limited knowledge mostly, people did not accept COVID as infectious and fatal disease, health authorities failed to provide effective and enough information therefore people did not accept Covid vaccine in small towns and villages" (MM, T-A).

Fear of side effects and concerns about community impact further exacerbate vaccine hesitancy.

"Many people did not go to the doctor because people think that doctors are injecting the vaccination and killing people on government demand to control the population" (SI, T-A).

Gender-specific concerns, particularly regarding the impact of vaccines on reproductive health, also contribute to negative calculations.

“Parents were concerned that the girls might have health problems in their future life due to this vaccine” (TS, T-A).

Positive Calculations as Vaccination Facilitator

Conversely, positive calculation, driven by organized vaccination campaigns and accurate information dissemination, promotes vaccine acceptance. Participants emphasize the importance of awareness campaigns through mass media and timely dissemination of information by healthcare providers and community leaders. When individuals are well-informed about the benefits and safety of vaccines, they are more likely to trust and participate in vaccination efforts.

“A campaign should be launched by concerned authorities to create awareness among people. Public should be informed about the efficacy of the vaccine. They should be told what is in the vaccine. And it does not have any side effects” (PN, T-A).

3.1.5.1.5 Collective Responsibility

The qualitative data emphasized that Collective Responsibility plays a crucial role in shaping vaccination behaviour in Pakistan, with both lack of and high levels of Collective Responsibility influencing individuals' decisions regarding vaccination.

Collective Responsibility as Vaccination Barrier

Lack of collective responsibility is evident when individuals perceive vaccination as solely an individual choice rather than a collective effort to protect the community. Participants expressed that socioeconomic disparities exacerbate this divide, with daily wage earners and street hawkers often refusing vaccination due to concerns about losing income.

“This is elite’s disease; we have nothing to do with it. We are labourers, we cannot compromise on our daily wages. No one comes to us to feed us when we are struggling why we should we go and get vaccine to keep others safe by wasting our time and losing our daily wages” (AM, T-A).

According to participants an estranged mindset, characterized by distrust in institutions and susceptibility to misinformation, further contributes to vaccine hesitancy.

“It is nothing, it is created by international establishment to counter xxxxx (name of country) so they can restrict them to become another superpower” (AI, T-A).

Collective Responsibility as Vaccination Facilitator

Transcripts also mentioned Collective Responsibility as Vaccination facilitator when a strong sense of communal responsibility fosters active participation in vaccination programs.

Participants recognize that vaccination is not just a personal choice but a shared responsibility for community health and well-being. This understanding motivates individuals to prioritize vaccination, particularly to protect vulnerable family members and ensure a sustainable future for the next generation.

“One strong reason why I rush to get covid vaccine and convince my family to get it done because I had young kids and 85 years old mother in my house” (AZ, T-A).

A transcript describes how the intention to keep their loved ones safe translated into vaccination behaviour.

“My brother in laws and sister in laws and their kids were visiting us often to spend time with my mother-in-law even during covid. So, I explained to her that it is infectious disease and can be avoided by getting vaccinated. She understood and then asked us to get her vaccinated as well” (SA, T-A).

Social cohesion and solidarity are enhanced when individuals work together to eliminate infectious diseases, fostering a sense of shared purpose and collective well-being.

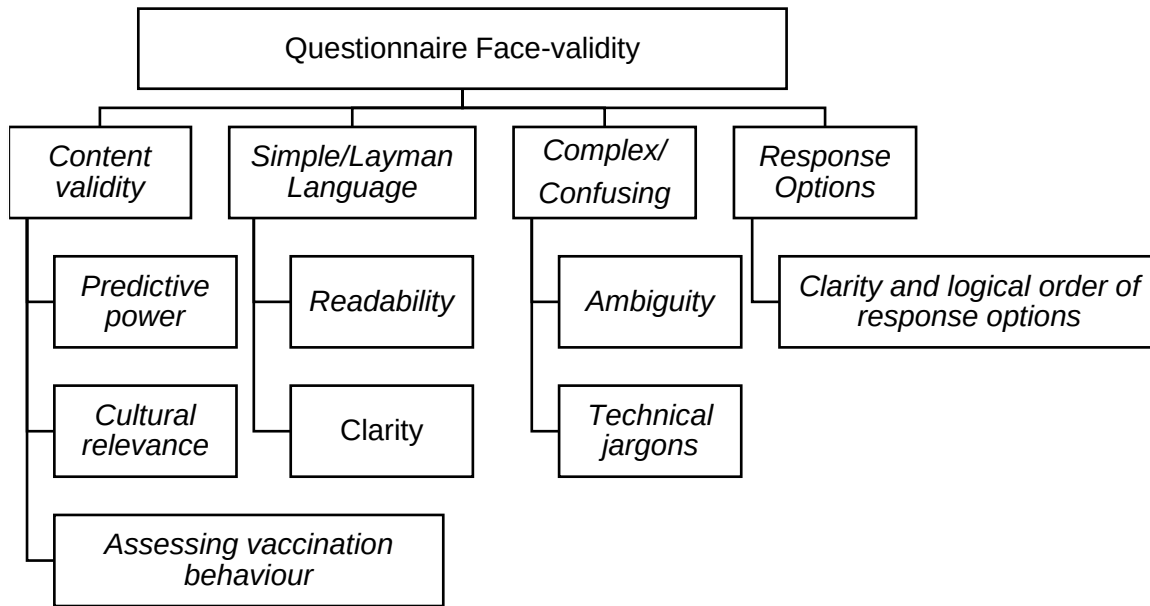
3.1.6 Usability and suitability of 5C(PK) within the population

During retrospective Think-Aloud the usability and suitability of the 5C(PK) Scale was also explored and questions were asked (Appendix 11) to perceive the Face-Validity of 5C(PK). Themes and sub-themes (Figure 7) were developed through a combination of both inductive and deductive approaches. Questionnaire face validity refers to the extent to which individuals, especially those who were participate in the survey, perceived that the questions in the questionnaire appear to be valid and relevant for measuring the construct of interest.

5C(PK) Face Validity Thematic Analysis

The study explored the face validity of the 5C(PK) questionnaire, revealing themes related to construct validity and response options, with sub-themes including predictive power and readability. Face validity, as described by (Taherdoost, 2016), involves a subjective evaluation of how well a measure represents a construct. This assessment considers factors such as feasibility, readability, and overall clarity of language, aligning with the definitions by Gaber & Gaber (2010). The study's findings (Figure 7) are grounded in the subjective interpretations and opinions of participants who completed the questionnaire.

Figure 8 5C(PK) Face Validity Thematic Analysis(Think-Aloud Study)



3.1.6.1.1 Content Validity

The content validity of the 5C Vaccine Hesitancy Questionnaire, particularly its adaptation to the Pakistani context, is essential for accurately measuring vaccine hesitancy. Content validity ensures that the questionnaire effectively covers all relevant aspects of vaccine hesitancy within the Pakistani population. This qualitative assessment aligns with the methodology outlined by Taherdoost (2016), which emphasizes the importance of ensuring that survey items accurately reflect the domain being measured. In the context of this study, participants' feedback on the content validity of the 5C(PK) Scale provides valuable insights into its appropriateness for assessing vaccine hesitancy in Pakistan. Most participants commented,

“Everything which can affect any one’s vaccination behaviour is mentioned in this questionnaire and simple language was used. There is nothing that cannot be understood in it” (TS, T-A).

I. Cultural Relevance

The transcriptions show that the language used is culturally sensitive and resonates with the diverse linguistic backgrounds in Pakistan. As a participant commented

“Urdu is national language of Pakistan, and all these statements and words used are such that an ordinary Pakistani who is middle pass or only knows how to read and write Urdu, can understand them easily” (PN, T-A).

II. Predictive Power

Predictive power assesses the ability of a questionnaire to predict future behaviour or outcomes. The quantitative results showed that 5C-(Pk) successfully predicted participants' vaccination behaviour in both direction that is vaccine hesitancy and vaccine acceptance.

III. Assessing Vaccination Behaviour

At large the transcripts successfully provided insight to participants' vaccination behaviour and how the psychological antecedents of vaccination behaviour influence vaccination hesitancy and vaccination acceptance. The transcripts highlight the predictive power of assessing vaccination behaviour in Pakistani population, a participant commented,

“This form absolutely helps to figure out about vaccination behaviour. When this form help you to find out about my vaccination behaviour, you can figure out everyone's attitude who completes this form” (SA, T-A).

Some participants also suggested the inclusion of different statements for people with traditional and religious mind set,

“Some people are traditionalists. They traditionally avoid drugs or these things (vaccinations). So, there must be a question here for them too, those who abstain from any medicine for any reason. This also can be a reason for not getting vaccinated” (MM, T-A).

“You should add question about religious beliefs” (A, T-A).

“I think if you add a specific statement about “how religion affects your vaccination behaviour”, it will help you to get more information about why people do not get vaccination in Pakistan” (TH, T-A)

3.1.6.1.2 Language

The simplicity and use of layman language in a questionnaire assess how easily participants can comprehend and respond to the items (Sato & Ikeda, 2015). Transcripts show that at large 5C(PK) Scale employs straightforward language that enabled the participants from different linguistic backgrounds, understanding and responding to the questions. This is essential for obtaining reliable data that reflects the true sentiments of the population.

I. Readability

The theme “readability” emerged from the transcriptions, where participants were asked to highlight any confusing sentence or difficult word, which was difficult for them to understand or to answer. Most participants were satisfied with the language of the questionnaire.

“Everything is easy to read and understand. The questions are in Urdu. It can be read easily. And everyone can answer them” (RA, T-A),

II. Clarity

The other distinctive sub-theme which appeared under the theme “language” explained that 5C(PK) questionnaire statements were presented with clear voice and there was no complex terms.

“These statements are simple. I don't need any explanation to understand them. Everyone can read. Everyone will understand. Words are written in easy Urdu. There is no need to explain or elaborate them further” (SA, T-A).

3.1.6.1.3 Complexity and Confusion

In the context of vaccine hesitancy in Pakistan, where language diversity is prevalent, a questionnaire that is unnecessarily complex may introduce measurement errors (Sato & Ikeda, 2015). A theme “complexity and confusion” emerged from transcripts and

highlighted that statements free from unnecessary complexity are more likely to yield reliable and valid responses. Ambiguity and technical jargons are two valuable sub-themes emerged from the qualitative data.

I. Ambiguity

Results Identified that any instances of ambiguity or vagueness in the questionnaire can lead to confusion among participants.

“Question 3 is ambiguous, the officials who are managing the whole vaccination process are corrupt, the system is corrupt, so how can they make policies for our betterment” (TH, T-A).

“I don't think every person can understand with my education level (matriculation) there are some difficult and complex words such as Immune system, everyday stress, public interest. You need to use simpler words. I understood these words as I have doctors in my family, and they use this language quite often. You must explain these words to people from village or do not have people around them who are using these words commonly”.

II. Technical Jargon

Participants commented that the presence of any technical jargon or terminology that might not be commonly understood by the common people in Pakistan. One participant commented,

“You need to change the “everyday stress” question. Write a word that is easily understood whether your compulsions prevent you from getting vaccinated. You can use some other expressions such as Everyday compulsions. Engagements Everyday compulsions or compulsions of life, constraints”. (MZ, T-A)

3.1.6.1.4 Response Options

The arrangement and presentation of answer options in a questionnaire impact participants' ability to provide accurate responses. The transcriptions highlighted that clear, well-organized answer options facilitate ease of comprehension and response.

I. Clarity and logical order of Answer Options

The qualitative data assess the clarity of the answer options presented for each question, and commented on the response options layout (presentation), whether the

options are concise and easily distinguishable and provide the range of possible responses. One participant commented as,

“.....if we can improve “moderately agree” and “moderately disagree” these terms can be bit confusing for common man and difficult to clearly understand”(ZB, T-A).

Transcriptions also commented on, whether the ordering of answer options follows a logical sequence or hierarchy, aiding participants in selecting the most relevant response.

“Just add these 4 options strongly agree, agree, disagree and strongly disagree. Neutral should also be there that if someone doesn't want to answer, that's fine, they have an option to choose. But these 7 options make it confusing”. (AZ, T-A)

3.1.7 Discussion Qualitative Analysis

This study explored the cultural adaptation of the 5C psychological antecedents questionnaire for measuring vaccine hesitancy in Pakistan. While the 5C Scale has been effective in developed countries (Abd ElHafeez et al., 2021; Alobwede et al., 2022; Betsch et al., 2018; Zhang et al., 2022), its application in developing nations like Pakistan requires cultural adaptation. The study identified confidence, complacency, constraints, calculations, and collective responsibility as crucial factors influencing vaccination behaviour in Pakistan.

Confidence

The lack of confidence in the vaccination process emerged as a significant barrier, particularly in rural and less educated communities. This aligns with previous findings (Mehmood et al., 2022; Rancher et al., 2023; Sheikh et al., 2023). Safety and efficacy concerns about the COVID-19 vaccine were prevalent, fueled by misinformation and conspiracy theories. Mistrust in government and healthcare authorities also played a significant role, with suspicions of profit-driven motives behind vaccination campaigns

(Perveen et al., 2022). These findings are consistent with studies highlighting barriers to COVID-19 vaccine acceptance (Diaz et al., 2022; Rancher et al., 2023; Rasheed et al., 2022).

However, confidence in vaccine safety and effectiveness, supported by positive past vaccination experiences and trust in government policies, emerged as motivators for vaccination. The findings suggest that addressing underlying distrust and misinformation while promoting accurate information and positive experiences could help build confidence in the vaccination process and improve uptake rates (Alobwede et al., 2022; Myburgh et al., 2023).

Complacency

According to this qualitative analysis, complacency is a multifaceted issue that both motivates and acts as a barrier to vaccination behaviour in Pakistan. Similar studies Myburgh et al. (2023) in South Africa and Zimbabwe highlight the same findings, with low complacency associated with heightened awareness of disease severity and proactive behaviour influenced by faith. However, barriers to vaccination include strong beliefs in the efficacy of the immune system, herbal remedies, and the perception of diseases as predetermined by fate or divine plan (Hadid, 2021; Sheikh et al., 2023; Woolf et al., 2021). Targeted interventions are needed to address specific cultural and religious perspectives and promote higher vaccination uptake in Pakistan.

On the motivational side, low complacency is associated with a heightened awareness of disease severity, advocating for the public health benefits of vaccination (Soomar et al., 2022). Participants express a sense of personal responsibility and proactive behaviour influenced by the belief in 'God helps those who help themselves,' aligning

vaccination with their faith. This cultural motivator complements the Theory of Planned Behaviour, where beliefs shape attitudes and intentions (Rasheed et al., 2022)

Constraints

According to our qualitative analysis, addressing constraints is crucial in devising effective strategies to tackle vaccine hesitancy (Quaife et al., 2023). The study highlights the impact of high constraints, including geographical, financial, and logistical challenges, particularly among socioeconomically disadvantaged individuals on vaccine uptake. These results are consistent with findings by Soomar et al. (2022) and (Myburgh et al., 2023).

The study found that inconvenience and time-consuming nature of the vaccination process exacerbate hesitancy, especially for those with demanding daily lives, aligning with research conducted in India by (Ayappan et al., 2022). However, low constraints facilitate vaccine uptake, as easy access to vaccination centers and doorstep visits by vaccinators remove significant barriers. Similar results have been documented in studies conducted in Pakistan by Quaife et al. (2023) and Perveen et al. (2022). The belief that "If you have life, you have the world" underscores the participants' recognition of health's importance, with vaccination prioritized for overall well-being.

Calculations

Participants in the study emphasized the necessity for well-organized vaccination campaigns to boost vaccine acceptance (Sheikh et al., 2023; Khan et al., 2023). They advocated for mass communication across diverse channels to inform decision-making, emphasizing transparency through television, radio, print, and social media, these results are in line with a cross-section study in Pakistan by (Sheikh et al., 2023).

Government-led campaigns during the COVID-19 vaccination period were particularly lauded for their effectiveness in building public trust (Organisation for Economic Co-operation and Development, 2021).

Negative aspects of vaccine hesitancy were rooted in various factors such as limited knowledge, conspiracy theories, and fear of side effects (Jaffe et al., 2022). Community influence significantly shaped participants' decisions, highlighting the collective nature of vaccine decision-making. Gender-specific concerns also emerged, emphasizing the need for tailored communication strategies (Choi et al., 2023).

To enhance vaccine acceptance in the Pakistani population, cultural adaptation strategies should focus on reinforcing positive calculation through targeted, transparent, and culturally sensitive communication campaigns. Addressing concerns related to misinformation, community influence, and gender-related perceptions will be crucial, requiring a multidimensional approach involving community leaders, healthcare providers, and culturally tailored educational materials.

Collective Responsibility

Understanding the cultural concept of collective responsibility is essential for developing targeted interventions to address vaccine hesitancy in Pakistan (Betsch et al., 2018; Ghazy et al., 2021; Rancher et al., 2023).

The qualitative analysis highlights the socio-economic divide affecting vaccine acceptance and highlighting a contrast in perspectives between the educated and less educated segments of society (Alobwede et al., 2022; Ghazy et al., 2021), emphasizing the need for equitable distribution strategies (Freeman et al., 2022).

Scepticism and conspiracy beliefs, distrust in institutions, and alienation also hinder vaccine acceptance.

However, there were positive indications of collective responsibility among participants who viewed vaccination as a communal duty toward one's health, family, and the wider community. This aligns with the cultural value of collective well-being and emphasizes the importance of community engagement in vaccination efforts (Ghazy et al., 2021). The analysis emphasizes the importance of addressing socio-economic disparities, combatting misinformation, and fostering communal responsibility behavioural interventions to enhance vaccination behaviour (Alobwede et al., 2022; Freeman et al., 2022).

Face Validity

Face validity, a fundamental test of validity, involves non-experts reviewing a questionnaire for clarity and suitability (Gaber & Gaber, 2010; Sato & Ikeda, 2015). In this study, participant feedback indicated a positive reception of the Urdu questionnaire, demonstrating good content validity and cultural relevance (Abd ElHafeez et al., 2021). The questionnaire was perceived as clear and easy to understand, with participants acknowledging its predictive power in anticipating real-life vaccination behaviour.

However, concerns were raised about ambiguous questions and technical jargon, highlighting the importance of simplification and transparency in communication (Sato & Ikeda, 2015). Participants emphasized the need for clear answer options and a well-structured layout to prevent confusion, especially considering the linguistic and educational diversity in Pakistan.

Overall, the cultural adaptation of the 5C Scale questionnaire to Urdu offers a valuable tool for assessing vaccine hesitancy in Pakistan, enhancing transparency, and reducing bias in research (Abd ElHafeez et al., 2021). Continuous refinement based on participant feedback is essential to ensure its effectiveness and reliability in capturing the nuances of vaccination behaviour in the Pakistani context (Gaber & Gaber, 2010; Sato & Ikeda, 2015).

3.2 Focus Group Results

The section presents findings from Focus Group session, detailing the rigorous evaluation of the 5C(PK) Scale by those with experience in vaccination.

In focus groups, participant selection is guided by the concept of 'Applicability,' emphasizing individuals with knowledge of the study area (Burrows & Kendall, 1997). Table 21 presents a comprehensive summary of the Focus Group data presenting Focus Group questions along with their respective themes. The themes and sub-themes that emerged from the Focus Group data have been linked with five important constructs of the 5C Scale. This provides a deeper understanding of the data collected during the Focus Group discussions and helps to identify key areas of focus for further research and development.

Table 21 Themes and Sub-themes with their reference codes for current study

Focus Group Questions	5C constructs/ current study Theme	Subthemes	Codes from Transcripts
what is your impression about 5C (PK) relevance in measuring vaccination hesitancy in our country?	Cultural Adaptation of 5C Scale	Cultural Relevance, Adaptation Insight Contextual Alignment	CA1. 5C Scale as a framework to understand vaccine hesitancy. CA2. Need for cultural adaptation in the context of Pakistan. CA3. Proposed adaptations to align with cultural beliefs and practices
Confidence how relevant do you consider confidence in the safety and effectiveness of vaccination and the confidence in the health system delivering it?	Confidence in Vaccination	Confidence in Safety, Confidence in Effectiveness, Trust in Vaccination System Healthcare System	CON1.Role of confidence in vaccine safety and effectiveness. CON2.Misinformation and distrust affecting vaccination decisions. CON3. Public trust in healthcare institutions and its impact on vaccination.
Complacency how relevant is the fact that people do not perceive the risk due to vaccine-preventable diseases	Perception of Risk	Underestimation of Disease Severity, Misconceptions about Disease Severity	Comp1. Inaccurate severity Comp2.Underestimate severity Comp3. Undue reliance on their immune system
Constraints When barriers and constraints to immunization decision are discussed, how relevant are these from your experience	Barriers and Constraints	Financial and Access Barriers Information Gaps Socio-cultural Barriers	Constr1. Barriers related to accessibility and affordability. Constr2.Role of education and misinformation as constraints. Constr3. Strategies to overcome barriers and constraints.
Calculation When barriers and constraints to immunization decision are discussed, how relevant are these from your experience	Information Seeking Behaviour	Trusted Information Sources Digital Information Trends	CAL1. Sources of information for vaccines in Pakistan. CAL2. Misconceptions fuelled by political suspicions and lack of information. CAL3. Community-oriented approaches for effective communication.
Collective Responsibility How important do you think is it to people that vaccines also protect other people	Community Involvement Sense of Community Responsibility	Community Engagement Influential Local Figures Community Well-being	COLR1. Importance of collective responsibility in vaccination decisions. COLR2. Community mindset influencing vaccination participation. COLR3.Vaccination for communal well-being and protection.
Additional Constructs Do you think of any other factor which contributes to VH in Pakistan people	Religious beliefs Use of Traditional medicine	Religious beliefs Use of Traditional medicine	RB. Humans are inherently equipped with an immune system by divine design, vaccines were deemed unnecessary. <u>UTradMe.</u> Use of traditional medication appeared as a cultural norm

3.2.1 Framework Analysis of Focus Group

3.2.1.1 Cultural Adaptation of 5C Scale

The focus group emphasized the importance of cultural adaptation of the 5C scale, highlighting factors such as cultural relevance, adaptation insight, and contextual alignment.

Regarding cultural relevance, participants noted the impact of rumours and religious beliefs on vaccination perceptions in Pakistan.

"There are various rumours about vaccine and vaccination process, these rumours are a negative propaganda, mostly linked with religious beliefs which psychologically affect the peoples' point of view about vaccination and vaccination process" (FG, AK, p1, line 2-10)

Adaptation insight was demonstrated through strategies like counselling and motivating individuals in various areas, indicating an understanding of the need for tailored approaches to address vaccine hesitancy effectively. Participants shared their experiences to promote the Covid-19 vaccination adaptation,

"In different areas where we took the vaccine drive, we used to counsel those who come to vaccine centres and motivate them to spread the information and encourage people to come for the vaccine..." (FG, TK, p1, line 9-11)

Contextual alignment was evident in efforts to involve healthcare professionals and plan campaigns based on local insights. This approach aimed to increase trust in vaccination and the vaccination process among the local population. Participants who were involved in recent COVID-19 vaccination drive described that,

"We had a meeting with the doctors and in those meetings we asked them how we together ran a campaign that could tell people about its usefulness." (FG, MAZ, p1, line 29-30)

3.2.1.2 Confidence

The participants emphasized the importance of confidence in vaccination, discussing subthemes such as confidence in safety, effectiveness, and trust in the vaccination

system. They highlighted that these factors significantly influence individuals' decisions regarding vaccination. Lack of trust in vaccine safety and effectiveness can deter people from getting vaccinated.

"Yes this construct will tell exactly whether they trust vaccine or not, this will ask people their opinion about its safety, its effectiveness and then ask about their confidence on healthcare system through which they will get vaccinated.....". (FG, ZH,P2, line 62-66)

Participants discussed the relevance of specific questions regarding vaccine safety, effectiveness, and trust in administrative authorities for measuring confidence in the vaccine. They debated whether the terms "safe" and "effective" are synonymous or if they represent distinct concepts. Some argued for including both statements in the questionnaire to capture nuanced perceptions.

" No, I don't think so safe and effective are same terms, I think they are different in their meanings and serve a different purpose. if you inject water to someone, then it is safe, but if it is not effective". (FG,BK, P4, line 53-56)

Examples of rumours and misinformation about vaccine harm were cited as factors contributing to declining confidence in vaccination. Trust in the healthcare system was also emphasized, with participants noting that faith in both the vaccination system and the authorities administering vaccines influences willingness to get vaccinated.

"I've seen cases where people opted for private clinics instead of government health centres for vaccinations, believing the private sector offers better quality and safety." FG, SM,P3, line 78-79)

The participants unanimously agreed that confidence is a crucial construct in assessing vaccination behaviour among the Pakistani population.

3.2.1.3 Complacency

2 sub-themes emerged from the focus group conversation (Underestimation of Disease Severity, Misconceptions about Disease Severity). Participants highlighted

the role of perception about the disease and its severity is vital to encourage people to be vaccinated and said,

"Perception of risk is crucial. If people underestimate the severity of these diseases, they may not see the need for vaccination, which is a significant barrier." (FG,MAZ , P , line 97-98)

Participants emphasized that individuals' perceptions about the severity and potential impact of diseases directly affect their willingness to get vaccinated.

Misconceptions about disease severity were identified as a barrier to vaccination uptake. Participants discussed how cultural beliefs and misunderstandings about diseases like polio can influence vaccination behaviour.

"In certain cultural beliefs, they downplay the risk of diseases like polio, thinking it's a thing of the past and politically motivated drive. This perception impacts their willingness to vaccinate." (FG, KM, P3, line 109-111)

Participants expressed consensus on the relevance of including the construct of complacency, specifically the perception of risk, in the 5C(PK) questionnaire

"Highly relevant. If people don't see these diseases as a real threat, they won't take preventive measures like vaccination seriously." (FG, MS, P4, line 118-119)

These excerpts demonstrate the participants' consensus on the significant relevance of the perception of risk associated with vaccine-preventable diseases.

3.2.1.4 Constraints

The participants discussed the significance of barriers and constraints in the context of immunization decisions in Pakistani population and 3 sub-themes emerged (Financial and Access Barriers, Information Gaps. Socio-cultural Barriers).

The participants pointed out that accessibility, affordability, education, and misinformation, are highly relevant and can deter individuals from getting vaccinated, in Pakistan.

"Barriers and constraints are highly relevant in Pakistan. Access to healthcare and awareness about immunizations are significant challenges." (FG, SM, P5, line 165-166)

"Absolutely, there are financial barriers as well. Affordability is a big issue for many people here." (FG, MW, P6, line 193-174)

Misinformation about vaccine side effects dissuading people, and lack of awareness in rural areas affecting prioritization of vaccination.

".....In Khyber Pakhtunkhwa areas people have strong belief that polio vaccine make the boys infertile.... vaccines can cause other severe health issues, and that fear prevents them from vaccinating their children." (FG, ZH, P6, line 226-228)

These examples highlight the impact of barriers and constraints on immunization decisions in Pakistan. Understanding and addressing these barriers is crucial for improving immunization rates in the country.

3.2.1.5 Calculations

While discussing Calculation construct of 5C, participants highlighted the importance of individuals seeking essential information about vaccinations to make informed decisions.

"People want to understand the basics: what the vaccine is for, its potential side effects, and why it's important. They generally want to know enough to feel confident in their decision to vaccinate." (FG, AK P6, line 221-223)

Criticism was directed towards the healthcare system and policymakers in Pakistan for imposing decisions on the public without proper information drives. Participants noted that people prefer to make informed decisions rather than having decisions imposed upon them.

"In Pakistan there is trend to impose the decisions on public.....In case of Covid vaccination without starting a proper information drive about vaccination, Government imposed restrictions. So, people found a way out to avoid the restriction instead of getting vaccinated". (FG, KM P6, line 216-214)"

2 sub-themes emerged from data to enhance vaccination behaviour in the population through improving positive Calculation via trusted sources of information and utilising

digital information trends. Regarding trusted information sources, participants mentioned that people in Pakistan commonly rely on local health clinics, hospitals, and healthcare professionals for accurate information.

".... people often turn to local community health workers who are accessible and trusted figures in the community." (FG,MAZ, P6, line 236-237)

Participants highlighted the increasing trends of using digital forums,

"Social media and the internet are becoming more popular. Many individuals, especially the younger generation, search online for information on vaccines." ."(FG, SM, P6, line 231-232)

These insights underscore the importance of providing clear and accessible information through various channels to build confidence in vaccination decisions.

3.2.1.6 Collective Responsibility

The focus group participants emphasized the importance of the 'Collective Responsibility' construct of the 5C(PK) scale in determining the vaccination behaviour of the Pakistani population. They identified 3 sub-themes within this construct, including community engagement, community well-being, and influential local figures.

Regarding community engagement, participants highlighted the strong bonds within Pakistani communities and families, emphasizing that vaccination decisions are interconnected with community and family well-being.

".....Vaccination decisions aren't just individual choices; they're interconnected with our community's and Families' well-being". (FG, BK,P6, line 235-236)

Some participants suggested rephrasing the wording of certain questions within the construct for better comprehension. Participants discussed sense of communal responsibility. where getting vaccinated is viewed as a duty to protect the broader community. They noted that this mindset is particularly strong in close-knit communities and families,

"During the COVID-19 pandemic, many individuals I know got vaccinated because they wanted to protect their elderly family members. It was about safeguarding the vulnerable." (FG, SM, P5, line 183-184)

In terms of influential local figures, participants highlighted the common practice of respecting and following the opinions of local political and religious leaders, particularly in rural areas.

"In our neighbourhood, local political leader and religious leaders organized awareness sessions for Covid 19. People listened because they knew and trusted these leaders. It created a ripple effect where more individuals felt responsible for the community's health" (FG, TK, P4, line 136-138).

They emphasized the effectiveness of involving these leaders in organizing awareness sessions and vaccination drives,

"Empower local leaders. They know the community dynamics best and can influence opinions positively". (FG, MAZ, p7, line 238-239)

3.2.1.7 Additional Constructs

Participants suggested few additional constructs for 5C(PK), but 3 constructs mentioned were considered most important namely "Religious Beliefs", "Traditional remedies" and "Cultural Norms" were suggested to add in the questionnaire.

The participants of the Focus group commented on how religious beliefs can configure peoples' vaccination behaviour in Pakistan and commented.

"As in Pakistan people religious beliefs shape peoples actions towards different healthcare initiatives taken by western world". (FG, AK, P5, line 171-172)

"In Pakistan people think that whatever happens it happens due to Allah's will,if something happened it's not because he did not take any medicine or vaccine, his time in the world was completed and he had to return to Allah. That's why they don't get vaccine". (FG, ZH P5, line 173-176)

Use of traditional medication appeared as a cultural norm in Pakistan, especially people in rural areas depend highly on traditional medications for their everyday healthcare.

“People in Pakistan usually rely on traditional medication for their everyday illness, they do not go to doctors quite often. For Covid in rural areas Pakistani were taking “Sana Maki” tea few times a day and were confident that they do not need any vaccination”. (FG, MAZ, P5, Line 177-179)

A lack of confidence in conventional medical treatments (Western medication) can be a common underlying factor for vaccine hesitancy.

3.2.2 Discussion Focus Group

The discussion centres on the Step 3 of cultural adaptation of the 5C Scale to assess vaccination behaviour in Pakistan. Participants generally agree that vaccination acceptance has improved in Pakistan during COVID-19 pandemic due to increased awareness about their importance (Tahir et al., 2021). However, pockets of resistance remain, often fuelled by misconceptions or fears about side effects). Government efforts, community involvement, and addressing trust issues within the healthcare system are seen as essential to bolster acceptance. These results are in line with findings of Rasheed et al.,(2022).

Most comments and examples shared by participants were about Polio and Covid. This was primarily because Covid was a recent event fresh in memories, and participants had a wealth of information to share due to its unprecedented nature and the ongoing events surrounding it. Pakistan is one of two countries which still have few cases of Polio therefore Polio vaccination drive is quite intense in Pakistan.

The 5C Scale is considered suitable for understanding vaccine hesitancy (Betsch et al., 2018). Building confidence in vaccine safety and effectiveness, fostering trust in the healthcare system, addressing risk perception, and tailoring communication to cultural contexts are identified as crucial aspects in shaping vaccination behaviour in Pakistan. Overcoming barriers and effectively conveying the importance of vaccines through various channels are seen as key strategies to improve vaccination rates. All

these findings align with 5C scale studies in Arab countries (Abd ElHafeez et al., 2021; Alenezi et al., 2022), Asian (Machida et al., 2021) and African (Adeyanju et al., 2022) countries.

Participants stress the importance of seeking information from reliable sources such as healthcare professionals, community health workers, and online platforms. Alongside they emphasized the use of important others (Michie et al., 2013) for disseminating the vaccine information to enhance the vaccine acceptance within the population. This viewpoint resonates with the (Bainbridge, 1993; Brewer et al., 2017), findings that to improve vaccine uptake among Muslims, it is imperative to actively involve religious leaders in vaccination drives.

Cultural nuances significantly shape attitudes toward vaccination, with individualist and collectivist cultures influencing messaging effectiveness. Recognizing these nuances is crucial for designing effective public health campaigns tailored to cultural contexts. As Pakistan is a country where mostly families enjoy a closeknit bonding, prioritize group harmony and social norms. In such society like Pakistan emphasizing community protection and adhering to societal expectations can enhance vaccine acceptance (Brewer et al., 2017).

The group suggested additional constructs of religious beliefs and use of traditional/herbal medication in the 5C(PK), as these are significant in determining individuals' vaccine-related decisions and attitudes. The official religion of Pakistan is Islam, as mandated by Article 2 of the Constitution of the country. 96.47% of the country's population is Muslim and remaining 3.53% follow diverse faith such as Christianity, Hinduism, Sikhism and other religions.(Pakistan Census, 2017).

Vaccine hesitancy research by (Qasim et al., 2022) indicates a correlation between lower levels of education and a stronger adherence to Islamic beliefs, with some individuals perceiving the vaccine as a Western scheme designed to divert them from their religious path.

The insight shared by group regarding use of traditional medication is in line with viewpoint reported by Rumetta J (2020), they found lack of confidence in modern medicine, pharmaceutical conspiracy to sell medicines, preference for a natural approach to health, and religious beliefs as prominent reasons for refusal of childhood vaccinations in Malaysian parents.

The Group's insight about use of traditional medications and vaccine hesitancy in Pakistani population align with Hornsey's (2020) study results where they found significant correlation between the utilization of complementary and alternative medicines (CAM) and an increased tendency toward vaccine hesitancy and suggest that peoples' trust in CAM might contribute to a heightened inclination toward vaccine hesitancy. A lack of confidence in conventional medical treatments (Western medication) can be a common underlying factor for vaccine hesitancy and use of herbal/CAM (M. Hornsey 2020).

Overall, participants view the cultural adaptation of the Urdu-language 5C Scale positively, providing valuable insights for refinement. Further research is warranted to validate the updated version in subsequent phases, including pilot studies assessing general or specific vaccination behaviour in the Pakistani population.

4 Revised 5C(PK)

4.1 Revised 5C(PK) Scale according to the quantitative and qualitative analysis

In step 4 main researcher (NZ) utilized the results from the step 2 (Think Aloud concurrent and retrospective study) and step 3 (The Focus Group) to develop a draft version of a revised 5 C scale, ensuring clarity and, relevance for the population. These changes were discussed with the research supervisors and research team in Pakistan before producing the draft version of the 5C(PK) Scale.

Table 22 Summary Of Findings In Step 2 (Think-Aloud) And Step 3 (Focus Group) Of Current Study

Cultural Adaptation of 5C Scale of Vaccine Hesitancy and its psychological constructs in Pakistani population	
Main Findings of the current study	
- Findings from both Phase 2 and Phase 3 indicate that the 5 constructs of the 5C Scale align well with cultural factors in Pakistan and are sufficient for capturing the complexity of vaccine hesitancy in this context - Through the cultural adaptation process, participant feedback revealed that the constructs resonated with the Pakistani population and effectively captured key drivers of vaccine acceptance and hesitancy. - The 5 constructs offer a comprehensive framework for assessing vaccine hesitancy by addressing various dimensions of psychological factors influencing vaccination behaviour. From concerns about vaccine safety and effectiveness (Confidence) to societal norms and collective responsibility (Collective Responsibility), the constructs provide a holistic understanding of vaccine hesitancy in Pakistan. - Previous research in similar cultural settings supports the utility of these constructs for understanding vaccine acceptance and hesitancy. - The adapted questionnaire provides a practical tool for healthcare practitioners, policymakers, and researchers to address vaccine hesitancy in Pakistan.	
5C (PK) Scale Improvements suggestions based on phase 2 and phase 3 findings	
- Simplify complex language and technical jargon to enhance comprehension, particularly for participants with lower educational levels. For example, the question "Everyday stress prevents me from getting vaccinated" was challenging for many participants to understand. - Ensure that questions are clear, concise, and free from ambiguity to minimize interpretation errors. - Incorporate culturally appropriate language to ensure relevance and resonance with the Pakistani population. Negative themes in Collective Responsibility and Complacency questions presented challenges, indicating need for cultural adaptation, such as "When everyone is vaccinated, I do not have to get vaccinated, too." - Provide clear and intuitive response options that accurately capture participants' attitudes and beliefs. As "moderately agree and moderately disagree" terms appeared complex to comprehend within large segment of population sample. - Suggestions for additional constructs in 5C (PK) include religious beliefs and use of traditional/herbal medication	

First version of 5C(PK) (Appendix 17) and the revised version (Appendix 18) were made to ensure inclusivity, considering participants from diverse educational backgrounds. The revisions focus on readability, making it easier for individuals with varying levels of Urdu proficiency to understand and respond effectively.

The research team took special care to employ terms that could be translated back into the original terminology of the 5C Scale (Table 23). Content analysis also revealed that participants encountered difficulties with certain terminologies, particularly technical terms related to vaccinations. For instance, the term "public authorities" was initially translated as "Intezami Hukaam (انتظامی حکام)" but was later changed to "hakoomat حکومت" (Government) based on participants' feedback. In Pakistan, people commonly refer to health promotions or public authority actions as Government acts.

Table 23 First Version And Revised Version Of 5C(PK) Scale And Their English Back Translation

Original scale items	Back translation of revised version in English	First version	Revised version
Vaccine is effective	Vaccine is effective	ویکسینشن مؤثر ہے	ویکسینشن کارآمد ہے
Regarding vaccines, I am confident that public authorities decide in the best interest of the community.	Regarding vaccines, I am confident that Government decides in the best interest of the community.	ویکسین کے بارے میں مجھے یقین ہے کہ انتظامی حکام عوام کے بہترین مفاد میں فیصلہ کرتے ہیں؟	ویکسین کے بارے میں مجھے یقین ہے کہ حکومت عوام کے بہترین مفاد میں فیصلہ کرتے ہیں؟
Complacency	Complacency	تسکین	اطمینان
Everyday Stress	Everyday Issues or Everyday Problems	روزمرہ کا تناؤ مجھے	روزمرہ کے مسائل مجھے
Calculations	Calculation	حساب کتاب	جانچ
When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.	When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.	جب میں ویکسین لگوں تو اس کے بارے میں سوچتا ہوں کہ اس کے فائدے اور خطرات کا موازنہ کرتا ہوں۔	جب میں ویکسین لگوں تو اس کے بارے میں سوچتا ہوں کہ اس کے فائدے اور خطرات کا موازنہ کرتا ہوں۔
For each vaccination, I closely consider whether it is useful for me.	For each vaccination, I assess thoroughly whether it is useful for me.	ہر ویکسین لگوانے کے وقت میں اس کی فائدہ دہن کی ضرورت پر غور کرتا ہوں۔	ہر ویکسین لگوانے کے وقت میں اس کی فائدہ دہن کی ضرورت پر غور کرتا ہوں۔
When everyone is vaccinated, I do not have to get vaccinated, too. (R)	When everyone is vaccinated, I do not have to get vaccinated, too. (R)	جب سب کو ویکسین لگائی جائے تو مجھے بھی ویکسین لگانی کی ضرورت محسوس نہیں ہوتی؟	جب سب کو ویکسین لگائی جائے تو مجھے بھی ویکسین لگانی کی ضرورت محسوس نہیں ہوتی۔

= The Urdu wording changed to Urdu wording to address the concerns regarding language.

4.1.1 Scale scoring

Many comments were related to the 7 points Likert scale, particularly regarding the moderately agree/disagree option, as in Urdu language the words used to explain moderation are quite complex.

4.1.2 Scale wording

One item, "Everyday stress prevents me from getting vaccinated", was not well received due to confusion regarding the real perspective of the daily stress restrain people from vaccine uptake. These qualitative results are consistent with the Arab study by Adu Elhafeezi (2021).

4.1.3 Scale answer options

The most prevalent issue identified during the Think Aloud study (concurrent and retrospective sessions) pertained to the answer options. Participants expressed difficulty in selecting answers, with comments such as

"They are too many." Notably, some participants altered their responses upon revisiting the questionnaire".

One participant explicitly stated,

"Can I change my answer? I got confused while choosing numbers for answer options. I thought 1 would be for 'Strongly Agree,' but actually, 1=Strongly Disagree."

To address concerns about potential confusion surrounding the term "moderation," adjustments were made to the answer options. The "moderately agree" and "moderately disagree" options were removed, simplifying the Likert scale to a 5-point scale (1=Disagree, 2=Slightly Disagree, 3=Neutral, 4=Slightly Agree, 5=Agree). These

changes were implemented based on feedback from participants during the Think-Aloud study.

Bestch et al., (2020) recommended to maintain the 7 Likert answer option. However, in telephone surveys or face-to-face settings, using a 5-point or 3-point was advised to reduce complexity and errors (Bestch et al., 2020). This decision was made to ensure consistency and accuracy in the assessment of participants' responses. This modification aimed to enhance the logical order of answer options, creating a more user-friendly experience within the population.

4.1.4 Culturally adopted Scale Language

We configured few statements for both male and female genders in first version of 5C(PK) (Table 23) so they can relate with the statements accordingly (Malik and Khan, 2020). Content analysis showed confusion and problems in readability for these gender specific terms within the statements. So, we decided to keep only one gender term for our 5C(PK) statements and opted for the masculine terms (Table 24).

Table 24 Culturally Adopted Scale Language

Suggested changes for 5C (PK) Scale Language and the revised version of the item for cultural adaptation of the Scale in Pakistan	
5C(PK) First version (Appendix 17)	جب میں ویکیسٹن لگوانے کے بارے میں سوچتا/ سوچتی تو بہتر فیصلہ کرنے کے لیے میں فوائد و خطرات کا موازنہ کرتا/ کرتی ہوں۔
5C (PK) Revised version (Appendix 18)	جب میں ویکیسٹن لگوانے کے بارے میں سوچتا ہوں تو بہتر فیصلہ کرنے کے لیے میں فوائد و خطرات کا موازنہ کرتا ہوں۔

In Pakistan, where societal structures have traditionally been more patriarchal, using masculine terms might be perceived as the norm (Chauhan, 2014). Similarly, research by Hussain (2019) highlights the pervasive influence of patriarchal values on language use, emphasizing the dominance of masculine language in various contexts, including

surveys. Moreover, in a study conducted by Malik and Khan (2020) on gender perceptions in language use, it was found that participants generally exhibited a preference for masculine terms due to their cultural familiarity and perceived inclusivity. This preference was attributed to the entrenched patriarchal norms prevalent in Pakistani society.

4.1.5 Additional Scale item

Another important finding was the role of religion. All qualitative analysis emphasized the inclusion of religion to predict the vaccine hesitancy as religion significantly influences decision-making regarding health treatment specifically vaccination within the population. These findings are in line with Nigerian 5C Scale studies by Adheyenju (2022). 5C study protocols (Bestch et al. 2020) allows addition of new items in a construct to cover additional facets of an antecedent. So, we decided to add an item “My religion does not support vaccination” for religious beliefs exploration in 5C(PK) Constraint construct.

Overall, this study provides valuable insights into the psychological determinants of vaccine hesitancy in Pakistan and lays the groundwork for further research to refine and validate the 5C(PK) Scale to help relevant authorities for developing targeted interventions to address vaccine hesitancy in the population.

5 Conclusion

5.1 Conclusion

In conclusion, this study addresses the critical issue of vaccine hesitancy in Pakistan, a concern amplified by the global impact of the COVID-19 pandemic. The lack of a vaccine hesitancy measure in Urdu language for the Pakistani population prompted this mixed-method research, following established protocols for cultural adaptation. The study unveils insights into the psychological antecedents of vaccination behaviour, with confidence, convenience, and complacency emerging as pivotal factors in shaping vaccine acceptance.

The findings highlight a pervasive lack of trust in the safety and efficacy of vaccines, fuelled by concerns about government motives, corruption, and misinformation. Challenges related to economic constraints, convenience, and accessibility further contribute to hesitancy. Despite these barriers, the study identifies positive attitudes toward vaccines among those who have received them, emphasizing the importance of building confidence through transparent information dissemination. Cultural nuances, including collective responsibility and the belief in a sustainable future for the next generation, shape vaccination decisions.

The results showed that the participants had high calculation in the 5C Scale, with lower scores in the complacency and constraint categories. The study also compared the scores with a similar study conducted in Arab populations and found that Calculation and Collective Responsibility had high mean scores among the respondents, indicating their desire for informed decisions and societal responsibility. However, the reliability results of the study differed from Western samples, and the 5C constructs showed better reliability among Pakistani participants than in a similar study

conducted in Nigeria. This highlights the need for qualitative analysis to understand the Scale's suitability for predicting vaccination hesitancy in Pakistan.

The correlation analysis revealed unique patterns that deviated from the initially proposed constructs, emphasizing the need for further investigation into cultural, social, and psychological factors influencing vaccination behaviour. The Think-Aloud and qualitative study highlighted the need for culturally sensitive survey design to improve question comprehension and presentation. The focus group discussions also emphasized the need for cultural adaptations to enhance the 5C Scale's relevance, including questions about traditional remedies and societal influences.

5.2 Limitations

While this study explored the usability, suitability and cultural adaptability of 5C Scale of vaccination behaviour in Pakistan it had some limitations related to convenient sampling and limited geographical representation, which could introduce selection bias and limit the generalizability of the findings to the broader Pakistani population. Additionally, participants' responses regarding their recent encounters with COVID-19 and vaccination may be subject to recall bias, and the study's findings may lack external validity due to the limited sample size and sampling method. Therefore, further research with larger and more diverse samples from multiple regions of Pakistan is needed to confirm the findings and enhance the study's external validity.

5.3 Contributions and further research recommendations

This study suggests that with small amendments this adapted questionnaire can be a helpful tool for healthcare practitioners, policymakers, and researchers to accurately assess vaccine hesitancy in Pakistan. It can identify psychological factors that affect

vaccination behaviour and help tailor communication strategies and educational campaigns to address specific concerns. The cultural adaptation process highlights the need for careful translation and adaptation to ensure relevance and clarity. Future research can use the questionnaire to understand the determinants of vaccine hesitancy in Pakistan and track changes in vaccination behaviour over time. Comparative studies across regions and demographic groups can provide insights into variations in vaccine hesitancy and inform targeted interventions.

6 List of Appendices

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WHODAS 2.0, 2.untitledWHODAS 2.0 TRANSLATION PACKAGE
(VERSION 1.0)

TRANSLATION AND LINGUISTIC EVALUATION PROTOCOL AND
SUPPORTING MATERIAL. *Whodas 2.0 Translation Package (Version 1.0)*
Translation and Linguistic Evaluation Protocol and Supporting Material,
<https://terrance.who.int/mediacentre/data/WHODAS/Guidelines/WHODAS%2020%20Translation%20guidelines.pdf>

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Appendix 1

University of Stirling
Cottrell 3B1
Stirling FK9 4LA

24/04/2023

Dear Neelam

Ethics Application Form : Cultural adaptation of the 5c Scale of antecedents of vaccination to assess the vaccination behaviour in Pakistan. 10684

Thank you for your submission of the above ethics application.

The ethical approaches of this project have been approved and you can now proceed with your project.

Please note that should any of your proposal change, a further amendment submission will be necessary.

If you have any further queries, please do not hesitate to contact the Panel by email to ethics@stir.ac.uk

Yours sincerely,

General University Ethics Panel

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Appendix 2

Risk assessment

Description of activity	The principal researcher (Neelam Zia) will carry out Think -Aloud study in Pakistan where participants will complete 5C Urdu translated questionnaire and organise an expert focus group for 5C questionnaire data collection. NZ will travel to Pakistan and for data collection NZ will travel from Islamabad to Attock. NZ will help with consent taking, provide advice to participants in completing the questionnaire and carry out interviews at the school. Data collection is during school hours 0930- 1500, Monday – Friday		Location	1. Islamabad 2. Attock Director of Education Office 3. Government High school No.2 for Girls, Attock city 4. Community center , Attock city
Researcher responsible	Neelam Zia	Signature & date	Neelam Zia 03/04/2023	
Assessed by (name & role)	Dr Vivien Swanson Dr Purva Abhyankar	Signature & assessment date		

Hazard (H) hazardous event (HE) consequence (C)	Who might be harmed	Current controls	Current risk LxC=R	Additional controls needed to reduce risk	Residual risk LxC=R
Travel from UK to Pakistan. Air travelling long hours, local climate, accommodation, documentation and ID loss, vaccination, local endemic and medical emergencies, crime, knowledge of local culture	NZ	NZ is Pakistani national and aware of Pakistani environment, climate, medical facilities. NZ has family support and family accommodation in Pakistan, NZ frequent traveller and has knowledge about entry requirements in Pakistan. NZ is familiar with societal rules and regulations and complaints registering procedure in case of any emergency. NZ will be in	Unlikely x catastrophic moderate - RISK	Research activity organiser AZ (District Education Officer) will accompany NZ in Pakistan and facilitate all research activities.	Unlikely x Major-Low - RISK

Hazard (H) hazardous event (HE) consequence (C)	Who might be harmed	Current controls	Current risk LxC=R	Additional controls needed to reduce risk	Residual risk LxC=R
		contact with supervisors in University of Stirling through email and Microsoft Teams. NZ well familiar with local culture and values.			
Driving from Islamabad to Attock for research activities. Road traffic accident. Major injuries possible fatalities. (Family driver drives NZ to research activity location in Attock) or NZ drive herself)	NZ, family Diver Other road users	Drivers follow the driving rules for research work travelling using their own vehicle risk assessment. NZ have a mobile and contact numbers for the research activity organizer and family contacts (as NZ will be with family in her native city). Only travel Monday – Friday 0830-1700.	Unlikely x catastrophic HIGH-RISK	NZ to confirm drivers are insured and competent to drive through licence checks. NZ has driving licence to drive in Pakistan and familiar with roads and local traffic behaviour	Very unlikely x catastrophic MEDIUM RISK Before data collection starts
Physical violence and verbal abuse. People (participants and others) are physically and/or verbally aggressive towards NZ and organiser. Major injury and emotional harm. (Will vary with location and participant or participants group interviewed)	NZ Research activity organiser	Research activity organiser will research location head before visiting. NZ trained in de-escalation techniques, lone working procedures, interview technique and personal safety. Lone worker procedure. Planned, rehearsed response measures in place and worker contact monitoring. Survey. Organiser to accompany NZ and wait at the location when research activity conducted. Interviews/questionnaire work conducted between 0930-1500, Monday to Friday. NZ will stop the research and inform the organiser and location head.	Very unlikely x major LOW RISK	If subjected to violence complete an incident report form, report it to the research organiser and Head of Location. Post incident support from Occupational Health.	Very unlikely x moderate VERY LOW RISK

Hazard (H) hazardous event (HE) consequence (C)	Who might be harmed	Current controls	Current risk LxC=R	Additional controls needed to reduce risk	Residual risk LxC=R
Excessive hours worked due to long driving hours and high number of interviews in one day. Fatigue.	NZ	Research carried out between 0930-1500. NZ to monitor interview timings. Take regular welfare breaks.	Unlikely and minor LOW RISK	No further controls needed	Unlikely and minor LOW RISK
Fire, first aid and local emergency arrangements. NZ not familiar with the emergency arrangements. Harm escalates due to their delayed response or incorrect emergency action. Major and potential fatalities.	NZ Participants and others.	NZ briefed on the emergency arrangements by the location contact before the research starts. NZ identify the local exit routes and follow the local emergency arrangements.	Very unlikely and major LOW RISK	No further controls	Unlikely and minor LOW RISK
Study subject welfare. Extremely emotional participant due to vaccination issues. Deterioration in participant welfare and increased risk to their safety. NZ experience emotional fatigue.	Participant NZ	NZ will stop the interview and immediately follow the procedure below: The recording will be immediately stopped, and participant will be asked if they want to take a break/end the interview/continue talking – participant's decision will be final. If participant decide to take a break and continue with the interview, confirmation will be sought that they are comfortable continuing, and there is no penalty for withdrawing. If participant wish to continue but remain distressed, NZ will make the decision	Unlikely and moderate LOW RISK	No further controls	Unlikely and moderate LOW RISK

Hazard (H) hazardous event (HE) consequence (C)	Who might be harmed	Current controls	Current risk $L \times C = R$	Additional controls needed to reduce risk	Residual risk $L \times C = R$
		to draw the interview to an end. At this point, NZ will provide participant with an opportunity to talk and ensure that they are not visibly distressed when leaving the interview. NZ will also offer participants to provide with a list of local contacts (e.g., counselling services, psychology services) if participants would like them. NZ will inform the research activity organiser and the location head.			

Periodic Review

Review date:			
Review by:			
Signed:			

Consequence	Catastrophic	Medium	High	Very High	Very high	Very High
	Major	Low	Medium	High	High	Very High
	Moderate	Very low	Low	Medium	Medium	High
	Minor	Very low	Low	Low	Medium	Medium
	Insignificant	Very low	Very low	Low	Low	Low
	$R = L \times C$	Very unlikely	Unlikely	Fairly likely	Likely	Very likely
Likelihood of hazardous event						

Appendix 3 5C Scale Translation Table

English version	translated version
Confidence	
I am completely confident that vaccines are safe.	
Vaccinations are effective.	
Regarding vaccines, I am confident that public authorities decide in the best interest of the community.	
Complacency	
Vaccination is unnecessary because vaccine-preventable diseases are not common anymore.	
My immune system is so strong, it also protects me against diseases.	
Vaccine-preventable diseases are not so severe that I should get vaccinated.	
Constraints	
Everyday stress prevents me from getting vaccinated.	
For me, it is inconvenient to receive vaccinations.	
Visiting the doctor's makes me feel uncomfortable; this keeps me from getting vaccinated.	
Calculations	
When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.	
For each vaccination, I closely consider whether it is useful for me.	
It is important for me to fully understand the topic of vaccination before I get vaccinated.	
Collective responsibility	
When everyone is vaccinated, I do not have to get vaccinated, too. (R)	
I get vaccinated because I can also protect people with a weaker immune system.	
Vaccination is a collective action to prevent the spread of diseases.	

Instruction: "Please evaluate how much you disagree or agree with the following statements." (1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree).

Appendix 4 5C Scale Urdu Language Translation Table

translated version	English version
اعتماد	Confidence
مجھے مکمل یقین ہے کہ ویکسین محفوظ ہے۔	I am completely confident that vaccines are safe.
ویکسینیشن مؤثر ہے	Vaccinations are effective.
ویکسین کے میں مجھے یقین ہے کہ انتظامی حکام عوام بارے الناس کے بہترین مفاد میں فیصلہ کرتے ہیں؟	Regarding vaccines, I am confident that public authorities decide in the best interest of the community.
تسکین	Complacency
ویکسینیشن غیر ضروری ہے کیونکہ ویکسین سے روکے جانے والی بیماریاں اب عام نہیں ہیں؟	Vaccination is unnecessary because vaccine-preventable diseases are not common anymore.
میرا مدافعتی نظام بہت مضبوط ہے یہ بیماریوں میں میری حفاظت کرتا ہے؟	My immune system is so strong, it also protects me against diseases.
ویکسین سے روکے جانے والی بیماریاں اب اتنی شدید نہیں ہیں کہ مجھے ویکسین لگوانی چاہیے؟	Vaccine-preventable diseases are not so severe that I should get vaccinated.
رکاوٹیں	Constraints
روز مرہ کا تناؤ مجھے ویکسین لگوانے سے روکتا ہے؟	Everyday stress prevents me from getting vaccinated.
میرے لیے ویکسین لگوانا تکلیف دہ ہے؟	For me, it is inconvenient to receive vaccinations.
ڈاکٹر کے پاس جانے سے مجھے بے چینی محسوس ہوتی ہے یہ احساس مجھے ویکسین لگوانے سے روکتا ہے؟	Visiting the doctor's makes me feel uncomfortable; this keeps me from getting vaccinated.
حساب کتاب	Calculation
جب میں ویکسین لگوانے کے بارے میں سوچتا/ سوچتی تو /بہتر فیصلہ کرنے کے لیے میں فوائد و خطرات کا موازنہ کرتا کرتی ہوں۔	When I think about getting vaccinated, I weigh benefits and risks to make the best decision possible.
ہر مرتبہ ویکسین لگواتے وقت باریک بینی سے دیکھتا/ دیکھتی ہوں کہ یہ میرے لیے سود مند ہے؟	For each vaccination, I closely consider whether it is useful for me.
یہ میرے لیے نہایت اہم ہے کہ میں ویکسین لگوانے سے قبل اس کے بارے میں اچھی طرح معلومات کر لوں۔	It is important for me to fully understand the topic of vaccination before I get vaccinated.
اجتماعی ذمہ داری	Collective responsibility
جب سب کو ویکسین لگائی جاتی ہے تو مجھے بھی ویکسین لگوانے کی ضرورت محسوس نہیں ہوتی؟ (R)	When everyone is vaccinated, I do not have to get vaccinated, too. (R)
میں ویکسینیشن کرواتا ہوں تاکہ کمزور مدافعتی نظام کے لوگوں کو بھی بچا سکوں	I get vaccinated because I can also protect people with a weaker immune system.
بیماریوں کے پھیلاؤ کو روکنے لیے ویکسینیشن ایک اجتماعی ذمہ داری ہے؟	Vaccination is a collective action to prevent the spread of diseases.

Appendix 5

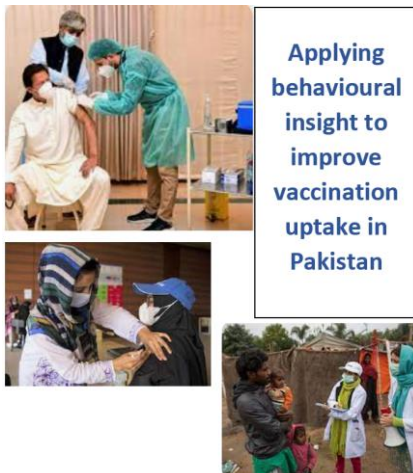
Study Flyer

Are you interested in talking about Vaccination for different diseases in Pakistan?



We would like to invite you to take part in our research study “Cultural adaptation of the 5C scale of antecedents of vaccination to assess the vaccination behaviour in Pakistan”. We understand that people have different opinions about Vaccination for themselves or their families in Pakistan. It is our aim, with your help, to adapt a scale that already measures vaccination behaviour in other countries, so that it can be used successfully in Pakistan.

Please contact us at: Neelam Zia neelam.zia@stir.ac.uk



Applying
behavioural
insight to
improve
vaccination
uptake in
Pakistan

What will I have to do if I take part?
Should you agree to take part we will ask you to attend a local session where you will fill out a questionnaire and will take part in an interview. Please contact us at neelam.zia@stir.ac.uk/ (Pakistani contact number) or leave your details with person you received this flyer from.

This study has been reviewed and approved by the Ethics Review Board of University of Stirling

Appendix 6

Demographic Form

Demographic Details Form

Vaccination Behaviour Study in Pakistan

Participants ID -----[number to be assigned by study investigators].

Date -----

Initials -----

Age: (18 -24), (25-35), (35- 45), (45-55), (55-75), (75+)

Profession: Govt. Employee =1, Non-Govt Employee= 2,
Businessman/woman = 3, Unemployed = 4 , Housewife =5, Student = 6

Gender: 1=Female, 2=Male, 3=Other

Education attainment: Matric, Diploma, BSc, Honours, MBBS/MBChB, MSc, PhD,

Other (please specify -----
-----)

Personal income: Less than Rs100000 per month, ☐

Rs100000-Rs250000 per month, ☐

More than Rs250000 per month ☐

Religion: -----

Have you ever completed used any vaccination behaviour questionnaire before?

Yes ☐ No ☐ Not Sure ☐

When is the last time you have completed any vaccination behaviour.

Recently (in last 6 months ☐ 2 years ago ☐ More than 5 years ago ☐

Appendix 7

Think-Aloud

Instructions for the Think-Aloud session

We suggest audio-recording (ask for participant consent).

Welcome

Thank you for your interest in this study.

We are in the process of developing a set of questions to assess why people in Pakistan vaccinate or do not vaccinate.

In this study, we are interested whether the questions that we have developed make sense to people filling in the questionnaire.

Questionnaire

Think-aloud sessions will be conducted at the organisation where participants have registered their interest. On the day of the individual session, participants will receive a printed copy of the participant information sheet, and written consent (Appendix IV) will be obtained. Participants will be provided with a quiet setting to facilitate thinking aloud and participate in follow-up interviews. The principal researcher (NZ) will conduct all think-aloud sessions and follow-up semi-structured interviews; no one else will be present during the sessions. Each session will start with a think-aloud exercise, with participants being instructed to verbalise their thoughts. First, they will be asked to complete the 5C Scale for vaccination behaviour and express their thinking throughout; while completing the 5C Scale; positive reinforcement will be used using verbal communication (e.g., "You are doing great") If the participant makes any opinion or suggestion, to claim insight researcher will ask (e.g., "what makes you say that" or "how would that help").

The non-verbal neutral acknowledgement will be given throughout the session to show that researcher is attentive and listening, like "uhu uhu" or "Humm" The verbal and non-verbal communication will be used to encourage participants to continue to express their views. In quiet moments, prompts will be used (e.g., "What are you thinking now?" and "Tell me what is on your mind"). Aside from reminders, all interaction between participant and researcher will be minimum. Think aloud session will be audiotaped and transcribed verbatim by the principal researcher. During the session, the researcher will take notes about what was verbalised, including points for clarification. Once data collection is completed, the researcher will conduct a brief follow-up interview with the help of a semi-structured interview guide (Appendix V) to clarify participants' thinking further and identify their reasoning strategies. The session will last between 45 -60 minutes. Hot/Cold drinks of participants' choice will be provided.

Now we would like to ask you to simply fill in the questionnaire. I will request you to talk about your thoughts while completing the form. I will be in the room sitting behind you

while you are completing the 5C scale. If you have any difficulty reading the questionnaire I will read it for you.

[Let participants fill in questionnaire].

Thank you.

Follow up

Now, please go through the questions again and circle all aspects that you did not understand or that were not clear in the way they were written.

[Let participants circle items].

For each aspect that you circled, please let me know what causes the confusion.

Follow-up sample questions:

What did you find difficult to understand? Where are there any difficult words?

Is there something missing that would make the information easier to understand?
What would that be?

Please describe the [specific aspect] with your own words.

[Let participants answer].

Closing and thank you

Is there anything else that is worthwhile mentioning?

Thank you for your support!

Appendix 8

Think-Aloud Information Sheet

Developing a measure of Vaccination Behaviour in Pakistan

INFORMATION SHEET

You are invited to take part in a research study. Before you decide if you want to take part, it is important for you that you understand why this research is being done and what it will involve. Please take time to read to the following information carefully and decide if you wish to take part.

Feel free to ask any questions and talk to others before you decide to take part.

Thank you for reading this.

What is this study about?

We are shortly beginning a study looking at how religious aspects, social aspects, economic constraints, perceived beliefs, cultural aspects, false community perceptions and not well-established healthcare system can affect Pakistani people's vaccination behaviour. For this study we will use a questionnaire about vaccination behaviour of people of Pakistan. This questionnaire has been developed and used before in western cultural contexts, so we want to find out how people in Pakistan understand the questions and find it relevant according to their social and cultural beliefs.

Who will conduct the research?

The research is a 'Think – Aloud' study conducted by Neelam Zia, a trainee health psychologist and doctorate student on a Health Psychology course at the University of Stirling who is being supervised by Professor Vivien Swanson and Dr Purva Abhyankar.

Why is this research being done?

It is important to know whether the people who have completed the questionnaire make sense of the questions in the same way as researcher intends and they find these questions relevant to explore Pakistani people's views. This is especially important if the results of this questionnaire are used to help improve vaccination behaviour in Pakistan.

Who can take part in it?

We are inviting adults (aged 18years +) who live in Pakistan. To take part you need to be able to understand written and/or spoken Urdu to be able to fill the

questionnaire and to talk aloud about your thoughts while filling it. You also need to be able to provide consent for this study.

Do I have to take part? No, taking part is voluntary. If you would prefer not to take part, you do not have to give a reason. If you take part but later change your mind you can withdraw your data at any time up until the point it is analysed.

What does the research involve?

You will be asked to complete a Questionnaire which measures vaccination beliefs while thinking aloud. What I mean by 'Think-Aloud' is that I want you to tell me what you are thinking as you read each question and decide how to answer it. This will take around 15 minutes. After completing the questionnaire there will be an interview where I will ask you few questions to understand better different statements you have made while completing the questionnaire. It will take 45 -50 minutes for the whole session. With your permission, you will be audio recorded through the session and all recordings will be transcribed by the researcher.

How will the information be kept confidential?

The University of Stirling is the sponsor for this study based in the United Kingdom. We will be using information you provide to undertake this study and will act as the data controller for this study. This means that we are responsible for looking after your information and using it properly.

All personally identifiable information will be kept anonymous and strictly confidential. This means that your identity will be always kept private. Neelam Zia, main researcher will write down what you say in the anonymised audio recordings of your interview. This will be conducted on a secure computer from encrypted data drive. The audio tapes will be always stored in a locked secure place and the computer data will be protected from intrusion also using secure passwords. All Think-Aloud sessions will be recorded by using digital recorders, digital audio files will be stored on the SharePoint site and deleted from the recording device after transcribing them. The audio tapes will be destroyed at the end of the study after transcribing them.

Your rights to access, change or move your information are limited, as we need to manage your information in specific ways for the research to be reliable and accurate. If you withdraw from the study, we will keep the information about you that we have already obtained. To safeguard your rights, we will use the minimum personally identifiable information possible. You can find out more about how we use your information <http://www.rec-man.stir.ac.uk/documents/RRSAcDept-V4.pdf>.

What are the possible risks of taking part? There are minimal risks for taking part in this research study. Thinking about personal problems such as any stressful memories or feelings attached with vaccination may be stressful. We would

encourage you to seek the advice of your general practitioner in case you feel more distressed than normal. You can stop your participation in the study at any time without giving any explanation. Data will be kept anonymous and will be stored by the research supervisor according to the ethical guidelines of the University of Stirling.

Are there any possible benefits? This study will help us to develop a scale to measure vaccination behaviour in Pakistan. This can highlight any possible challenges and changes in whether people choose to be vaccinated, so those who make vaccination policies can make decisions that are most helpful to promote people's health and wellbeing in future.

Will the research be published? The interviews will be analysed by using a computer package by Neelam Zia. At the end of the research, I will write a report. No participant will be identifiable from any publications.

Who has reviewed this research project? This study has been reviewed by the Ethics Review Board of the University of Stirling

Who do I contact if I have concerns about this study or I wish to complain?

If you have any other queries, please feel free to contact the research team at the.

Names: Neelam Zia

Pakistan contact number: -----

Email: -----nez1@stir.ac.uk-----

Thank you for your consideration and taking part in this study.

If you would like to take part in the interview, please complete your contact details below and return the strip to the researcher. Thank you.

Name: _____

Telephone: _____

Email (optional): _____

Next Week Availability (maximum one hour slot):

Appendix 8

Think-Aloud Consent Form

5C Scale for Vaccination Behaviour in Pakistani Population

CONSENT TO PARTICIPATE

Principal Investigator: *Neelam Zia*

Please read each statement and put an initial in each box to indicate your agreement:

	<i>Please Initial</i>
I confirm that I have read and understood the information sheet Version No: < 1 > Date: 07/02/2023 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
I have agreed to take part in the study as it has been outlined to me. I understand that I am free to withdraw from the study or any part of the study at any time, without having to give a reason.	
I understand that relevant sections of my data collected during the study may be looked at by individuals from the University of Stirling, UK, from regulatory authorities if appropriate, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.	
I agree to the interview/discussion being audio recorded.	
I agree to anonymised quotes being used in study reports, publications, or presentations.	
I agree to take part in the above study.	

Participant Name: _____ Date: _____ Signature: _____

Researcher Name: _____ Date: _____ Signature: _____

1 copy for participant; 1 copy for researcher

Appendix 10 Script for demonstrating Think-Aloud Study to Participants

Demonstrators:

- Main Researcher. NZ
- Fellow Research team member

Researcher (NZ): Hello and thank you for participating in our think-aloud study today. We're interested in gathering your feedback on a survey questionnaire about weather forecasting services in Pakistan. It includes Likert scale questions ranging from 1 to 7, where 1 represents "Strongly Disagree" and 7 represents "Strongly Agree." As you go through each question, please verbalize your thoughts, feelings, and any difficulties you encounter. Remember, there are no right or wrong answers; we're interested in understanding your thought process. Let's begin.

Research team member: Yes, I'm ready to begin.

Researcher (NZ): Excellent! (shares the questionnaire with the research team member)

Research Team member: Reads aloud the first question and verbalise their thoughts)

R: Thank you for sharing your perspective. Let's move on to the next question.

[The researcher and participant proceed through the survey for another question, with the participant verbalizing their thoughts and the researcher taking notes on their responses and any areas of confusion or difficulty encountered and encouraged them to verbalise their thoughts.]

Main Researcher: We appreciate your time and input. If you have any further questions or feedback, please feel free to reach out. Thank you again.

Survey Questions

1. Please rate your level of satisfaction with the weather forecasting services provided in Pakistan

1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree

2. The weather patterns in Pakistan have become more unpredictable in recent years'.

1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree

3. The weather conditions in Pakistan affect my daily activities

1 = strongly disagree, 2 = moderately disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = moderately agree, 7 = strongly agree

Appendix 11

Follow up Questions guide detailed

Detailed Follow up Qualitative Questions

Construct	Adult	Rationale
General	Tell me a little about yourself	Warm-up question Orients interviewer to participant's situation
About Questionnaire	Now, please go through the questions again and circle all aspects that you did not understand or that were unclear or misleading in the way they were formulated. Tell me, what did you find difficult. Probe: — Why do you feel that way?	Shows participant's understanding of the questionnaire and the terms used. Will tie in with later question about getting vaccine
	Is there something missing that would make the information easier to understand? Probe: What would that be? Please describe the [specific aspect] with your own words.	Understand participant's perception of questionnaire and its purpose
	Is there something that would make the information harder to understand? Probe: What would that be? Please describe the [specific aspect] with your own words.	Enables probing for the presence of/experience of stigma, which will tie in with vaccine question below
Have you ever had a vaccine	How do you feel about it? Probes: What makes you decide to have vaccine.	Elicits what their intentions and decisions are towards the general vaccination process.

	Take me through how you will or have decided whether to get a vaccine. Probe: — who else was/will be involved in that decision? Who else did/will you discuss it with? Why?	
Have you ever decided on someone else behalf to get vaccine	Who are they? Probe: — who else was involved in the decision? Who else did you discuss it with? Why?	Elicits what their intentions and decisions are towards the vaccine.
Confidence	How much do you believe in vaccines. What do you think Pakistani population in general feel about getting vaccination?. Probes: — Are people's views different for different kinds of vaccines? — What are your thoughts about the safety of the vaccines? — What about the safety of new vaccines? — What do you think about how well the vaccines work? How well do they prevent us from infectious diseases?	Elicits the participant's confidence in the vaccine, probe questions will cover the different aspects, such as safety, importance etc.
Complacency	What do you think getting vaccine provides you immunity against risks of disease or its only satisfy the psychological aspects. Do you believe that vaccines can immune you from disseises / pandemics?	Covers decision autonomy, but also the decision-making process more broadly, with a view to understanding what kinds of social processes might be involved
Constraints	What might be the reasons for which people in Pakistan may refuse to get vaccinated? Probe: use only if and when needed - Due to work or family commitments - Due to unacceptance in society - Due to cultural issues - Due to lack of information - Due to lack of resources	This covers the societal constraints and if there are different type of constraints for different community sctors

	Due to lack of confidence Due to religious issues	
Calculations	How do you decide whether or not to get vaccinated? What things do you consider? How do you think Pakistani population in general decide about getting vaccinated or not? What things do you think people consider as important when deciding?	Understand participant's health and wellbeing preferences and what they think general Pakistani population consider before making decision about their health and wellbeing
Collective Responsibility	Do you feel getting vaccinated is your responsibility towards your community and your nation	Understand the societal patterns and trends in Pakistani population for their health and wellbeing and their society's health and wellbeing
Close	Now going back to the questionnaire, is there anything missing in the items? For example, are there any beliefs/feelings about vaccines that are specific to people in Pakistan, but are not included in the items? Can you think of anything else that influences people's vaccination decisions, but is not included in the questionnaire? Is there anything else you'd like to say?	Leave option for unexpected findings, or elaboration on things expressed previously.

Thank you for your support!

Appendix 12

Focus Group Invitation Email

Subject: Nomination Guidance for Focus Group Participation in the Cultural Adaptation of 5C Scale of vaccine Hesitancy in Pakistani Population Study

Dear Sir/Madam,

We hope this message finds you well. We are currently seeking participants for an upcoming focus group session related to the cultural adaptation of the 5C Scale for understanding vaccine hesitancy in the Pakistani population. As your organisation is a key stakeholder in current COVID-19 vaccination drive. Your insights and experiences are highly valued, and we believe your participation would significantly contribute to the success of our study. Can you please nominate one of your colleagues to participate in this Focus group, following are the inclusion and exclusion criteria for participation:

Inclusion criteria	Exclusion criteria
Over 18	Under 18 years
Provide consent to attend the focus group	Not able to provide consent
Read and write Urdu	Not able to comprehend the Urdu language
Self-identify as someone from the key stakeholder roles or nominated by a stakeholder organization.	

If you or your colleague meet the inclusion criteria and are willing to participate, please confirm your interest by replying to this email by 07/05/2023. We will provide further details regarding the focus group schedule, location, and any additional information you may need upon your confirmation. We have attached an invitation letter and study information sheet along with this email.

Your representation and participation is integral to the success of our study, and we genuinely appreciate your time and contribution. If you have any questions or require further clarification, please feel free to reach out to nez1@stir.ac.uk

Thank you for considering this opportunity.

Best regards,

Neelam Zia

Lead Researcher
03001377763
Nez1@stir.ac.uk

Appendix 13

Focus Group Invitation Letter

Letter of invitation to Expert panel for participation in step 3 Focus Group

Disseminated by emails to the concerned departments/organisations

Dear Sir/Madam,

Title of project: **Developing a measure of Vaccination Behaviour in Pakistan**

I am writing to ask if you would kindly consider taking part or nominating one of your team members to take part in a focus group for a research study for Developing a measure of Vaccination Behaviour in Pakistan.

I am attaching some further information about the research and what agreeing to take part in the focus group may involve for you. I would be grateful if you could read this carefully. I hope this is clear but if you have any further questions, please contact the main researcher Neelam Zia at **nez1@stir.ac.uk**.

If after reading the information leaflet and discussing this with others, you feel happy to participate then please email the main researcher (see above) who will then contact you about taking part. If you do not feel as if you want to be involved in the study, then thank you for your time and you will not be contacted again.

Yours sincerely

Signed

Neelam Zia (Lead Investigator)

Appendix 14

Focus Group Information Sheet

Developing a measure of Vaccination Behaviour in Pakistan

We would like to invite you to take part in a focus group for a research study. This study is looking at how to assess vaccination behaviour in Pakistani population by using 5C scale of psychological antecedents of vaccination behaviour. For this study we will use a questionnaire about vaccination behaviour of people of Pakistan. This questionnaire has been developed and used before in western cultural contexts, so we want to find out how people in Pakistan understand the questions and find it relevant according to their social and cultural beliefs. In step 1 and 2 of this study we will translate the 5C scale in Urdu and recruit participants from general public to complete the translated version and share their views about it in a Think-Aloud session. We need your participation for step 3 as this step of the study aims to seek views of experts and key stakeholders on whether the agreed-on translation covers the concepts as defined and will identify whether the items capture the definitions of their respective antecedents in relation to the Pakistani context.

Before you make any decision regarding participation you need to understand why the research is being done and what it would involve for you. Please take time to read the following information carefully. Talk to others about the study if you wish, if you have any further questions, please contact the Main Researcher (contact details provided at the end of this leaflet).

What is the purpose of the study?

The purpose of the study is to understand how religious aspects, social aspects, economic constraints, perceived beliefs, cultural aspects, false community perceptions and not well-established healthcare system can affect Pakistani people's vaccination behaviour.

Who is conducting the study?

This research is conducted by Neelam Zia, a trainee health psychologist and doctorate student on a Health Psychology course at the University of Stirling who is being supervised by Professor Vivien Swanson and Dr Purva Abhyankar.

Why have I been invited?

You have been invited as you are either Urdu/English Language Researchers, public health professionals, Allied health professional, Expanded programme on immunisation (EPI) local member, Representative of parent council from High school and primary school, Representative of Civil society, Representative of religious organisation or a Representative of local vaccination team. We have

approached your department/organisation deanery which has agreed for you to be approached regarding participation in the study.

Do I have to take part?

A decision to take part in this study is entirely voluntary and it is entirely your decision whether to take part or not. Any decision regarding your participation will be confidential between you and the main researcher NZ. You are also free to withdraw from the study at any time without any repercussions to yourself.

What does agree to take part involve?

Your involvement would be to participate in one focus group discussion with other experts, facilitated by main researcher NZ. You will meet with other experts at local community centre for one and half hour session. Main researcher (NZ) will lead the session and request all attendees to introduce themselves to the group. NZ will explain the study share the 5C questionnaire with the group. You will be requested to share your opinion about 5C questionnaire whether its constructs are relevant to assess Pakistani population vaccination behaviour or not. You will also suggest any additional items for the existing 5C Scale if necessary. If needed, the set of items can be extended by adding novel items that cover additional facets of an antecedent. Data collected from the focus group will be analysed independently by the main researcher.

What about confidentiality and data protection?

All information you may give will be treated in the strictest confidence. The researcher will take notes during the discussion and session will be recorded but any information you give during the focus group will be fully anonymised and combined with the views and experiences of other experts who agree to participate. If an issue is raised by participants during the focus groups which is judged to have serious consequences for the well-being of expert panel, then this issue may be discussed with research supervisors at University of Stirling. However, no individual member of expert panel will be identifiable at any stage in discussions, publication or presentation of the findings. This means that your identity will be always kept private.

The focus group discussion will be audio recorded on a digital recorder and later transcribed by Neelam Zia, the main researcher. The digital audio files will be stored on the researcher's One Drive (cloud storage) in a password protected folder, only accessible to the researcher and deleted from the recording device once they have been transferred. The audio recordings will be deleted from the Sharepoint site once they have been transcribed and anonymised. The anonymised transcripts will be stored in a password protected file on One Drive and will be accessible to the researcher and supervisors. The anonymised data will be deposited to the University's secure data repository DataStore for a period of 10 years. Your response will be treated with full confidentiality and anyone who

takes part in the research will be identified only by code numbers. The University of Stirling will keep identifiable information about you, in a secure separate file on OneDrive until the study is finished, after which it will be destroyed.

What are the risks of participating?

We understand that there are many demands on your time and there is some inconvenience in taking part in the focus group. We are also aware you may have concerns about taking part in further evaluation of your role along with your work-based assessments. The focus group will be organised at a time which is convenient to you and is likely to take place your work hours after agreeing with your deanery.

There is a very small chance you may become upset if you voluntarily disclose an experience

that was particularly stressful or unhappy. You are free at any stage to withdraw from the focus group or take time out if you wish. The focus group is designed to be a supportive environment, and the facilitator has experience to in this methodological approach. Only other experts and the main researcher will be present at the focus group.

How will I benefit from this study?

We hope you will find the experience of taking part in the focus group interesting and useful. You will have the opportunity to receive feedback from the main researcher in a short report of the overall focus group findings if you wish to.

What will happen as a result of the study?

The data collected from you will be aggregated with the data from other members of focus group and this will be analysed and used to produce a report which will be made available for all participants.

Who has reviewed the study?

This study has been reviewed by the Ethics Review Board of the University of Stirling

What should I do now?

You should take enough time as you feel you need to consider whether to take part. If you do wish to take part, there is a contact email/number for the main researcher to reply to below. The main researcher will then forward a consent form for you to sign along with the details of when and where it is suggested the focus group will take place. If you do not wish to take part, then you are not required to do anything, and we will not contact you again.

What will happen if I don't want to carry on with the study?

If you after consenting to take part in the focus group, you subsequently change your mind about participating, you can withdraw from the study at any time (including during or after the focus group itself). Any data collected from you would not be included in the study.

Further contact

If you have any further questions, then please feel free to contact Neelam Zia at **nez1@stir.ac.uk**

Thank you for your time

Appendix 15

Focus Group Consent Form

Developing a measure of Vaccination Behaviour in Pakistan

Consent to participate in Expert Panel Focus Group

Principal Investigator: *Neelam Zia*

Please read each statement and put an initial in each box to indicate your agreement:

	<i>Please Initial</i>
I confirm that I have read and understood the information sheet Version No: < 1 > Date: 23/02/2023 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
I have agreed to take part in the study as it has been outlined to me. I understand that I am free to withdraw from the study or any part of the study at any time, without having to give a reason.	
I understand that relevant sections of my data collected during the study may be looked at by individuals from the University of Stirling, UK, from regulatory authorities if appropriate, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my records.	
I agree to the Focus Group being audio recorded.	
I agree to anonymised quotes being used in study reports, publications, or presentations.	
I agree to take part in the above study.	

Participant Name: _____ Date: _____ Signature: _____

Researcher Name: _____ Date: _____ Signature: _____

1 copy for participant; 1 copy for researcher

Appendix 16

Focus Group Guidelines

Focus group discussion topic guide

Setting the scene and ground rules

- **Thanking** participants
- Facilitator **introduction** (M A Zia)
- Outline **purpose** of the meeting- Explained by main Researcher NZ
- Outline **session's structure**: in the form of discussion, everyone invited to contribute, feel free to express/agree/disagree, no right/wrong answers, want to hear your views and experiences.
- Explain **audio-recording** - later transcribed and analysed; avoid talking over each other
- Explain **confidentiality** & what will happen to the data. Confidentiality by the participants- treat what others say as confidential and do not repeat outside the session.
- Remind to sign and return the **consent forms**

Individual introductions

- Introductions round the table – name, place of work, how long been a midwife, posts held prior to this post.

Main Discussion. Discuss the 5C(PK) Scale psychological constructs one by one, their suitability to Pakistani Culture.

Any Suggestions about additional constructs

Any other issues you would like to discuss?

Concluding the session: Anything else to say before we finish? Anything we have left out or that people feel they haven't had a chance to say? Thanking the group.

Appendix 17

5C(PK) Version 1



پاکستانی عوام کا ویکسینیشن بارے رویہ

"پدایت": براہ کرم یہ جانچیں کہ آپ ان بیانات کے ساتھ کتنا اتفاق یا اختلاف رکھتے ہیں۔

1 = بالکل غیر متفق	2 = اعتدال سے غیر متفق	3 = تھوڑا سا غیر متفق	4 = غیر جانبدار	5 = تھوڑا سا متفق	6 = اعتدال سے متفق	7 = بالکل متفق	اعتماد	
☐	☐	☐	☐	☐	☐	☐	مجھے مکمل یقین ہے کہ ویکسین محفوظ ہے۔	1
☐	☐	☐	☐	☐	☐	☐	ویکسینیشن مؤثر ہے	2
☐	☐	☐	☐	☐	☐	☐	ویکسین کے میں مجھے یقین ہے کہ انتظامی حکام عوام بارے الناس کے بہترین مفاد میں فیصلہ کرتے ہیں؟	3
1 = بالکل غیر متفق	2 = اعتدال سے غیر متفق	3 = تھوڑا سا غیر متفق	4 = غیر جانبدار	5 = تھوڑا سا متفق	6 = اعتدال سے متفق	7 = بالکل متفق	تسکین	
☐	☐	☐	☐	☐	☐	☐	ویکسینیشن غیر ضروری ہے کیونکہ ویکسین سے روکے جانے والی بیماریاں اب عام نہیں ہیں؟	4
☐	☐	☐	☐	☐	☐	☐	میرا مدافعتی نظام بہت مضبوط ہے۔ بیماریوں میں میری حفاظت کرتا ہے؟	5
☐	☐	☐	☐	☐	☐	☐	ویکسین سے روکے جانے والی بیماریاں اب اتنی شدید نہیں ہیں کہ مجھے ویکسین لگوانی چاہیے؟	6
1 = بالکل غیر متفق	2 = اعتدال سے غیر متفق	3 = تھوڑا سا غیر متفق	4 = غیر جانبدار	5 = تھوڑا سا متفق	6 = اعتدال سے متفق	7 = بالکل متفق	رکاوٹیں	
☐	☐	☐	☐	☐	☐	☐	روز مرہ کا تناؤ مجھے ویکسین لگوانے سے روکتا ہے؟	7
☐	☐	☐	☐	☐	☐	☐	میرے لیے ویکسین لگوانا تکلیف دہ ہے؟	8
☐	☐	☐	☐	☐	☐	☐	ڈاکٹر کے پاس جانے سے مجھے بے چینی محسوس ہوتی ہے یہ احساس مجھے ویکسین لگوانے سے روکتا ہے؟	9
1 = بالکل غیر متفق	2 = اعتدال سے غیر متفق	3 = تھوڑا سا غیر متفق	4 = غیر جانبدار	5 = تھوڑا سا متفق	6 = اعتدال سے متفق	7 = بالکل متفق	حساب کتاب	
☐	☐	☐	☐	☐	☐	☐	جب میں ویکسین لگوانے کے بارے میں سوچتا/ سوچتی تو بہتر فیصلہ کرنے کے لیے میں فوائد و خطرات کا موازنہ کرتا/ کرتی ہوں۔	10
☐	☐	☐	☐	☐	☐	☐	ہر مرتبہ ویکسین لگوانے وقت باریک بینی سے دیکھتا/ دیکھتی ہوں کہ یہ میرے لیے سود مند ہے؟	11
☐	☐	☐	☐	☐	☐	☐	یہ میرے لیے نہایت اہم ہے کہ میں ویکسین لگوانے سے قبل اس کے بارے میں اچھی طرح معلومات کر لوں۔	12
1 = بالکل غیر متفق	2 = اعتدال سے غیر متفق	3 = تھوڑا سا غیر متفق	4 = غیر جانبدار	5 = تھوڑا سا متفق	6 = اعتدال سے متفق	7 = بالکل متفق	اجتماعی ذمہ داری	
☐	☐	☐	☐	☐	☐	☐	جب سب کو ویکسین لگائی جاتی ہے تو مجھے بھی ویکسین لگوانے کی ضرورت محسوس نہیں ہوتی؟	13
☐	☐	☐	☐	☐	☐	☐	میں ویکسینیشن کروانا ہوں تاکہ کمزور مدافعتی نظام کے لوگوں کو بھی بچا سکوں	14
☐	☐	☐	☐	☐	☐	☐	بیماریوں کے پھیلاؤ کو روکنے کے لیے ویکسینیشن ایک اجتماعی ذمہ داری ہے؟	15



Appendix 18

Revised version of 5C(PK)

پاکستانی عوام کا ویکسینیشن بارے رویہ

ہدایت: براہ کرم یہ جانچیں کہ آپ مندرجہ ذیل خیالات سے کتنا اختلاف کرتے ہیں یا متفق ہیں۔

اعتماد	5 = متفق	4 = تھوڑا سا متفق	3 = غیر جانبدار	2 = تھوڑا سا غیر متفق	1 = غیر متفق
1	☐	☐	☐	☐	☐
2	☐	☐	☐	☐	☐
3	☐	☐	☐	☐	☐
اطمینان					
4	☐	☐	☐	☐	☐
5	☐	☐	☐	☐	☐
6	☐	☐	☐	☐	☐
رکاوٹیں					
7	☐	☐	☐	☐	☐
8	☐	☐	☐	☐	☐
9	☐	☐	☐	☐	☐
9a	☐	☐	☐	☐	☐
جائزہ					
10	☐	☐	☐	☐	☐
11	☐	☐	☐	☐	☐
12	☐	☐	☐	☐	☐
اجتماعی ذمہ داری					
13	☐	☐	☐	☐	☐
14	☐	☐	☐	☐	☐
15	☐	☐	☐	☐	☐