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## Key factors to improve maternal and child health in Sindh province, Pakistan

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# **Key factors to improve maternal and child health in Sindh province, Pakistan**

## **PhD thesis**

to obtain the degree of PhD at the University of Groningen  
on the authority of the Rector Magnificus Prof. C. Wijmenga  
and in accordance with the decision by the College of Deans.

This thesis will be defended in public on

21 April at 09.00 hours

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# Abbreviations

<b>ANC</b>	Antenatal Care
<b>HBR</b>	Home-Based Records
<b>LMICs</b>	Low- and Middle-Income countries
<b>MCH</b>	Maternal and Child Health
<b>MDGs</b>	Millennium Development Goals
<b>MMR</b>	Maternal mortality ratio
<b>MNCH</b>	Maternal, newborn and child health
<b>MOH</b>	Ministry of Health
<b>PDHS</b>	Pakistan Demographic and Health Survey
<b>PSLM</b>	Pakistan Social and Living Standards Measurement
<b>SDGs</b>	Sustainable Development Goals
<b>USAID</b>	United States Agency for International Development
<b>WHO</b>	World Health Organization
<b>LHV</b>	Lady Health Visitor
<b>LHW</b>	Lady Health Worker
<b>TBA</b>	Traditional Birth Attendant



**Chapter 1**

# **Introduction**

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# Chapter 1: Introduction

## 1.1. Background Information

### 1.1.1. Maternal health in Pakistan

Maternal mortality is one of the greatest health concerns in the developing world [1]. The global maternal mortality ratio (MMR) declined substantially over the course of the Millennium Development Goals implementation period (1990–2015). However, many low-income countries did not meet the target for Millennium Development Goal 5, which was a 75% reduction in MMR between 1990 and 2015 [2,3]. Compared with other low-income countries, the MMR in Pakistan is high, with an extremely slow declining trend [4,5]. The MMR in rural areas of Pakistan is almost twofold that of urban areas, 319 deaths versus 175 deaths per 100,000 live births [6].

### 1.1.2. Child health in Pakistan

Children are the key to the world's future prosperity, because today's children are tomorrow's engaged citizens and productive workers. There were 80.4 million children in Pakistan in 2017, 39% of Pakistan's population is under 18 years [7]. The Government of Pakistan presented a national development framework in its Vision 2025, in which it committed to developing elemental building blocks of Pakistan's economic growth strategy. Included in this strategy is that all children have the right to grow up healthy, well-educated, protected from violence and exploitation, and in an environment marked by gender equality and equity across geographic and socio-economic status [7]. These aims are in agreement with the Sustainable Development Goals (SDGs) [8].

The under-five mortality rate in Pakistan declined between 1990 and 2015, from 139 to 81 per 1000 live births [9]. However, Pakistan's neonatal mortality rate in 2017 was 44 per 1000 live births, with an under-five mortality rate of 75 per 1000 live births. According to the 2017 United Nations Inter-Agency Group for Child Mortality Estimation, this was the highest rate for any country in the World Health Organization (WHO) Eastern Mediterranean Region, except for Somalia [10]. Thus, Pakistan's declining trend in child mortality is insufficient compared with other low-income countries.

### 1.1.3. Maternal and child health (MCH) policy and strategic planning in Pakistan

The 2015–2030 SDGs are the best vehicle to address poverty in Pakistan. The governments'

historic pledge is to end poverty, achieve gender equality, and ensure universal access to education and healthcare [8]. It will use the SDG's 2015–2030 global goals to guide Pakistan's policy and funding for the next 10 years. The Government of Pakistan seeks to improve health services and MCH policy [11]. Part of this goal is to reduce maternal and child deaths by improving the population's overall health status, particularly for the poor and marginalized, by improving access to high-quality MCH services for all.

Pakistan has developed and implemented a sustainable MCH program at all levels of the health delivery system. The program has five components: (1) integrated delivery of MCH services at the district level; (2) training and deployment of community midwives; (3) provision of comprehensive family planning services; (4) strategic communications for maternal, newborn, and child health (MNCH) care; and (5) strengthening program management.

## 1.2.Problem Statement

### 1.2.1.Importance of healthcare services for MCH

Complications during pregnancy and childbirth are the most frequent cause of death and disability among women of childbearing age [1,12]. Millions of women in low-income countries do not have access to appropriate healthcare services during pregnancy and childbirth [12], which is the main cause for the inadequate health status of women in these areas [12, 13]. Previous studies have shown that securing access to appropriate care around delivery and to skilled health professionals can substantially reduce maternal and newborn mortality [14]. Therefore, the quality of comprehensive care during this critical period has a great impact on MCH. Pakistan still faces several challenges in providing quality care to women during pregnancy, childbirth, the postpartum period, and beyond to ensure full and timely care for women and their children, including for childhood immunization.

#### 1.2.1.1.Antenatal care

Antenatal care (ANC) is a key healthcare service that can decrease maternal and child mortality [12,15]. The WHO previously defined sufficient ANC as at least four healthcare service visits during pregnancy for pregnant women with no perinatal complications. In 2016, the WHO changed its ANC recommendations to a minimum of eight healthcare provider contacts [12]. Pregnant women learn about various danger signals and symptoms during ANC visits, and such care can significantly improve pregnant women's health, and their infants' health, during pregnancy, delivery, and postpartum [12,13]. In Pakistan, ANC is provided as part of the primary healthcare system. The 2017–2018 Pakistan Demographic and Health Survey reported that 86%

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of women who gave birth in the 5 years preceding the survey attended at least one ANC visit, but only 51% of women attended the recommended four or more visits; just 55% had their initial visit during the first trimester of pregnancy [16]. While these numbers are higher than in the past, a large number of women fail to receive the full set of ANC services.

#### **1.2.1.2.Skilled birth attendance**

Facility birth can improve MCH. Appropriate professional medical attention and hygienic conditions during childbirth significantly decrease the risk of complications and infections that can lead to death or serious disability for both the mother and her baby. Therefore, increasing the proportion of facility births in a safe and hygienic environment under the supervision of qualified health professionals is important to the survival and well-being of both the mother and the child [17-19]. The National Maternal, Newborn and Child Health Program in Pakistan has trained midwives and deployed them in rural communities; they provide birth services in basic health service units and rural health centers to increase skilled birth attendance. However, according to the 2017–2018 Pakistan Demographic and Health Survey, one-third of births (34%) occurred at home without skilled birth attendance [16].

#### **1.2.1.3.Breastfeeding**

A 2016 Lancet series on breastfeeding estimated that about 823,000 deaths of children under 5 years could be prevented each year with optimal breastfeeding practices [20]. However, according to the Global Breastfeeding Scorecard, which evaluated 194 nations, the current global rate of exclusive breastfeeding is still unsatisfactory; only 23 of these countries had exclusive breastfeeding rates above 60% [21]. Pakistan has an extremely low rate of exclusive breastfeeding; only 38% of infants under 6 months are exclusively breastfed [22].

#### **1.2.1.4.Child immunization**

Achieving high immunization coverage is crucial in the prevention of infections, especially for infants and children.

The lives of nearly 3 million children in Pakistan are at risk due to lack of a full course of basic vaccines each year [23]. Every year, approximately 400,000 children under 5 die from vaccine-preventable diseases in Pakistan [23]. A 2014–2015 Pakistan Social and Living Standards Measurement survey showed that Pakistan’s full immunization coverage was 60%, but the coverage rate ranged from 27%–70% [24].

### 1.2.2. Project and data description

This thesis used data from the 2013 and 2014 MCH Program Indicator Surveys, which were conducted to provide data on key indicators required to monitor the implementation of MNCH and family planning/reproductive health interventions in Sindh and Punjab provinces under a 5-year MCH program [25]. This program was funded by U.S. Agency for International Development (USAID), under the terms of Associate Cooperative Agreement No. AID-391-LA-13-00001, Maternal, Newborn and Child Health Services Project [25]. The MCH Program Indicator Survey is conducted by the MNCH services component of the USAID/Pakistan’s MCH program. The survey instrument was based on the Pakistan Demographic and Health Survey questionnaire developed by Macro International, Inc., and the Knowledge, Practice and Coverage Survey questionnaire developed by the Johns Hopkins University/Child Survival Support Program 1990 [25].

The survey employed a multi-stage, stratified sampling design using district-level population information. Districts are the third-order administrative divisions of Pakistan. Based on the most recent census of Pakistan, 1998, a disproportionate sampling approach was used to allocate the sample to districts of rural and urban areas for better representation of smaller districts. Then a probability proportionate to size method was used to select cities and villages. A maximum of 10 participants were allocated to each village and 15–200 to each city selected to take part in the study. Ultimately, data were collected in all 23 districts of Sindh between June 2013 and October 2014 [25]. Trained interviewers visited each selected household. Study participants included married women age 15–49 who had a live birth in the two years prior to the survey and who resided in houses that were sampled for study participation. Only one participant was selected from each household. Each woman completed a questionnaire about her last live birth. Data were collected from a total of 10,200 women (4,000 from the 2013 survey and 6,200 from the 2014 survey).

The female literacy rate is low in the Sindh Province of Pakistan. Therefore, female interviewers obtained informed consent verbally from each respondent and then signed on behalf of the respondent. This study was approved by the Johns Hopkins University School of Public Health Internal Review Board (IRB00005002) and the National Bioethics Committee of Pakistan.

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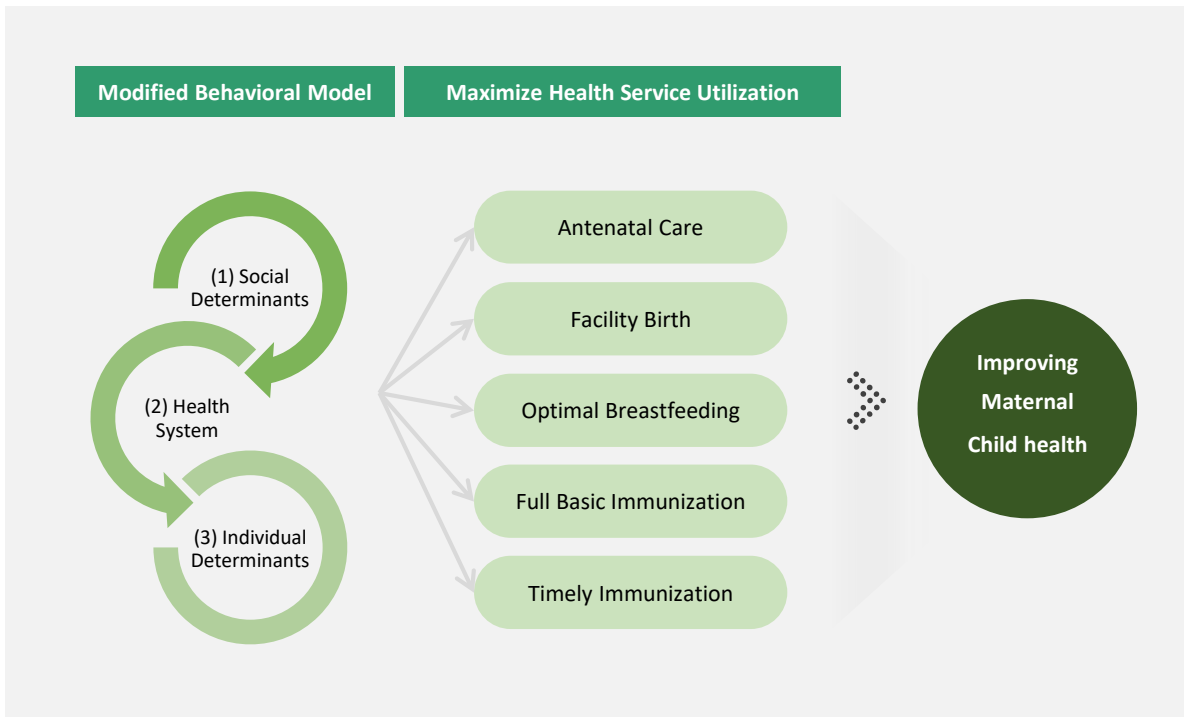
### 1.3. Thesis Aim, Conceptual Framework, and Research Questions

The aim of this thesis is to explore factors affecting MCH and contribute to improving MCH and MCH policy and planning in Sindh province, Pakistan, by exploring factors affecting health service utilization, including health facility utilization. This thesis focuses on ANC, facility-based birth, breastfeeding, and child immunization. Health service utilization is a key to improving outcomes, however, utilization is influenced by individual, social, and health system determinants. Our thesis's theoretical framework (Fig1) is based on Andersen's and Newman's health services utilization framework [26], which emphasizes (1) individual determinants, (2) social determinants, and (3) healthcare delivery system determinants. For this thesis, the framework was adopted and modified [26] so that, unlike the Andersen–Newman framework, each component affects the other components, either directly or indirectly. The thesis calls this the modified behavioral model.

- (1) Social determinants of utilization include social norms [27] relating to treatment of illness and use of health service [28]. Information sources were measured for MCH, number of ANC visits, place of delivery, breastfeeding, and immunization as determinants of use of health services, and sex difference and living area (rural and urban) as determinants of social norm.
- (2) Healthcare delivery system determinants are defined by resources and organization. The resource factors are quantity and geographical distribution of resources, while those of organization are access and structure. Access is the way the client obtains entry to the healthcare system. Structure refers to the characteristics of the healthcare system that determine what happens to the client following entry to the health service delivery system. Skilled birth attendants (doctor, nurse, midwife), ANC providers (doctors, nurse/midwives, lady health workers/traditional birth attendants), and delivery place (private, public facility, home) were designated as healthcare delivery system determinants.
- (3) Individual determinants of utilization can be viewed as characteristics of individual behavior. A number of individual conditions contributes to the type and frequency of personal health service utilization. Such use is dependent on a person's (a) predisposition toward personal use of services, (b) ability to secure services, and (c) illness level or condition. This thesis measured age, education level, household wealth, and number of children in a household as individual determinants.

This thesis was conducted to find out which factors influence health service utilization, a key component of improving MCH, so that policy makers can set priorities and focus the limited resources that are available on what is important. Efforts should be made to minimize unsatisfactory healthcare by providing proper programming and encouraging community involvement. Therefore, the demographic and socio-economic variables of the modified

behavioral model were applied to our thesis. The theoretical framework is presented within the context of the impact on the healthcare system and empirical findings are described to demonstrate how the framework could be employed to explain key patterns and trends in health service utilization.



**Figure 1.1.** Interaction of the thesis' aim with the conceptual framework

\* Andersen and Newman utilization framework (1973) modified. [26]

Applying this framework studies in this thesis were conducted to answer three research questions.

- 1. What are the demographic, socio-economic, and health information source determinants of health service utilization for ANC, facility birth, and child immunization in Sindh province, Pakistan?**
- 2. What are the sources of information that are associated with positive health behavior regarding ANC visits and optimal breastfeeding in Sindh province, Pakistan?**
- 3. What are the factors that affect timely and full immunization in Sindh province, Pakistan?**

These research questions were answered through five studies. Table 1 shows how the research questions relate to the different studies and shows a summary of the applied methodologies.



**Table 1.1.** Research questions/interaction of the thesis with the conceptual model

Research Question	Thesis Chapter	Studies	Methodology
1. What are the demographic, socio-economic, and health information source determinants of the health service utilization for ANC, facility birth, and child immunization in Sindh province, Pakistan?	2: Antenatal care	Which factors affect the utilization of ANC in Sindh province, Pakistan?	A subset of data was analyzed from MCH Program Indicator Surveys conducted in Sindh province, Pakistan in 2013 and 2014. Respondents included 10,200 women who had given birth in the past two years. The outcome measure was making at least four ANC visits. Logistic regression models were used to identify demographic, socio-economic, characteristics of ANC, and information sources associated with ANC use.
	3: Facility birth	Do demographic characteristics, socio-economic factors, and varied health information sources influence the uptake of birth services in Pakistan?	Pooled data was used from MCH Program Indicator Surveys in 2013 and 2014. The study population was 9,719 women. A generalized linear model with log link and a Poisson distribution was used to identify factors associated with place of birth.
2. What are the sources of information that are associated with positive health behavior regarding ANC visits and optimal breastfeeding in Sindh province, Pakistan?	4: Optimal breastfeeding	How can you increase optimal breastfeeding?	A secondary analysis was performed on data on 10,028 women with a birth in the preceding two years who had participated in the 2013 and the 2014 MCH Program Indicator Surveys. Multiple logistic regressions were used to test the association between breastfeeding status (ever breastfed and still breastfeeding) and various factors.



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## Chapter 2

# Antenatal Care

Factors associated with the use of antenatal care in Sindh province, Pakistan: A population-based study

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Young Dae Kwon, Jelle Stekelenburg  
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## RESEARCH ARTICLE

# Factors associated with the use of antenatal care in Sindh province, Pakistan: A population-based study

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## Abstract

### Background

Antenatal care (ANC) is critical to decrease maternal and neonatal mortality. However, little is known about the utilization of ANC services in Pakistan. This study assessed the utilization of ANC in Sindh province, Pakistan, and identified the factors that affect its use.

### Methods

We analysed a subset of data from Maternal and Child Health (MCH) Program Indicator Surveys conducted in Sindh province, Pakistan in 2013 and 2014. Respondents included 10,200 women who had given birth in the past two years. The outcome measure

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**Data Availability Statement:** All relevant data are within the manuscript and its Supporting Information files.

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**Competing interests:** The authors have declared that no competing interests exist.

was making at least four ANC visits. Logistic regression models were used to identify demographic, socioeconomic, characteristics of ANC, and informational factors associated with ANC use.

## Results

Most women (83.5%) received one or more ANC, mostly by doctors (95%), but only 57.3% of them made the recommended four or more visits, and just 53.7% received their initial ANC care during the first trimester. Making four or more ANC visits was associated with: fewer household occupants (odds ratio [OR] = 0.98; 95% confidence interval [CI] = [0.97, 0.99]), large city residence (OR = 1.92; 95% CI = [1.57, 2.35]), higher women's education (OR = 1.70; 95% CI = [1.33, 2.15]), greater household wealth (OR = 5.66; 95% CI = [4.22, 7.60]), and receiving MCH information from lady health worker (OR = 1.17; 95% CI = [1.00, 1.37]), mother-in-law (OR = 1.17; 95% CI = [1.01, 1.36]), other relatives/friends (OR = 1.19; 95% CI = [1.03, 1.38]), or nurse/midwife (OR = 1.31; 95% CI = [1.06, 1.61]).

## Conclusions

This study demonstrates that both socioeconomic factors and health information sources are associated with women's use of ANC. Therefore, programs should target socially disadvantaged and vulnerable groups, particularly rural, less educated, and poor women, to improve utilization of ANC. In addition, strategies to increase exposure to MCH information sources should be a priority in Sindh, Pakistan.

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APPENDIX



## Introduction

Maternal mortality is one of the greatest health and development concerns worldwide, but especially in the developing world [1]. Complications throughout pregnancy, delivery and the postnatal period are the most common causes of death and disability among women of child-bearing age [1,2]. Millions of women in developing countries do not have access to adequate healthcare services during pregnancy [2]. This fact alone is a major reason for poor health overall in the women [2, 3].

Antenatal care (ANC) is a key health service that can decrease maternal and neonatal mortality [2, 4]. For pregnant women with no perinatal complications, the World Health Organization (WHO) defined sufficient ANC as at least four healthcare visits during pregnancy.

Recently, the 2016 WHO ANC model replaces four-visit focused model and recommends a minimum of eight healthcare provider contacts (up to 12 weeks, at 20 and 26 weeks of gestation, and at 30, 34, 36, 38 and 40 weeks) [2]. During ANC visits, pregnant women are educated about various danger signs and symptoms, which can significantly improve their own health and that of their infants during pregnancy, delivery, and the postpartum period [2, 3].

A growing body of literature has demonstrated a protective effect of ANC on maternal and child survival. According to Demographic and Health Surveys between 1990 and 2013 from 69 low-income and middle-income countries, at least one ANC visits reduced the probability of neonatal mortality by a 1.04% points and the probability of infant mortality by a 1.07%. Having recommended four or more ANC visits and at least once seen a skilled provider decreased the probability by an additional 0.56% and 0.42% points, respectively [4]. Several Indian studies have reported that ANC use increases the rate of institutional deliveries or home deliveries aided by skilled birth attendants [5, 6]. However, ANC use remains in low- and middle- income countries for several reasons, including poverty, low educational levels, and lack of access to a health facility [5–9].

In Pakistan, ANC is provided through the maternal and child health (MCH) services that are part of the existing primary healthcare system. The 2012–13 Pakistan Demographic and Health Survey (PDHS) revealed that 76% of women made at least one ANC visit during their last pregnancy (within five years of the survey). Furthermore, 73% of women received ANC from skilled providers (doctor, nurse, midwife, or lady health visitor[LHV]) during their last pregnancy. However, only 37% of women attended four or more ANC visits, while just 42% made their initial visit during the first trimester of pregnancy. The percentage of women whom received four or more ANC visits or early ANC initiation during their pregnancy varied by their place of residence, region/province, educational level, and household wealth index [10]. These findings justify further investigation into ANC services in Pakistan. However, few studies have focused on the quality of ANC in Pakistan, and little is known about the factors that influence its use. The purpose of this study was to assess the utilization of ANC in Sindh province, Pakistan, and

identify the factors that affect utilization.

## Methods

### Data and subjects

We analysed a subset of data from the 2013 and 2014 MCH Program Indicator Surveys, which were conducted in the province of Sindh. Sindh has the highest total fertility rate in Pakistan at 4.3% [11]. The MCH Program Indicator Survey was created to monitor the implementation of maternal, newborn, and child health interventions as well as family planning and reproductive health interventions in Sindh [11]. The survey instrument was based on the PDHS questionnaire developed by Macro International, Inc. and the Knowledge, Practice and Coverage Survey questionnaire developed by the Johns Hopkins University/Child Survival Support Program 1990.

The survey employed a multi-stage, stratified sampling design using district-level population information. Districts are the third-order administrative divisions of Pakistan. Based on the most recent Census of Pakistan in 1998, a disproportionate sampling approach was used to allocate the sample to districts of rural and urban areas for better representation of smaller districts. Then a probability proportionate to size method was used to select cities and villages. A maximum of 10 participants were allocated to each village and 15–200 to each city selected to take part in the study. Ultimately, data were collected in all 23 districts of Sindh between June 2013 and October 2014 [11]. Trained interviewers visited each selected household. Study participants included married women age 15–49 who had a live birth in the two years prior to the survey and who resided in houses that were sampled for study participation. Only one participant was selected from each household. Each woman completed questionnaires about her last live birth. Data were collected from a total of 10,200 women (4,000 from the 2013 survey and 6,200 from the 2014 survey). A total of 10,200 were included with no missing variables in this analysis.

The female literacy rate is low in the Sindh Province of Pakistan. Therefore, female interviewers obtained informed consent verbally from each respondent, and then signed on behalf of the respondent. This study was approved by the Johns Hopkins University School of Public Health Internal Review Board (IRB00005002), and the National Bioethics Committee of Pakistan.

### Variables and measurement

The primary outcome variable was ANC utilization, which was defined as attending at least four ANC visits, as recommended by WHO four-visit focused model [2] because the data were obtained before establishing the 2016 WHO ANC model. To assess ANC use, respondents were asked: “How many times did you receive ANC during this pregnancy?” ANC referred to any pregnancy-related services provided by skilled health personnel, including doctors, nurse, LHV,

and trained community midwives.

We reviewed previous literature [12] and the MCH Program Indicator Survey report [11] to identify factors that may be associated with ANC use and included them as independent variables in our study. They included two demographic factors (woman's age and the number of household occupants), four socioeconomic factors (residence, women's education level, husband's education level, and the household wealth index), and MCH information sources. The wealth index was calculated using principal components analysis based on household assets [10]. Principal component analysis is a well-known statistical method to reduce dimensionality [13]. It was used to assess household wealth based on the value of 35 household assets. This index was then classified into quintiles.

To assess MCH information sources, respondents were asked, "During the last 12 months have you received any information about MCH from the following sources?" Possible

responses included lady health worker (LHW), mother-in-law, other relatives/friends, Dai-traditional birth attendant (TBA), LHV, nurse/midwife, doctor, and media (radio, television, telephone helpline, text messages on mobile phone, health education/awareness session, print media). Binary variables (yes/no) were included for each response in the MCH information source section.

The characteristics of ANC included information on ANC use, number of ANC visits, type of ANC provider, place of ANC provision, timing of first ANC visit, and physical and laboratory examination received. The type of ANC provider is a multiple response question by asking, "Whom did you see?" Possible responses consist of LHW/Dai-TBA, nurse/midwife, and doctor.

## Statistical analysis

Descriptive statistics appropriate for the level of measurements were computed for all demographic and socioeconomic factors, MCH information sources, and characteristics of ANC variables. The ANC attendance was dichotomized as at least four times ANC visits (≥ 4, utilization, coded as "1") and less than four times attendance (1–3, underutilization, coded as "0") in binary logistic regression analyses, not including no ANC visit. Unadjusted model was run for demographic factors (woman's age, number of household occupants), socioeconomic factors (residence, woman's education level, husband's education level, household wealth index), place of ANC, type of ANC provider, MCH information sources (LHW, mother-in-law, other relatives/friends, Dai-TBA, LHV, nurse/midwife, doctor, media), and survey year shown to be influential in the literature [12] using ANC utilization as the dependent variable. The unadjusted model showed significance for all demographic factors, socioeconomic factors, place of ANC, type of ANC provider (Dai-TBA, doctor), and MCH information sources. After controlling for all independent variables, the final multiple logistic regression was conducted. All analyses were performed using IBM SPSS software package version 25.0 (SPSS, Inc., IBM, Chicago, IL).

## Results

The mean age of the 10,200 respondents was 27.74 years (SD, 5.78 years), with a range of 15 to 49 years. The majority of women lived in rural areas (47.5%) and had no formal education (66.0%). Almost half of their husbands had no formal education (49.4%). Most women (83.5%, 8,521/10,200) received ANC during their last pregnancy. Among these women received any ANC, 42.7% of women had poor utilization of ANC during their pregnancy with once (10.9%), twice (16.5%), and three times (15.3%); more than half of women (57.3%) made the recommended four or more ANC visits. In addition, 53.1% of women made their initial ANC visit during the first trimester; 18.8% of the women did not initiated ANC until their third trimester. More women sought ANC from private health care facilities (69.6%) than public health care facilities (25.8%) or home (4.6%) (Table 1).

In the binary logistic regression, all independent variables were significant except for ANC from nurse/midwife and survey year. After controlling for the independent variables, most of the demographic and socioeconomic factors and information sources were significantly related to making at least the recommended four ANC visits compared to underutilization of ANC. The final model was significant,  $\chi^2$  (27, n = 5,458) = 1079.10,  $p < 0.001$ . The odds of making four or more ANC visits decreased significantly with the number of household occupants (odds ratio [OR] = 0.98; 95% confidence interval [CI] = [0.97, 0.99],  $p = 0.001$ ), but not with women's age. Women residing in large cities were significantly more likely to make the recommended number of ANC visits than rural residents (OR = 1.92; 95% CI = [1.57, 2.35],

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APPENDIX

**Table 1.** Characteristics of survey respondents (n = 10,200).

Variables	Category	Mean (SD)/n (%)			p-Value
		Total	Underutilization (1–3) (n = 3,635)	Utilization (4+) (n = 4,886)	
<b>Demographic factors</b>					
<b>Woman's age (year), range</b>		27.74 (5.78), 15–49	27.82 (6.05)	27.26 (5.33)	<b>&lt; 0.001</b>
<b>Number of household occupants, range</b>		8.45 (4.63), 1–50	8.79 (4.81)	8.22 (4.55)	<b>&lt; 0.001</b>
<b>Socioeconomic factors</b>					
<b>Residence</b>	Rural	4,846 (47.5)	2,147 (59.1)	1,386 (30.3)	<b>&lt; 0.001</b>
	Town/small city	2,749 (27.0)	1,044 (28.7)	1,270 (27.8)	
	Large city	2,605 (25.5)	444 (12.2)	1,917 (41.9)	
<b>Woman's education level</b>	No education	6,073 (66.0)	2,616 (74.8)	1,827 (48.5)	<b>&lt; 0.001</b>
	Primary or middle	2,007 (21.8)	652 (18.6)	1,124 (29.8)	
	Secondary or higher	1,120 (12.2)	230 (6.6)	816 (21.7)	
<b>Husband's education level</b>	No education	3,857 (49.4)	1,576 (53.3)	1,192 (38.5)	<b>&lt; 0.001</b>
	Primary or middle	2,128 (27.3)	830 (28.1)	893 (28.9)	
	Secondary or higher	1,816 (23.3)	550 (18.6)	1,010 (32.6)	
<b>Household wealth quintile</b>	First (poorest)	2,040 (20.0)	921 (25.3)	328 (7.2)	<b>&lt; 0.001</b>
	Second	2,040 (20.0)	1,003 (27.6)	530 (11.6)	
	Third	2,040 (20.0)	860 (23.7)	839 (18.3)	
	Fourth	2,040 (20.0)	547 (15.0)	1,290 (28.2)	
	Fifth (richest)	2,040 (20.0)	304 (8.4)	1,586 (34.7)	
<b>Characteristics of ANC</b>					
<b>Timing of first ANC visit</b>	First trimester	4,391 (53.1)	975 (27.2)	3,249 (72.3)	<b>&lt; 0.001</b>
	Second trimester	2,320 (28.1)	1,232 (35.0)	1,029 (22.9)	
	Third trimester	1,557 (18.8)	1,315 (37.3)	213 (4.7)	
<b>Place of ANC</b>	Public care facility <sup>a</sup>	2,195 (25.8)	1,011 (27.8)	1,098 (24.0)	<b>&lt; 0.001</b>
	Private care facility <sup>b</sup>	5,931 (69.6)	2,351 (64.7)	3,380 (73.9)	
	Home	394 (4.6)	273 (7.5)	95 (2.1)	
<b>ANC provider (multiple responses allowed)</b>					
<b>LHW/Dai-TBA</b>	No	8,109 (95.2)	3,351 (92.2)	4,461 (97.6)	<b>&lt; 0.001</b>
	Yes	410 (4.8)	283 (7.8)	111 (2.4)	
<b>Nurse/midwife</b>	No	7,988 (93.7)	3,409 (93.8)	4,291 (93.8)	<b>0.927</b>
	Yes	549 (6.3)	226 (6.2)	282 (6.2)	
<b>Doctor</b>	No	461 (5.4)	311 (8.6)	124 (2.7)	<b>&lt; 0.001</b>
	Yes	8,060 (94.6)	3,324 (91.4)	4,449 (97.3)	
<b>Mother and child health information source</b>					
<b>LHW</b>	No	7,955 (78.0)	2,892 (79.6)	3,422 (74.8)	<b>&lt; 0.001</b>
	Yes	2,245 (22.0)	743 (20.4)	1,151 (25.2)	
<b>Mother-in-law</b>	No	6,365 (62.4)	2,791 (76.8)	3,123 (68.3)	<b>&lt; 0.001</b>
	Yes	3,835 (37.6)	844 (23.2)	1,450 (31.7)	
<b>Other relatives/friends</b>	No	6,365 (62.4)	2,497 (68.7)	2,578 (56.4)	<b>&lt; 0.001</b>
	Yes	3,835 (37.6)	1,138 (31.3)	1,995 (43.6)	
<b>Dai-TBA</b>	No	8,440 (82.7)	2,971 (81.7)	3,956 (86.5)	<b>&lt; 0.001</b>
	Yes	1,760 (17.3)	664 (18.3)	617 (13.5)	
<b>LHV</b>	No	9,298 (91.2)	3,371 (92.7)	4,059 (88.8)	<b>&lt; 0.001</b>
	Yes	902 (8.8)	264 (7.3)	514 (11.2)	
<b>Nurse/midwife</b>	No	9,016 (88.4)	3,280 (90.2)	3,885 (85.0)	<b>&lt; 0.001</b>
	Yes	1,184 (11.6)	355 (9.8)	688 (15.0)	
<b>Doctor</b>	No	5,866 (57.5)	2,229 (61.3)	2,228 (48.7)	<b>&lt; 0.001</b>
	Yes	4,334 (42.5)	1,406 (38.7)	2,348 (51.3)	
<b>Mediac</b>	No	7,863 (77.1)	2,993 (82.3)	3,160 (69.1)	<b>&lt; 0.001</b>
	Yes	2,337 (22.9)	642 (17.7)	1,413 (30.9)	
<b>Survey</b>					
<b>Year</b>	2013	4,000 (39.2)	1,496 (41.2)	1,806 (39.5)	<b>0.127</b>
	2014	6,200 (60.8)	2,139 (58.8)	2,767 (60.5)	

**Note:** Numbers may not sum to total due to missing data.

ANC, antenatal care; LHV, lady health visitor, LHW, lady health worker; SD, standard deviation; TBA, traditional birth attendant

<sup>a</sup> Includes government hospital, rural health clinics, basic health unit, dispensary, other public facilities

<sup>b</sup> Includes private hospital/clinic, private doctor, homeopath clinic, dispenser/compounder, haki/dawakhana, other private facilities

<sup>c</sup> Includes radio, television, telephone helpline, text message on mobile phone, health education/awareness session, print media

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$p < 0.001$ ). While ANC use also increased significantly with women's education, peaking among those with secondary or higher education (OR = 1.70; 95% CI = [1.33, 2.15],  $p < 0.001$ ), there was no association with husband's education. Wealth was the strongest determinant of ANC use: women in the top wealth quintile were six times more likely to make at least four ANC visits than women in the bottom quintile (OR = 5.66; 95% CI = [4.22, 7.60],  $p < 0.001$ ). Women were significantly more likely to make the recommended number of ANC visits if they had received MCH information from a LHW (OR = 1.17; 95% CI = [1.00, 1.37],  $p =$ , mother-in-law (OR = 1.17; 95% CI = [1.00, 1.36],  $p = 0.043$ ), other relatives/friend (OR = 1.19; 95% CI = [1.03, 1.38],  $p = 0.016$ ), or nurse/midwife (OR = 1.31; 95% CI = [1.06, 1.61],  $p = 0.012$ ) (Table 2).

## Discussion

Although a large majority of pregnant women in Pakistan (83.5%) received ANC, many did not meet all of the accepted standards for ANC [2, 4]. In this sample, only 57.3% of women made at least four visits and 53.1% attended in the first trimester (ideally before 12 weeks, but no later than 16 weeks). After controlling for all independent variables, appropriate ANC utilization (i.e., making at least four ANC visits) was significantly associated with smaller household size, large city residence, higher education for woman, greater household wealth, and MCH information from LHWs (trained personnel providing family planning and basic health services through home visits in rural areas), mother-in-law, other relatives/friends, or nurses/midwives.

Household size, measured as the number of persons in a particular household, was negatively associated with the use of ANC in this study. This is consistent with previous research indicating that women with larger family sizes were less likely to utilize ANC due to excessive demand of their money, time and other resources [7, 9, 14–16]. In addition, women living in big cities were more likely to receive the recommended ANC visits than those in rural area in this study. This finding is consistent with previous studies, which found that urban women were more likely to use ANC than rural women [8, 10, 17–20]. This is not surprising since women living in a large city are better informed and have more access to health care. While rural women may depend on primary health care centers for MCH services, urban women have more options for ANC [18].

**Table 2.** Logistic regression for making at least four antenatal care visits (n = 8,521).

		Adjusted	
		OR	95% CI
<b>Demographic factors</b>			
Woman's age		1.00	(0.99, 1.01)
Number of household occupants		0.98	(0.97, 0.99)◆◆
<b>Socioeconomic factors</b>			
Residence	Rurala	1.00	
	Town/small city	0.87	(0.74, 1.02)
	Large city	1.92	(1.57, 2.35)◆◆◆
Woman's education level	No educationa	1.00	
	Primary or middle	1.33	(1.14, 1.55)◆◆◆
	Secondary or higher	1.70	(1.33, 2.15)◆◆◆
Husband's education level	No educationa	1.00	
	Primary or middle	0.89	(0.77, 1.03)
	Secondary or higher	1.07	(0.91, 1.25)
Household wealth quintile	First (poorest)a	1.00	
	Second	1.31	(1.10, 1.59)◆◆
	Third	2.03	(1.66, 2.49)◆◆◆
	Fourth	3.53	(2.79, 4.50)◆◆◆
	Fifth (richest)	5.66	(4.22, 7.60)◆◆◆
<b>Characteristics of ANC</b>			
Place of ANC	Publica	1.00	
	Private	1.14	(1.00, 1.29)
<b>ANC provider</b>			
LHW/Dai-TBA		1.16	(0.70, 1.91)
Nurse/midwife		1.11	(0.70, 1.75)
Doctor		0.98	(0.75, 1.28)
<b>Mother and child health information source</b>			
LHW		1.17	(1.00, 1.37)◆
Mother-in-law		1.17	(1.01, 1.36)◆
Other relative/friends		1.19	(1.03, 1.38)◆
Dai-TBA		0.91	(0.77, 1.08)
LHV		1.26	(0.99, 1.61)
Nurse/midwife		1.31	(1.06, 1.61)◆
Doctor		1.14	(1.00, 1.30)
Media		0.99	(0.84, 1.16)
<b>Survey</b>			
Year	2013a	1.00	
	2014	0.98	(0.88, 1.14)

**Note:** Mother and child health information source and ANC provider coded as 0 = no, 1 = yes.  
 ANC, antenatal care; CI, confidence interval; LHV, lady health visitor; LHW, lady health worker; OR, odds ratio;  
 TBA, traditional birth attendant  
 a the reference category

- ◆ p < 0.05
- ◆◆ p < 0.01
- ◆◆◆ p < 0.001

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The more education women had, the more likely they were to make at least four ANC visits, confirming previous research on the impact of education on ANC utilization [8–11, 17, 21–24]. Educational level was also significantly associated with the timing of the first ANC check-up in Sindh [11]. One study has found that maternal education is a key factor that allows women to care about their ANC [25]. The impact of education is not limited to ANC: highly educated people engage in an array of healthy behaviors more often than less educated people. Education not only increases women’s awareness of the importance of health services, but also gives them the ability to select the most appropriate service for their needs [26, 27]. The impact of education is a particularly important issue for Pakistan, where only 11% of women have secondary or higher education. Our findings call for the establishment and expansion of health-promoting programs targeting less educated women to increase their awareness of the importance of ANC and enhance their use of it. In the long term, policies aimed at raising woman’s education may also increase the utilization of ANC services.

Several studies have found that a husband’s educational level is positively associated with adequate ANC use [8, 17, 24, 28]. In contrast, we found that the husband’s education was not significantly associated with making four or more ANC visits in Sindh. The sociocultural construct of masculinity in Pakistan offers a possible explanation. In joint families, a man is considered *besharam* (shameless) if he exhibits too great an interest in his pregnant wife. A belief system views pregnancy as a uniquely feminine attribute; therefore, men are excluded from their wives’ reproductive health issues, including ANC utilization [25].

Household wealth was strongly associated with ANC utilization. Women in the richest wealth quintile were approximately six times more likely to make the recommended number of ANC visits than women in the poorest wealth quintile. Previous studies have reported similar findings [7, 8, 10, 11, 16, 17, 22, 28]. Women from wealthier households are more likely to be able to afford routine health services like ANC and their associated costs, such as transportation, than are poor women [16]. More women received ANC in private health care facilities than public health care facilities. This may explain the high level of ANC utilization from private health care facilities among women who are living in urban areas with greater household wealth. It could be that educated and high socioeconomic class have better access to health care and have capacity to pay for health care and ANC visits and seek care from private sector because of their ability to pay that may affect ANC utilization.

The number and diversity of information sources associated with making the recommended number of ANC visits suggests that MCH information plays a vital role in determining ANC utilization. Few studies have explored the effect of MCH information on ANC utilization. Therefore, further research is needed to evaluate to what degree MCH information impacts women’s awareness of ANC in Pakistan, what messages and which sources have the greatest impact, and how they can be harnessed to promote ANC utilization. In this study, LHWs,



nurse/midwife, mother-in-law, and relatives/friends who provided MCH information had a positive association with ANC use. In particular, women who received information from nurse/midwife among a skilled health provider were more likely to make a recommended ANC visits. The findings suggest that nurse/midwife play an important role by providing integrated preventive and curative health services, resulting in promoting ANC utilization in Pakistan. Several studies have found that women with high levels of exposure to mass media, such as television and radio, are more likely to receive ANC [8, 20, 29, 30]. In this study, however, the media were one of the few information sources that were not associated with ANC utilization. This discrepancy may be explained by the limited access to mass media in Pakistan and the severe restrictions on media freedom. In addition, media use in Pakistan—including mobile phones, the internet, and social media—is most common among men, young people, and urban residents [31]. Further research is needed to examine the effect of media-based MCH

information on ANC utilization, after adjusting for demographic and socioeconomic determinants in Pakistan.

Several limitations of this study should be acknowledged. First, the study design was cross-sectional so that the associations found cannot necessarily be interpreted as causal relationships. The study used data from a single province, so the findings cannot be generalized to all of Pakistan. Second, women who had a live birth in the two years prior to the survey were included as study participants. Although trained interviewers assisted the participants using structured questions, respondents may under-report activities which are difficult to remember in detail because of the recall bias, the time lapse between childbirth and survey. Third, even though the study used the pretested and structured survey instrument, the independent variables were assessed at the time of the survey, not when the woman was pregnant and making decisions about ANC. It is possible that some of these variables, such as household wealth and MCH information source, changed after the birth of the child, which might lead to differences in interpretation and responses. Lastly, this study could not consider enough variables to see the utilization of ANC because of the data limitation. Therefore, further studies are needed to consider factors such as parity and place of birth.

## Conclusions

Our study found significant associations between socioeconomic factors and utilization of ANC services. These findings have demonstrated that efforts to improve ANC utilization should pay particular attention to the needs of rural, less educated, and poor women. Strategies to increase the accessibility and availability of health care service should be a priority in Sindh, Pakistan, particularly in rural areas. It is critical to develop health promotion programs that target women with low educational levels to enhance their awareness regarding the importance of ANC and increase their uptake of ANC services. At policy level, the study suggests that financial support that enables women from poor households reduce their out-of-pocket expenditure will have a positive effect on long-term ANC utilization. In addition, motivating women to receive ANC during their first trimester and recommended physical and laboratory examinations may help in enhancing the quality of ANC. As reflected by the results, there should also be strategies that emphasize on encourage women expose the MCH information sources to promote ANC utilization. Future research should investigate barriers to ANC utilization to inform appropriate interventions.

## Supporting information

### S1 Dataset.

(XLSX)

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| APPENDIX |





## Chapter 3

# Facility Birth

Impact of socio-economic factors and health information sources on place of birth in Sindh province, Pakistan: a secondary analysis of cross-sectional survey data

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Article

# Impact of Socio-Economic Factors and Health Information Sources on Place of Birth in Sindh Province, Pakistan: A Secondary Analysis of Cross-Sectional Survey Data

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## Abstract

Medical facility birth with skilled birth attendance is essential to reduce maternal mortality. The purpose of this study was to assess the demographic characteristics, socio-economic factors, and varied health information sources that may influence the uptake of birth services. We used pooled data from Maternal-Child Health Program Indicator Survey 2013 and 2014. Study population was 9719 women. Generalized linear model with log link and a Poisson distribution was used to identify factors associated with place of birth. 3403 (35%) women gave birth at

a medical facility. After controlling for all covariates, women's age, number of children, education, wealth, and mother and child health information source (doctors and nurses/midwives) were associated with facility births. Women were significantly less likely to give birth at a medical facility if they received maternal-child health information from low-level health workers or relatives/friends. The findings suggest that interventions should target disadvantaged and vulnerable groups of women after considering rural-urban differences. Training non-health professionals may help improve facility birth. Further research is needed to examine the effect of individual information sources on facility birth, both in urban and rural areas in Pakistan.

## Keywords

maternal-child health; socio-economic factor; health information source; place of birth; Pakistan

## 1. Introduction

Maternal mortality is one of the greatest health and development concerns worldwide, especially in the developing world [1]. Over the course of the Millennium Development Goals (1990–2015), the global maternal mortality ratio (MMR) declined substantially. However, many low-income countries did not reach the target for Millennium Development Goal 5, which aimed for a 75% reduction in the MMR between 1990 and 2015 [2,3]. Compared with other low- and middle-income countries, the MMR in Pakistan remains high and the decline has been extremely slow [4,5]. Furthermore, the MMR in Pakistan is almost twice as high in rural as urban areas (319 versus 175 deaths per 100,000 live births) [6].

Facility birth can make a difference. Appropriate medical attention and hygienic conditions during birth decrease the risk of complications and infections that may lead to death or serious illness for the mother, the baby, or both. Therefore, increasing the proportion of babies delivered in a safe and clean environment under the supervision of qualified and experienced health professionals is important for the survival and well-being of the mother and her child [7–9]. In addition, skilled birth attendance has a positive impact on childhood immunization coverage, ultimately increasing child survival [10].

Pakistan's National Maternal, Newborn and Child Health Program has introduced trained community midwives in rural areas and provided birth services by lady health visitors in basic health units and rural health centers to increase skilled birth attendance. However, more than half of births (52%) occurred at home without skilled attendance, according to the 2012–2013 Pakistan Demographic and Health Survey (PDHS) [8]. Hence it is vital to identify the barriers and facilitators affecting women's decisions about whether to give birth at home or at a medical facility. Understanding these determinants is important to develop appropriate interventions, health systems, and health policies to improve the use of birth care services and ultimately



achieve the reduction in MMR [7,11–13].

Previous studies have identified several socioeconomic factors associated with the use of a medical facility birth, including mother's education, husband's education, household wealth, and residence [8,11,12,14–17]. Information sources on maternal-child health (MCH) also may influence facility deliveries by increasing women's knowledge regarding the importance of giving birth at a facility, although this has been less well studied than socio-economic status and results are controversial. Some studies have found that lack of exposure to health information in the mass media decreases the likelihood of women delivering at a medical facility [16,17]. In contrast, another study [14] found no significant association between receiving MCH information from a Lady Health Worker (LHW) and medical facility birth.

In-depth investigations of the determinants of women's decisions regarding home versus facility deliveries in Pakistan, especially socio-economic factors and information sources, are limited. The purpose of this study was to assess the demographic characteristics, socio-economic factors, and varied health information sources that may affect the uptake of birth services in Pakistan.

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## 2. Methods

### 2.1. Sampling and Subjects

This study used a subset of data drawn from two rounds of a larger household survey conducted in Sindh Province, Pakistan, with the support of the United States Agency for International Development (USAID). The MCH Program Indicator Survey 2013 and 2014 was a cross-sectional survey that employed a multi-stage stratified sampling design using district-level population information [18]; districts are the third-order administrative division of Pakistan. The sampling process was designed to yield a representative sample at the provincial level. Trained interviewers visited each selected household. Participants were limited to women aged 15–49 years who had a live birth in the two years before the survey. One eligible woman per household was randomly selected. As female literacy is low in Sindh Province, female interviewers obtained informed consent verbally from each respondent and then signed the consent form on behalf of the respondent. The overall refusal rate was 15%. The analysis included 10,200 respondents (4000 from the 2013 survey and 6200 from the 2014 survey); 481 respondents were excluded because of missing data, resulting in a study group of 9719. Of these, 35% (3403 women) gave birth at home, and 65% (6316 women) gave birth at a medical facility.

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The sample size of this study was calculated based on the article of Peduzzi et al. (1996) and the Medcalc manual [19]. The suggested minimum number of samples is approximately 371. The number of samples in each subgroup is over 2000. So the sample size is enough to conduct the regression.

The study was approved by the Johns Hopkins University School of Public Health Institutional Review Board (IRB #00005002) and the National Bioethics Committee of Pakistan. Both Institutional Review Boards approved the verbal consent. Married women 15 and older are considered adults in the cultural context of Pakistan. Many of these women may live in nuclear households where no elder relative is in co-residence. National surveys conducted in Pakistan, including the Demographic and Health Surveys conducted in 2006–2007 and in 2011–2012, regularly interview married women 15 and older. They also collect data from married women 15 and older (15–49 to be precise) in order for this survey to be comparable to other surveys which have been conducted in Pakistan. They requested Institutional Review Boards permission to conduct interviews with married women 15 and older without seeking permission from an older adult or guardian. Female interviewers obtained informed consent verbally from each respondent and then signed the consent form on behalf of the respondent. Interviewers were required to sign the consent form attached to the survey questionnaire to confirm that they had read the informed consent script.

## 2.2. Variables

Place of birth was the dependent variable. Interviewers asked “Where did you give birth?” (referring to women’s last live birth), and responses were categorized into home (own home, other home) or medical facility (private hospital/clinic, government hospital, rural health centers, MCH centers).

Demographic characteristics, socio-economic characteristics, and MCH information sources were the independent variables. Demographic characteristics included women’s age (15–24, 25–34, 35) and number of living children (1, 2, 3, 4). Socio-economic characteristics included residence (rural, town or small city, large city), women’s education (no education, primary or middle, secondary or higher), husband’s education level (no education, primary or middle, secondary or higher), and household wealth (quintiles). The wealth index was derived from the household ownership of assets by principal components analysis and classified into quintiles [8]. For MCH information sources, interviewers asked, “During the last 12 months have you received any information about MCH from the following sources?” Respondents could select multiple



responses. Responses were categorized into: doctor, nurse/midwife, lady health visitor, low-level health workers (Dai-traditional birth attendant, LHW, homeopath, Hakim herbal medicine practitioner, outreach worker), relatives/friends (mother-in-law, other relative, friend), and media.

### 2.3. Statistical Analysis

The data from the 2013 and 2014 surveys were pooled. Proportion between the categorical variables was tested by Chi-square test. Then generalized linear model with log link and a Poisson distribution was used to identify the factors associated with place of birth. Due to high rate of facility birth, log-binomial regression is better than logistic regression. Because of fail convergence, we decided to use that model including robust variance estimates [20]. Residence was a potential confounding factor, because of differences in availability of and access to medical facilities [21], inequities in antenatal care services, and social development ranking [22]. Therefore, we conducted a subgroup analysis for residence. A priori, based on existing evidences [8,11,12,14–17], demographic factors (women's age, number of living children), socioeconomic factors (residence, woman's education, husband's education, household wealth), and MCH information sources (doctor, nurse/midwife, lady health visitor, relatives/friends, media) were identified as likely predictors and included in the model. A  $p$ -value of 0.05 was used to determine statistical significance. All statistical analyses were performed using SAS software (SAS Institute, Inc., Cary, NC, USA) version 9.4.

### 3. Results

Most women were age 25–34 ( $n = 5444$ , 56.0%), had four or more children ( $n = 3696$ , 38.0%), and had no education ( $n = 5818$ , 59.9%) (Table 1).

**Table 1.** Characteristics of respondents, by place of birth.

Characteristic						Total ( $n = 9719$ )	p-Value
		Home ( $n = 3403$ )		Medical Facility ( $n = 6316$ )			
		n	%	n	%	n	
Demographic characteristics							
Women's age	15–24	923	31.6	1997	68.4	2920	<0.001
	25–34	1921	35.3	3523	64.7	5444	
	35+	559	41.3	796	58.7	1355	
Number of living children	1	520	23.6	1679	76.4	2199	<0.001
	2	673	30.8	1515	69.2	2188	
	3	559	34.2	1077	65.8	1636	
	4+	1651	44.7	2045	55.3	3696	
Socio-economic characteristics							
Residence	Rural	2205	47.0	2491	53.0	4696	<0.001
	Town/Small city	804	31.0	1791	69.0	2595	
	Large city	394	16.2	2034	83.8	2428	
Woman's education	No education	2750	47.3	3068	52.7	5818	<0.001
	Primary or middle	477	24.0	1512	76.0	1989	
	Secondary or higher	176	9.2	1736	90.8	1912	
Husband's education	No education	1811	48.3	1936	51.7	3747	<0.001
	Primary or middle	752	34.7	1414	65.3	2166	
	Secondary or higher	840	22.1	2966	77.9	3806	
Household wealth	First/poorest	1221	61.4	768	38.6	1989	<0.001
	Second	904	46.2	1053	53.8	1957	
	Third	677	34.8	1267	65.2	1944	
	Fourth	430	22.3	1499	77.7	1929	
	Fifth/richest	171	9.0	1729	91.0	1900	
Mother and child health information received from:							
Doctor	No	2436	43.5	3164	56.5	5600	<0.001
	Yes	967	23.5	3152	76.5	4119	
Nurse/Midwife	No	3159	36.7	5441	63.3	8600	<0.001
	Yes	244	21.8	875	78.2	1119	
Lady health visitor	No	3184	36.0	5665	64.0	8849	<0.001
	Yes	219	25.2	651	74.8	870	
Low-level health workers †	No	2946	34.4	5626	65.6	8572	<0.001
	Yes	457	39.8	690	61.2	1147	
Relatives/friends	No	2039	38.9	3210	61.2	5249	<0.001
	Yes	1364	30.5	3106	69.5	4470	
Media	No	2933	39.0	4581	61.0	7514	<0.001
	Yes	470	21.3	1735	78.7	2205	
Survey Year	2013	1386	36.2	2438	63.8	3824	0.041
	2014	2017	34.2	3878	65.8	5895	

† Low-level health workers include: Dai-traditional birth attendant, lady health worker, homeopath, Hakim-herbal medicine practitioner, outreach worker.

Almost half ( $n = 4969$ , 51.1%) lived in rural areas. The likelihood of a facility birth significantly decreased with women's age and number of children. It significantly increased with women's education, husband's education, and wealth. Residence was also associated with place of birth: rural women were most likely to give birth at home, while women in large cities were most likely to give birth at a medical facility. Facility birth was positively associated with

receiving MCH information from all but one information source: low-level health workers (Table 1). The results of generalized linear model with log link and a Poisson distribution are shown in Table 2.

**Table 2.** Generalized linear model with log link and a Poisson distribution: medical facility birth by demographic and socio-economic characteristics and maternal and child health information sources.

Characteristic		Relative Risk (95% Confidence Interval (CI))
Demographic characteristics		
Women's age	15–24	1.00
	25–34	1.03 (0.99–1.06)
	35+	1.08 (1.03–1.14) **
Number of living children	1	1.00
	2	0.91 (0.88–0.94) ***
	3	0.88 (0.85–0.92) ***
	4+	0.81 (0.79–0.84) ***
Socio-economic characteristics		
Residence	Rural	1.00
	Town/small city	0.97 (0.93–1.01)
	Large city	1.00 (0.96–1.04)
Woman's education	No education	1.00
	Primary or middle	1.14 (1.10–1.18) ***
	Secondary or higher	1.19 (1.14–1.23) ***
Husband's education	No education	1.00
	Primary or middle	1.07 (1.02–1.11) **
	Secondary or higher	1.09 (1.05–1.13) ***
Household wealth	First/poorest	1.00
	Second	1.35 (1.26–1.44) ***
	Third	1.55 (1.45–1.66) ***
	Fourth	1.71 (1.59–1.83) ***
	Fifth/richest	1.84 (1.71–1.98) ***
Mother and child health information received from:		
Doctor	No	1.00
	Yes	1.23 (1.20–1.27) ***
Nurse/midwife	No	1.00
	Yes	1.09 (1.05–1.13) ***
Lady health visitor	No	1.00
	Yes	1.01 (0.97–1.05)
Low-level health workers †	No	1.00
	Yes	0.89 (0.85–0.94) ***
Relatives/friends	No	1.00
	Yes	0.92 (0.89–0.95) ***
Media	No	1.00
	Yes	1.00 (0.98–1.03)
Survey Year	2013	1.00
	2014	1.01 (0.98–1.04)

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ . † Low-level health workers included Dai-traditional birth attendant, lady health worker, homeopath, Hakim-herbal medicine practitioner, outreach worker.

They confirm the link between facility birth and women's age, number of children, education,

and wealth. After controlling for all other variables, wealth was the strongest determinant: women in the top wealth quintile were more likely to have a facility birth than women in the bottom quintile (relative risk (RR) = 1.84; 95% confidence interval (CI): 1.71–1.98). Women's education (RR = 1.19 for women with secondary or higher education; 95% CI: 1.14–1.23) was a stronger determinant of facility birth than husband's education (RR = 1.09 for husbands with secondary or higher education; 95% CI: 1.05–1.13).

The impact of MCH information sources was mixed. Women were significantly more likely to give birth at a medical facility if they received MCH information from doctors (RR = 1.23; 95% CI: 1.20–1.27) or nurses/midwives (RR = 1.09; 95% CI: 1.05–1.13). However, women were significantly less likely to give birth at a medical facility if they received MCH information from low-level health workers (RR = 0.89; 95% CI: 0.85–0.94) or relatives/friends (RR = 0.92; 95% CI: 0.89–0.95). There was no association with information received from lady health visitors or the media (Table 2).

Residence itself was not a significant determinant of facility birth in the result. However, the subgroup analysis in Table 3 shows that other determinants of facility birth varied by women's residence. The number of children was significant everywhere. While women's education was significant everywhere, husband's education was significant in rural areas and large cities. Wealth was the strongest determinant of all in rural areas (RR = 1.92; 95% CI: 1.74–2.12) and in towns/small cities (RR = 1.63; 95% CI: 1.30–2.03), but was not significant in large cities. Doctors as source of health information were positively associated with facility birth in all residence groups, whilst this association was significant in rural areas (RR = 1.19; 95% CI: 1.11–1.29) and in large cities (RR = 1.04; 95% CI: 1.00–1.09) for nurses as source of information. Otherwise, lady health visitors as source of health information were not significantly associated with facility birth in all subgroups, whilst this association was negatively significant in rural areas (RR = 0.87; 95% CI: 0.80–0.94) and towns/small cities (RR = 0.90; 95% CI: 0.82–0.98) for low-level health workers and in rural areas (RR = 0.86; 95% CI: 0.81–0.91) and large cities (RR = 0.96; 95% CI: 0.92–0.99) for relatives/friends as source of information (Table 3).



**Table 3.** Generalized linear model with log link and a Poisson distribution: medical facility birth by demographic and socio-economic characteristics and maternal and child health information sources.

Characteristic		Rural (n = 4696)	Town/Small City (n = 2595)	Large City (n = 2428)
		RR (95% CI)	RR (95% CI)	RR (95% CI)
Demographic characteristics				
Women's age	15–24	1.00	1.00	1.00
	25–34	1.03 (0.97–1.09)	1.06 (0.99–1.12)	1.01 (0.97–1.05)
	35+	1.07 (0.98–1.18)	1.09 (0.99–1.2)	1.08 (1.01–1.16) *
Number of living children	1	1.00	1.00	1.00
	2	0.83 (0.77–0.89) ***	0.93 (0.87–0.99) *	0.97 (0.93–1.00)
	3	0.82 (0.76–0.89) ***	0.88 (0.82–0.95) **	0.96 (0.92–1.00)
	4+	0.77 (0.71–0.83) ***	0.81 (0.76–0.88) ***	0.86 (0.81–0.91) ***
Socio-economic characteristics				
Woman's education	No education	1.00	1.00	1.00
	Primary or middle	1.14 (1.07–1.21) ***	1.10 (1.03–1.17) **	1.20 (1.12–1.28) ***
	Secondary or higher	1.16 (1.07–1.25) ***	1.14 (1.06–1.21) ***	1.27 (1.20–1.35) ***
Husband's education	No education	1.00	1.00	1.00
	Primary or middle	1.11 (1.04–1.19) **	1.00 (0.92–1.09)	1.07 (1.01–1.14) *
	Secondary or higher	1.13 (1.06–1.2) ***	1.06 (0.99–1.14)	1.06 (1.00–1.12) *
Wealth	First/poorest	1.00	1.00	1.00
	Second	1.31 (1.22–1.41) ***	1.28 (1.02–1.6) *	1.85 (0.33–10.32)
	Third	1.55 (1.43–1.67) ***	1.37 (1.10–1.70) **	1.81 (0.33–9.89)
	Fourth	1.76 (1.62–1.92) ***	1.50 (1.21–1.87) ***	2.07 (0.38–11.29)
	Fifth/richest	1.92 (1.74–2.12) ***	1.63 (1.30–2.03) ***	2.23 (0.41–12.16)
Mother and child health information received from:				
Doctor	No	1.00	1.00	1.00
	Yes	1.34 (1.27–1.42) ***	1.21 (1.14–1.28) ***	1.12 (1.07–1.16) ***
Nurse/Midwife	No	1.00	1.00	1.00
	Yes	1.19 (1.11–1.29) ***	1.03 (0.97–1.11)	1.04 (1.00–1.09) *
Lady health visitor	No	1.00	1.00	1.00
	Yes	0.99 (0.91–1.08)	1.05 (0.98–1.12)	0.95 (0.89–1.01)
Low-level health workers †	No	1.00	1.00	1.00
	Yes	0.87 (0.80–0.94) **	0.90 (0.82–0.98) *	0.94 (0.86–1.02)
Relatives/friends	No	1.00	1.00	1.00
	Yes	0.86 (0.81–0.91) ***	0.99 (0.93–1.06)	0.96 (0.92–0.99) *
Media	No	1.00	1.00	1.00
	Yes	1.00 (0.94–1.07)	0.98 (0.93–1.04)	1.03 (0.99–1.07)
Survey Year	2013	1.00	1.00	1.00
	2014	1.06 (1.00–1.12) *	0.99 (0.93–1.04)	0.99 (0.95–1.02)

RR, relative risk; CI, confidence interval. \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ . † Low-level health workers included Dai-traditional birth attendant, lady health worker, homeopath, Hakim-herbal medicine practitioner, outreach worker.

## 4. Discussion

Low rates of facility birth pose a continuing challenge for Pakistan's efforts to reduce maternal mortality. In this study we aimed to identify the factors—demographic, socio-economic and information sources - that influence women's choices about where to give

birth in Sindh Province. The facility birth rate in this study was 65% overall, but it was 1.5 times higher in large cities (84%) than in rural areas (53%). This is consistent with previous findings showing that the proportion of women giving birth at health facilities was 1.5 to 4 times higher in urban than rural areas of Pakistan [8,23,24]. Women living in large cities have easier access to and more opportunities to use facility-based maternal health services because of their higher socio-economic status, the greater density of skilled health professionals (especially female doctors), and better transportation, communication, and other infrastructure. Urban advantages and rural disadvantages may result from differential government investments, remoteness of the location, lack of necessity to give birth in the medical facilities, and cultural differences [14,25–27].

The best educated women were more likely to give birth in a medical facility than the least educated, even after controlling for all other factors. The fact that educated women are more likely to delay their first birth until a later age, as other studies have found, may contribute to their use of health facilities for giving birth [8,24,28–30]. In addition, educated mothers may attach greater importance to their health and may be more aware of potential risks during birth. It is also possible that more educated mothers have greater autonomy to make healthcare decisions, greater confidence in their healthcare providers' ability, and greater willingness to travel outside their homes [28,30].

Interestingly, husband's educational level was also a significant predictor of facility birth in rural areas and in large cities. In traditional Muslim culture, where women are not allowed to step out alone without their husband's approval, men play a paramount role in deciding when and where women should seek health care, and their interest or approval is an important determinant of use of health services of all kinds [28,29,31]. Half of Pakistani women have no power to make decisions about their own health care and medical purchases [8,27,28]. Given men's role in family life, raising husbands' awareness of potential birth complications, treatment options, and the importance of facility birth could be important for Pakistani women [28,29]. Especially, distance to the medical facility in rural areas [8] may exacerbate the situation, because husbands must take women to the facility. Furthermore, cultural preference for home birth, distrust of medical facilities, or husbands' disinterest in the health of their wives may be also barriers to facility birth.

In this study, household wealth was an important determinant of facility birth in rural areas, towns and small cities, but not in large cities. This supports previous findings that poor women choose to give birth at home because it is a cheaper option, especially in rural areas where medical facilities are more distant and transportation costs are higher [12,24,27,28,30]. In contrast, women living in big cities have good health infrastructure and easy access to facilities, so household wealth has less impact on health care utilization, including facility birth [14,25,32,33].



Notably, the impact of receiving MCH information on facility birth varied dramatically in this study, depending on the source of that information. Information from skilled birth attendants, including doctors, nurses, and midwives, encouraged facility birth. However, information from lady health visitors, low-level health workers, and relatives and friends either had no impact or, in some locations, discouraged facility deliveries—suggesting that these information sources are not reinforcing, and may even be undermining, government messages promoting facility birth. Some lady health visitors assist at home deliveries in Pakistan [32,34] as do traditional birth attendants and lady health workers [32], so they may have a vested interest in the continuation of home deliveries. Conservative Muslim family members, especially husbands, mothers-in-law, and grandmothers, have a cultural preference for home deliveries and may prohibit pregnant women from going to a hospital to give birth [29,31].

In this study, the media was not an influential information source for facility birth. A study using 2013 survey data found that the most important source of information regarding place of birth in Sindh was doctors (21%); only 14% of women said television was an important information source [18]. Another study found that mass media exposure was associated with facility birth in rural areas of Pakistan [28], but it did not adjust for other health information sources, such as doctors and nurses, unlike our study. Further research is needed to examine the effect of individual information sources on facility birth after adjusting for demographic and socioeconomic determinants in urban and rural areas in Pakistan.

Policy makers and program managers in Sindh Province can use the results of this study to devise more effective strategies to promote facility birth and decrease MMR. In rural areas, interventions should target women who are uneducated, poor, and having no information source from doctors, nurses and midwives. The effect of a low-cost voucher scheme and reimbursement of travel costs on facility birth was proven in a single rural area in Pakistan [28], therefore, provision of low-cost/free vouchers and incentives for travel could help improve facility birth and could be as part of interventions for facility birth in Pakistan. The lady health visitors and low-level health workers should be trained to motivate Pakistani women to use maternal health care services by emphasizing the benefits of facility birth and should act as a mediator between Pakistani women and medical facilities [25]. Establishing a well-organized referral system for lady health visitors and low-level health workers shall help Pakistani women's transition from home birth to facility birth.

Encouraging more women to make use of institutional maternal health services obliges policy maker and health workers to ensure adequate quality of antenatal care and emergency obstetric care. Too frequently women are encouraged to give birth in health institutions where quality of care is not guaranteed, which could even pose more risk on the health of mothers and babies than giving birth at home. Timely access to quality maternal health services is the key to decreasing maternal and neonatal complications.

This study has limitations. As noted, the data come from one single province so the findings cannot be generalized to all of Pakistan. Second, this study did not control for some important determinants of the utilization of maternal health service, such as complications during pregnancy and birth, past use of healthcare services, and distance from health facilities. Third, the variable regarding MCH information sources may not adequately represents whether information sources within the past 12 months had an impact on women's choice of delivery location because the study participants were women who had a live birth in the two years before the survey. Lastly, this cross-sectional study could not make causal inferences from the findings. Despite the limitations, the strength of the present study was the use of large sample of Pakistani women in Sindh using recent data from MCH Program Indicator Survey. The study findings suggested the evidence for target populations to improve facility birth by identifying socially disadvantaged and vulnerable groups, and for the need of training program among non-health professionals.

## 5. Conclusions

The study findings suggest that interventions to promote facility birth in Pakistan should target young women with lower socio-economic status, especially poor and uneducated, and women who live in rural areas with uneducated husbands, and who receive MCH information from non-health professionals. Educating women and their husbands to use health facilities for varied services and training lady health visitors and low-level health workers may help encourage women to give birth there. Policy makers should focus on rural-urban differences, identification of disadvantaged and vulnerable women, the density and composition of the health work force, and recognize and address cultural and religious factors, which may restrict maternal health-seeking behavior.

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APPENDIX



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## Chapter 4

# Optimal Breastfeeding

Factors affecting breastfeeding practices in Sindh province,  
Pakistan: a secondary analysis of cross- sectional survey data

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Article

## Factors Affecting Breastfeeding Practices in Sindh Province, Pakistan: A Secondary Analysis of Cross-Sectional Survey Data

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### Abstract

Breastfeeding practices are critical for child health and growth. This paper investigates demographic factors, socioeconomic status, and information sources that affect breastfeeding practices in Sindh Province, Pakistan. A secondary analysis was performed of data on 10,028 women with a birth in the preceding two years who had participated in the 2013–14 Maternal and Child Health Program Indicator Survey. Multiple logistic regressions were used to test the association between breastfeeding status (ever breastfed and still breastfeeding) and age,

number of living children, residence, education, wealth, information sources about breastfeeding, assistance during delivery, and place of delivery. Of the 9955 women included in the analysis, 97.9% had breastfed and 83.9% were still breastfeeding at the time of the survey. Being in the second, third, or fourth wealth quintiles and receiving breastfeeding information from relatives and friends were associated with ever breastfeeding. Women who were 35 years or older, living in a town/small city, higher maternal education, middle wealth quintile, and receiving breastfeeding information from the media were associated with still breastfeeding. The findings suggest the need to develop interventions considering maternal socioeconomic status and peer counseling interventions. Mass media campaigns to promote breastfeeding practices should be accompanied by governmental restrictions on the marketing of infant formula.

**Keywords:** breastfeeding; Pakistan; maternal and child health; socioeconomic status

## 1. Introduction

Optimal breastfeeding practices improve the survival, health, and development of children [1]. Benefits of breast milk include enhanced cognitive development [2], an optimized immune system [3], reduced risk of some autoimmune and atopic diseases [4,5], obesity [6] and leukemia [7] of children.

In 2016, a *Lancet* series on breastfeeding estimated that 823,000 deaths of children under the age of five years could be prevented every year through optimal breastfeeding practices [8]. However, according to the *Global Breastfeeding Scorecard*, which evaluated 194 nations, the current global rate of exclusive breastfeeding is still unsatisfactory (40 percent of infants under six months of age) and only 23 of the countries have exclusive breastfeeding rates above 60 percent although overall rates of continued breastfeeding at one year are higher (74%) [9].

Given the benefits of breastfeeding infants, it is important to identify which factors may influence breastfeeding practices and help to develop effective intervention programs [10]. A growing body of literature reports that, maternal socioeconomic factors are related to breastfeeding practices in both low and middle income countries [11–18]. Maternal education has been reported to be a significant predictor of breastfeeding practices; mothers with a low level of education are at high risk of stopping exclusive breastfeeding [11,13,17,19,20]. Several studies also found a negative association between household income and the practice of exclusive breastfeeding [15,19,20]. Institutional delivery and antenatal care have been found to predict exclusive breastfeeding [11,20], while advertisements and articles promoting breastfeeding are positively correlated with increasing breastfeeding rates [18].

Pakistan has a frighteningly low rate of exclusive breastfeeding, with only 38 percent of infants less than six months being exclusively breastfed [21]. However, we have limited knowledge on how to influence the breastfeeding practices of Pakistani women. In particular, no published



studies have assessed important modifiable factors that may be associated with breastfeeding practices in Pakistan, such as information about breastfeeding or healthcare during pregnancy and delivery. Therefore, a population-based study of Pakistani women may be helpful to understand breastfeeding practices and the factors that may influence their desire to breastfeed. Healthcare providers and policy makers could use such information to design and develop successful interventions, such as peer counseling, lactation consultation, and breastfeeding education.

The purpose of this analysis was to measure breastfeeding practices in Sindh province, Pakistan and to identify determinants, demographic factors, socioeconomic status, and information sources that affect breastfeeding practices.

## 2. Methods

### 2.1. Data and Subjects

This paper presents a secondary analysis of data collected by the Maternal and Child Health Program Indicator Survey from recent mothers in Sindh province, Pakistan in 2013 and 2014 [22]. The survey was cross-sectional and used a multi-stage, stratified sampling design. Data were collected for two years. The sampling frame was developed by urban and rural categorization based on the national census of Pakistan. First, disproportionate sampling was used to allocate samples in different districts; then the probability proportional to size method was used to select the required number of cities or villages in each district [22]. After selection of the cities or villages, interviews were conducted with a maximum of 10 random subjects in each city in urban areas or each village in rural areas. Data were collected on respondents' socioeconomic status, reproductive history, health knowledge, pregnancy experience, breastfeeding practices, child health, and fertility preferences, along with mass media and communication exposure.

The total survey population consisted of 10,200 women who had a live birth within the previous two years; their answers to the survey questions pertained to their last live birth. This analysis excludes women with missing information on number of living children ( $n = 23$ ), wealth ( $n = 34$ ), education level ( $n = 22$ ), husband's education level ( $n = 93$ ), baby's age ( $n = 73$ ), reducing the sample size to 9955 women.

The Maternal and Child Health Program Indicator Survey was approved by the Johns Hopkins University School of Public Health Institutional Review Board (IRB00005002) and the National Committee of Pakistan. The analysis reported here used secondary data; there was no direct intervention and it was not possible to identify individual respondents.

### 2.2. Variables

The dependent variables in this analysis were *ever breastfed* and *still breastfeeding*. Ever

breastfed was defined by the mother's yes or no response to the question, "Did you ever breastfeed?" and captured whether respondents had any breastfeeding experience or not about respondent's last pregnancy that resulted in a live birth within past two years. Still breastfeeding was defined by the mother's yes or no response to the question, "Are you still breastfeeding?" This question was only asked to respondents whose child was still living at the time of the survey. Among the 9955 women in the sample, 105 reported their child had died; an additional 224 women had missing answers for questions about still breastfeeding and/or whether the child was still living. Therefore, the analysis for still breastfeeding is limited to 9626 women.

Independent variables were selected based on a systematic review of factors associated with breastfeeding in developing countries [23]. They included baby's age, maternal age, number of living children, socioeconomic status, source of information about breastfeeding, healthcare during pregnancy and delivery and survey year. Baby's age at the time of the survey was included as a variable and based on the World Health Organization breastfeeding guideline, categorized into 0–6 months, 7–12 months, 13–18 months and more than 18 months.

We examined residence (rural, town/small city, large city), woman's education, husband's education, and wealth quintiles as socioeconomic status. Wealth quintiles were calculated from household assets using principal components analysis [24].

The survey asked women, "During the last 12 months have you received any information about breastfeeding from the following sources?" Sources were categorized as health professionals (doctors, nurse/midwives and female health visitors), low-level health workers (Dai-traditional birth attendants, female health workers, homeopaths, Hakim-herbal medicine practitioners and outreach workers), media (television, radio, telephone helpline, text message, health education/awareness session and print media) and relatives/friends. Respondents were able to choose multiple categories.

To assess healthcare during pregnancy and delivery, we included the person who attended the delivery and the place of delivery as variables. Attendance during delivery was classified into traditional birth attendant, health professional and no one/others. Place of delivery was classified into home, private facility, and public facility.

### 2.3 Statistical Analysis

We used chi-squared tests to conduct bivariate analyses for general distribution between ever breastfed or still breastfeeding and independent variables. Then we conducted multiple binary logistic regressions for each of the dependent variables: ever breastfed and still breastfeeding. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated for multiple binary logistic regressions to measure the association between independent variables and each dependent variable. The significance level was set at 0.05. Survey weights were applied to all analyses. All analyses were performed using SAS version 9.4 (SAS Institute, Inc., Cary, NC, USA).

### 3. Results

At the time of the survey, 97.9% of women had ever breastfed and 83.9% of women were still breastfeeding. Residence and wealth quintile were associated with both dependent variables. Baby's age, education level, wealth, health professional, media, attendance during delivery, and survey year were associated with still breastfeeding. The still breastfeeding rate was higher when women lived in a large city (85.3%), had received no education (85.8%), were in the lowest wealth quintile (87.1%), received no information from health professional (84.6%) or media (85.1%), received attendance during delivery from a traditional birth attendant (85.7%) and were surveyed in 2013 (86.2%) (Table 1).

**Table 1.** Characteristics of survey respondents by breastfeeding status (n = 9955).

Characteristic	Ever Breastfed			Still Breastfeeding			
	Number	Yes (Weighted %)	p-Value	Number	Yes (Weighted %)	p-Value	
<i>Demographics</i>							
Baby's age, in months	0–6	2251	98.4	0.260	2173	95.0	<0.001
	7–12	3056	97.7	2956	90.0		
	13–18	2677	98.1	2586	81.7		
	19–	1971	97.7	1911	64.4		
Woman's age, in years	15–24	2994	97.8	0.524	2896	83.8	0.148
	25–34	5586	98.0	5405	83.5		
	35–	1375	98.3	1325	85.8		
Number of living children	1	6017	97.8	0.241	5811	84.3	0.424
	2	2249	98.0	2174	83.4		
	3–	1689	98.4	1641	83.2		
<i>Socioeconomic</i>							
Residence	Rural	2552	97.9	0.006	2472	81.7	<0.001
	Town/small city	2659	97.0	2551	85.1		
	Large city	4744	98.3	4603	85.3		
Woman's education	No education	5927	98.1	0.568	5725	85.8	<0.001
	Primary or middle	2043	98.0	1982	81.3		
	Secondary or higher	1985	97.7	1919	81.7		
Husband's education	No education	3801	97.8	0.752	3677	84.9	0.090
	Primary or middle	2224	98.2	2143	83.8		
	Secondary or higher	3930	97.9	3806	83.0		
Wealth quintile	First (poorest)	2004	99.0	0.007	1957	87.1	<0.001
	Second	1987	97.4	1915	85.8		
	Third (middle)	1978	97.9	1904	82.6		
	Fourth	1985	97.6	1913	82.6		
	Fifth (richest)	2001	98.0	1937	82.1		
<i>Information sources about breastfeeding</i>							
Health professional	No	6391	97.8	0.218	6160	84.6	0.019
	Yes	3564	98.2	3466	82.8		
Low-level health workers <sup>†</sup>	No	7180	97.9	0.838	6935	83.9	0.846
	Yes	2775	98.0	2691	83.8		
Media	No	7819	98.0	0.473	7552	85.1	<0.001
	Yes	2136	97.8	2074	79.9		
Relatives/friends	No	5522	97.5	<0.001	5309	84.1	0.531
	Yes	4433	98.5	4317	83.7		

Table 1. (Continued)

Characteristic		Ever Breastfed			Still Breastfeeding		
		Number	Yes (Weighted %)	p-Value	Number	Yes (Weighted %)	p-Value
<i>Healthcare during pregnancy and delivery</i>							
Assistance during delivery	Traditional birth attendant	3052	98.1	0.479	2953	85.7	0.012
	Health professional	6769	97.9	6542	83.2		
Place of delivery	No one/others	134	99.3	131	83.6		
	Home	3448	98.1	0.455	3333	85.1	0.096
	Private facility	4901	97.8	4736	83.3		
Survey year	Public facility	1606	98.2	1557	83.6		
	2013	3897	97.6	0.052	3734	86.2	<0.001
	2014	6058	98.2	5892	82.4		

† Low-level health workers include Dai-traditional birth attendants, lady health workers, homeopaths, Hakim-herbal medicine practitioners and outreach workers.

Table 2 shows the factors associated with ever breastfed and still breastfeeding using multiple logistic regressions. The references of both dependent variables were 'no'; therefore, an OR over one suggests that a factor is associated with ever breastfeeding or still breastfeeding. The odds that women ever breastfed were significantly lower for women in the second, third (middle), fourth wealth quintiles; they were significantly higher for women who received breastfeeding information from friends or relatives (OR = 1.72, 95% CI = 1.24–2.39). The odds that women were still breastfeeding at the time of the survey were significantly greater for women who were 35 years or older (OR = 1.36, 95% CI = 1.11–1.66) and living in towns or small cities (OR = 1.22, 95% CI=1.01–1.49); they were significantly lower for women who had more education, were in the middle wealth quintile (OR = 0.76, 95% CI = 0.610.95), had received breastfeeding information from the media (OR = 0.82, 95% CI = 0.71–0.95) (Table 2).

**Table 2.** Factors associated with breastfeeding status in multiple logistic regressions

Factors		Ever Breastfed (ref = no)		Still Breastfeeding (ref = no)	
		OR	95% CI	OR	95% CI
<i>Demographic</i>					
Baby's age, in months	0–6	1.00		1.00	
	7–12	0.70	(0.47–1.05)	0.48	(0.39–0.61)
	13–18	0.83	(0.54–1.27)	0.23	(0.19–0.29)
	19–	0.65	(0.42–1.01)	0.09	(0.07–0.12)
Woman's age, in years	15–24	1.00		1.00	
	25–34	1.11	(0.82–1.51)	1.12	(0.98–1.27)
	35–	1.43	(0.87–2.35)	1.36	(1.11–1.66)
Number of living children	1	1.00		1.00	
	2	1.21	(0.85–1.71)	1.08	(0.93–1.24)
	3–	1.48	(0.98–2.25)	1.03	(0.88–1.20)
<i>Socioeconomic</i>					
Residence	Rural	1.00		1.00	
	Town/small city	0.77	(0.51–1.18)	1.22	(1.01–1.49)
	Large city	1.22	(0.76–1.95)	1.18	(0.97–1.45)
Woman's education	No education	1.00		1.00	
	Primary or middle	1.00	(0.67–1.48)	0.77	(0.66–0.91)
	Secondary or higher	0.81	(0.52–1.28)	0.77	(0.63–0.93)
Husband's education	No education	1.00		1.00	
	Primary or middle	1.36	(0.92–2.00)	1.05	(0.90–1.23)
	Secondary or higher	1.32	(0.91–1.91)	1.11	(0.95–1.30)
Wealth quintile	First (poorest)	1.00		1.00	
	Second	0.40	(0.23–0.69)	0.92	(0.75–1.12)
	Third (middle)	0.53	(0.29–0.98)	0.76	(0.61–0.95)
	Fourth	0.49	(0.25–0.97)	0.86	(0.66–1.11)
	Fifth (richest)	0.57	(0.27–1.22)	0.89	(0.66–1.19)
<i>Information sources about breastfeeding</i>					
Health professional	No	1.00		1.00	
	Yes	1.07	(0.77–1.50)	1.00	(0.88–1.14)
Low-level health workers†	No	1.00		1.00	
	Yes	0.85	(0.60–1.21)	0.98	(0.85–1.13)
Media	No	1.00	1.00		
	Yes	0.83	(0.58–1.19)	0.82	(0.71–0.95)
Relatives/friends	No	1.00		1.00	
	Yes	1.72	(1.24–2.39)	1.13	(0.99–1.29)
<i>Healthcare during pregnancy and delivery</i>					
Assistance during delivery	Traditional birth attendant				
	Health professional	0.92	(0.46–1.84)	0.78	(0.57–1.01)
	No one/others	3.11	(0.35–27.99)	0.82	(0.48–1.39)
Place of delivery	Home	1.00		1.00	
	Private facility	0.99	(0.51–1.95)	1.20	(0.91–1.59)
	Public facility	1.27	(0.61–2.66)	1.26	(0.93–1.69)
<i>Survey year</i>					
Survey year	2013	1.00		1.00	
	2014	1.20	(0.88–1.63)	0.91	(0.80–1.04)

Ref, reference; OR, odds ratio; CI, confidence interval, † Low-level health workers included Dai-traditional birth attendants, lady health workers, homeopaths, Hakim-herbal medicine practitioners, and outreach workers.

## 4. Discussion

The 2013-14 Maternal and Child Health Program Indicator Survey found very high levels of breastfeeding in Sindh province. Virtually all women (97.9 %) had some experiences of breastfeeding, but the odds of women still breastfeeding decreased rapidly during the next six months from baby's birth, while World Health Organization (WHO) recommended mothers to breastfeed up to the age of two years or beyond [1]. The high percentage of mothers who were still breastfeeding in this study (83.9%) did not indicate that babies older than six months meet their nutritional requirements. Unfortunately, we could not examine or adjust for the type and quality of breastfeeding practices including early initiation of breastfeeding, exclusive breastfeeding, prelacteal and supplemental feeding. These are essential WHO recommendations, which advise that breastfeeding should begin within the first hour of life and exclusive breastfeeding should be sustained for six months after birth [1].

In previous studies of Pakistan, the percentages of women to sustain exclusive breastfeeding for six months ranged from 38% to 54% [24,25] and the median duration of exclusive breastfeeding was less than one month [24]. These findings suggest that breastfeeding mothers may not engage in best practices, as babies grow older. Therefore, at least once every six months, post-natal follow-up support for all breastfeeding women are needed to find women who consider discontinuing breastfeeding and encourage them to breastfeed for at least two years with appropriate complementary food based on the WHO recommendations.

In this study, women who live in town/small city showed higher odds of breastfeeding their babies for longer periods than those who live in rural, while living in large city was not a determinant of still breastfeeding. A study reported that Pakistani mothers with babies under six months who live in suburban areas showed 61% of exclusive breastfeeding, which was higher than 47% of mothers who live in urban areas, which may be due to non-affordability of the prepared formula milk and cultural values [25]. Most rates for health care utilization and public health practice among women living in town/small city were between those living in large city and rural areas in Pakistan [22], which indicated that women living in town/small city were influenced by both urban and rural environments. Factors associated with the use of medical facility as the place of birth in town/small city were different from those in large city or rural areas [26]. Therefore, further studies should determine unique characteristics of women in town/small city and it is necessary to approach them with different maternal and child health promotion strategies based on the results of those studies.

Findings from previous studies about the relationship between maternal education and breastfeeding practices are inconsistent [12–14,17,27,28]. In this study, maternal education was not a significant determinant of starting breastfeeding, which was aligned with the findings of a previous study conducted in two rural districts of Sindh, Pakistan [29], but





it was negatively associated with longer breastfeeding. The inconsistency in findings about the relationship between maternal education and breastfeeding practices may be due to cultural beliefs regarding prelacteal feeding, that is, the practice of giving food to newborns before the initiation of breastfeeding [25,30,31] and the misconception that breastfeeding is a cause of weakness in mothers [25,31]. Educated women were more likely to deliver in a health facility [24], but 74.6% of women who deliver in a health facility provided prelacteal feed, which was similar to 75.8% of women who deliver at home [24]. Another possible reason for the negative association between maternal education and breastfeeding may be that women with higher education have more opportunities to engage in formal employment and control over their cash earnings, which leads to less still breastfeeding due to their *affordability* [16,17,24,28,32]. According to the Pakistan Demographic and Health Survey 2012–13 [24], the majority of highly educated women were employed at the professional/technical/managerial job, whereas the majority of uneducated women were employed at the unskilled manual or employed in agriculture. Possibly, more highly educated women have jobs away from home, which makes it unpractical to breastfeed because they are away for long hours.

Interestingly, women in the second, third (middle), fourth wealth quintiles were less likely to have ever breastfed than those in the poorest wealth quintile, but being in the richest wealth quintile was not a significant determinant of breastfeeding practices. Previous studies have noted that infant formula and cow milk are not *affordable* for poor mothers so they are more likely to engage in exclusive breastfeeding [15,29]. Mothers and fathers who participated in focus group discussions in Punjab province, Pakistan, believed that wealthy people bought expensive milk to show their wealth [31]. In contrast, a study from Nigeria reported that more mothers from wealthier households practiced exclusive breastfeeding than those from poorer households, which may reflect better health care access for wealthier mothers [13]. The findings about the relationship between five wealth quintiles and breastfeeding practices in this study may be due to a *difference* in the distribution of occupations among the wealth quintiles. The two common occupations in the fifth (richest) quintile were the professional/technical/managerial job and sales/services, whereas three common occupations in the first to fourth wealth quintiles were sales/services, unskilled manual and agriculture [24]. Program managers may need to develop appropriate interventions for women after considering women's economic status and occupational characteristics simultaneously in Pakistan.

This analysis revealed a negative association between receiving information from the media and still breastfeeding. A previous intervention study in Sindh examined the *effect* of mass media campaigns (mainly television spots) on breastfeeding practices. It found that the proportion of mothers who received information about the importance of early breastfeeding initiation and exclusive breastfeeding increased significantly, but there was no significant improvement in breastfeeding practices. This suggested that mass media campaigns may have been helpful in

delivering information and driving conversations about breastfeeding to Pakistani women but did not lead to changes in actual practice [33]. The adverse effect of mass media on breastfeeding practices documented here may be explained by research on the impact of marketing breast milk substitutes on breastfeeding practices in low- and middle-income countries [34]. Companies advertise infant formula as a breast milk substitute that is modern and better than breast milk via television, radio, print advertisements, internet websites and social media [35]. The prevalence of mothers who recalled advertisement or promotion of breast milk substitutes on television was 28% in 2012 in Pakistan [35]. Even though Pakistan adopted the International Code of Marketing of Breast-milk Substitutes in 2002 to restrict the marketing of infant formula [36,37], most healthcare providers were not aware of the law and the marketing of formula may have continued after the law was applied [37]. Our findings suggest that mass media campaigns to improve breastfeeding practices in Pakistan will not have a positive impact unless they are accompanied by the government restrictions on the marketing of infant formula.

We found that receiving breastfeeding information from relatives or friends had a positive impact on starting breastfeeding. This may be due to the nature of their advice. In the Muslim community, relatives or friends are the main people providing breastfeeding advice [30,38]. An intervention study conducted in urban Bangladesh has highlighted the need for community-based peer counseling using trained community female volunteers to promote good breastfeeding practices. When peer counseling at home included other family members, mothers were five times more likely to practice exclusive breastfeeding for up to five months compared to mothers who received no intervention [38]. Peer counseling also had a positive effect on early initiation of breastfeeding within the first hour of birth [38]. Peer counseling interventions may be tested in Pakistan to improve early breastfeeding initiation and exclusive breastfeeding.

This analysis has several limitations. First, due to the cross-sectional nature of the survey, causal relationships with determinants cannot be ascertained. Second, questions about breastfeeding were dichotomized to yes/no answers, so there is no information on when breastfeeding was initiated after birth, the duration of exclusive and non-exclusive breastfeeding and the practice of prelacteal feeding, all of which were significant elements in previous studies of breastfeeding behaviors [1,33,38]. Third, the findings cannot be generalized to all mothers in Pakistan because the survey was limited to a single province, Sindh.

However, the finding about negative association between baby's age and still breastfeeding rate suggests the need to follow-up breastfeeding mothers to continue breastfeeding at least once every six months. This analysis also found an association between the socioeconomic status of women and good breastfeeding practices and suggests the need to develop better-shaped interventions in line with maternal educational level and economic status. In countries where



Islam is the dominant religion, relatives or friends could be a good support to promote breastfeeding. Therefore, public health *officials* and health care providers should consider peer counseling interventions targeting relatives and friends.

## 5. Conclusions

This analysis provides evidence for further *efforts* to improve breastfeeding practices in Sindh province, Pakistan by identifying factors associated with breastfeeding. Policy makers and program managers need to develop targeted interventions to improve breastfeeding practices based on the baby's age and maternal socioeconomic status. This analysis highlights the role of mass media and relatives/friends as information sources about breastfeeding. Mass media campaigns to improve breastfeeding practices should be accompanied by the governmental restriction of marketing of formula milk in Pakistan. In addition, it is necessary to consider development of peer counseling interventions to improve breastfeeding practices.

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APPENDIX



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## Chapter 5

# Full Basic Immunization

Factors affecting complete and timely childhood immunization coverage in Sindh, Pakistan; A secondary analysis of cross-sectional survey data

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## RESEARCH ARTICLE

# Factors affecting complete and timely childhood immunization coverage in Sindh, Pakistan; A secondary analysis of cross-sectional survey data

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## Abstract

### Background

Pakistan has a high burden of newborn mortality, which would be significantly preventable through appropriate routine immunization. The purpose of this study was to measure the basic timely childhood immunization coverage and to identify determinants of factors influencing childhood immunization coverage in Sindh, Pakistan.

### Methods

We analysed a subset of data from Maternal and Child Health

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(MCH) Program Indicator Surveys conducted in Sindh Data from Maternal and Child Health Program Indicator Survey 2013–2014 which was conducted in Sindh province of Pakistan was used. Outcome measure was full coverage of the basic immunization schedule from child's vaccination card. The association of receiving basic immunization with demographic factors, socioeconomic status, mother and child health information sources, and perinatal care factors were tested by binary logistic regression.

## Results

Among 2,253 children, 1,156 (51.3%) received age-based full basic immunization. The basic immunization rates were 69.1% for under five weeks old, 38.3% for six to nine weeks, 18.8% for 10–13 weeks, 44.0% for 14 weeks–eight months, 60.4% for nine to 11 months, and 59.1% for over one year. Child's age, number of living children, parents' education level, wealth, the source of mother and child health information, number of antenatal care, and assistance during delivery were associated with completing basic immunization.

## Conclusions

The overall full basic immunization coverage in Pakistan was still low. Policy makers should identify children at risk of low immunization coverage and obstacles of receiving antenatal care, implement educational interventions targeting on less educated parents, and conduct mass immunization campaigns for timely and complete immunization.

## Introduction

Children across Pakistan are at risk of falling ill with life-threatening diseases because of lack of access to vaccinations. Approximately, 400,000 children under five years of age die every year from vaccine-preventable diseases in Pakistan [1]. The Pakistan Demographic Health Survey from 2013 estimated that almost three million children dropped out of the basic course of

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vac- cines every year [1]. The survey of Pakistan Social and Living Standards Measurement (2014–showed that Pakistan’s full immunization coverage was 60%. In addition, the coverage rate stood at 27–70% with large variations between the provinces, districts and communities [2]. Given the low vaccination rates in Pakistan, immunization programs play an essential role in the strategy to raise the level of herd immunity, ultimately reducing child mortality. In com- munities with herd immunity through sufficient immunization coverage of the population, vulnerable children are protected because the majority of individuals they come into contact with are immune and therefore incapable of spreading communicable disease [3]. In addition, timing of childhood immunization is critical because if children are immunized too early or if the immunizations are too closely spaced, it can significantly shorten the duration of protection or interfere with the immune response [4, 5]. Delayed immunizations lead to prolonged potential exposure to vaccine-preventable diseases [6, 7]. Hence, it is important to assess when, not just if, children are receiving immunizations. The current immunization schedule in Pakistan was first introduced in July 2011 [8] (Table 1).

Understanding factors that influence immunization coverage is essential to increase routine immunization coverage rates. Several studies found that substantial health inequity according to socioeconomic status, such as residency [9], wealth [9–11], educational status [9, 11, 12], and number of children in a household [13, 14], affects immunization coverage. In addition, immunization coverage is influenced by mother and child health information sources, such as antenatal care (ANC) visits [15] and accessibility to mass media [10, 11, 16].

Information about factors that influence immunization coverage might be valuable for healthcare providers and policy makers to develop and provide effective programs

**Table 1.** Immunization schedule in Pakistan and definition of full basic immunization.

Immunization schedule		Definition of full basic immunization, by age group	
Immunizations		Age group	Requirements for full basic immunization
At birth	BCG+ Polio 0	0–5 weeks	BCG, Polio 0
6 weeks	Penta 1 + Polio 1	6–9 weeks	BCG, Polio 0, Polio 1, Penta 1
10 weeks	Penta 2 + Polio 2	10–13 weeks	BCG, Polio 0, Polio 1, Polio 2, Penta 1, Penta 2
14 weeks	Penta 3 + Polio 3	14 weeks– 8 months	BCG, Polio 0, Polio 1, Polio 2, Polio 3, Penta 1, Penta 2, Penta 3
9 months	Measles 1	9–11 months	BCG, Polio 0, Polio 1, Polio 2, Polio 3, Penta 1, Penta 2, Penta 3, Measles 1
12–15 months	Measles 2	12 months– 23 months	BCG, Polio 0, Polio 1, Polio 2, Polio 3, Penta 1, Penta 2, Penta 3, Measles 1, Measles 2

BCG: Bacillus Calmette–Gue´rin (BCG) is an antituberculosis vaccine.

Penta: Pentavalent vaccine for diphtheria, tetanus, acellular pertussis, poliomyelitis, and Haemophilus influenzae type b

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contributing to the increase in the childhood immunization coverage rates [1]. Although the need to improve routine immunization across all regions and districts in Pakistan has been strongly emphasized [1], influencing factors have not been examined in depth. The purpose of this study was to measure the basic timely childhood immunization coverage and to identify determinants such as age group, socio-demographic characteristics, information sources, and perinatal care that influence childhood immunization coverage in Sindh, one of the four provinces of Pakistan.

## Methods

### Data and subjects

We used survey data in 2013 and 2014 from the Maternal and Child Health (MCH) Program Indicator Survey which was conducted in Pakistani province of Sindh [17]. Sindh province is located in the southeastern part of Pakistan. Its area is 140,914 km<sup>2</sup> and it includes approximately 44 million people [18]. In Sindh, total fertility rate was 3.9, the under-five mortality rate was 93 deaths per 1,000 live births, and the infant mortality rate was 74 per 1,000 live births from the results of Pakistan Demographic and Health Survey (PDHS) 2012–2013 [18].

The MCH Program Indicator Survey was set to monitor the implementation of maternal, newborn, and child health (MNCH) and family planning/reproductive health interventions by the United States Agency for International Development (USAID) [17]. The survey instrument was based on the PDHS instrument developed by Macro International, Inc. and the Knowledge, Practice and Coverage Survey instrument developed by the Johns Hopkins University/Child Survival Support Program 1990 [17]. The study team pilot tested the survey questionnaire in the local languages of Urdu and Sindhi.

This survey data is from 23 districts of Sindh province. The sample is representative of urban and rural areas of Sindh. It is a cross-sectional study using a multi-stage, stratified sampling design. Based on the most recent Census of Pakistan in 1998, USAID used a disproportionate sampling approach to allocate the sample in districts in rural and urban areas for better representation of smaller districts. Then probability proportionate to size method was used to select cities and villages. USAID allocated a maximum of 10 participants in each village and 15–200 participants in each selected city to take part in the study. Finally, data were collected in all 23 districts of Sindh from June to October in 2013 and 2014 [17]. The study participants included married women 15–49 who had a live birth in the two years prior to the survey and who resided in the houses sampled for study participation. Only one study participant was selected from a household. Each woman completed questionnaires about her last live birth. An assessment of data quality was conducted by the director of Monitoring and Evaluation of the MNCH Services Component after the data were made available for analysis. Both internal and external validity checks were conducted.

The study was approved by the Johns Hopkins University School of Public Health Institutional Review Board (IRB00005002) and the National Bioethics Committee of Pakistan. Both Institutional Review Boards approved the verbal consent. Female interviewers obtained informed consent verbally from each respondent and then signed the consent form on behalf of the respondent. Interviewers were required to sign the consent form attached to the survey questionnaire to confirm that they had read the informed consent script.

## Outcome measure

The primary outcome variable was full coverage of the basic immunization schedule ([Table 1](#)). Survey respondents were asked to show their child's vaccination card, so that data collectors could collect their immunization records. Secondly, we evaluated the percent of children in a certain age group who had received all of the immunizations as per the national recommended immunization schedule for a child that age. For this purpose, we categorized children's age into under five weeks, six to nine weeks, 10 weeks–13 weeks, 14 weeks–eight months, nine months–11 months, and 12 months–23 months. Definitions of full basic immunization per age group are presented in [Table 1](#).

## Independent variables

Demographic factors, socioeconomic status, MCH information sources, and factors regarding perinatal care were included to identify the factors associated with immunization conditions in this study. These independent variables were derived from previous studies [[19](#), [20](#)] and MCH Program Indicator Survey report [[17](#)].

Mother's age and number of living children were included as demographic factors. The mother's age was classified into 15–24, 25–34, 35 and older, and number of living children was classified into one, two, three, four, and five- based on MCH Program Indicator Survey report [[17](#)]. To determine socioeconomic status of the respondents, data was collected on rural-urban residence, mother's and father's education, and household wealth. Wealth index was calculated by principal components analysis based on the household ownership of assets [[8](#)]. Principal component analysis is a well-known statistical method to reduce dimensionality [[21](#)] and was used to assess household wealth based on the value of 35 households' assets. Thus, we made a wealth variable from the value of 35 household assets. After calculating the index, it was classified into quintiles.

MCH information source was assessed by asking, "During the last 12 months have you received any information about MCH from the following sources?" Responses were categorized into health professionals (doctor, nurse/midwife, lady health visitor), lower-level health workers (Dai-traditional birth attendant, lady health worker, homeopath, Hakim-herbal medicine

practitioner, outreach worker), relatives/friends, and media (radio, TV, telephone help-line, text message on mobile phone, health education/awareness session, print media). Binary variables (yes/no) for each response in MCH information source were included. Number of ANC visits, assistance during delivery, and place of delivery were included as factors of perinatal care.

## Statistical analysis

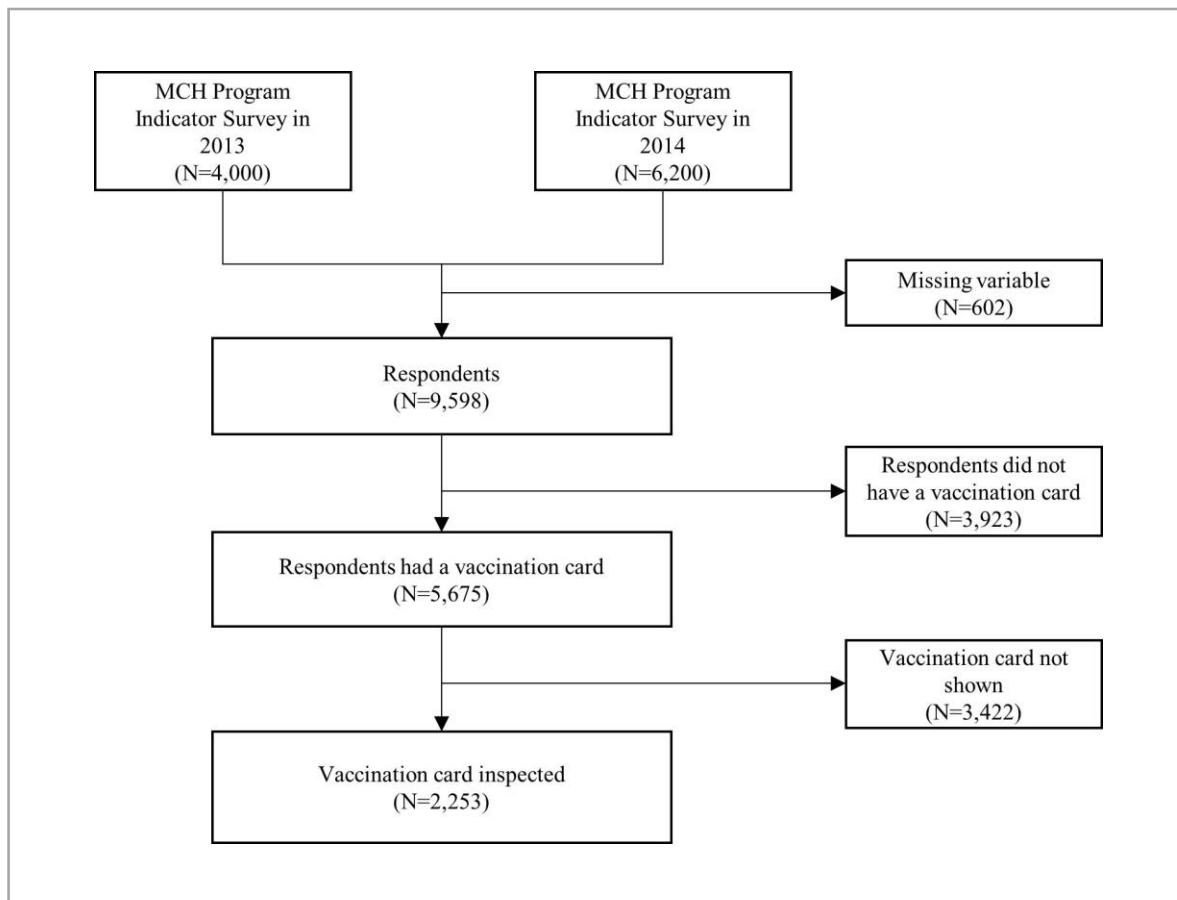
Data from 2013 and 2014 were pooled for this analysis. A chi-squared test was used to test distribution of general characteristics for the bivariate analysis, between full basic immunization and independent variables. For multivariate analysis, binary logistic regression was used to investigate factors associated with full basic immunization. The criterion for significance was  $p < 0.05$ , two-tailed. Odds ratio (OR) and 95% confidence interval (CI) were calculated. We presented the crude OR and adjusted OR in our results table. The adjusted OR were results of binary logistic regression by adjusting all the independent variables (children's age, mother's age, number of living children, residence, mother's education, father's education, wealth, MCH information source, number of ANC visits, assistance during delivery, place of delivery). All analyses were performed in SAS version 9.4 (SAS Institute, Cary, NC, USA).

## Results

Data were collected from a total of 10,200 women, 4,000 women in 2013 and 6,200 women in 2014. Details of the study population selection is shown in [Fig 1](#); 602 subjects were excluded because of missing variables for wealth (N = 34), father's education level (N = 94), mother's education level (N = 21), mean number of living children (N = 23), ANC use information (N = 309), and immunization care (N = 121) ([Fig 1](#)). Then respondents who did not have a vaccination card (N = 3,923) and did not/could not show a vaccination card (N = 3,422) were excluded. Finally, 2,253 subjects were selected as study population.

[Table 2](#) shows the general characteristics of the mothers and children that were included in the study. Among 2,253 children, 1,156 children (51.3%) received age-based full basic immunization. The percentage of children having received full basic immunization varied by children's age ([Fig 2](#)); 69.1% of the children under five week old had received full basic immunization, compared with 38.3% for children aged six weeks—nine weeks and just 18.8% for children age 10 weeks-13 weeks.

Based on the results of chi-square test, children's age, mother's education, father's education, wealth quintile, MCH information source (health professional, relatives/friends, media), number of ANC visits, assistance during delivery, and place of delivery were significant. The proportion steadily increased among older age groups, from 44.0% of children age 14 weeks- eight months, to 60.4% of children aged nine-11 months, and 59.1% of children aged one year. Higher



**Fig 1.** Flow chart showing study population selection.

education level in both father and mother showed higher proportion of full basic immunization. High wealth group showed a high proportion of full basic immunization, but the proportion of the fourth wealth group (49.7%) was lower than the third wealth group (52.2%). Women who received MCH information from health professionals, relatives/friends, and media showed a higher proportion of full basic immunization than those who did not.

Women who only visited the ANC clinic 1–2 times showed the lowest proportion of full basic immunization (40.9%). The proportion of full basic immunization in women whose birth was assisted by a traditional birth attendant was 53.1%. It was 45.7% in health professional, 24.0% in no one/others. Women who delivered at home showed the lowest proportion (44.1%), compared to 54.1% in women who gave birth in private facilities, and 51.8% in women who gave birth at public facilities (Table 2).

Table 3 shows the results of crude and adjusted binary logistic regression. Compared to children who were under five weeks old, older children were less likely to have completed age-based basic immunization except children who were nine-11 months. Children who were nine-11

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**Table 2.** Percentage of children age 0–23 months who have completed full basic immunization, by age group, sociodemographic characteristics, information sources, and perinatal care.

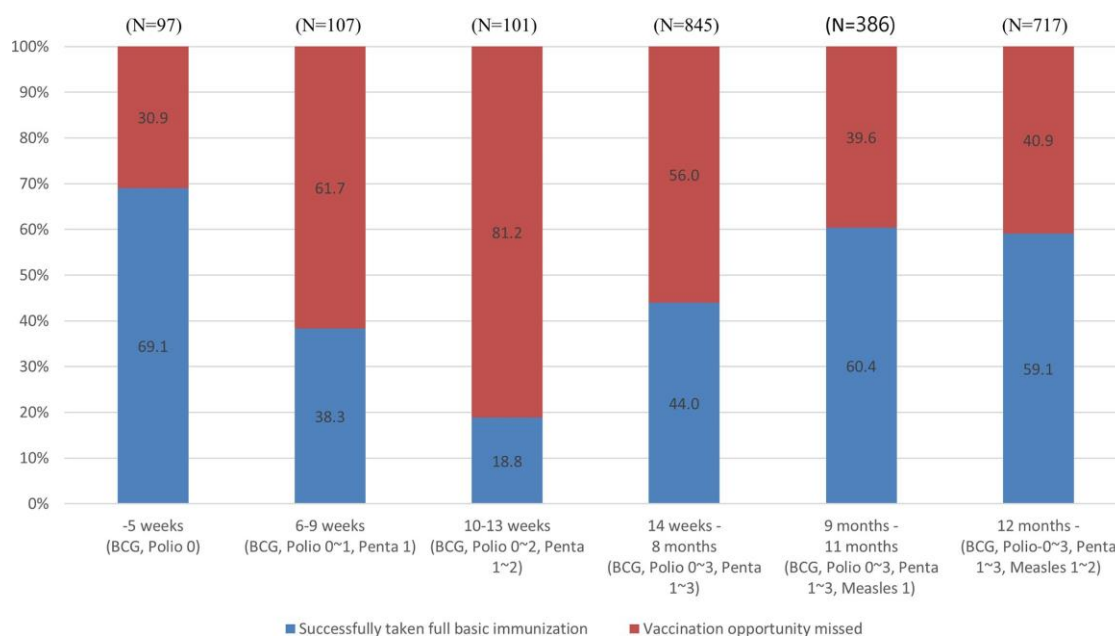
		Full basic immunization		Total (n = 2,253)	p-value
		Yes (n = 1,156)			
		N	%	N	
Children's age	0–5 weeks	67	69.1	97	< .001
	6–9 weeks	41	38.3	107	
	10–13 weeks	19	18.8	101	
	14 weeks–8 months	372	44.0	845	
	9–11 months	233	60.4	386	
	12–23 months	424	59.1	717	
<b>Demographic factors</b>					
Mother's age	15–24	381	49.0	777	0.287
	25–34	652	52.6	1239	
	35–	123	51.9	114	
Number of living children	1	315	47.6	662	0.083
	2	308	55.3	557	
	3	193	52.2	370	
	4	136	53.5	254	
	5+	204	49.8	410	
<b>Socioeconomic status</b>					
Residence	Rural	331	47.8	692	0.089
	Town/Small city	420	53.0	793	
	Large city	405	52.7	768	
Mother's Education	No education	420	44.5	943	< .001
	Primary or middle	328	52.6	624	
	Secondary or higher	408	59.5	686	
Father's education	No education	248	43.1	576	< .001
	Primary or middle	251	48.5	517	
	Secondary or higher	657	56.6	1,160	
Wealth quintile	First (poorest)	60	35.1	171	< .001
	Second	124	44.4	279	
	Third	250	52.2	479	
	Fourth	315	49.7	634	
	Fifth (richest)	407	59.0	690	
<b>Information about maternal and child health received from:</b>					
Health professional	No	486	44.9	1,083	< .001
	Yes	670	57.3	1,170	
Low-level health workers <sup>†</sup>	No	1027	51.5	1993	0.561
	Yes	129	49.6	260	
Relatives/friends	No	476	44.7	1064	< .001
	Yes	680	57.2	1189	
Media <sup>‡</sup>	No	734	47.3	1,551	< .001
	Yes	422	60.1	702	
<b>Health care during pregnancy and delivery</b>					
Number of antenatal care visits	1–2	160	40.9	391	< .001
	3	167	53.7	311	
	4+	829	53.4	1,551	
Assistance during delivery	Traditional birth attendant	945	53.1	1,779	< .001
	Health professional	205	45.7	449	
	No one/others	6	24.0	25	
Place of delivery	Home	239	44.1	542	< .001
	Private facility	718	54.1	1,327	

<sup>†</sup>Low-level health workers included Dai-traditional birth attendant, lady health worker, homeopath, Hakim-herbal medicine practitioner, and outreach worker.

<sup>‡</sup>Media included radio, TV, telephone helpline, print media, health education/awareness session, and text message on mobile phone.

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months showed OR = 0.64, but it was not significant compared to children who were under five weeks old. Hence, the proportion of children with completed full basic immunization was higher for children age under five weeks. Compared to the children under five weeks old, the OR of children who were six-nine weeks were 0.25 (95% CI, 0.14–0.45), the OR of children who were 10–13 weeks old showed the lowest result (OR, 0.09; 95% CI, 0.05–0.18), the OR of children who were 14 weeks–eight months were 0.34 (95% CI, 0.21–0.54) and the OR of children who were over 12 months were 0.59 (95% CI, 0.37–0.94) (Table 3).

**Table 3.** Results of logistic regression for full basic immunization (n = 2,253).

		Crude			Adjusted <sup>†</sup>		
		O R	95% Confidence Interval		O R	95% Confidence Interval	
Children's age	0–5 weeks	1.00			1.00		
	6–9 weeks	0.28	0.16	0.50	0.25	0.14	0.45
	10–13 weeks	0.10	0.05	0.20	0.09	0.05	0.18
	14 weeks–8 months	0.35	0.22	0.55	0.34	0.21	0.54
	9–11 months	0.68	0.42	1.10	0.64	0.39	1.05
	12–23 months	0.65	0.41	1.02	0.59	0.37	0.94
<b>Demographic factors</b>							
Mother's age	15–24	1.00			1.00		
	25–34	1.15	0.97	1.38	1.00	0.81	1.23
	35–	1.12	1.84	1.50	0.98	0.69	1.40
Number of living children	1	1.00			1.00		
	2	1.36	1.09	1.71	1.40	1.10	1.78
	3	1.20	0.93	1.55	1.24	0.94	1.65
	4	1.27	0.95	1.70	1.47	1.06	2.03
	5+	1.09	0.85	1.40	1.42	1.04	1.93

Table 3. (Continued)

		Crude			Adjusted <sup>†</sup>		
		OR	95% Confidence Interval		OR	95% Confidence Interval	
<b>Socioeconomic status</b>							
Residence	Rural	1.00			1.00		
	Town/small city	1.23	1.00	1.51	0.96	0.75	1.23
	Large city	1.22	0.99	1.50	0.78	0.59	1.04
Mother's education	No education	1.00			1.00		
	Primary or middle	1.38	1.13	1.69	1.17	0.93	1.49
	Secondary or higher	1.83	1.50	2.23	1.37	1.04	1.80
Father's education	No education	1.00			1.00		
	Primary or middle	1.25	0.98	1.58	1.08	0.83	1.40
	Secondary or higher	1.73	1.41	2.11	1.30	1.03	1.65
Wealth	First (poorest)	1.00			1.00		
	Second	1.48	0.99	2.19	1.25	0.83	1.90
	Third	2.02	1.41	2.90	1.52	1.01	2.27
	Fourth	1.83	1.29	2.59	1.21	0.79	1.88
	Fifth (richest)	2.66	1.88	3.77	1.53	0.95	2.45
<b>Information about maternal and child health received from:</b>							
Health professional	No	1.00			1.00		
	Yes	1.65	1.39	1.94	1.24	1.02	1.52
Low-level health workers <sup>‡</sup>	No	1.00			1.00		
	Yes	0.93	0.72	1.20	1.06	0.79	1.44
Relatives/friends	No	1.00			1.00		
	Yes	1.65	1.40	1.95	1.38	1.12	1.71
Media <sup>¶</sup>	No	1.00			1.00		
	Yes	1.68	1.40	2.01	1.32	1.08	1.61
<b>Health care during pregnancy and delivery</b>							
Number of antenatal care visits	1–2	1.00			1.00		
	3	1.67	1.24	2.26	1.61	1.17	2.22
	4+	1.66	1.32	2.08	1.39	1.09	1.79
Assistance during delivery	Traditional birth attendant	1.00			1.00		
	Health professional	1.35	1.10	1.66	0.72	0.45	1.14
	No one/others	0.38	0.15	0.96	0.26	0.10	0.71
Place of delivery	Home	1.00			1.00		
	Private facility	1.50	1.22	1.83	1.54	0.99	2.39
	Public facility	1.36	1.05	1.77	1.50	0.94	2.41

<sup>†</sup>Children's age, mother's age, number of living children, residence, mother's education, father's education, wealth, maternal and child health information source, number of antenatal care use, assistance during delivery, and place of delivery were adjusted.

<sup>‡</sup>Low-level health workers included Dai-traditional birth attendant, lady health worker, homeopath, Hakim-herbal medicine practitioner, and outreach worker.

<sup>¶</sup>Media included radio, TV, telephone helpline, print media, health education/awareness session, and text message on mobile phone Notes. OR>1: successfully taken full basic immunization

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Living with two children (OR, 1.40; 95% CI, 1.10–1.78) or four children (OR, 1.47; 95% CI, 1.06–2.03) or five and more children (OR, 1.42; 95% CI, 1.04–1.93) did increase likelihood of full basic immunization compare to only one child. Parents' education level, which was secondary or higher group, was significantly and positively associated with completing basic immunization. Mothers who were educated at the level of secondary or higher showed significant odds ratios (OR, 1.37; 95% CI, 1.04–1.80). Father's odds ratio who was educated at the level of secondary or higher was significant, but lower than mother's (OR, 1.30; 95% CI, 1.03–1.65).

Greater wealth increased the odds of completing basic immunization in the crude result. After adjusting covariates, only the third level of wealth showed significant odds ratio (OR, 1.52; 95% CI, 1.01–2.27). The source of MCH information had significant impact on the likelihood of full basic immunization. If health professionals provided information about MCH, the likelihood of full basic immunization increased (OR, 1.24; 95% CI, 1.02–1.52); relatives/friends (OR, 1.38; 95% CI, 1.12–1.71) and media (OR, 1.32; 95% CI, 1.08–1.61) as MCH information source did increase likelihood of full basic immunization. The likelihood of full basic immunization was higher (1.61 OR; 95% CI, 1.17–2.22) for those who received three sessions of ANC, and 1.39-fold higher (95% CI, 1.09–1.79) for those who received more than four sessions of ANC. Mother's age, residence, low-level health workers, MCH information source, and place of delivery were not significant in multiple logistic regression.

## Discussion

In this study, we examined the coverage, timing, and determinants of full immunization among children aged 0–23 months in Sindh, Pakistan, based on survey data. Just over half (51.3%) of all children had received full basic timely immunizations, and the key determinants for full immunization were children's age, number of living children, parents' educational level and wealth, MCH information sources, number of ANC sessions, and assistance during delivery.

Since the Expanded Program on Immunization (EPI) started in Pakistan in 1978 with the goal of vaccinating children aged 0–23 months, full basic immunization rate has been increasing. In this study, the average full basic immunization rate in 2013–2014 in Sindh was 51.3%, which was almost double the rate (28%) in 2006–2007 in Sindh [22]. However, the rate was still lower when compared to the rates in other low- and middle-income countries [9, 10, 23] as well as the goal rate of World Health Organization (WHO) and United Nations International Children's Fund (UNICEF) (at least 90% by 2015) [24].

Children's age was a significant determinant of full immunization. Interestingly, there was significantly lower immunization coverage in the age category 10–13 weeks. Late immunizations may influence this finding [9, 20]. Late immunizations were frequently reported for Polio and DTP in Pakistan [20] and for BCG and DTP-HepB-Hib (diphtheria, tetanus, whooping cough, hepatitis B, haemophilus influenza type B) in rural Ghana [9]. Median delays for immunization was two-four weeks [9], which explained why the immunization coverage in the age category 14 weeks–8 months old increased after 10–13 weeks of birth. Delays for the first immunization led to delays for second and third Polio and DTP, which indicated that the children remained vulnerable to vaccine-preventable diseases [20]. The common reasons of parents' vaccine hesitancy, defined as delays in acceptance and/or refusal of vaccination [25], were socioeconomic status, cultural factors, religious reasons, personal beliefs, social/peer

environment, philosophical reasons, safety concerns, a desire for more information from healthcare providers, and lack of access to vaccine services [18, 25–29].

WHO recommended that countries achieve vaccination coverage of at least ninety percent nationally and at least eighty percent in every district by 2020 [30]. As we know, the benefits of vaccination are experienced even by unvaccinated children through herd immunity [31]. However, low vaccination coverage (51.3%) and delays for immunization in Pakistan results in the loss of herd immunity which indicates an increased risk of exposure to vaccine-preventable diseases in unvaccinated infants. Previous studies found that there were substantial differences in timeliness of immunization across parents' educational levels and socioeconomic status [9, 20].

Family characteristics should be considered in determining strategies to improve immunization rates. In this study, the number of living children in the household was associated with successfully completing the basic immunization. More children mean more exposure to the knowledge about immunization and more adherence to the schedule because of repeated learning curve and education effect. Indeed, education level of both mother and father was associated with their children completing basic immunization, which is in line with the findings of previous studies [9, 19, 22, 32]. Parents' low educational level may influence their general health literacy and lessen their ability to properly understand the benefits of timely and complete immunization and to have better knowledge of vaccine-preventable diseases [22, 33–35].

These findings suggest that educational interventions aimed at less educated parents may have the potential to improve vaccination coverage in Pakistan, where the overall adult literacy rate was 54.9% between 2008 and 2012 [36]. A study was conducted to provide a simple educational intervention (easy to-understand pictorial cards, using very simple language, to convey three key messages) designed for low-literate populations in Pakistan [37]. This intervention improved DPT-3/Hepatitis B vaccine completion rates by 39%. Another study in Malaysia also showed the effect of a short educational intervention (an animated movie and lecture using simple understandable language) on improving parents' knowledge of immunization [38].

Previous studies showed a positive relationship between residing in wealthier households with complete full immunization status [10, 20, 33, 39] but, wealth was not significantly associated with full basic immunization in this study. One possible reason is that wealth did not have much effect on the full immunization coverage as it used to be because immunization provided by the EPI program is free, and public efforts to access vulnerable mothers and infants are continued. Another possible reason is that Sindh provinces is a more unequal and polarized area than Punjab, Khyber-Pakhtunkhwa, and Balochistan in Pakistan [20, 26] and, therefore, different determinants based on wealth quintiles may influence immunization coverage compared with other study findings.

Having access to health information could play a pivotal role in improving mothers' awareness

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regarding full immunization. In this study, mothers who had received information about MCH in the last year—whether from healthcare professionals, other persons, or the media—showed higher odds of completing basic immunization than those who did not. This is supported by previous studies, including in Pakistan, that found contact with health facilities and access to mass media were positively associated with full immunization [10, 16, 22, 23]. Contact with health facilities is a proxy for interactions with healthcare professionals, which provides an opportunity to receive information about immunization [23, 40, 41].

Likewise, access to radio, television, phones, and computers permits women to receive health-related information more easily [42–44]. However, recent studies concerned about the adverse effects of social media on completing basic immunization, because social media often has contributed to a dissemination of rumors, misconceptions or inaccurate beliefs about vaccination that ultimately led to the higher degrees of vaccine hesitancy and lower immunization rates [45–48]. Further studies should verify the accuracy of information provided by radio, television, phones, and the internet and should develop appropriate television/online programs to convey accurate information regarding immunization and to improve the full basic immunization in Pakistan. Previous studies reported that other persons, such as mother-in-law, relatives, and friends, played a significant role as health information source in Pakistan [49, 50]. They helped mother's birth preparedness and health behaviors, which might lead to increase in full vaccination.

In the current study, making at least three ANC visits was significantly associated with completing basic immunization. Most Pakistani women in Sindh received specific elements of ANC, such as checking blood pressure, urine testing, blood tests, iron supplementation, tetanus immunizations, weight measurement, and counseling about danger signs of pregnancy [17]. Studies conducted in Ethiopia [51] and the Philippines [33] reported that infants whose mothers received the WHO recommended number of four ANC visits were significantly more likely to have their children immunized. In India, the immunization rate of children aged 12 to 23 months among a group of mothers who had one to two ANC visits was 13%, whereas the immunization rate among a group who had more than two visits were 19% [15]. ANC visits may be important signal to show mothers' ready access to a health facility (i.e., a short distance from a health facility or having transportation options/alternatives). Furthermore, increased contact with the healthcare facility for obtaining ANC would improve the full immunization rate of children because mothers would have more opportunity to be informed about child healthcare, including the importance of full immunization, and to be encouraged by healthcare staff to use the healthcare service [15, 33]. Policy makers should assess the obstacles of receiving ANC in Pakistan based on mother's background (i.e., socioeconomic status, residence, number of health facilities, cultural norms/beliefs) and develop strategies to increase ANC check-up (i.e., increase in number of health facilities/female healthcare professionals, free public transportation for

pregnant women, mass campaigns), which may ultimately result in an increase in the immunization rate.

This cross-sectional study has several limitations. First, because of the cross-sectional design, we could not assess the causal relationship between immunization coverage and any of the other independent variables as they were collected at the same time point. Prospective studies determining predictors of full immunization coverage are needed to provide evidence for developing educational intervention studies. Second, this study was restricted to the mother's last live birth in the two years prior to the study in one of four provinces in Pakistan; therefore, the findings cannot be generalized to all children in Pakistan. Further studies are needed to include all children under five years of age in all provinces in Pakistan. Lastly, the basic immunization rate was extracted from the immunization cards, which may have led to selection bias because infants whose parents had not immunization cards were excluded. Selection bias may be overcome through case-control matching, in which cases are selected based on the presence of the immunization cards and matched to controls that do not have the immunization cards. The refusal rate among respondents could have introduced response bias.

Despite the limitation, the study findings have important implications for countries who aim to improve immunization coverage and decrease the infant mortality rate. Mass immunization campaigns to stress the benefits of timely and complete immunization are needed, especially targeting parents in low educational and socioeconomic classes. The activities of mass media and healthcare professionals should be reinforced to improve women's awareness of timely and complete immunization and importance of health care utilization.

## Conclusions

Increasing childhood immunization coverage rates remains a national public health goal in low income countries. The immunization completion rate among children aged 0–23 months in Pakistan has been increased since the EPI program was initiated by the WHO in 1978, but was still lower than the rates of other low- and middle-income countries as well as the goal of the WHO and UNICEF. This study provided strong support for further efforts to improve the full basic immunization rate by identifying the key determinants of complete and timely childhood immunization coverage. Low vaccination coverage and delays for immunization results in the loss of herd immunity which lead to the outbreaks of vaccine-preventable diseases in unvaccinated infants in Pakistan. Policy-makers should identify mothers at risk of low immunization coverage and make the effort to tailor interventions informing mothers of the need for full immunization and motivating them to receive regular WHO-recommended ANC. Further longitudinal studies are needed to explore the factors associated with timely and complete full immunization and to determine the effect of educational interventions and mass immunization campaigns on completing immunizations and on infant mortality rates.

## Supporting information

### S1 Dataset.

(XLSX)

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## Chapter 6

# Timely Immunization

Determinants of timeliness in early childhood vaccination among mothers with vaccination cards in Sindh province, Pakistan: a secondary analysis of cross-sectional survey data

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## Original research

## Determinants of timeliness in early childhood vaccination among mothers with vaccination cards in Sindh province, Pakistan: a secondary analysis of cross-sectional survey data

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### Abstract

**Objective** Untimely vaccination refers to receiving the given dose before (early) or after (delayed) the recommended time window. The purpose of this study was to assess the extent of timeliness of childhood vaccinations and examine the determinants of vaccination timeliness in Sindh province, Pakistan.

**Design** Cross-sectional analysis of data from the 2013 and 2014 Maternal and Child Health Program Indicator Surveys.

**setting** Community-based maternal and child health surveys.

**Participants** Among 10 200 respondents of Maternal and Child Health Program Indicator Surveys, 1143 women who had a live birth in the 2 years preceding the survey were included.

**Outcomes** At the participants' home, an interviewer asked mothers to show their children's vaccination cards, which contained information regarding vaccinations.

Children's vaccination status was categorised into timely or early/delayed compared with vaccination schedule.

A logistic regression analysis using Firth's penalised likelihood was performed to identify factors associated with timeliness of vaccinations.

**results** 238 children (20.8% of children who received a full set of basic vaccinations) received all vaccinations on schedule among children who received a full set of basic vaccinations. The percentages of timely vaccinations ranged from 2.3% for second

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measles vaccination to 89.3% for bacillus Calmette-Guérin. Child's age and place of delivery were associated with timely vaccinations. Older child age and institutional delivery were associated with decreased timely vaccination rate.

**Conclusions** Home-based vaccination record is a key tool to improve the timeliness of vaccinations. The redesigned vaccination cards, the new electronic registries for vaccination card information and the vaccination tracking system to remind the second/third vaccination visits may be helpful to improve timely vaccinations for children under 2 years old.

## Introduction

Achieving high vaccination coverage is crucial in the control and prevention of childhood as

### strengths and limitations of this study

- This study is the first study to examine the timeliness of childhood vaccination coverage and its determinants in Sindh province, Pakistan.
- We used vaccination card to get information and then categorised each child's vaccination status into timely or early/delayed.
- The  $\chi^2$  test was used to determine if a statistically significant relationship and binary logistic regression analysis was performed to identify factors associated with timeliness of vaccination.
- This is a cross-sectional study, and samples were selected using a multistage, stratified, sampling design.
- A possible limitation of this study is restricted to one province, Sindh, in Pakistan, so the study findings might not be generalisable to all regions.

well as older age infections. Currently, standard estimates of vaccination coverage are based on vaccination statuses at predefined ages, typically at 12 months, 24 months and 4–6 years. The most widely accepted indicator internationally is the proportion of children who have received recommended routine vaccinations by 24 months of age, as prescribed by the WHO.<sup>1 2</sup> This indicator does not measure delays in the acquisition of immunity caused by late vaccination.<sup>3</sup>

The timeliness of immunisations, that is, receiving vaccinations at the earliest appropriate age, is an important public health goal



for several reasons. First, if children are vaccinated too early or if vaccinations are too closely spaced, it can significantly shorten the duration of protection or interfere with the body's immune response.<sup>4</sup> Second, delayed immunisation potentially leads to prolonged exposure to vaccine-preventable diseases.<sup>5</sup> In addition, timely vaccination heightens populations' herd immunity levels,<sup>6</sup> thereby protecting those who are too young to be vaccinated, those who have medical contra- indications and those who do not produce an adequate immunological response. Despite the importance of the timeliness of childhood immunisations, vaccination delays are prevalent across lower income countries, including Pakistan. An analysis of the 2006–2007 Pakistan Demographic and Health Survey found substantial variations in the timeliness of vaccinations, including considerable delays in many cases.<sup>7</sup>

Factors associated with lack of childhood vaccination have been studied extensively, and specific patterns have been identified.<sup>8–11</sup> In contrast, less is known about factors associated with delayed vaccination and whether these factors follow the same patterns in different societies.<sup>12–15</sup> Information about factors that influence the timeliness of childhood vaccination might be valuable for health- care providers, programme managers and policymakers in identifying sub-populations at risk, which should be targeted with interventions and public health policies.<sup>16</sup> The timeliness of childhood vaccination has received close attention in the USA and in Europe,<sup>8</sup> but in-depth investigations in low-income countries have been limited, particularly in Pakistan. The purpose of this study was to examine the timeliness of childhood vaccination coverage and its determinants in Sindh province, Pakistan.

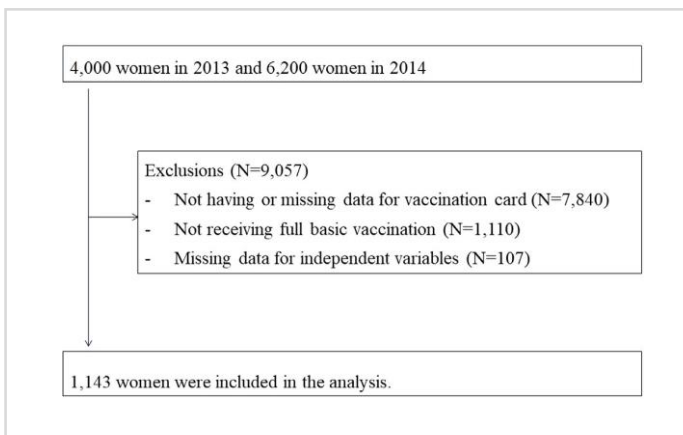
## Methods

### Data and subjects

This study analysed a subset of data from the Maternal and Child Health Program Indicator Survey, which was conducted in June to October of 2013 and 2014 in 23 districts of Sindh province and Karachi in Pakistan.<sup>17</sup> The survey was a cross-sectional study, and samples were selected using a stratified multistage sampling design. Survey respondents included 4000 women in 2013 and 6200 women in 2014 who had a live birth in the 2 years preceding the survey. Women answered questions about maternal and child health (MCH) related to their last live birth. The inclusion criterion of this analysis was the respondents who answered all variables of interest and who presented a vaccination card to the data collector. The vaccination card is a home-based record (HBR), which documents immunisation status in developing countries.<sup>18</sup> It contains each child's specific vaccination information, including child's name, birthdate, type of vaccination and vaccination date. It is issued to each child at its first vaccination.

Seven thousand eight hundred and forty (76.9% of total survey respondents) women were excluded due to not having vaccination cards or to missing information on their vaccination

cards. An additional 107 women were excluded because they were missing information on the number of living children (n=1), woman's education (n=6), husband's education (n=15), household wealth (n=11) or antenatal care (ANC) visit (n=74). Women with children who did not receive a full set of basic vaccinations (n=1110) were also excluded. Finally, a total of 1143 women who had all the information needed for analysis and whose children received a full set of basic vaccinations were included in this study (figure 1). It was 11.2% of total survey respondents. As female literacy is low in Sindh province, female interviewers obtained verbal informed consent from each respondent and then signed the consent form on behalf of the respondent.



**Figure 1** Flowchart showing study population selection

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from each respondent and then signed the consent form on behalf of the respondent.

## Patient and public involvement

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

## Measurement for timeliness in vaccination

From the vaccination card, we collected information and then categorised each child's vaccination status into timely or early/delayed. The definitions of timely and early/delayed vaccinations followed those used in Zaidi *et al.*<sup>7</sup> The measles 2 schedule, which was not included in the study by Zaidi *et al.*, was updated using a report by Khan<sup>19</sup> and the WHO recommendation.<sup>1</sup> Our definition of timely and early/delayed vaccination is shown in table 1.

Children who had received all appropriate vaccinations on schedule were put into the 'timely' vaccination group. If children received all appropriate vaccinations for their age, but one or more

vaccinations were not administered on time, they were put into the ‘early or delayed’ group. We combined children who received vaccinations early and those who received vaccinations late into one group due to a small number, and both eventualities cause timely vaccination problems.<sup>20 21</sup>

### Independent variables

To identify the determinants of timely vaccination, our analysis included the following independent variables: child’s age, woman’s age, number of living children, residence, woman’s education, husband’s education, wealth quintile, information source about MCH, number of ANC visits, assistance during delivery and place of delivery. Previous studies of a similar type conducted in Pakistan and other low/middle-income countries included the same variables.<sup>7 9 17</sup>

Categories of independent variables followed the Maternal and Child Health Program Indicator Survey report<sup>17</sup> Wealth quintile was derived from household assets using a principal components analysis, as described previously.<sup>22</sup> To identify MCH information sources, inter- viewers asked: ‘During the last 12 months, have you received any information about MCH from the following sources?’. Sources were categorised as medical professionals (doctors, nurse/midwives and female health visitors), low-level health workers (Dai-traditional birth attendants, female health workers, homeopaths, Hakim- herbal medicine practitioners and outreach workers), relatives/friends and media (radio, TV, telephone help- line, text message on mobile phone, health education/ awareness session and print media). As multiple answers were permitted, answers per category were included in our model. The number of ANC visits was categorised into ‘1’ or ‘2, 3’ and ‘4+’. Assistance during delivery was categorised into traditional birth attendants, medical professionals and no one/others. Place of delivery was categorised into home, private facility and public facility.

**Table 1.** The definition of early, timely and delayed for each vaccine

Recommended age (days)	Early (days)	Timely (days)		Delayed (days)
0	–	0–28	>28	
42	<39	39–70	>70	
70	<67	67–98	>98	
98	<95	95–126	>126	
273	<270	270–301	>301	
365–455	<Min (28 days from measles 1 or 362)	Min (28 days from measles 1 or 362) - 455	>455	

Authors edited this table with the articles of WHO,<sup>1</sup> Zaidi *et al*<sup>7</sup> and Khan<sup>19</sup>.

## Statistical analysis

The  $\chi^2$  test was used to determine if a statistically significant relationship existed between each independent variable and timeliness of vaccination. Then, binary logistic regression analysis was performed to identify factors associated with timeliness of vaccination. A binary logistic regression analysis was conducted for early or delayed (reference) versus timely vaccination. Because the number of events were low, logistic regression using Firth's penalised likelihood was conducted in this study.<sup>23</sup> The criterion for significance was  $p \leq 0.05$ , two-tailed. ORs and 95% CIs were calculated. ORs were calculated after adjusting for all independent variables. All analyses were performed using SAS V.9.4.

## Results

The general characteristics of the study subjects are shown in table 2: 238 children (20.8%) received all vaccinations on schedule, while 905 children (79.1%) received all vaccinations, but some or all were early or delayed. The rate of early and delayed vaccinations increased as children got older, being 5.6% in children aged 0–5 weeks and increasing to 100.0% in the oldest children (12–23 months) (table 2).

The timeline of vaccinations is presented in table 3. The percentage of children with timely vaccinations was 89.3% for bacillus Calmette-Guérin (BCG) and 87.7% for polio 0; all other rates of timely vaccinations were lower. Due to early vaccination, the number of subjects was more than the eligible number of subjects. The percentage of delayed vaccinations increased for polio 3 and penta 3 in children aged 14 weeks to 8 months. The percentage of delayed vaccinations for penta 3 was 43.4%, which was the highest among all vaccines. Over 90% of children in this study received measles 1–2 earlier than the recommended timeframe (table 3).

Table 4 shows the factors associated with timely vaccination. As children aged, the timeliness of vaccination decreased. Children 70–97 days old were less likely to receive timely vaccinations (OR=0.12; 95% CI 0.04 to 0.36) compared with children 0–69 days old. The OR became 0.02 (95% CI 0.01 to 0.04) for children 98 days or older. With regard to place of delivery, compared with home deliveries, deliveries in both private facilities (OR=0.39; 95% CI 0.17 to 0.96) and public facilities (OR=0.34; 95% CI 0.14 to 0.89) showed significantly lower ORs for timely vaccinations (table 4).

## Discussion

In Pakistan, the vaccination rates for the full set of basic vaccines has been increasing due to the expanded programme on immunisation (EPI), but little is known about the vaccination timeliness and the determinants for early, timely and delayed vaccination. The present study aimed to assess the extent of timeliness of childhood vaccinations and found two critical issues related to

**Table 2.** General characteristics of the study population

Variable	Category	Early/delayed, but complete ion (n=905)		Timely and complete vaccination (n=238)		Total (n=1143)
		n	%	n	%	
Child's age (days)	0–41	4	5.6	63	94.0	67
	42–69	9	22.0	32	78.1	41
	70–97	10	52.6	9	47.4	19
	98–272	237	64.6	130	35.4	367
	273–365	226	98.3	4	1.7	230
	365–	419	100.0	0	0	419
Woman's age (years)	15–24	294	78.4	81	21.6	375
	25–34	516	79.9	130	20.1	646
	35+	95	77.9	27	22.1	122
No of living children	1	246	78.9	66	21.2	312
	2	246	80.4	60	19.6	306
	3	149	77.6	43	22.4	192
	4	105	79.0	28	21.1	133
	5+	159	79.5	41	20.5	200
Residence	Rural	270	82.6	57	17.4	327
	Town/small city	319	77.2	94	22.8	413
	Large city	316	78.4	87	21.6	403
Woman's education	No education	328	79.4	85	20.6	413
	Primary or middle school	267	82.2	58	17.9a	325
	Secondary school or higher	310	76.5	95	23.5	405
Husband's education	No education	195	79.0	52	21.1	247
	Primary or middle school	208	83.2	42	16.8	250
	Secondary school or higher	502	77.7	144	22.3	646
Wealth quintiles	First (poorest)	49	83.1	10	17.0	59
	Second	99	79.8	25	20.2	124
	Third	200	80.7	48	19.4	248
	Fourth	243	78.6	66	21.4	309
	Fifth (richest)	314	77.9	89	22.1	403
<b>MCH information source</b>						
Medical professional	No	367	76.8	111	23.2	478
	Yes	538	80.9	127	19.1	665
Low-level health workers*	No	805	79.1	210	20.7	1015
	Yes	100	78.1	28	21.9	128
Relatives/friends	No	363	76.6	111	23.4	474
	Yes	542	81.0	127	19.0	669
Media	No	575	79.2	151	20.8	726
	Yes	330	79.1	87	20.9	417
No of antenatal care visits	1–2	132	83.5	26	16.5	158
	3	128	77.6	37	22.4	165
	4+	645	78.7	175	21.3	820
Assistance during delivery	Traditional birth attendant	168	82.8	35	17.2	203
	Medical professional	733	78.5	201	21.5	934
	No one/others	4	66.7	2	33.3	6
Place of delivery	Home	187	79.2	49	20.8	236
	Private facility	557	78.6	152	21.4	708
	Public facility	161	81.3	37	18.7	198

\*Low-level health workers, including Dai-traditional birth attendants, female health workers, homeopaths, Hakim-herbal medicine practitioners and outreach workers.  
BCG, bacillus Calmette-Guérin; MCH, maternal and child health.

**Table 3.** Vaccination status in children aged 0–23 months

	BCG	Polio 0	Polio 1	Polio 2	Polio 3	Penta2	Penta2	Penta3	Measles1	Measles2
No of eligible subjects to be vaccinated	1143	1143	1076	1035	1016	1076	1035	1016	649	419
No of vaccinated subjects	1143	1143	1088	1041	1021	1086	1040	1019	1010	938
Early (%)	-	-	19.9	13.9	11.2	19.9	14.9	11.4	92.9	94.8
Timely (%)	89.3	87.7	62.8	57.2	46.2	61.0	55.5	45.2	2.7	3.3
Delayed (%)	10.7	12.3	17.3	28.9	42.6	19.1	29.6	43.4	4.5	1.9

BCG, bacillus Calmette-Guerin; Polio, oral polio vaccine; Penta, diphtheria tetanus pertussis–hepatitis B–*Haemophilus influenzae* type b.

**Table 4.** Factors associated with timely vaccination

Variable	Category	Early/delayed (reference) versus timely	
		OR	95% CI
Child's age (ref=0–69 days)	70–97	0.12	0.04 to 0.36
	98–272	0.02	0.01 to 0.04
	273–365		
Woman's age (ref=15–24 years)	365–		
	25–34	1.20	0.79 to 1.84
No of living children (ref=1)	35+	1.29	0.63 to 2.61
	2	0.68	0.42 to 1.08
Residence (ref=rural)	3	0.98	0.58 to 1.65
	4	0.64	0.33 to 1.22
	5+	0.71	0.37 to 1.33
	Town/small city	1.45	0.88 to 2.41
Woman's education (ref=no education)	Large city	1.31	0.75 to 2.33
	Primary or middle school	0.81	0.50 to 1.32
Husband's education (ref=no education)	Secondary school or higher	0.98	0.58 to 1.65
	Primary or middle school	0.76	0.44 to 1.32
Wealth quintiles (ref=first (poorest))	Secondary school or higher	1.00	0.63 to 1.62
	Second	1.10	0.41 to 3.16
	Third	1.37	0.54 to 3.78
	Fourth	1.20	0.44 to 3.55
<i>MCH information source</i>	Fifth (richest)	1.42	0.50 to 4.38
	Medical professional (ref=no)	Yes	0.99
Low-level health workers* (ref=no)	Yes	1.02	0.56 to 1.83
	Relatives/friends (ref=no)	Yes	0.72
Media (ref=no)	Yes	1.15	0.79 to 1.66
	No of antenatal care visits (ref=1–2)	3	1.88
Assistance during delivery (ref=traditional birth attendant)	4+	1.59	0.89 to 2.97
	Medical professional	2.22	0.86 to 5.42
Place of delivery (ref=home)	No one/others	1.07	0.07 to 11.83
	Private facility	0.39	0.17 to 0.96
	Public facility	0.34	0.14 to 0.89

\*Low-level health workers, including Dai-traditional birth attendants, female health workers, homeopaths, Hakim-herbal medicine practitioners and outreach workers.

†All independent variables were adjusted. MCH, maternal and child health; ref, reference.

the reliable estimates.

In this study, 7840 (76.9%) women did not have vaccination cards or missed information on their vaccination cards in the dataset from the Maternal and Child Health Program Indicator Survey in 2013–2014, which might have overestimated or underestimated the vaccination status. Only 23.1% of total survey respondents were included in this analysis. According to the WHO guidance on vaccination coverage surveys, the survey can rely on HBRs as an important, effective, inexpensive source of documented evidence of vaccination history.<sup>18</sup> A systematic review found that there was relatively good agreement between vaccination based on documented evidence in HBRs and that obtained from maternal/care-giver recalls, but comparatively poor agreement versus facility-based records.<sup>24</sup> HBRs are a key tool to let families know when the child needs to go back for their next vaccine, however, in Pakistan, current HBR prevalence was 36% and HBR loss rate was 52% in 2012, which reflect that Pakistan has HBRs access problems.<sup>25–26</sup> Therefore, it is necessary to conduct large nationally representative surveys or to introduce the electronic system such as m-health for improving the vaccination information and vaccination uptake.<sup>27–28</sup>

Another issue in this study was that there is no global consensus on the definitions of timely, early and delayed vaccinations between governments, organisations and researchers. For example, recommended and minimum acceptable ages and intervals for routine vaccinations differed between the Centers for Disease Control and Prevention in the USA,<sup>29</sup> the Pan American Health Organization<sup>30</sup> and a study of Zaidi *et al* in Pakistan.<sup>7</sup> Vaccine doses administered 4 days before the minimum interval or age are considered valid in the USA, whereas Zaidi *et al* defined as ‘early’ if there were administered 3 days prior to the recommended age.<sup>7–29</sup> The uniform global and national guideline for recommended and minimum ages and intervals between vaccine doses are required to enable consistent and comparable measurement of adherence to the guideline. One uniform guideline would improve timely complete immunisation of infants regardless of their country and would help infants to receive recommended vaccine doses, which may prevent side effects from overdose vaccination or reduce the risk of vaccine-preventable diseases from underdosing.<sup>31</sup>

In this study, only 238 children (20.8%) received a full set of vaccinations on schedule in the Sindh province of Pakistan. Determinants for receiving timely vaccinations were the child’s age and the place of delivery. The proportion of children who had not received age-appropriate vaccinations increased with age, which was consistent with the findings of a previous study using 2006–2007 Pakistan Demographic and Health Survey data.<sup>7</sup> In that study, the proportions of children who had early immunisations were 19.9% for the first vaccination for polio1 and penta, and these proportions progressively decreased by 11.2% in polio 3 and 11.4% in penta 3. Correspondingly, the proportions of delayed immunisations progressively increased by 42.6% in polio 3 and by 43.4% in penta3. One possible reason for the early/delayed vaccination may be

that the mothers were reminded of the importance of vaccinations for children due to the efforts by the EPI programme and the government of Pakistan and, as a result, had their children vaccinated at birth, but had difficulty remembering and/or complying to vaccination appointments over time due to other family/social activities, lost or misplaced vaccination cards and lack of an institutional vaccination monitoring system giving reminders for second/third vaccines.<sup>2 25 32</sup> Therefore, a considerable proportion of children in Pakistan do not receive a timely, full set of vaccinations, placing them at risk of vaccine-preventable diseases such as meningitis, diarrheal disease and pneumonia as the main causes of death in children under 5 years old in Pakistan.<sup>33</sup>

Even though there has been no study to describe the reasons that children do not receive timely vaccinations in Pakistan, a systematic review indicated that out-of-hospital delivery and a lack of reminders about the next follow-up visit required for vaccinations were associated with delayed vaccination in low-income countries.<sup>2 24</sup> Therefore, a tracking systems for health workers to provide correct information about vaccines and immunisation may be helpful to improve timely and complete vaccination of children. Tracking systems are also necessary to ensure that children do not drop out of the system once they have begun the vaccination series. A randomised, controlled trial in rural peripheries of Karachi, Pakistan found that the redesigned vaccination cards were effective in helping women and children achieve in a timely manner the third dose of diphtheria-tetanus-pertussis (DTP3) immunisation.<sup>34</sup> The redesigned card was a bright colour, placed in a plastic jacket, provided with a hanging string and showed the immunisation date for the DTP2 and DTP3 visits written in a large font and information about the EPI centres for women. In another study in Karachi, Pakistan,<sup>35</sup> every infant received three activated vaccine indicator and reminder (VIR) bands for each visit, and secured to their ankle. When the VIR bands' timestrip membrane turned completely different colour, parents could know it is time to visit the vaccination centre. At the fourth visit, digital vaccine registry for all infants was created and updated during each immunisation visit. The results showed more than 86% retention of the VIR band at each vaccination visit and 62% of infants completed penta 3. Further interventions regarding the redesigned HBRs, such as photographing cards, VIR bands and setting electronic collection formats and platforms to register HBRs information are required to improve the timeliness of childhood vaccinations.<sup>18 24 34 35</sup> In our study, >10% of children did not receive BCG and polio 0 in time. Previous studies of the non-specific effects of the BCG vaccine and oral polio vaccine (OPV) within the first 2 days of life indicated that those vaccines might reduce the risk of all-cause mortality.<sup>36 37</sup> Administration of the BCG and polio vaccines timely may stimulate children's immune systems, which may lead to a decrease in mortality as a result of other infectious diseases. In previous studies, delays in the first polio and DTP vaccinations led to delays in the second and third vaccinations in the series, which indicated that these children remained vulnerable to vaccine-preventable diseases.<sup>7 20 34 38</sup> Unfortunately, there has been no study to examine the factors influencing delays in BCG and OPV vaccinations in



Pakistan. Further studies should determine the factors that impede timely vaccinations in Pakistan to prevent exposure of children to vaccine-preventable diseases at birth and to develop interventions to improve the rates of BCG and OPV vaccinations in Pakistan.

Interestingly, most children had early vaccination for measles 1 and 2 in this study, at rates that were dramatically higher than the early vaccination rates of previous studies.<sup>8 37</sup> One possible explanation is that the measles outbreaks started in December 2012 in Sindh province which killed 360 children in 2012-2013.<sup>39 40</sup> The provincial Ministry of Health conducted a large vaccination campaign targeting 2.9 million children in Sindh between 31 December 2012 and 9 January 2013. As a result, 1.3 million children aged 9 months to 10 years were vaccinated,<sup>37</sup> which may have contributed to the increased early vaccination rates in 2013–2014. A previous study reported that institutional delivery was a positive determinant for full childhood vaccination<sup>2 32</sup>; however, in the present study, children who were born in public and private facilities were less likely to receive timely vaccinations compared with those who were born at home.

In many cases, children received vaccinations at the place they were born. When they deliver in facilities, mothers may try to have their babies receive all possible vaccines even if it is not the right time for vaccinations, due to limited access to healthcare services.<sup>41 42</sup> Therefore, the accessibility issue may have affected the result. Unfortunately, there has been no study to describe how and when children are given vaccines and who gives vaccines to children under 2 years old who were born in the public or the private facilities in Pakistan. Therefore, further studies should be conducted to determine the reasons why institutional delivery was associated with early or delayed vaccination among children under 2 years old and to develop intervention programme to improve timely vaccination rates among children who are born in institutions.

This study has several limitations. First, it was restricted to one province, Sindh, in Pakistan, so the study findings might not be generalisable to all regions because there is a wide regional demographic variation in Pakistan. Second, study participants were limited to mostly women who had vaccination cards; therefore, the vaccination coverage rates and vaccination timeliness might have been overestimated in this study population compared with the general population, because they are more likely to have taken their children for vaccinations than other women who cannot present cards. However, as our variable of interest was vaccination status, we excluded those who did not have a vaccination card or who could not present a vaccination card. Reviewing the vaccination card is currently the only way to analyse children's vaccination status and date in Pakistan. Also, most studies (49/62, 79%) used data from vaccination cards, according to the systematic review of vaccination status.<sup>28</sup> Finally, other possible determinants of timely vaccination, such as the number of facility visits, previous experience of healthcare service use, and distance from a health facility or having transportation options/alternatives,

were not included in this study.

Despite these limitations, this study is the first to identify the determinants of timely vaccination among children aged 0–23 months in Sindh Province, Pakistan. In this study, two-thirds of women did not have vaccination cards or missed information on their vaccination cards. Therefore, vaccination programme managers should monitor HBR prevalence and the causes which lead to women not having cards or missed vaccinations on the cards, and should identify solutions to increase current HBR prevalence. To improve timely vaccination rates, the redesigned HBRs, the new electronic collection formats and platforms to register HBRs information, and a vaccination tracking system for health workers that provides information about age-appropriate vaccinations and appropriate follow-up vaccinations for children under 2 years old may be helpful for women and children, to achieve herd immunity for vaccine-preventable diseases. In addition, it is necessary to conduct large nationally representative surveys about vaccination. To improve timeliness, it is necessary to not only understand factors associated with timeliness (or un-timeliness) well but also do a root-cause analysis and identify the evidence around interventions. Also, future investigators should determine the inhibiting factors for timely vaccinations and the factors related to the utilisation of follow-up vaccine doses, and develop intervention programme to improve timely vaccinations for children who were born in institutions.

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N and KBY cleaned and analysed the data and wrote sections of the manuscript. JC and LJJ reviewed the literature, interpreted the findings and wrote sections of the manuscript.

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APPENDIX

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**Chapter 7**

# **General Discussion**



# Chapter 1: General Discussion

## 7.1. Main Findings

The aim of this thesis is to explore factors affecting MCH in Sindh province of Pakistan. Findings from this thesis can contribute to improvements in MCH services and the associated MCH policy and planning interventions in Pakistan and other LMICs. This thesis is focused on health service utilization for ANC, birth, breastfeeding, and child vaccination based on our analyses of data from MCH Program Indicator Surveys conducted in Sindh province in 2013 and 2014. We set out to answer these research questions:

1. What are the demographic, socio-economic, and health information source determinants of health service utilization for ANC, facility birth, and child immunization in Sindh province, Pakistan?
2. What are the sources of information that are associated with positive health behavior regarding ANC visits and optimal breastfeeding in Sindh province, Pakistan?
3. What are the factors that affect timely and full immunization in Sindh province, Pakistan?

Table 7.1 is a summary of the results from chapter 2, 3, 4, 5 and 6 that shows what determinants affect ANC utilization, facility birth, breastfeeding, and timely full immunization.

**Table 7.1.** Summary of results of key factors that determine health service utilization from five published papers

Published Paper	Focus	Results: Key Factors
Chapter 2: Utilization of ANC	Utilization of ANC in Sindh province, Pakistan, and identified the factors that affect its use	Demographic: number of households  Socio-eco: residence, education, and wealth MCH  information sources: lady health worker, mother-in-law, other relatives/friends, nurse/midwife
Chapter 3: Facility birth	Demographic characteristics, socio-economic factors, and varied health information sources that may influence the uptake of birth services in Sindh	Demo: women’s age and number of children,  Socio-eco: education and wealth MCH information sources: <ul style="list-style-type: none"> <li>• Higher facility birth when information received from doctors or nurses/midwives</li> <li>• Lower facility birth when information received from low-level health workers* or relatives/friends</li> </ul>

Table 7.1 (Continued)

Published Paper	Focus	Results: Key Factors
Chapter 4: Optimal breastfeeding	Demographic factors, socio-economic status, and information sources that affect breastfeeding practices in Sindh	Demo: women's age and residence Socio-eco: education and wealth Breastfeeding information sources: <ul style="list-style-type: none"> <li>• Higher breastfeeding when information received from friends or relatives</li> <li>• Lower breastfeeding when information received from the media</li> </ul>
Chapter 5: Full basic immunization	Basic timely childhood immunization coverage and identifying determinants of factors influencing childhood immunization coverage in Sindh, Pakistan	Demo: children's age and number of living children Socio-eco: education and wealth MCH information source: higher full basic immunization when received information from health professional, relatives/friends, media Health care during pregnancy and delivery: number of ANC visits, assistance during delivery (traditional birth attendant)
Chapter 6: Timely immunization	Extent of timeliness of childhood immunization and determinants of immunization timeliness in Sindh	Demo: children aged, the timeliness of vaccination Socio-eco: place of delivery

\*Low-level health workers included Dai-traditional birth attendant, lady health worker, homeopath, Hakim-herbal medicine practitioner, outreach worker.

Four findings emerged from this thesis. First, study findings suggest that health information dissemination from a skilled health professional is important for health service utilization (Chapters 2, 3, 5). Second, community-level peer counselors play an important role in advocating for use of health facilities by individuals, families, and the community (Chapters 2, 4). Third, MCH policy and strategic plans need to focus interventions, including information campaigns, on target population groups, such as parents in low educational and socio-economic classes and parents of children in specific age groups (Chapters 5, 6). Fourth, to increase health service utilizations (finding 1), healthcare workers need to be trained to be effective health and behavior change communicators. The findings are summarized in Table 2 within the conceptual framework and research questions. These findings can be used to develop strategies to maximize MCH in Sindh province, Pakistan.

**Table 7.2** Research findings placed within the expanded behavioral model

Research question intervention focus areas	Output: Strategy to maximize health service utilization (the main finding)	Domain of expanded behavioral model	Outcome: Improving MCH (thesis aim)	Discussed in paragraph
What are the demographic, socio-economic, and health information source determinants of health service utilization for ANC, facility birth, and child immunization in Sindh, Pakistan?	Information from skilled health professionals is important for health service utilization.	Social Determinants	Improve demand for quality health services	7.2 Health service utilization
What are the sources of information that are associated with positive health behavior regarding ANC visits and optimal breast feeding in Sindh, Pakistan?	Community-level peer counseling is important for advocacy.	Individual Determinants	Increase the demand for health service	7.3 Peer counseling for positive health behavior advocacy
What are the factors that affect timely and full immunization in Sindh province, Pakistan?	MCH strategic plans should target specific populations, especially low educational and socio-economic classes and children in specific age groups.	Health System	Strengthen the existing health systems	7.4 Factors that affect immunization
Overarching	Healthcare workers need to be trained to be effective health and behavior change communicators to increase health service utilizations.		Improve the quality of health services	7.5 Skilled healthcare providers

This thesis has identified important sources of information that affect the utilization of health services, which can have a positive impact on maternal and infant morbidity and mortality. In sum, if women meet with compassionate and skilled health workers, who offer these women relevant and reliable information, then a positive chain of events is started: women attend ANC, opt for institutional birth, attend child care clinics, and have their children vaccinated.

Our findings point to two key factors for healthy behavior change: increased opportunities to learn about pregnancy and child healthcare and the encouragement from the skilled health professionals.

## 7.2. Health Service Utilization

The thesis studies showed that the mother's wealth, place of residence, and education were determinants of health service utilization for ANC and for facility births; a child's age, number of living siblings, parent's education level, and mother's attendance at ANC visits were determinants of health service utilization for full basic immunization. Studies also showed that receiving information from healthcare workers and family/friends was positively associated with health service utilization for ANC, breastfeeding, and immunization. However, receiving information from the skilled birth attendants was positively associated with facility birth, but this was not the case for the lady health visitors, an important cadre in Sindh. Home deliveries through un-trained birth attendants are common in remotely placed rural settings. These are mainly due to the conservative social pressures on pregnant women, extensive walking distance to the health facilities, and lack of resources and education about pregnancy and maternal health practices. Based on our analysis of demographic and socio-economic variables, efforts to increase health service utilization should focus on poor, rural, and less educated women.

Several studies have also found that women with high levels of exposure to mass media, such as television and radio, were more likely to attend ANC [1-4]. Pregnant women who received information from a skilled health provider, especially a nurse or midwife, were also more likely to make the recommended number of ANC than those who didn't receive information or didn't get the correct information about the importance of ANC in Southwestern Ethiopia [5]. During ANC visits, pregnant women are educated about various danger signs and symptoms, which can significantly improve their own health and that of their infants during pregnancy, delivery, and the postpartum period [6,7]. ANC also provides an important opportunity for healthcare workers to help prevent, detect, and manage

concurrent diseases through integrated service delivery in Pakistan [8]. This suggests the important role of skilled health professionals, especially nurses/midwives, in providing MCH information in low-income countries [9, 10]. When skilled health professionals offer information to pregnant women, it promotes the use of integrated preventive health service and increases women's use of health facilities, including the ANC services.

The thesis study findings showed that obtaining information from skilled birth attendants, including doctors, nurses, and midwives, also encouraged facility births; pregnant women relied on facility-based health professionals and followed their recommendations (Chapter 3).

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Encouraging pregnant women to seek ANC at a health facility increased the likelihood that they would meet with a health professional and receive reliable information encouraging facility births. However, pregnant women in Pakistan were less likely to have direct contact with doctors, nurses, and midwives than with low-level community-based health workers, which includes lady health workers, lady health visitors, and traditional birth attendants. Unfortunately, our findings showed that obtaining information from low-level health workers had no positive impact on facility births. In reality, lady health visitors had an inherent conflict of interest because they were responsible for assisting deliveries at home [11,12] and thus might undermine government messages promoting facility birth. It is essential to offer lady health visitors and other low-level health workers, who routinely interact with pregnant women, education, and training about their proper roles and responsibilities, which includes encouraging pregnant women to use health facilities instead of delivering at home [8]. Indeed, a well-organized referral system must be established for lady health visitors and other low-level health workers. If the system is structured to include them, these workers might not worry about facility births reducing their traditional roles and will help Pakistani women choose a facility birth.

The study findings also showed that obtaining MCH information from healthcare professionals, relatives/friends, or the media, and attendance at ANC visits were each significant determinants of full basic immunization (Chapter 5). Studies in the Philippines and Ethiopia have also reported that infants whose mothers attended four ANC visits were significantly more likely to be vaccinated [13,14]. Visiting a health facility increases the opportunity for interactions with healthcare professionals, including doctors, nurses/midwives, and lady health visitors, which provides increased opportunities to obtain information about immunizations [15-17].

### **7.3. Counseling for Positive Health Behavior**

The thesis study findings showed that peer counselors can be effective advocates for healthy behaviors in their communities, including ANC attendance and breastfeeding. They can bring attention to healthy behaviors and utilization of MCH services. To improve community health outcomes, intervention programs should consider training and using peer counselors as advocates for social and behavioral changes

Other studies have also found that peer counseling can positively affect behavior change [18], assuming correct information is provided. If peer counselors offer incorrect information, appropriate behavior change may be discouraged. The use of trained community female volunteers can motivate women to follow good practices; training enables community female volunteers to use effective social mobilization approaches. In other words, trained community female volunteers can motivate women to follow good practices, which can lead to improvements in MCH.

Chapter 4 shows that women who received information about breastfeeding from relatives or friends were more likely to breastfeed than those who did not, suggesting that the source of the advice affects the decision to breastfeed or not [19]. Relatives and friends are the main communicators among childbearing women in Muslim communities [20,21], and they often give breastfeeding advice. A study in Bangladesh highlighted the important role of community-based peer counseling and the need for trained community female volunteers to advocate for good breastfeeding practices [21]. Indeed, that study found that peer counseling had a positive impact on the initiation of breastfeeding within the first hour after birth [21]. Community health workers, friends, or relatives as peer counseling may be important advocates for breastfeeding among the groups of women with lower rates, including those in higher wealth quintiles, and more education.

Interestingly, information about breastfeeding provided through a media campaign, radio, and television, was not associated with a change in the appropriate breastfeeding behavior according to a previous study in Sindh, Pakistan [22]. The findings suggest that mass media campaigns may be helpful in improving knowledge of breastfeeding but do not drive behavior change. However, it will be difficult to obtain a positive impact from mass media campaigns about breastfeeding practices in Pakistan without strict restrictions on the advertising of infant formula. Currently, commercial advertising in Pakistan is spreading the message that infant formula is a superior substitute for breast milk despite government efforts to rein in the marketing of infant formula [23,24]. Despite excessive promotion of

formula milk, low income cannot afford to provide regular supply of commercial milk and hence others opt to breast milk. However, due to the limited diversity of nutritious foods to the low-income households, the mother and the child are at risk of nutritional deprivation issues. In countries where Islam is the dominant religion, relatives or friends could be a good support to promote breastfeeding. Therefore, public health officials and healthcare providers in Sindh should consider peer counseling interventions targeting relatives and friends. In addition, health education messaging may also focus on promotion of low-cost diverse foods which households could afford from their limited income.

#### **7.4. Factors that Affect Immunization**

In addition to improving coverage, completeness and timeliness of immunization are a significant public health goal. Early immunization or immunization at too short an interval can reduce the period of protection or interrupt the body's immune response [25]. Delayed immunization can potentially lead to continuing exposure to vaccine-preventable diseases [26].

Studies in Pakistan and Ghana reported that delays in infants' first immunizations led to delays in subsequent immunizations [27,28], which is similar to results reported in Chapters 5 and 6.

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Chapter 6 shows that the proportion of children who had not received full basic timely immunizations increased with age, consistent with a previous study using data from the Pakistan Demographic and Health Survey [29]. This suggests that after children were vaccinated at birth, mothers had difficulty following up or remembering follow-up appointments, possibly due to family/social activities, limited education, lack of awareness, or lost immunization cards. However, another explanation could be the lack of systematic monitoring at the facility level, including regular reminders for mothers, which is part of the Expanded Programme on Immunization in Pakistan [30-32].

Therefore, this thesis emphasizes strengthening the existing health system to improve immunization coverage and timeliness. Pakistan has a national level plan and strategy for immunization but the plan has weaknesses and unmet needs remain. For example, the immunization cards are manually provided to the people and many of them do not keep the immunization cards. In addition, the follow up ratio for immunization is lower as they get older. It would be helpful to develop an age-targeted strategic plan or to amend the existing plan to increase the proportion of age-appropriate immunizations [33,34]. It is important to note that expanding on the existing program will be simpler than starting a totally new program with a new plan. If we try to adopt a new program, it needs more funding and considerable effort to initiate and implement a new system. Therefore, maintaining and adapting existing system to the people's needs and adding more resource may be more efficient.

## **7.5. Skilled Healthcare Providers**

Maternal and child health professionals (doctors, nurses, midwives), traditional birth attendants, and community health workers (lady health visitors, lady health workers, and other low-level health workers) play an important role in providing community-based health information and improving demand for MCH services. They perform many services and activities, such as delivering basic healthcare and information, providing health education to pregnant women, and promoting the uptake of birthing facility services and facility-based healthcare services [8,35]. As covered in 7.2, maternal and child

health-related professionals play an important role in providing community-based health information and improving demand for MCH services. In addition to providing healthcare services, professionals perform many health promotion services and activities [8,35]. Literature reviews show that intervention programs involving maternal health-related professionals can effectively reduce maternal, newborn, and child mortality in low-resource settings by providing education on a variety of topics, such as the promotion of exclusive breastfeeding [13], the importance of immunization, food safety [35], and nutrition [8].

Chapters 2, 3, 4, 5, and 6 discuss the important role that trained healthcare workers can play in.

the increasing use of facility-based health services. These chapters and the studies noted above demonstrate the power and the importance of having health workers who are competent to provide health information and behavior change communication, which is dependent upon a national education program to improve the capacities of healthcare workers. Healthcare-seekers, our focus is on pregnant women and mothers of young children, need proper education and information, and healthcare providers require training and education to not only perform their jobs properly but to also provide the education and information their clients need. Community health workers are an effective and powerful intervention to improve community health. They can play an important role in improving health services at the community level by educating people, but they, like licensed providers, need training in health and behavior change communication.

## 7.6. Recommendations

The following recommendation for the Ministry of Health, health providers, healthcare workers, and communities are based on the findings in the thesis studies.

### 7.6.1. Ministry of health

#### 7.6.1.1. Promote healthcare workers as advocates of health behaviors

Doctors, nurses, and midwives play an important role in providing information and promoting health services utilization in Sindh, Pakistan. Health promotion programs should target women with low educational levels and in rural areas to increase their use of services from health professionals.

At the policy level, the study suggests wealth is a determinant of ANC utilization, lower quintiles have lower rates of use, therefore financial support that enables women from poor households to reduce their out-of-pocket expenditure may have a positive effect on long-term ANC utilization. In addition, strategies should motivate women to attend ANC during their first trimester, which would enable them to achieve the recommended number of visits and accept healthcare workers' recommendation for physical and laboratory examinations at subsidized or no costs. Programs should be designed to increase women's and their healthcare decision making family members' exposure to MCH information that promotes ANC utilization.

Interventions should promote facility birth in Sindh and should target young women with lower socio-economic status, especially poor and uneducated, and women who live in rural areas with uneducated husbands, and those who receive MCH information from non-health professionals. Educating women and their husbands to use health facilities for varied services



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and training lady health visitors and other low-level health workers may encourage women to give birth at facilities. Policy makers should focus on rural-urban differences, identification of disadvantaged and vulnerable women, and the density and composition of the health workforce. In doing so, they should recognize and involve communities to address cultural and religious factors, which may restrict maternal health-seeking behavior.

#### **7.6.1.2. Improve immunization coverage through home-based records**

Pakistan has a centralized health system in which all major health decisions are under the control of the federal government. Pakistan also has a national plan and strategy for immunization [74]. This can be beneficial for adapting monitoring systems. For example, some children are vaccinated at birth but their mothers find it difficult to remember or attend subsequent immunization appointments. Many people do not keep the immunization card. According to this thesis, two-thirds of women did not have immunization cards or missed information on these cards due to social activities or misplaced immunization cards. Follow up ratio is lower as they get older. According to the WHO, home-based records (HBRs) are an inexpensive and effective source of immunization history documentation [37,38] Based on documented evidence, HBSs are a good way to keep records compared to the information obtained from maternal recalls [21,39]. Therefore, immunization program managers should monitor and evaluate the prevalence of HBRs and why women do not have cards or missed immunization data on the cards. In addition to these, managers should accommodate solutions for increase in HBR usage, including redesigning HBRs for electronic data collection formats and change platforms to develop more registered HBRs information.

In a redesigned HBRs, an immunization tracking system for health workers should provide information about age-appropriate immunizations [33, 40]. For example, a systematic vaccination monitoring program can provide reminders for second/third vaccines to facilitate timely immunization. Follow-up immunizations for children younger than 2 years may help to improve timely immunization rates in women and children and achieve herd immunity for vaccine-preventable diseases. It would be helpful for the MOH to develop strategic plans or amend the existing plans to target mothers of children at certain ages to increase the proportion of age-appropriate immunizations.

#### **7.6.1.3. Develop context-specific strategic plans linked to local challenges**

To meet SDG commitments, MOH should prioritize strategic plans, within their limited resource, that are context-specific and linked to local unmet needs in MCH in Sindh. This thesis demonstrated that efforts to improve ANC utilization should pay particular attention to the needs of rural, less educated, and poor women. Strategies to increase demand for healthcare services should be a priority in Sindh, particularly in rural areas. Health promotion programs

targeting women with low educational levels must be developed to enhance their awareness of the importance of ANCs and to increase their uptake of ANC services. Interventions to promote facility births in Pakistan should target young women with a lower socio-economic status, especially those who are poor and uneducated, residing far from health facilities, and women who live in rural areas with uneducated husbands and who receive MCH information from non-health professionals.

In addition, policy-makers should develop systems and process for identification of mothers who may be at risk of low immunization coverage. In addition, they should also tailor interventions for informing mothers about the need for full immunization. Likewise, policy-makers and program managers must develop targeted interventions to improve health service utilization based on the baby's age including addressing the barriers causes by the maternal socio-economic status. Indeed, as babies get older, his/her vaccination rates decline. So, strategies that target specific ages are needed for improving delivery and access to regardless of their social economic.

## 7.6.2. Healthcare providers and health-related workers

### 7.6.2.1. Improve capacity

While healthcare workers are distributed across the country, there are still unmet needs. Effective coverage has become a serious issue because of poor management; 30–50% of the population in several rural districts lack lady health workers, especially the poorest and most remote areas. To increase skilled birth attendance, Pakistan has introduced trained health professionals, such as community midwives, in rural areas where they provide birth services in basic health units and rural health centers. However, many births still occur at home without skilled attendants because of a lack of human resources. We suggest two options to improve this situation. One, in the short-term, lady health workers have the initial and refresher skills needed to safely assist at deliveries. Second, their role needs to be redefined so that their primary job would be to refer pregnant women to facilities when they go into labor, where more highly skilled nurse and midwives could assist the delivery. A detailed strategy for human resource planning, capacity development, retention, and management is needed to fill gaps at the community- based primary care level and to improve qualified training programs.

### 7.6.2.2. Enhance behavior change communication skills

Counseling delivered by health professionals raises awareness of positive health behaviors such as using ANC, giving birth in a facility birth, breastfeeding, and ensuring that children get timely immunizations. Counseling can produce a positive cycle of health behaviors and of care

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availability and its timely access. Therefore, the preservice education and continuing professional development of healthcare professionals should be reinforcing health and behavior change communication so they can improve

women's awareness of the importance of healthcare service utilization.

### **7.6.2.3. Promote peer communicators as advocates of health behaviors**

Health care provider and health-related workers need to develop targeted interventions to improve breastfeeding practices based on maternal socio-economic status and cultural context and baby's age to encourage mothers to continue exclusive breastfeeding for six months. Mass media campaigns to improve breastfeeding practices should be accompanied by the governmental restriction of the marketing of formula milk in Pakistan. In addition, it is necessary to consider the development of peer counseling interventions to improve breastfeeding practices.

## **7.6.3. Communities**

### **7.6.3.1. Improve knowledge**

All community members must learn about health and be receptive to essential education delivered by health professionals and community health workers. The social learning curve is improved when members of a community try to improve their knowledge together.

### **7.6.3.2. Supporting social and behavioral changes**

We found that the social environment factors, including social norms, make usage of the health services harder for women. Conservative Muslim family members, especially husbands, mothers-in-laws, and grandmothers, have a cultural preference for home deliveries and may prohibit pregnant women from going to a hospital to give birth [24,36]. It is hard to change cultural behavior related to conservative customs and social norms. In particular, there is the need to tackle social determinants like education and income level affecting MCH in Pakistan. These relate to fundamental issues surrounding the status of women and their education and empowerment. Given the critical role of women's education in improving uptake of MCH services, like immunization, there is an urgent need to improve social awareness. Such development should be started, even if it may take time. This in turn will provide a supportive environment that will enable people to initiate and maintain positive behavioral changes.

## 7.7. Strengths, Limitations, and Future Research

### 7.7.1. Strengths and limitations of the study

Several limitations of this thesis should be acknowledged. First, this thesis is a cross-sectional design. So, it cannot make causal inferences from the findings. Second, the data is obtained from Sindh, one single province in Pakistan. Therefore, the findings cannot be generalized to the entire country without careful adoption. Third, study participants include 15–49 years old married women who had a live birth in the two years prior to the survey. The time lapse between childbirth and survey can make it difficult for women to remember, because of the recall bias, although trained interviewers used structured questions to minimize this bias. Fourth, other possible determinants of MCH services utilization were not included because of the data limitations. Fifth, the data is rather old. Therefore, further studies are needed to consider other important variables and to monitor the recent trends.

However, this thesis has a comprehensive framework of health service utilization taking into account social, behavioral, and health system determinants., Along with the framework, this study analyzes data from a large sample of women in Sindh, Pakistan, from the MCH Program Indicator Surveys. The empirical findings demonstrated how the framework might be employed to explain key patterns and trends in maximizing health services utilization. The findings have important implications for countries who aim to improve MCH because those emphasize the importance of a supportive environment, which will enable people to initiate, sustain, and maintain positive and desirable behavior outcomes and the importance of improving the training and education of health workers for effective and sustainable human resource management interventions.

### 7.7.2 Implications for future research

Further research is needed to evaluate the degree to which each determinant affects health service utilization in Pakistan. For example, which messages and sources have the greatest impact, and how can they be harnessed to promote ANC utilization? Research is also needed to examine the effect of media- based MCH information on health service utilization, after adjusting for demographic and socio- economic determinants, in Pakistan. Specifically, the effect of individual information sources on facility births after adjusting for demographic and socio-economic determinants in urban and rural areas of Pakistan must be examined. Further studies including all children younger than 5 years in all provinces of Pakistan are also needed because this thesis only included those in Sindh province. A large nationally representative survey of immunizations is required. To improve immunization timeliness, it is necessary to not only understand factors associated with timeliness (or un-timeliness) but also to perform a

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APPENDIX

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root- cause analysis and to identify evidence concerning interventions. In addition, future investigators should determine factors that prevent timely immunization and factors related to uptake of follow-up vaccine doses. Studies are also needed to develop intervention programs to improve timely immunizations for children born in institutions. This thesis' findings indicate the need for training programs for professional and nonprofessional healthcare workers to be able to effectively communicate about breastfeeding, ANC visits, and facility births. The findings suggest future researchers should study competency training programs to develop and utilize interventions to improve MCH.

## **7.8. Conclusions**

This study demonstrates substantial disparities in health service utilization between poor and wealthy households in Sindh. Disparities exist across a wide range of indicators along the continuum of care from antenatal care to immunization. The burdens of high fertility and low contraceptive use remain challenges and are compounded by the fact that the majority of women in Sindh have limited access to MCH information.

As study findings showed, information from the health professionals was positively associated with better attendance to ANC. Women who attended ANC were significantly more likely to have skilled birth attendants in health facilities during their delivery. This positive chain of health-related behavior identifies a key intervention area to improve health service utilization. Training of lady health visitors and other lower tier health workers could contribute to the quality of health information and encourage women to attend ANC and quality maternity care services and immunization with skilled health workers. Similarly, mothers who received information about MCH from health professionals had a higher probability of completing basic immunization. Mass media and relatives/friends are other important information sources. Information about breastfeeding received from relatives or friends encouraged women to start breastfeeding. This emphasizes the importance of community-based peer counseling using trained community female volunteers to promote good breastfeeding practices. Delivery of proper information leads to greater health service utilization and promotes better health-related behavior.

Improvements in strategies for increasing health services utilization remain important policy objectives in lower-middle-income countries. Political strategies can refer to the dynamics of health-related socioeconomic changes and provide the final push to remove healthcare barriers. Interventions must focus on the needs and opinions of the target population and strategies that lead to positive changes in health behavior. In the context of Sindh, as this study recommended, policy-makers should focus on rural-urban differences, with appropriate attention to the and identification of disadvantaged and vulnerable women. The awareness about healthy cultural and religious factors is also significant for maternal and child health-seeking behaviors.

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# Appendix



## SUMMARY

Maternal mortality is one of the greatest health concerns in the developing world. Compared with other low-income countries, the maternal mortality ratio in Pakistan is high, with an extremely slow declining trend. In rural areas of Pakistan, the maternal mortality ratio is almost twofold that of urban areas, 319 versus 175 deaths per 100,000 live births. Complications during pregnancy and childbirth are the most frequent cause of death and disability among women of childbearing age. Indeed, Pakistan's neonatal mortality rate in 2017 was 44 per 1000 live births, with an under-five mortality rate of 75 per 1000 live births. Securing access to and use of appropriate care and skilled health professionals can substantially reduce maternal, newborn, and child mortality and morbidity. However, health service utilization is a key to improving outcomes, but use is influenced by individual, social, and health system determinants.

This thesis was conducted to find out which factors influence health service utilization, a key component of improving maternal, newborn, and child health (MNCH), so that policy makers can set priorities and focus the limited resources that are available on what is important. The thesis focuses on antenatal care (ANC), facility-based birth, breastfeeding, and child immunization.

Studies for the thesis used data from the 2013 and 2014 MNCH Program Indicator Surveys that were conducted to provide data on key indicators required to monitor the implementation of MNCH and family planning/reproductive health interventions in Sindh and Punjab provinces in Pakistan. Data were collected in all 23 districts of Sindh between June 2013 and October 2014 from a total of 10,200 women (4,000 from the 2013 survey and 6,200 from the 2014 survey).

Four findings emerged from the studies. First, health information dissemination from a skilled health professional is important for health service utilization. Second, community-level peer counselors play an important role in advocating for use of health facilities by individuals, families, and the community. Third, MNCH policy and strategic plans need to focus interventions, including information campaigns, on target population groups, such as parents in low educational and socio-economic classes and parents of children in specific age groups. Fourth, to increase health service utilization (finding 1), healthcare workers need to be trained to be effective health and behavior change communicators. The studies showed that if women meet with compassionate and skilled health workers, who offer relevant and reliable information, then a positive chain of events is started: women attend ANC, opt for institutional birth, attend child care clinics, and have their children vaccinated. Our findings point to two key factors for healthy behavior change: increased opportunities for women to learn about pregnancy and child healthcare and the encouragement from the skilled health professionals. These findings can be used to develop strategies to maximize utilization of MNCH in Sindh province, Pakistan, such as training of lady health visitors and other lower tier health workers and use of media and peer

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communicators to improve the quality and quantity of health information provided to women.

Improvements in strategies for increasing health services utilization remain important policy objectives in lower-middle-income countries. Interventions must focus on the needs and opinions of the target population and strategies that lead to positive changes in health behavior. In the context of Sindh, as this study recommends, policy makers should focus on rural-urban differences, with appropriate attention to and identification of disadvantaged and vulnerable women.

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## Nederlandse samenvatting

Moedersterfte is een van de grootste gezondheidsproblemen in lage inkomenslanden. In vergelijking met andere lage inkomenslanden is de moedersterfte in Pakistan hoog en gaat de daling extreem langzaam. Op het platteland van Pakistan is de moedersterfte bijna tweemaal zo groot als in stedelijke gebieden, 319 versus 175 sterfgevallen per 100.000 levendgeborenen. Complicaties tijdens de zwangerschap en bevalling zijn de meest voorkomende oorzaak van sterfte en blijvende beperkingen bij vrouwen in de vruchtbare leeftijd. Ook baby- en kindersterfte zijn veel te hoog in Pakistan. Het aantal pasgeborenen dat overlijdt in de eerste vier levensweken is 44 per 1000 en de sterfte van kinderen onder de 5 jaar is 75 per 1000 levendgeborenen. Door het verbeteren van de toegankelijkheid van de zorg en het aanbieden van passende zorg door goed opgeleide gezondheidswerkers, kunnen mortaliteit en morbiditeit van moeders, pasgeborenen en kinderen aanzienlijk worden teruggedrongen. Het gebruiken van gezondheidszorg is de sleutel tot het verbeteren van de resultaten, maar wordt beïnvloed door individuele, sociale en gezondheidsdeterminanten.

Dit proefschrift is geschreven om te achterhalen welke factoren het gebruik van gezondheidszorg beïnvloeden, zodat beleidsmakers prioriteiten kunnen stellen en de beperkte beschikbare middelen kunnen richten op wat belangrijk is. Het proefschrift richt zich op prenatale zorg, institutionele bevallingen, borstvoeding en vaccinaties van jonge kinderen.

Voor de studies in dit proefschrift werden gegevens gebruikt van het indicatoronderzoek van het 'Maternal Newborn and Child Health (MNCH)'-programma uit 2013 en 2014, dat werd uitgevoerd om gegevens te verschaffen over de belangrijkste indicatoren die nodig zijn om de implementatie van MNCH en interventies op het gebied van reproductieve gezondheid te volgen in de provincies Sindh en Punjab. Tussen juni 2013 en oktober 2014 werden gegevens verzameld in alle 23 districten van Sindh van in totaal 10.200 vrouwen (4000 uit de enquête van 2013 en 6200 uit de enquête van 2014).

Uit de onderzoeken kwamen vier bevindingen naar voren. Ten eerste is de verspreiding van gezondheidsinformatie door een bekwame gezondheidswerker belangrijk voor het gebruik van gezondheidszorg. Ten tweede spelen lokale 'influencers' op gemeenschapsniveau een belangrijke rol bij het adviseren over het gebruik van gezondheidsfaciliteiten. Ten derde moeten het MNCH-beleid en de strategische plannen zich richten op interventies, waaronder informatiecampagnes, in specifieke doelgroepen: laag opgeleide ouders, lage sociaaleconomische klassen en ouders van kinderen in specifieke leeftijdsgroepen. Ten vierde, om het gebruik van de gezondheidszorg te vergroten moeten gezondheidswerkers worden opgeleid in hoe effectief te communiceren over gedragsverandering. De onderzoeken toonden aan dat als vrouwen bekwame gezondheidswerkers ontmoeten, die met compassie relevante

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en betrouwbare informatie bieden, er een positieve reeks gebeurtenissen op gang komt: vrouwen kiezen voor prenatale zorg, kiezen voor een institutionele bevalling, gaan naar kindzorgklinieken en laten hun kinderen vaccineren. Onze bevindingen wijzen op twee sleutelfactoren voor gezonde gedragsverandering: meer kansen voor vrouwen om meer te weten te komen over zwangerschap en kindergezondheidszorg en de aanmoediging van bekwame gezondheidswerkers. Deze bevindingen kunnen worden gebruikt om strategieën te ontwikkelen om MNCH in de provincie Sindh in Pakistan te verbeteren, zoals training van vrouwelijke 'health visitors' en andere lager opgeleide gezondheidswerkers en het gebruik van media en lokale raadgevers om de informatie die vrouwen krijgen, te verbeteren.

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모성사망률은 개발도상국에서 가장 중요한 건강 지표 중의 하나이다. 다른 저소득층 국가와 비교했을 때, 파키스탄의 모성사망률은 높은 수준이며, 매우 느리게 낮아지고 있다. 파키스탄 시골지역의 모성사망률은 출생아 10만 명당 사망자 319명으로 175명인 도시지역의 두 배에 가깝다. 임신과 출산 중 합병증은 가임기 여성의 사망과 장애의 가장 흔한 원인이다. 실제로 파키스탄의 2017년 신생아사망률은 출생아 천 명당 44명이었으며, 5세 미만 어린이사망률은 출생아 천 명당 75명이었다. 적절한 진료와 숙련된 의료전문가에 대한 접근성과 이용의 보장은 모성, 신생아, 그리고 어린이의 사망률과 유병률을 상당히 감소시킬 수 있다. 보건의료서비스의 이용은 건강 결과 개선의 해결책이지만 이용은 개인, 사회, 그리고 보건의료체계 측면 결정요인의 영향을 받는다.

이 연구는 모성, 신생아와 어린이 보건(maternal, newborn, and child health, MNCH) 개선의 가장 중요한 요소인 보건의료서비스 이용에 영향을 미치는 요인을 규명함으로써 정책 입안자가 우선 사항을 설정하고 중요한 사안에 제한된 가용자원을 집중할 수 있도록 도움을 주고자 하였다. 이 연구는 산전관리, 보건의료시설 분만, 모유 수유, 그리고 어린이 예방접종에 관한 연구이다.

이 연구에서는 MNCH Program Indicator Survey의 2013-2014년 자료를 이용하였다. 해당 설문조사는 파키스탄의 신드(Sindh)와 펀자브(Punjab) 주에서 진행된 MNCH 및 가족계획/생식건강 개입의 이행 모니터링에 필요한 핵심 지표 자료 제공을 위해 수행되었다. 2013년 6월부터 2014년 10월까지 신드 주의 23개 구에서 총 1만2백명(2013년 조사 4,000명, 2014년 조사 6,200명)의 여성을 대상으로 수집한 자료를 분석하였다.

이 연구에서는 다음의 네 가지 주요 결과를 도출하였다. 첫째, 숙련된 의료전문가에 의한 건강 정보의 보급은 보건의료서비스 이용의 중요한 영향 요인이다. 둘째, 지역사회의 동료 상담가는 개인, 가족, 그리고 지역사회 의료시설 이용을 지지하는데 중요한 역할을 한다. 셋째, MNCH 정책과 전략적 계획은 정보 캠페인 같은 개입을 저학력자와 낮은 사회경제적 지위의 부모, 특정 연령대의 자녀를 둔 부모 같은 목표 인구집단에 집중시켜야 한다. 넷째, 보건의료서비스의 이용을 증가시키기 위해(첫째 결과), 보건의료인력은 효과적인 건강 및 행태 변화 의사전달자가 될 수 있도록 훈련을 받아야 한다. 이 연구를 통해 여성이 자신과 관련된 신뢰할 수 있는 정보를 제공해주는 공감적이고 숙련된 보건의료인력을 만나면, 긍정적인 선순환이 시작된다는 점을 알 수 있다: 산전관리 방문, 시설 분만 선택, 어린이 진료소 방문, 어린이 예방접종. 이러한 연구 결과는 건강행태 변화를 위한 두 가지 핵심 요인을 가리킨다:

## 요약

임신과 어린이 보건에 대한 여성의 교육 기회 확대, 숙련된 의료전문가의 권장. 이는 여성보건방문인력(lady health visitors)과 기타 하위 보건의료인력의 교육훈련, 여성에게 제공되는 건강 정보의 품질과 양 개선을 위한 미디어와 동료 의사소통자 이용 등 파키스탄 신드 주에서 모자보건서비스 이용을 극대화하기 위한 전략 개발에 활용될 수 있을 것이다. 중-저소득 국가에서 보건의료서비스 이용 증대를 위한 전략의 개선은 여전히 중요한 정책 목표이다. 개입은 목표 인구집단의 필요와 의견, 건강행태의 긍정적 변화를 이끄는 전략에 집중되어야 한다. 신드 주의 경우, 이 연구 결과가 보여준 것처럼 정책입안자가 사회적 약자이자 취약한 입지의 여성인구에 대한 적절한 관심 및 식별과 함께 도농격차 해소에 집중하길 권고한다.

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I really want to thank my family. My family supported me in whatever I decided to do. I feel strongly how important family harmony is in one’s life. I want to dedicate this PhD to my grandmother. She raised me and brought me to the United States when I was 20 years old. She showed me the wide world and gave me endless love. She died during my studies, in 2017. I know she will be happy for me and will be with me always. Thanks to my parents for raising me up and supporting me. My son, Jun, is the man in my life. I feel so proud of him, he is growing well while mommy works and studies. Love my family all!

I could not have done my second PhD without these graceful people.

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## CURRICULUM VITAE OF THE AUTHOR

**Jin-Won Noh**, born and grown up in Seoul, Republic of Korea, graduated from Ewha Womans University of Seoul in 2002 with a B.S. in Statistics and a B.B.A. in business administration. In 2004, she became a member of the American Institute of Certified Public Accountants. She obtained an M.A., specializing in product management in business administration, from the Ewha Womans University in 2005. In 2008, Korea University in Seoul awarded Ms. Noh a Ph.D. in Public Health; she specialized in health policy and hospital management. In 2011, Ms. Noh earned an M.P.H. at the Bloomberg School of Public Health, with a concentration in health leadership and



management, and an M.B.A. at the Carey Business School, both at the Johns Hopkins University, Baltimore, Maryland, USA, where she also earned a Health Finance and Management Certificate. Ms. Noh served as a researcher at the Samsung Healthcare Management Institute for three years, has nearly two decades of teaching experience, and has published more than 100 papers. She is currently an associate professor at Yonsei University, in Seoul. Ms. Noh has focused her research on health behaviour science, concentrating on vulnerable people, especially, mothers, children, and the elderly; she is also interested in gender equity. Ms. Noh has experience with projects related to risk management in low income countries, North Korean refugees' health, and economic evaluation of hospital management and health policy management.

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APPENDIX

## PUBLICATION LISTS OF THE AUTHOR

Jin Won Noh published 90 peer reviewed publications in International journals and 57 peer reviewed publications in Korean journals. Below are short lists of them.

1. Factors associated with post-traumatic stress disorder among bereaved family members and surviving students two and half years after the Sewol ferry accident in South Korea  
So Hee Lee\*, **Jin-Won Noh(co-first author)\***, Kyoung-Beom Kim, Eun Ji Kim\*\*, Jihoon Oh, Jeong-Ho Chae\*\*  
Psychiatry Research Volume 296, February 2021, 113666  
<https://doi.org/10.1016/j.psychres.2020.113666>
2. A Mixed-Methods Systematic Review of the Impacts of Coronavirus on Society and Culture  
Yeon Jung Yu, Young Su Park, Alison Keller, **Jin-Won Noh(corresponding author)**, Jiho Cha  
Int J Environ Res Public Health. 2021 Jan; 18(2): 491.  
Published online 2021 Jan 9. doi: 10.3390/ijerph18020491
3. Impacts of smoking ban policies on restaurants in Seoul, South Korea: Analysis of objective sales information  
**Jin-Won Noh**, Minjae Choi , Young Dae Kwon, Ki-Bong Yoo  
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4. Trauma History and Mental Health of North Korean Defectors  
**Jin-Won Noh**, So Hee Lee  
Current Behavioral Neuroscience Reports, 7, pages250–257(2020)
5. Self-rated health and risk of incident non-alcoholic fatty liver disease: A cohort study  
Yoosoo Chang\*, **Jin-Won Noh (co-first author) \***, Joo Young Cheon, Yejin Kim, Young Dae Kwon, Seungho Ryu  
Scientific Reports 2020; 10: 3826. ISSN: 2045-2322 2018-2019 IF 4.116 Q1
6. Effect of Information Disclosure Policy on Control of Infectious Disease: MERS-CoV Outbreak in South Korea  
**Jin-Won Noh\***, Ki-Bong Yoo\*, Young Dae Kwon, Jin Hyuk Hong, Yejin Lee and Kisoo Park  
Int. J. Environ. Res. Public Health 2020, 17, 305; doi:10.3390/ijerph17010305 IF(2019-20): 2.62
7. Factors associated with Health-related Quality of Life (HRQOL) in Students who survived the Sewol Ferry Disaster in South Korea  
**Jin-Won Noh**, Kyoung-Beom, Kim Yejin Lee, Ju Hyun Lee, Eun Ji Kim, So Hee Lee  
*Journal of Affective Disorders* Volume 249, 15 April 2019, p 223-225. **SSCI** IF(2018/2019) 4.084, Q1

## PUBLICATION LISTS OF THE AUTHOR

8. Self-rated health and the risk of incident type 2 diabetes mellitus: A cohort study  
**Jin-Won Noh**, Yoosoo Chang, Minsun Park, Young Dae Kwon, Seungho Ryu  
*Scientific Reports* 2019 Mar 6;9(1):3697. IF(2017): 4.122, IF(2018/2019): 4.011, Q1
9. Gender differences in the impact of retirement on depressive symptoms among middle-aged and older adults: A propensity score matching approach  
**Jin-Won Noh**, Young Dae Kwon, Jumin Park, In-Hwan Oh, Jinseok Kim  
*PLoS ONE* 14(3): e0212607. IF(2017): 2.766, Q1
10. Medical Expenses of North Korean Defectors with Post-Traumatic Stress Disorder  
**Jin-Won Noh**, Yejin Lee, Hyunchun Park, So Hee Lee  
*Psychiatry Investigation* Volume 16(2), p 154-158. **SSCI** IF(2017): 1.434, Q3
11. Health-Promoting Behavior and Influencing Factors in Young North Korean Refugees (NKR) Living in South Korea  
Jumin Park, Young Dae Kwon, Hyunchun Park, ShiEun Yu, **Jin-Won Noh(corresponding author)**  
*Journal of Immigrant and Minority Health* Volume 20 Issue 6 (2018) Pages 1355-1361;  
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12. Relationship between body image and weight status in East Asian countries: Comparison between South Korea and Taiwan  
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13. Factors Related to the Attitude of North Korean Refugees Towards People with Mental Illness  
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14. Factors Associated with Complicated Grief in Students Who Survived the Sewol Ferry Disaster in South Korea  
Lee SH, Nam HS, Kim HB, Kim EJ\*, **Noh JW(co-corresponding)\***, Chae JH  
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15. Gender Differences and Socioeconomic Factors Related to Osteoporosis: A Cross-Sectional Analysis of Nationally Representative Data  
**Jin-Won Noh**, Hyunchun Park, Minji Kim, Young Dae Kwon  
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**Jin-Won Noh**, HyunChun Park, Minji Kim, Young Dae Kwon, Jin-Seok Kim, Shieun Yu  
*Psychiatry Investigation* 2018 Jan;15(1):49-53. **SSCI** IF(2017): 1.434, Q3

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17. Gender Differences in Suicidal Ideation and Related Factors among North Korean Refugees in South Korea  
**Jin-Won Noh**, Hyunchun Park, Young Dae Kwon, InHyeKim, YoHanLee, YoonJungKim, SinGonKim  
*Psychiatry Investigation* 2017 Nov; 14(6): 762–769. **SSCI** IF(2017): 1.434, Q3
18. The elderly and falls: Factors associated with quality of life A cross-sectional study using large-scale national data in Korea  
**Jin-Won Noh**, Kyoung-Beom Kim, Ju Hyun Lee, Byeong-Hui Lee, Young Dae Kwon, Seon Heui Lee  
*Archives of Gerontology and Geriatrics* 2017 Nov;73:279-283. IF(2017): 2.241, Q3
19. Relationship between the Number of Family Members and Stress by Gender: Cross-Sectional Analysis of the Fifth Korea National Health and Nutrition Examination Survey  
**Jin-Won Noh**, Kyoung-Beom Kim, Jumin Park, Janghun Hong, Young Dae Kwon  
*PLOS ONE* 2017 Sep 8;12(9):e0184235. IF(2017): 2.766, Q1
20. Body mass index and self-rated health in East Asian countries: Comparison among South Korea, China, Japan, and Taiwan  
**Jin-Won Noh**, Jinseok Kim, Youngmi Yang, Jumin Park, Jooyoung Cheon, Young Dae Kwon  
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21. Relationship between number of household members and prevalence of chronic diseases: a cross-sectional analysis of Korea Health Panel data  
**Jin-Won Noh**, Jin Hyuk Hong, In Hye Kim, Minjae Choi, and Young Dae Kwon  
*Population health management* Volume 20(2), 2017/ Letter to the Editor. IF(2017): 1.29, Q3
22. Gender differences in outpatient utilization: a pooled analysis of data from the Korea Health Panel  
**Jin-Won Noh**, Kyoung-Beom Kim, Hyunchun Park, Young Dae Kwong  
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23. Age and gender differential relationship between employment status and body mass index among middle-aged and elderly adults: a cross-sectional study  
**Jin-Won Noh**, Jinseok Kim, Jumin Park, In-Hwan Oh, Young Dae Kwon  
*BMJ Open* 2016;6:e012117. IF(2017): 2.413, Q1
24. Relationship between physical disability and depression by gender: A panel regression model  
**Jin-Won Noh**, Young Dae Kwon, Jumin Park, In-Hwan Oh, Jinseok Kim  
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25. Public satisfaction with the healthcare system performance in South Korea: Universal healthcare system  
Kisoo Park, Jumin Park, Young Dae Kwon, Yoonjeong Kang, **Jin-Won Noh (corresponding author)**  
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Barbara J. Rawlins, Young-Mi Kim, Aleisha M. Rozario, Eva Bazant, Tambudzai Rashidi, Sheila N. Bandazi, Fannie Kachale, Harshad Sanghvi, **Jin Won Noh (Corresponding Author)**  
*Midwifery*, Volume 29, Issue 1, Pages 53-59. **SSCI** IF(2017): 1.787, Q1

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This thesis is published within the **Research Institute SHARE** (Science in Healthy Ageing and healthcaRE) of the University Medical Center Groningen / University of Groningen. Further information regarding the institute and its research can be obtained from our internet site: <http://www.share.umcg.nl/>

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(supervisors are between brackets)

## 2021

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Management of heavy menstrual bleeding  
(*prof MY berger, prof MY Bongers, dr JH Dekker*)

### **Brouwer MA**

At the boundaries of life; suffering and decision-making in children with life-threatening conditions (1-12 years)  
(*prof AAE Verhagen, dr E Maevkelberghe*)

### **Beune IM**

Standardization in fetal growth restriction; progression by consensus  
(*prof JJ Erwich, dr SJ Gordijn, dr JW Ganzevoort*)

### **Keizer MNJ**

Neuromuscular control of knee laxity after an anterior cruciate ligament reconstruction  
(*prof E Otten, dr JM Hijmans, dr RW Brouwer*)

### **Habtewold TD**

Data-driven subphenotypic dissection of the clinical heterogeneity of schizophrenia spectrum disorders  
(*prof HM Boezen, prof R Bruggeman, dr BZ Alizadeh, dr EJ Liemburg*)

### **Ferdiana A**

Quality of life, work, and social participation among individuals with spinal cord injury  
(*prof U Bültmann, prof JLL van der Klink, prof MWM Post*)

**Tuvdenjorj A**

Economic evaluation of tobacco control in Asia; dynamic population health impact assessment in Mongolia

*(prof E Buskens, prof TL Feenstra)*

**Nanninga CS**

Home & place making after stroke; exploring the gap between rehabilitation and living environment

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Physical activity and functional recovery in late-life depression

*(prof RC Oude Voshaar, dr P Naarding, dr R Collard)*

**Hovenkamp-Hermelink A**

The long-term course of anxiety disorders; an epidemiological perspective

*(prof RA Schoevers, dr H Riese, dr B Jeronimus)*

**Moazzen S**

Nutrients and diet quality in gastrointestinal cancers

*(prof GH de Bock, dr BZ Alizadeh)*

**Poonsiri J**

Exploring cycling and sports in people with a lower limb amputation: prosthetic aspects

*(prof JHB Geertzen, prof PU Dijkstra, prof R Dekker, dr JM Hijmans)*

**Rausch CP**

Geriatric syndromes prevalence: associated factors and outcomes

*(prof U Bültmann, prof SEJA de Rooij, prof L Laflamme, dr J Möller)*

**Shahabeddin Parizi A**

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*(prof PFM Krabbe, prof SJL Bakker, prof E Buskens, dr KM Vermeulen)*

**Vervoort D**

Adaptability of gait and balance across the adult lifespan

*(dr CJC Lamothe, prof T Hortobagyi, dr N Vuillerme, dr AR den Otter)*



**Munck L de**

Breast cancer: screening, stage and outcome; studies based on the Netherlands Cancer Registry  
(*prof GH de Bock, prof S Siesling*)

**Wijnen A**

Rehabilitation policies following total hip arthroplasty; across borders  
(*prof SK Bulstra, prof D Lazovic, dr M Stevens*)

**Spinder N**

Maternal occupational exposure and congenital anomalies  
(*prof HM Boezen, prof H Kromhout, dr HEK de Walle, dr JEH van Kammen-Bergman*)

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The Dutch Working Party ‘International Safe Motherhood and Reproductive Health’ aims to contribute to improvement of the reproductive health status of women around the globe, in particular by collaborating with local health workers (<http://www.safemotherhood.nl>).

The Working Party is part of both the Dutch Society of Obstetrics and Gynaecology (NVOG) and the Dutch Society for International Health and Tropical Medicine (NVTG). The activities that are undertaken under the umbrella of the Working Party can be grouped into four pillars: education, patient care, research and advocacy.

Research activities are undertaken by (medical) students, Medical Doctors International Health and Tropical Medicine and many others. Some research activities develop into PhD-trajectories. PhD- candidates all over the world, Dutch and non-Dutch, work on finding locally acceptable and achievable ways to improve the quality of maternal health services, supervised by different members of the Working Party. Professor Jos van Roosmalen initiated the Safe Motherhood Series, which started in 1995.

### THE SAFE MOTHERHOOD SERIES

- The role of oral (methyl)ergometrin in the prevention of postpartum haemorrhage. (**Akosua N.J.A. de Groot**), Radboud UMC, Nijmegen, the Netherlands, 1995
- Perinatal assessment in rural Tanzania. (**Gijs E.L. Walraven**), Radboud UMC, Nijmegen, the Netherlands, 1995
- Confidential enquiries into Maternal Deaths in the Netherlands, 1983- 1992. (**Nico W.E.Schuitemaker**), UMC Leiden, the Netherlands, 1998
- Confidential enquiries into Maternal Deaths in Surinam. (**Ashok S. Mungra**), UMC Leiden, the Netherlands, 1999
- Reproductive health matters in rural Ghana. (**Diederike W. Geelhoed**), UMC Leiden, the Netherlands, 2003
- Vaginal birth after caesarean section in Zimbabwe and The Netherlands (**Wilbert A.Spaans**), AMC Amsterdam, the Netherlands, 2004

## THE SAFE MOTHERHOOD SERIES

- Safe Motherhood and Health systems research: Health care seeking behaviour and utilization of health services in Kalabo District (**Jelle Stekelenburg**), VU Amsterdam, the Netherlands, 2004
- Enhancing survival of mothers and their newborns in Tanzania (**Godfrey Mbaruku**), Karolinska Institute, Stockholm, Sweden, 2005
- Beyond the numbers: confidential enquiries into maternal deaths in Accra- Ghana (**Afisah Yakubu Zakariah, Accra, Ghana**), Vrije Universiteit Brussel, Belgium, 2008
- Severe maternal morbidity in the Netherlands: the LEMMoN study (**Joost Zwart**), UMC Leiden, the Netherlands, 2009
- Obstetric audit in Namibia and the Netherlands (**Jeroen van Dillen**), VU Amsterdam, the Netherlands, 2009
- Confidential enquiries into maternal deaths in the Netherlands 1993- 2005 (**Joke Schutte**), VU Amsterdam, the Netherlands, 2010
- Delay in Safe Motherhood (**Luc van Lonkhuijzen**), UMC Groningen, the Netherlands, 2011
- Medical Mirrors: Maternal care in a Malawian district (**Thomas van den Akker**), VU University Medical Centre, Amsterdam, the Netherlands, 2012
- Leading change in the maternal health care system in Tanzania: application of operations research (**Angelo Nyamtema, Ifakara, Tanzania**), VU Amsterdam, the Netherlands, 2012
- Health professionals and maternal health in Malawi: mortality and morbidity at district level (**Jogchum Beltman**), VU Amsterdam, the Netherlands, 2013
- Obstetric emergencies in primary midwifery care in the Netherlands (**Marrit Smit**), UMC Leiden, the Netherlands, 2014
- Improving maternal outcome in rural Tanzania using obstetric simulation-based training (**Ellen Nelissen**), VU Amsterdam, the Netherlands, 2014
- The aberrant third stage of labour (**Giel van Stralen**), UMC Leiden, the Netherlands, 2015
- Terugvinden van waardigheid, community-based sociotherapie in Rwanda, Oost-Congo en Liberia (**Cora Bakker**), VU Amsterdam, the Netherlands, 2016
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- Safe Motherhood: Improving the quality of maternal and perinatal health care in a rural hospital in Tanzania (**Rob Mooij**), UMC Groningen, the Netherlands, 2020
- Strategies to improve intrapartum care: foetal monitoring in low resource settings (**Natasha Housseine**), UMC Utrecht, the Netherlands, 2020
- Maternal mortality in Suriname: Implementation of Maternal Death Surveillance and Response to reduce preventable maternal deaths (**Lachmi Kodan**), UMC Utrecht, the Netherlands, 2020

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## THE SAFE MOTHERHOOD SERIES

- Maternal mortality, near-miss and stillbirths in Suriname: time to respond (**Kim Verschueren**), UMC Utrecht, the Netherlands, 2020
- Key factors to improve maternal and child health in Sindh province, Pakistan (**Jin Won Noh**), UMC Groningen, the Netherlands, 2021