

Gender differentials in spatial distribution of immunisation status in children aged 12-23 months by district in Punjab — Results from Pakistan Social and Living Standards Measurements Survey 2014-15

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Abstract

In Pakistan routine immunisation for children is offered free of cost in the public sector and several studies have been conducted analysing coverage at the village, city, district, and provincial levels that show wide variation in immunisation coverage rates. Using the district level Pakistan Bureau of Statistics 'Pakistan Social and Living Standards Measurements' survey data for 2014-15, various immunisation indices were analysed and mapped for Punjab province. The mapping of gender disaggregated, three immunisation indices at the district level illustrate that immunisation of 12-to-23-month children is wide spread in the Punjab province. In the southern and central districts, immunisation coverage was not at par with the northern districts. Gender-based immunisation coverage proportions does show differentials that is a cause of concern. Disease mapping brings out these immunisation coverage and differences in an easily understandable format that could help better plan, target, and deliver childhood routine immunisations in the province.

Keywords: Immunisation, Disparities, Pakistan.

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Introduction

Paediatric vaccine preventable diseases are decreasing globally and routine vaccination rates are increasing.¹ In Pakistan routine immunisation for children is offered free of cost in the public sector healthcare facilities ensuring that infants and children are protected from serious and often life-threatening diseases with this effective preventive measure.²

Several studies have been conducted in Pakistan analysing data at the village, city, district, and provincial levels.³⁻⁵ Wide variation in immunisation rates between provinces and districts within provinces exists in Pakistan.³⁻⁶

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'Pakistan Social and Living Standards Measurements' (PSLM) surveys. As of December, 2020, the district level data for third PSLM conducted in 2014-15 was available on the PBS website. The PSLM provides district level representative data on various social and health indices including childhood immunisations. In 2011 the Federal Ministry of Health was dissolved, and health became a provincial government responsibility.⁷

As the planning, provision and quality assurance of healthcare delivery is now a provincial matter, it is imperative to study various health indices, including paediatric immunisation coverage at the provincial level with data available at the lowest administrative level.

Geographic Information Systems (GIS) provide a unique opportunity to depict diseases and coverage rates of paediatric immunisation coverage rates and other health indicators at lowest administrative level for which data is available. In this study the latest available district level PSLM data was used to map various paediatric immunisation coverage percentages, disaggregated by gender. Additionally, descriptive and comparative data analysis was done to determine gender differentials.

Methods and Results

The PSLM survey data is freely available as PDF files on the Pakistan Bureau of Statistics website.⁸ The data quality control checks are also explained on the website. The PDF files of district level PSLM health data were downloaded for the latest round of 2014-15, for which district level data are available. Punjab province data was entered into a spreadsheet programme Excel, pertaining to district level proportion/percentage of immunisation data for the children aged 12 to 23 months that were immunised. The PSLM 2014-15 defines full immunisation entailing 11 recommended vaccines (BCG, DPT1, DPT2, DPT3, Polio1, Polio2, Polio3, H.B1, H.B2, H.B3 and measles). The Excel file was joined with the Punjab districts shapefile in GIS programme ArcGIS 10.7.

Three pairs of choropleth maps were created depicting immunisation status by gender, in terms of recall of at least one immunisation; full immunisation based on record; and full immunisation based on recall as well as

Table: Descriptive statistics of the percent immunization status of children aged 12 to 23 months by gender, and their statistical significance.

Children aged 12-23 months	Sex	Mean	Standard Deviation	Range	P-Value
Based on recall - at least one immunization	Male	98.97	1.50	94 - 100	0.880
	Female	99.03	1.61	94 - 100	
Fully immunised based on record	Male	72.14	14.16	38 - 97	0.954
	Female	72.33	14.60	40 - 96	
Fully immunised based on recall & record	Male	90.72	5.40	78 - 100	0.701
	Female	90.19	6.19	70 - 100	

P-values are based on Student's t-test.

**Figure-1:** Map showing the districts of Punjab province, Pakistan.

record. Choropleth maps use colour coding based on attribute being depicted for each polygon e.g. district in this study. Five classes were used to depict various levels of immunisation status in terms of percentage of children immunised. Natural breaks method was used to define five classes for males, and similar classes were used for creating choropleth maps for females as well, to allow comparisons by district. Three choropleth maps depicting districts in which males and females had either same

proportion of immunisation, males exceeding females, and females exceeding males in immunisation proportions; based on recall of at least one immunisation; full immunisation based on record; and full immunisation based on recall as well as record. Finally, descriptive analysis and Student's t-tests were applied to test for the statistical difference between gender and immunisation proportions for all districts, based on either recall of at least one immunisation; full immunisation based on record; and full immunisation based on recall as well as record. Maps were created using the ArcMap ArcGIS 10.7, and Stata 16 for statistical analysis.

Having received at least one immunisation based on recall category had the highest percent of immunised children, with mean of 98.97% for boys and 99.03% for girls aged 12 to 23 months old. None of the three immunisation groups i.e. at least one immunisation based on recall, fully immunised based on record, and fully immunised based on recall and record showed statistical significance based on gender. Table shows the descriptive statistics based on three immunisation groups, disaggregated by gender, and their statistical significance.

Figure-1 shows the map of Punjab province showing all 36 districts. Figure-2 shows the gender disaggregated maps in terms of recall of at least one immunisation. In 3 districts, the percentage of male children who were immunised ranged from 94% to 96%, while in another 7 districts immunisation percent ranged from 97% to 98%. While in 4 districts, the percentage of female children who were immunised ranged from 94% to 96%, and in another six districts immunisation percentage ranged from 97% to 98%.

Figure-3 shows the gender disaggregated maps in terms of recall of full immunisation based on record. In 10 districts, the percentage of male children who were

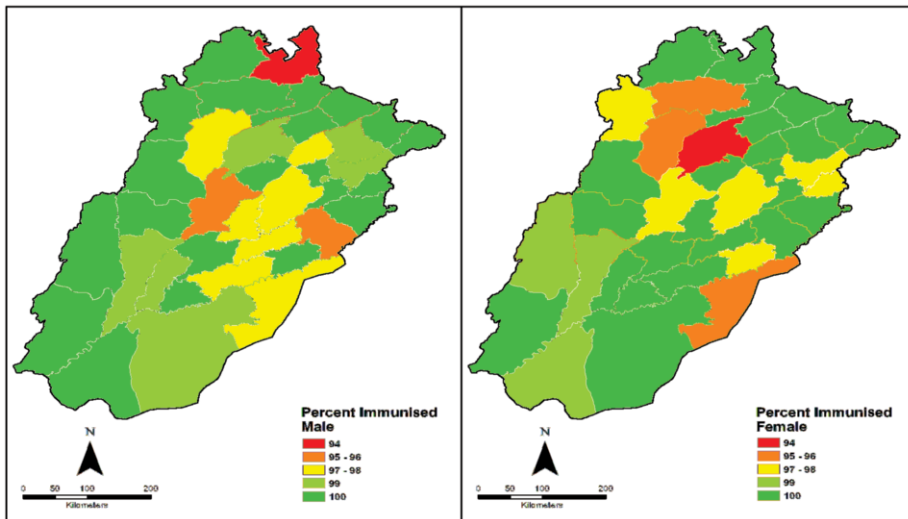


Figure-2: Map showing the proportion of at least one immunisation by district in Punjab, disaggregated by gender.

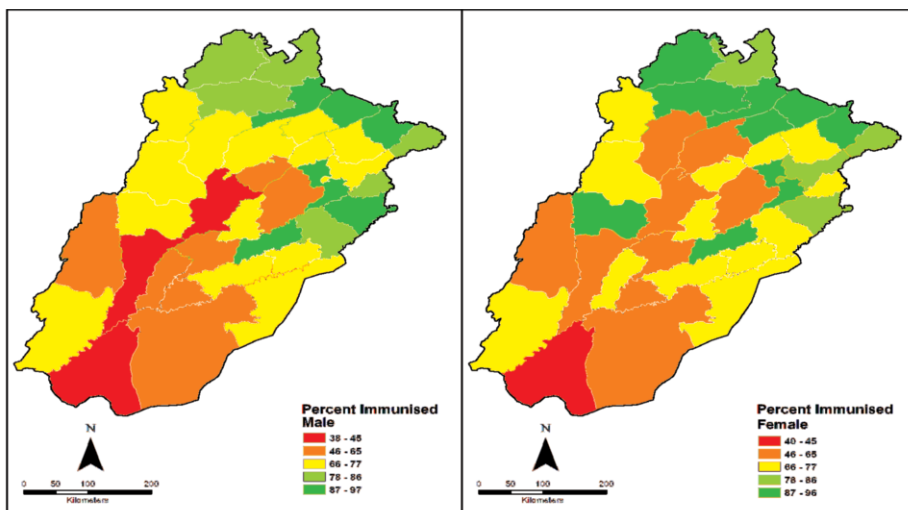


Figure-3: Map showing the proportion of fully immunised based on record by district in Punjab, disaggregated by gender.

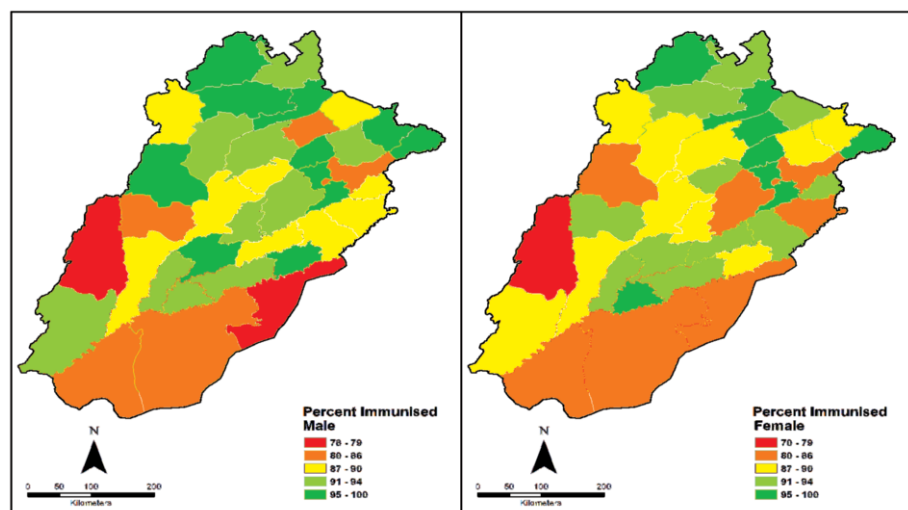


Figure-4: Map showing the proportion of fully immunised based on recall and record by district in Punjab, disaggregated by gender.

immunised ranged from 38% to 65%, while in another 14 districts immunisation percent ranged from 66% to 77%. While in 10 districts, the percentage of female children who were immunised ranged from 40% to 65%, and in another 13 districts immunisation percentage ranged from 66% to 77%. Figure 4 shows the gender disaggregated maps in terms of recall and record of full immunisation.

In 7 districts, the percentage of male children who were immunised ranged from 78% to 86%, while in another 9 districts immunisation percent ranged from 87% to 90%. While in 8 districts, the percentage of female children who were immunised ranged from 70% to 86%, and in another 10 districts immunisation percentage ranged from 87% to 90%.

Figure-5 shows three choropleth maps depicting gender differentials based on recall of at least one immunisation; full immunisation based on record; and full immunisation based on recall as well as record. Regarding recall of at least one immunisation, in 11 districts, males had higher percentage of immunisation compared to females; in 10 districts females had higher percentage of immunisation compared to males; while in 15 districts the immunisation percentage was the same for both gender groups. Regarding gender differentials for full immunisation based on record, in 17 districts, males had higher percentage of immunisation compared to females; in 18 districts females had higher percentage of immunisation compared to males; while in 1 district the immunisation percentage was the same for both gender groups. Regarding gender differentials for full immunisation based on recall as well as record, in 16 districts, males had higher percentage of immunisation

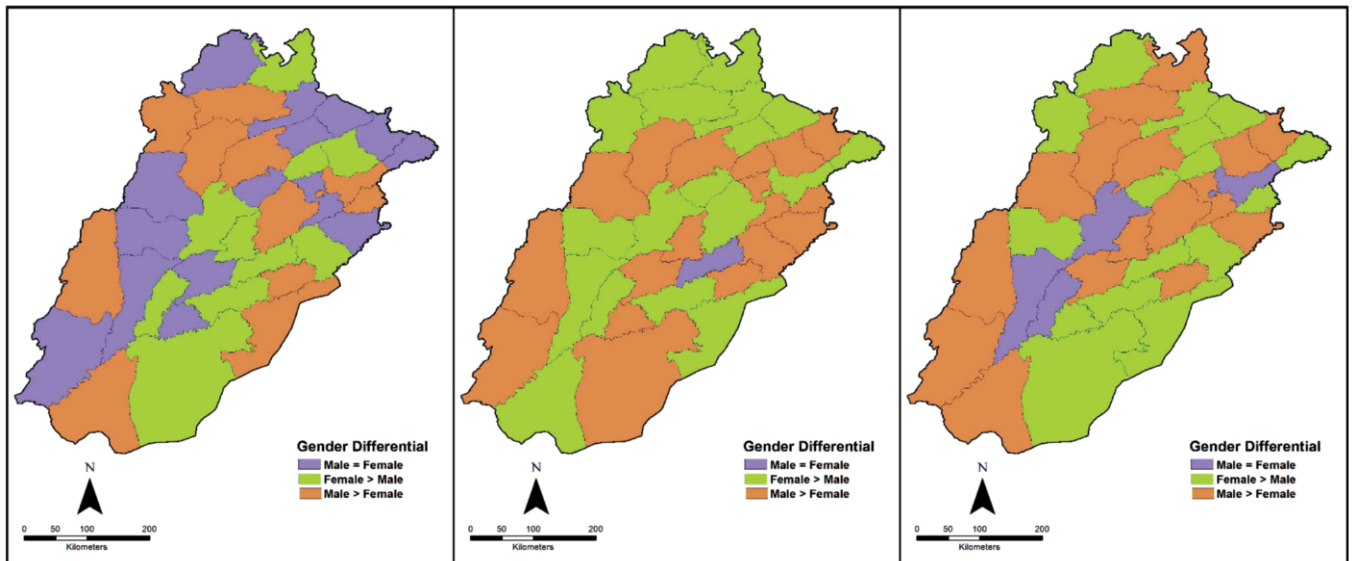


Figure-5: Map showing the gender differentials based on three immunisation indices: left map showing gender differentials based on recall of at least one immunisation, middle map showing gender differentials based full immunisation based on record, and right map showing gender differentials based on full immunisation based on recall as well as record.

compared to females; in 16 districts females had higher percentage of immunisation compared to males; while in 4 districts the immunisation percentage was the same for both gender groups.

Discussion

This is the first study on mapping of gender disaggregated district level representative data on immunisation for the province of Punjab for children aged 12 to 23 months. Although PSLM data for the 2014-15 survey was used, it would help determine baseline profile of immunisation status based on gender and to facilitate district level immunisation trends analysis when the next wave of PSLM will be released. Statistical differences in the immunisation levels by gender in Punjab, by the three indices mapped i.e. at least one immunisation based on recall; full immunisation based on record; full immunisation based on recall and record, did not show statistical differences.

Based on PSLM 2014-15, the immunisation coverage in Punjab was 99% for both genders, for at least one immunisation based on recall; 70% for both genders, for full immunisation based on record; while 90% for males and 89% for females, for full immunisation based on recall and record. However, mapping of gender disaggregated maps displaying immunisation proportions at district level show stark differences.

Understandably the highest immunisation proportions were reported for children with at least one immunisation based on recall. The lowest proportion was reported for males in the Rawalpindi district of 94%, while for females

the lowest proportion was reported for Sargodha district of 94%. In the Okara and Jhang districts the immunisation proportion ranged from 95%-96% for males, while in the districts of Bahawalnagar, Chakwal, and Khushab similar range of immunisation proportion was reported. As Figure-2 shows, in rest of the districts, immunisation proportions were 97% or above. Hence districts with lowest proportions were in the central and northern parts of province.

As Figure-3 shows, the lowest immunisation proportions were reported for full immunisation based on record alone. The lowest immunisation proportion was reported for males in the Rahim Yar Khan, Muzzafargarh, and Jhang districts for males in the range of 38% to 45%, while for females the lowest proportion was reported for the district of Rahim Yar Khan of 40%. The southern and central districts reported lower immunisation proportions, while northern and few eastern districts reported the highest immunisation proportions. None of the districts, for either gender, reported 100% immunisation coverage.

Compared to at least one immunisation based on recall, and full immunisation based on record alone, intermediate immunisation proportions were reported for full immunisation based on recall as well as record. For full immunisation based on recall and record, the lowest proportion was reported for males in the Dera Ghazi Khan and Bahawalnagar districts in the range of 78% to 79%, while for females the lowest proportion was reported in the district of Dera Ghazi Khan of 70%. As Figure-4 shows, the districts with lowest proportions were in the southern

and central parts of the province.

Regarding gender-based differences in the three immunisation indices studied, an interesting pattern emerged, that is depicted in the Figure-5. About equal number of districts for all three immunisation indices had where each gender group exceeded the other. For recall of at least one immunisation, about equal number of districts had males exceeding the females (11 districts), and females exceeding males (10 districts); similarly, for full immunisation based on record, 17 districts had males exceeding females, and in 18 districts females exceeded males; while for full immunisation based on recall and record, an equal number of districts i.e. in 16 districts immunisation proportions in males exceeded females and vice versa. Based on recall of at least one immunisation, in 15 districts the proportions were the same for both gender groups; for full immunisation based on record, in one district the immunisation proportion was the same; while for full immunisation based on recall and record, in the 4 districts, there was no difference in immunisation proportions in the two gender groups.

Collectively, the mapping of gender disaggregated, three immunisation indices at the district level illustrate that immunisation of 12-to-23-month children is wide spread in the Punjab province, but record keeping of immunisation by parents/guardians is an area that necessitates further exploration. In the southern and central districts, immunisation coverage was not at par with the northern districts. Finally, gender-based immunisation coverage proportions does show differentials that is a cause of concern. Disease mapping brings out these immunisation coverage differences and coverages in an easily understandable format that could help better plan, target, and deliver childhood routine immunisations in the province.

Gender and district-based disparities identified in immunisation coverage ostensibly reflect social, cultural, and economic factors that underpin them, in addition to

health beliefs, availability and access to immunisation sites. Depicting these disparities underscore the need for examination of factors driving them, for crafting better health policy plans and strategies.

Although, the data used, reflect the district-wise immunisation coverage for the year 2014-15. Nonetheless use of GIS to display the coverage and gender-based, district level disparities in immunisation coverage would help for trend analysis and benchmarking in the future spatial analyses.

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Conflict of Interest: None.

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