



Expanded Program on Immunization
Government of Pakistan

Third-Party Verification Immunization Coverage Survey
(TPVICS) Round 2

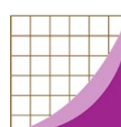
Vaccination Coverage Quality Indicators (VCQI) Analyses Survey Report

April 2023

Centre of Excellence in Women and Child Health
The Aga Khan University
and
Biostat Global Consulting



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Abbreviations

1YL	First year of life
AJK	Azad Jammu and Kashmir
AKU	Aga Khan University
BCG	Bacille Calmette-Guérin
CI	Confidence Interval
DLIs	Disbursement Link Indicators
EBs	Enumeration Blocks
EPI	Expanded Programme on Immunization
KP-NMD	Federally Administered Tribal Areas or Khyber Pakhtunkhwa Newly Merged Districts
GB	Gilgit-Baltistan
HBR	Home-based vaccination record (often called a <i>vaccination card</i>)
IPV	Inactivated Polio Vaccine
KP	Khyber Pakhtunkhwa
KP-NMD	Khyber Pakhtunkhwa Newly Merged Districts/ Federally Administered Tribal Areas
MCV	Measles-Containing Vaccine
MICS	Multiple Indicator Cluster Survey
MoNHSRC	Ministry of National Health Services Regulation & Coordination
NISP	National Immunization Support Project
NNS	National Nutrition Survey
OPV	Oral polio vaccine
OPWC	OPV coverage including evidence of coverage from campaigns (WC means <u>with</u> <u>campaigns</u>)
PBS	Pakistan Bureau of Statistics
PCV	Pneumococcal Conjugate Vaccine
PSUs	Primary Sampling Units
R1	TPVICS Round 1 Survey – with fieldwork in 2020 and early 2021
R2	TPVICS Round 2 Survey – with fieldwork in 2022
SOPs	Standard Operating Procedures
SSUs	Secondary Sampling Units
TPVICS	Third-party Verification Immunization Coverage Survey
VCQI	Vaccination Coverage Quality Indicators
WHO	World Health Organization

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List of Supplemental Files

This report is supplemented by 16 additional files available in an online Dropbox folder¹.

Supplement 01 - TPVICS R2 VCQI tables - sample demographics.xlsx

Supplement 02 - TPVICS R2 VCQI tables - overview output.xlsx

Supplement 03 - TPVICS R2 VCQI tables - supplementary detailed output.xlsx

Supplement 04 - TPVICS R2 VCQI tables - VCQI data quality report.xlsx

Supplement 05a - TPVICS R2 VCQI bar charts - vaccination coverage and timeliness charts.pptx

Supplement 05b - TPVICS R2 VCQI bar charts - vaccination coverage and timeliness tables.xlsx

Supplement 06 - TPVICS R2 VCQI maps - national maps only.pptx

Supplement 07 - TPVICS R2 VCQI maps - provincial and regional maps.pptx

Supplement 08 - TPVICS R2 VCQI bar charts - province and region level results.pptx

Supplement 09 - TPVICS R2 VCQI bar charts - district level results.pptx

Supplement 10 - TPVICS R2 VCQI tables - outcome comparisons between demographic subgroups.xlsx

Supplement 11 - TPVICS-R2 Questionnaire ENG Ver 3.9.docx

Supplement 12 - TPVICS-R2 Questionnaire URD Ver 3.9.docx

Supplement 13 - TPVICS VCQI R1 to R2 coverage comparison plots - district level.docx

Supplement 14 - TPVICS VCQI R1 to R2 coverage comparison tables - all levels.xlsx

Supplement 15 – TPVICS R2 VCQI district level overview posters.pdf

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¹ The folder of supplemental files for the Round 2 VCQI Analyses Report is:
<https://www.dropbox.com/sh/eu5ou0yv6mf6hla/AAByhkwnQNJVU1b5wL574Lra?dl=0>

The folder of supplemental files for the Round 1 VCQI Analyses Report is:
<https://www.dropbox.com/sh/dv7y5sq7erkd563/AADe6vUuBUulsV92IngQZ9Iua?dl=0>

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Executive Summary

The 2022 Third-Party Verification Immunization Coverage Survey (TPVICS) Round 2 – conducted by the Aga Khan University (AKU) with the support of the Federal Expanded Program on Immunization (EPI) – collected information about routine immunization for children aged 12-23 months across all districts in Pakistan. The primary purpose of the survey was to provide an independent verification of the validity of immunization coverage data reported by the provinces and districts in Years 3 and 5 of the National Immunization Support Program (NISP) on four Disbursement Link Indicators (DLIs). Secondary objectives were to measure additional indicators of vaccination coverage and assess factors potentially impacting coverage in Pakistan.

TPVICS employed a stratified cluster sampling approach designed to yield a sample representative at the health district level. Overall, 8,786 clusters, 113,878 households, and 108,089 children were covered in the Round 2 survey, which enrolled children born between April 2020 and August 2021. Survey data were weighted to make results representative at the levels of health district, province, and nation, and were used to develop vaccination coverage estimates for children who were aged 12-23 months at the time of the survey. Background, methods, and findings addressing TPVICS objectives are detailed in the main survey report [1]. The findings of the 2020-21 Round 1 survey are available in two earlier reports [2], [3].

This report supplements the earlier AKU Round 2 report by summarizing an additional set of coverage indicators that use children's birth dates and vaccination dates to assess vaccination coverage and timeliness and missed opportunities for simultaneous vaccination (MOSVs) in accordance with World Health Organization (WHO) recommendations. Vaccination coverage and its associated indicators were calculated using the WHO's freely available software known as Vaccination Coverage Quality Indicators (VCQI)² [4].

The Pakistan TPVICS Round 1 and 2 surveys are the largest vaccination coverage surveys in Pakistan's history: largest in terms of respondents aged 12-23 months (N=110,790 in Round 1 108,089 in Round 2) and largest in terms of number of administrative strata for which to summarize vaccination program performance (N=152 districts nested in 8 provinces and regions). To document all vaccination coverage indicators for each stratum thoroughly would take many hundreds of pages. Rather than document those findings here, this report is intended to serve as an overview of the available results and to facilitate further dialog with the stakeholders of vaccination in Pakistan. While we have highlighted some features in the outcomes that caught our attention, we expect that persons more familiar with Pakistan's immunization challenges and

² Note that some coverage outcomes differ slightly between this report and AKU's main report; usually the differences are a fraction of a percent. For some districts and provinces, this report suggests that coverage for some doses is very slightly higher than the results from the main report. The differences are due to a subtle distinction concerning whether and how to fill holes in vaccination evidence. If a child had evidence of receiving a later dose in a series, but was missing evidence for an earlier dose, the main report does not give credit for the earlier dose, whereas the VCQI software fills that hole in the evidence by conducting calculations as if the earlier dose was, indeed, recorded on the child's home-based vaccination card.

successes and interventions and investments will be able to glean additional information from this report and the online tables and maps and figures that accompany it.

In brief:

1. The datasets are representative of children aged 12-23 months at the time of the surveys.
2. Vaccination evidence for half or more of the children in the datasets come from photos of home-based vaccination records (HBRs), also known as *vaccination cards*.
3. After incorporating survey weights, the children with vaccination cards represent two-thirds of Pakistan's children aged 12-23m at the time of the Round 1 survey and 71% in Round 2.
4. Of the more than 750,000 dates transcribed from those ~55,000 cards in Round 1, and of the more than one million dates transcribed from more than 60,000 cards in Round 2, over 96% passed VCQI's data quality tests for expected relationships among dates.
5. Vaccination coverage indicators are summarized in tables, maps, and figures and results are stratified by geographic strata as well as demographic subgroups.
6. Vaccination coverage varies from very high in Punjab to very low in Balochistan. Individual indicators are tabulated and portrayed in figures for every district in the online files that accompany this report and accompany the Round 1 report.
7. Twenty percent of the doses with dates documented on cards were received more than two months late. and as the children got older they received more and more doses more than two months late.
8. Most tables with outcomes summarized by demographic category in this report show evidence of poorer outcomes among children of poorly educated mothers and children of poorer families. The education and wealth variables each have five levels and in many cases the color bars show monotonic stair-step evidence of correlation between the outcomes and those simple measures of socioeconomic status. This dataset could form the basis for careful follow-up multivariable logistic regression to calculate adjusted odds ratios of various outcomes, accounting for several family and respondent characteristics that were measured in the survey.
9. There is little evidence of disparity in outcomes between boys and girls, and where it was found, the differences were very modest³.
10. In Round 2, 40 of the 96 urban versus rural statistical hypothesis test comparisons were statistically significant. Two-thirds of the significant differences documented better outcomes among urban

³ Details are listed in the accompanying file named Supplement 10.

respondents. The other one-third documents better outcomes among rural respondents⁸.

11. In both rounds, the data from cards indicates that in more than 80% of documented vaccination visits, the vaccinators gave the child all the doses for which s/he was eligible.
12. Missed opportunities for simultaneous vaccination (MOSVs) were observed for about half the children who showed vaccination cards. Most of the MOSVs were for IPV. When children received either (Penta1/OPV1/PCV1/Rota1) or (Penta2/OPV2/PCV2/Rota2) after the age of 14 weeks, the vaccinators often did not also administer IPV, although they could have.⁴ In Round 2, MOSVs were observed for IPV1 for about 45% of children who showed cards. Of those who experienced IPV MOSVs, 85% did receive the dose at a later vaccination visit. We say that their MOSV was corrected. But 15% did not have any record or recollection of receiving the dose at a later visit. At the time of the survey, their IPV MOSV was still uncorrected.
13. MOSVs were observed for MCV1 for about 7.5% of Round 2 children who showed vaccination cards, and at the time of the MCV1 MOSV, most of those children were also just receiving doses due at 6- or 10- or 14-weeks even though they were more than 9 months old. Where MOSVs were observed, the vaccinators also did not administer MCV1 with the other doses. Of those with MOSVs for MCV1, 57% went on to receive it at a later visit and 43% had not received MCV1 by the time of the survey.
14. Changes in coverage from Round 1 to 2 at the provincial and regional levels were mostly modest with some consistent statistically significant declines in KP and GB and modest improvements in Sindh and KP-NMD. Some of the changes at the district level were of larger magnitude: some districts saw notable gains and some had consistent and notable decline in their outcomes; they are documented using maps in Annex C and with confidence interval figures in Supplement 13.

The online supplement files that accompany this report hold many hundreds of pages. They each have interesting features. If a reader looks at only two of those files, we recommend:

- 1) Supplement 05a – Vaccination coverage and timeliness charts for every province, region, and district. Those figures provide a lot of information in a small number of pages.
- 2) Supplement 06 – Maps of most outcomes for all districts. When reviewing the many maps, the reader will notice an overall pattern of excellent outcomes in Punjab, poor outcomes in Balochistan and KP-NMD, and a mix of good and poor outcomes elsewhere. (But note from the coverage and timeliness charts that even in Punjab

⁴ We note here that this outcome is not limited to Pakistan. We also see a predominance of IPV MOSVs in the 2018 DHS in Nigeria and both the 2016-17 and the 2021 UNICEF MICS-NICS in Nigeria.

where coverage is high, many doses are administered late, and note that the map of IPV1 MOSVs indicates many Punjabi children experience MOSVs for IPV1.)

If any sections of this report raise questions in the reader's mind, we would be happy to have a discussion and either point them toward the appropriate part of a supplement that might shed light on the question or formulate a plan to query the survey microdata or results datasets. If any of the supplements are confusing or overwhelming, we would be happy to schedule a videoconference to give a guided tour of what is available and to discuss what else might be possible. Finally, if it would be helpful to assemble province-specific or region-specific subsets of tables and figures, we can give advice on where to find what is wanted or assist with assembling curated subsets of the VCQI output. Please do not hesitate to contact Dale Rhoda with questions. (E-mail: Dale.Rhoda@biostatglobal.com)

1.0 Introduction

The 2020 Round 1 Third-Party Verification Immunization Coverage Survey (TPVICS) collected information about routine immunization for children aged 12-23 months across all districts in Pakistan, yielding data on a representative sample of 110,790 children aged 12-23 months. Round 1 was followed with an identical Round 2 survey in 2022 studying a new cohort of 108,089 children in the same age range. These are among the largest immunization coverage surveys ever conducted and their datasets yield a rich set of insights about the performance of the Expanded Programme on Immunization (EPI) in Pakistan.

The primary objective of the TPVICS was to provide an independent verification of the validity of immunization coverage data reported by the provinces and districts in Years 3 and 5 of the National Immunization Support Program (NISP) on four Disbursement Link Indicators (DLIs) developed by the Federal EPI:

- percentage of children aged 12-23 months in each province who are fully immunized⁵ (DLI 1)
- percentage of districts in each province reporting at least 80% coverage of Penta3 immunization in children between 12-23 months of age (DLI 2)
- percentage of children under two years of age with HBRs (also known as *vaccination cards*) available in each project province (DLI 8)
- percentage of children aged 12 to 23 months in each targeted city who are fully immunized (DLI 10).

Secondary objectives of the survey were to measure additional indicators of vaccination coverage and assess factors potentially impacting coverage in Pakistan. Specifically, TPVICS explored

- differences in immunization coverage across wealth quintiles
- vaccination coverage across vaccines recommended from birth to 9 months for a child to be considered “fully immunized” (i.e., BCG, four doses of OPV, three doses of DTP-HepB-Hib pentavalent vaccine, and three doses of PCV)
- source of vaccination information (e.g., vaccination card vs. caregiver recall), vaccination card availability
- vaccination coverage by urban/rural residency, sex of the child, level of maternal education, and household living standards
- reported reasons for not vaccinating a child and reasons for the lack of utilization of vaccination services nationwide

⁵ The DLI definition of *fully vaccinated* is the child had evidence of receiving BCG, four doses of OPV, three doses of DTP-HepB-Hib pentavalent vaccine, three doses of PCV, and one dose of measles vaccine.

- vaccination coverage at district, provincial, and national levels.

Background, methods, and findings addressing these primary and secondary objectives are reported in the TPVICS Round 2 Survey Report [1].

In addition to standard descriptions of vaccination coverage and card availability, the 2018 WHO *Vaccination Coverage Cluster Survey Reference Guide* recommends calculating and reporting additional analyses that use children's birth dates and vaccination dates to assess vaccination timeliness and missed opportunities for simultaneous vaccination (MOSVs) [5], [6]. The VCQI report for TPVICS Round 1 and this report for Round 2 summarize those indicators and present relevant results [3]. In some cases, the outcomes are summarized entirely and in some cases the report points to additional supplementary tables and maps and figures that hold additional detail.

2.0 Methods

Survey Sample Design & Sample Size

The Round 2 survey used the same design, the same strata, and the same clusters as the Round 1 survey. Within each cluster the teams revisited all the households and made a fresh list of those with children aged 12-23m. This new list served as the updated sampling frame from which a new sample of 13 households was selected for interviews.

The survey sample was designed to provide estimates of key indicators at the health district level. Data may also be aggregated across districts to provide representative estimates at provincial and national levels. The survey sample design and weight description from the Pakistan Bureau of Statistics (PBS) are appended as Annex A.

For the Round 1 survey design, administrative data from each district were assessed in the survey design phase and each district was classified into one of two categories: a) likely to have 80% or more children fully vaccinated, or b) likely to have fewer than 80% of children fully vaccinated. Districts likely to have high coverage were allocated 49 primary sampling units (PSUs or *clusters*) each. Those likely to have lower coverage were allocated 64 clusters. Recall that, given two estimated proportions based on the same sample size, the 95% confidence interval is wider for outcomes near 50% than for those near 0% or 100%. The strategy of assigning larger samples to districts with lower expected coverage was to make the precision of district-level outcomes more uniform than if all districts used a single fixed number of clusters. Table 5 in the Round 1 main survey report indicates the number of primary sampling units (PSUs) or clusters sampled in each district [2].

In each cluster, a field team enumerated all the households and established whether each had a child aged 12-23 months. A central sampling team used rigorously random selection to identify 13 households that had an eligible child to be interviewed, in hopes that each PSU would yield a completed interview with at least 10 eligible respondents. In Round 2, data collection teams visited each cluster and made a fresh listing of households that included at least one eligible child, aged 12-23m, and selected a sample of 13 households from that list.

Survey Data Collection

The TPVICS questionnaire is available in both English and Urdu; it is contained in Supplements 11-12 in the online folder of files that accompany this report. The Round 1 main survey report describes the process of collecting and processing the survey data [2]. In addition to asking questions of caregivers of children aged 12-23 months, the survey interviewers took digital photographs of the children's HBRs.

The questionnaire included questions about the number and kinds of consumer goods the respondents own, ranging from a television to a bicycle or car, and housing characteristics such as source of drinking water, toilet facilities, and flooring materials. Responses to those questions were used to calculate wealth quintiles whereby households are divided into five equal categories (lowest, second, middle, fourth, and highest), each encompassing 20% of the population [7], [8].

Data Quality Pre-Processing Using Human Review

Survey staff checked vaccination evidence transcribed from HBRs using an online dashboard. A data quality script identified nonsensical dates (e.g., September 31) and identified date combinations that appeared to violate the expected order relationships (e.g., vaccination date before the child's date of birth or vaccination dates out of order or vaccination dates after the survey interview date). Data collection supervisors and quality assurance team members checked dates flagged by the script at least twice. The dashboard included the capability to correct dates in cases where the photograph provided a clear picture and when the interviewer had made an initial data entry error.

Data Quality Pre-Processing by VCQI

Vaccination coverage and its associated indicators were calculated using the World Health Organization's freely available software known as Vaccination Coverage Quality Indicators (VCQI) [9]. The analyses were conducted using Stata version 17 [10] and assessed coverage for children who were aged 12-23 months at the time of the survey.

The TPVICS dataset was converted to be compatible with VCQI [11], [12]. VCQI employs its own data cleaning process that makes some edits to the data. Vaccination evidence for an individual dose can take the form of:

- a) a date from an HBR
- b) a tick mark from an HBR (indicating that there was a pen or pencil mark or signature indicating the child received the dose but there was no date or the date was illegible), or
- c) a yes/no/do not know caregiver recollection response concerning whether the child received the dose. If the caregiver said they did not know whether a dose was received, VCQI assumes that the child did not receive it.

In several well-defined circumstances, VCQI converts evidence in the form of a date to a tick mark before estimating coverage indicators. Dates are converted to simple yes/no tick marks under these conditions:

- If the date is only partially specified
- If the date is nonsensical (e.g., February 30 or September 31)
- If the date falls outside the possible period for eligible respondents (in this case, dates of birth should fall between 12 and 24 months before the survey interview and dates of vaccination should fall between the child's date of birth and the date of the survey interview)

- If doses in a series have dates that are equal (e.g., Penta1 date is the same as Penta2)
- If doses in a series have dates that are out of order (e.g., Penta2 date is before Penta1)

VCQI reports the number of dates that were converted to tick marks, and why.

Vaccination Coverage Indicators

VCQI was employed to calculate a set of indicators. Each indicator is described in detail in the VCQI software documentation. Calculation details are described in the *VCQI Working List of Vaccination Survey Analyses and Software Specifications* [13] and guidance for interpreting the outcomes and using them correctly in English language sentences is provided in the *VCQI Results Interpretation Quick-Reference Guide* [14]. VCQI's convention is that outcomes where all children are in the denominator are weighted and reported with confidence intervals whereas outcomes where only a subset of the children aged 12-23 months are in the denominator are unweighted and reported without confidence intervals. The outcome descriptions in this document and the footnotes accompanying tabular output annotate which outcomes are weighted.

Outcomes that do not rely on vaccination date data include the following:

1. Demographics – Weighted estimation of demographics of the households holding children aged 12-23 months sampled for each region and district including the percentage of respondents in urban/rural areas; percentage of children who are boys and girls; and the percentage of households categorized by years of maternal education, years of paternal education, wealth quintiles, and the first language of the head of the household.
2. Card availability – Weighted estimate of the proportion of children aged 12-23 months for whom a home-based record (HBR or *vaccination card*) was available to be seen.
3. Crude coverage – Weighted estimate of the proportion of children who had any evidence of receiving the dose, either via the home-based record (HBR) or via the recollections of the child's caregiver. Crude coverage is reported by dose.
4. Drop-out – Unweighted estimate of the proportion of children who began a dose series but did not complete it.
5. Fully vaccinated – Weighted estimate of the proportion of children who received all the doses in Pakistan's schedule for the first year of life (1YL) (excluding Rota⁶): BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV, MCV1.
6. Not vaccinated or Zero-dose – Weighted estimate of the proportion of children who did not receive any of the doses in the fully vaccinated list.

⁶ Rota doses were excluded from the definition because that is the vaccine most recently introduced into the national schedule.

Outcomes that make use of vaccination dates on HBRs:

7. Valid coverage – Weighted proportion of children with documented evidence of having received the dose when they were age eligible and, in the case of doses in a series, when sufficient time had elapsed since the previous dose.
8. Timeliness – Weighted proportion of children who had documented evidence of receiving the dose too early, within 28 days of the appropriate age, 1-2 months late, or more than two months late.
9. Dose interval assessment – Unweighted proportion of dose pairs in a series that were given with an interval that was too short (< 28 days), an appropriate interval of 28-56 days, or an interval that was too long (> 56 days).

Missed opportunities for simultaneous vaccination (MOSVs) – An MOSV occurs when a child receives one or more doses on a particular day but does not receive all the doses for which s/he was eligible.

10. Visits with MOSVs – Unweighted proportion of vaccination visits that include one or more MOSVs; these are reported by dose and proportion of visits with an MOSV for any dose.
11. Children with MOSVs – Unweighted proportion of children who experienced one or more MOSVs; these are reported by dose and MOSVs for any dose.
 - a. Corrected MOSVs – Unweighted proportion of doses that were missed at the first eligible visit but were received at a later visit.
 - b. Uncorrected MOSVs – Unweighted proportion of MOSVs that were still uncorrected at the time of the survey. Corrected and uncorrected MOSVs are reported by dose and overall.
 - c. Time to MOSV correction – Among children who missed a dose at their first eligible visit and received it later, unweighted median time to correction, in days⁷.
12. Consequence of eliminating MOSVs and early doses – Weighted proportion of children who would have had documented evidence of receiving a valid dose if every child with an HBR had received every dose they were eligible for at every one of their documented vaccination visits. (This outcome is summarized in Supplements 02, 06, 07, 08, and 09 but not discussed in the report.)

⁷ Of all the outcomes listed, Time to MOSV Correction is the only one not automatically summarized in tabular or graphic form by VCQI. We have developed an R Shiny app to explore this outcome interactively using a web browser and one of VCQI's output files. An opportunity to browse those results can be made available on request.

3.0 Results

The large volume of TPVICS output tables, maps, and figures stratified by 152 districts and by demographic variables is too large to fit practically in this document, so this report summarizes important outcomes using district level maps and province/region level tables and points the reader to additional resources in two online folders of files for additional detail. One folder holds supplemental files for the Round 1 survey and another holds supplemental files for Round 2 [15], [16].

Note that results for Khyber Pakhtunkhwa do not include districts in the former semi-autonomous Federally Administered Tribal Areas (FATA). FATA results are reported separately. In the Round 1 report, they are labeled FATA and in this report they are labeled KP-NMD for *Khyber Pakhtunkhwa – Newly Merged Districts*.

Map Orientation

Many of the outcomes described below are documented using sets of colored maps:

- 1) A national map showing outcomes at the province or region levels
- 2) A national map showing outcomes at the district level
- 3) A regional map for AJK showing results at the district level (includes district names)
- 4) A regional map for Balochistan showing results at the district level (includes district names)
- 5) A regional map for KP-NMD showing results at the district level (includes district names)
- 6) A regional map for GB showing results at the district level (includes district names)
- 7) A district map of Islamabad showing results at the district level (includes district names)
- 8) A regional map for KP showing results at the district level (includes district names)
- 9) A regional map for Punjab showing results at the district level (includes district names)
- 10) A regional map for Sindh showing results at the district level (includes district names)

Because of limited space, this document shows only national maps. If the reader is intrigued by the color of an individual district, s/he may consult the district keys in Annex B or the detailed maps in Supplement 07 to learn the name of the district and may consult the appropriate Excel table in the supplementary files to learn the precise indicator outcome values for that district.

Supplement 06 holds maps of many VCQI outcomes showing all 152 districts at a time on a single page. Supplement 07 contains the same maps as 06 as well as a magnified version of each outcome with one page per province or region including district names. Each outcome is also tabulated precisely, many with confidence intervals, in the Excel files that are Supplements 02 and 03. Most outcomes are summarized graphically with VCQI bar charts (one row per region or province) in Supplement 08 and figures with one bar per district in Supplement 09.

Sample Demographic Characteristics

The TPVICS Round 2 sample is representative of Pakistani children who were aged 12-23 months in mid-2022. Tables 3-1 to 3-5 summarize selected demographic characteristics of the households, parents, and children in the sample⁸. Subsequent tables in this section summarize coverage outcomes by maternal education, child sex, wealth quintile, and urban/rural status.

Additional detail on sample demographic characteristics at the national, regional, and district levels, is provided in Supplement 01.

Table 3-1. Total children aged 12-23 months, by sex and by urban/rural, Pakistan TPVICS 2022

	Boys (%)	Girls (%)	Rural (%)	Urban (%)	N
<i>Punjab</i>	51.4	48.6	63.1	36.9	23,253
<i>Sindh</i>	52.5	47.5	45.7	54.3	23,500
<i>Khyber Pakhtunkhwa</i>	52.4	47.6	80.7	19.3	16,532
<i>Balochistan</i>	56.3	43.7	74.3	25.7	24,629
<i>ICT Islamabad</i>	49.8	50.2	48.6	51.4	1,450
<i>KP-NMD</i>	56.7	43.3	96.6	3.4	5,711
<i>Total*</i>	52.1	47.9	61.5	38.5	95,075
<i>Azad Jammu and Kashmir</i>	51.1	48.9	82.9	17.1	7,411
<i>Gilgit Baltistan</i>	51.5	48.5	82.1	17.9	5,433

* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan

⁸ This report analyzes data for 107,919 children aged 12-23m whereas the main AKU report for the same survey analyzes data for an additional 170 children (or 0.1% more). The inclusion criterion for the two analyses differed very slightly, with this report using the date of birth transcribed from the home-based record or vaccination card, and the AKU report used the age given by the child's caregiver. For those 170 children, the card showed the child to be somewhat less than 12 months of age, so they were allocated to the younger cohort and not analyzed here. Including them would not make a noteworthy difference in any of the outcomes in this report.

Table 3-2. Years of education of mothers of children aged 12-23 months, Pakistan TPVICS 2022

	None (%)	Primary (1-5) (%)	Middle (6-8) (%)	Secondary (9-10) (%)	Higher (11 and above) (%)	N
<i>Punjab</i>	34.8	17.6	10.3	18.0	19.4	23,253
<i>Sindh</i>	54.8	10.2	4.4	14.2	16.3	23,500
<i>Khyber Pakhtunkhwa</i>	48.3	15.1	7.0	12.1	17.5	16,532
<i>Balochistan</i>	74.9	6.2	2.8	4.8	11.3	24,629
<i>ICT Islamabad</i>	18.0	10.4	8.8	19.8	43.0	1,450
<i>KP-NMD</i>	75.8	5.1	5.3	5.5	8.4	5,711
<i>Total*</i>	44.1	14.5	7.9	15.5	18.0	95,075
<i>Azad Jammu and Kashmir</i>	18.8	13.2	14.4	26.2	27.5	7,411
<i>Gilgit Baltistan</i>	42.3	9.2	7.0	17.6	23.9	5,433

* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan

Table 3-3. Years of education of fathers of children aged 12-23 months, Pakistan TPVICS 2022

	None (%)	Primary (1-5) (%)	Middle (6-8) (%)	Secondary (9-10) (%)	Higher (11 and above) (%)	N
<i>Punjab</i>	28.2	14.5	13.3	24.5	19.5	23,253
<i>Sindh</i>	42.5	11.7	5.7	16.7	23.4	23,500
<i>Khyber Pakhtunkhwa</i>	33.4	10.1	9.0	20.2	27.3	16,532
<i>Balochistan</i>	65.9	6.3	2.8	7.0	17.9	24,629
<i>ICT Islamabad</i>	15.9	6.9	9.7	20.8	46.6	1,450
<i>KP-NMD</i>	67.5	6.7	7.9	8.5	9.3	5,711
<i>Total*</i>	34.9	12.7	10.2	20.8	21.5	95,075
<i>Azad Jammu and Kashmir</i>	12.7	9.9	16.5	33.8	27.1	7,411
<i>Gilgit Baltistan</i>	33.5	8.2	7.2	22.2	28.9	5,433

* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan

Table 3-4. Household wealth quintile, Pakistan TPVICS 2022

	Lowest (%)	Poor (%)	Middle (%)	Rich (%)	Highest (%)	N
<i>Punjab</i>	3.4	8.6	15.1	27.6	45.2	23,253
<i>Sindh</i>	22.6	13.0	13.3	21.2	29.8	23,500
<i>Khyber Pakhtunkhwa</i>	7.5	14.7	24.3	28.3	25.1	16,532
<i>Balochistan</i>	29.9	26.2	20.7	13.3	9.9	24,629
<i>ICT Islamabad</i>	3.3	0.8	4.2	16.3	75.4	1,450
<i>KP-NMD</i>	27.2	38.1	25.0	8.1	1.6	5,711
<i>Total*</i>	10.6	11.8	16.0	24.9	36.7	95,075
<i>Azad Jammu and Kashmir</i>	2.4	9.6	20.6	38.3	29.1	7,411
<i>Gilgit Baltistan</i>	22.4	31.3	25.9	12.8	7.7	5,433

* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan

Table 3-5. First language of head of household, Pakistan TPVICS 2022

	Urdu (%)	Punjabi (%)	Sindhi (%)	Pashto (%)	Baluchi (%)	Siraiki (%)	Hindko (%)	Other (%)	N
<i>Punjab</i>	10.3	62.7	0.2	1.4	0.9	22.8	0.7	1.1	23,253
<i>Sindh</i>	23.4	5.0	41.3	5.4	5.3	9.1	4.2	6.2	23,500
<i>Khyber Pakhtunkhwa</i>	1.9	0.9	0.0	75.9	0.1	4.0	11.7	5.6	16,532
<i>KP-NMD</i>	1.7	0.9	8.2	30.7	35.7	3.6	0.1	19.2	24,629
<i>Balochistan</i>	32.4	39.6	0.6	21.4	0.1	1.8	1.6	2.6	1,450
<i>ICT Islamabad</i>	0.3	0.1	0.1	99.2	0.0	0.0	0.0	0.3	5,711
<i>Total*</i>	12.5	35.8	11.5	14.5	3.5	15.4	2.9	3.8	95,075
<i>Azad Jammu and Kashmir</i>	8.8	13.7	0.0	1.2	0.0	0.2	63.5	12.5	7,411
<i>Gilgit-Baltistan</i>	0.4	0.1	0.0	0.9	0.0	0.0	0.1	98.4	5,433

* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan.

Card or Home-Based Record (HBR) Availability

In Round 2, home-based records were seen for just over half (55.7%) the children in the survey, but after accounting for survey weights, that half represents 71.0% of children in the provinces, 77.2% in AJK and 54.8% in GB. Table 3-6 and Figures 3-1 and 3-2 show card availability by province and region and by demographic subgroups within the provinces and regions.

Additional data on card availability is provided in Supplements 02, 06, 07, 08, 09, 10, 13, 14, and 15.

A note on shaded table cells in this report

Each cell in Table 3-6 is shaded to portray the weighted proportion of children whose caregivers showed cards to the interviewers. If 100% of children had cards for a particular group, the table cell would be 100% filled with the color green. The point of shading the cells is to help the reader notice patterns of similarity or differences across categories. In this report, there are numerous examples where outcomes differ by maternal education or by wealth or by urban vs. rural. These come through as monotonic stair-step patterns in the tables. For example, focus for a moment on card availability by wealth quintile in Table 3-6:

- In AJK there is a very subtle increase in availability with wealth quintile, but the numbers are so similar, varying from 73.3% to 79.2%, that the cell shading does not form an obvious pattern.
- In contrast, in columns for Sindh, KP, Balochistan, and Total, there is a visually obvious stair-step pattern where the proportion of children with cards increased notably with increasing wealth.
- Special note: We have not indicated which differences are statistically significant. Supplement 10 summarizes results of tests of statistical significance. Most outcomes with obvious stair-step patterns in the tables have significant differences between the outcome of the top and bottom categories (poorest/lowest wealth versus richest/highest or most educated versus least educated).

A note on statistical significance of differences

In many cases, coverage outcomes differ notably by socio-economic indicators in this report. Differences by urban vs rural can be quite large and there are many outcomes for which the shaded cells show a stair-step pattern of better outcomes for children with caregivers who had more years of formal education and for children from wealthier families. VCQI assessed the statistical significance of these differences using a Rao-Scott survey-adjusted chi-squared procedure [17]–[19]. The results are reported in Supplement 10.

In each case, the null hypothesis is that there is no difference between population levels of the outcome between the first and second demographic groups being compared. Within each province and region, four comparisons were calculated:

1. Mothers with no formal education (0 years) versus those with 11 or more years of formal education
2. Boys versus girls
3. Those in the poorest (lowest) wealth quintile versus the richest (highest)
4. Children who live in urban clusters versus rural

These tests indicate that many of the differences in the tables are statistically significant, meaning that their p-value is smaller than 0.05. While small p-values are noteworthy, these results should be considered an initial exploration of differences, and not a thorough exposition [20]. In this report, p-values have not been adjusted for multiple comparisons and the analyses are simple bivariate chi-squared tests. For a more nuanced assessment of factors associated with coverage outcomes, the relationships should be examined using logistic regression and simultaneously adjusted for several demographic factors after assessing possible collinearity of the factors [21]. Further, both education and wealth are five-level variables and the simple tests reported here only examine differences between the lowest and highest levels. There are other tests that would yield a p-value for a trend instead of a difference between two levels. For this initial examination, the reader may combine their visual analysis of the trend in stair-step color bar lengths with the reported p-value of the difference between the top and bottom stairs to decide whether the relationship warrants additional consideration and analysis.

We have not reported on the significance of differences in outcomes *between* provinces and regions, only *within* those provinces and regions. There are very obvious differences in most outcomes between Balochistan and Punjab, for instance. If it is of interest to the readers, we could facilitate formal tests for any outcomes between any pairs or groups of strata.

A note on visual tests of statistical significance

All the vaccination coverage outcomes summarized in tables and maps in this report are tabulated in more detail in the supplemental files that accompany this report in an online folder [16]. Outcomes that are weighted include 95% confidence intervals in those tables. It may be of interest to conduct informal significance tests for outcomes, for example, between individual districts, by comparing the confidence intervals for two districts. This note is to remind the reader how to think about those tests [22]–[24].

Generally speaking:

- If the two confidence intervals do not overlap (e.g., coverage among urban children is estimated to be 80% [95% CI: 75.0-85.0] and among rural children it is 67.3% [95% CI: 60.0%-74.5%]), we can confidently say that the p-value for a formal hypothesis test would be smaller than 0.05. The difference may be described as *statistically significant*.
- If the intervals overlap, and the interval for one group contains the point estimate for the other group (e.g., coverage among urban children is 80% [95% CI: 75.0-85.0] and among rural children it is 72% [95% CI: 62.0%-82.0%]), we can confidently say that the p-value for a formal hypothesis test would be larger than 0.05. The difference in this case is *not statistically significant*.
- If the two intervals overlap, but neither group's interval contains the point estimate of the other group –e.g., coverage among urban children is 80% (95% CI: 75.0-85.0) and among rural children it is 72% (95% CI: 67.0%-77.0%) – then *more details are needed* and it will be prudent to obtain the survey microdata and conduct the hypothesis test. The p-value might be larger than or smaller than 0.05. To be clear, just because the two confidence intervals have some overlap, that is not grounds to say that the difference is not statistically significant. In many cases where the intervals overlap slightly, the result of the formal test is that the p-value is smaller than 0.05, and the difference is, indeed, statistically significant.

If a reader is interested in conducting hypothesis tests for specific outcomes and strata, the authors of this report can assist them by either conducting the tests on their behalf or helping them obtain the data and set up the syntax to do it themselves.

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Table 3-6. Card availability, by region & demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	82.5	62.3	58.9	23.0	65.5	53.3	71.0	77.2	54.8
Maternal Education (years)									
None	78.5	54.3	54.8	19.8	66.3	57.9	62.3	75.7	44.0
Primary (1-5)	85.0	65.2	64.1	29.6	71.2	41.1	77.2	79.3	44.6
Middle (6-8)	87.1	75.2	67.9	32.0	58.6	27.0	81.3	79.4	62.3
Secondary (9-10)	84.5	75.0	64.5	37.9	63.4	30.0	79.0	77.2	69.0
Higher (11 and above)	83.2	72.9	58.1	31.7	66.2	51.6	75.7	75.9	65.2
Sex									
Boys	82.7	62.2	58.2	21.8	66.1	50.9	70.6	77.2	55.9
Girls	82.3	62.4	59.6	24.6	65.0	56.5	71.4	77.2	53.6
Wealth									
Lowest	76.2	45.4	39.7	11.5	80.4	53.5	46.6	73.3	39.3
Second	76.2	55.3	53.3	21.3	70.1	58.4	60.3	75.6	53.2
Middle	79.5	59.3	58.3	23.2	58.8	50.2	67.2	76.3	63.7
Fourth	84.6	71.2	62.8	36.9	64.8	41.6	77.1	76.8	67.5
Highest	84.0	73.2	64.1	43.1	65.3	39.2	79.1	79.2	56.0
Area									
Urban	80.9	69.6	67.3	29.5	65.0		74.0	73.7	57.4
Rural	83.5	53.7	56.9	20.7	66.1		69.2	77.9	54.3
N	23,253	23,500	16,532	24,629	1,450	5,711	95,075	7,411	5,433
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is a population estimate that incorporates survey weights.									

Figure 3-1. Card availability, by region, Pakistan TPVICS 2022

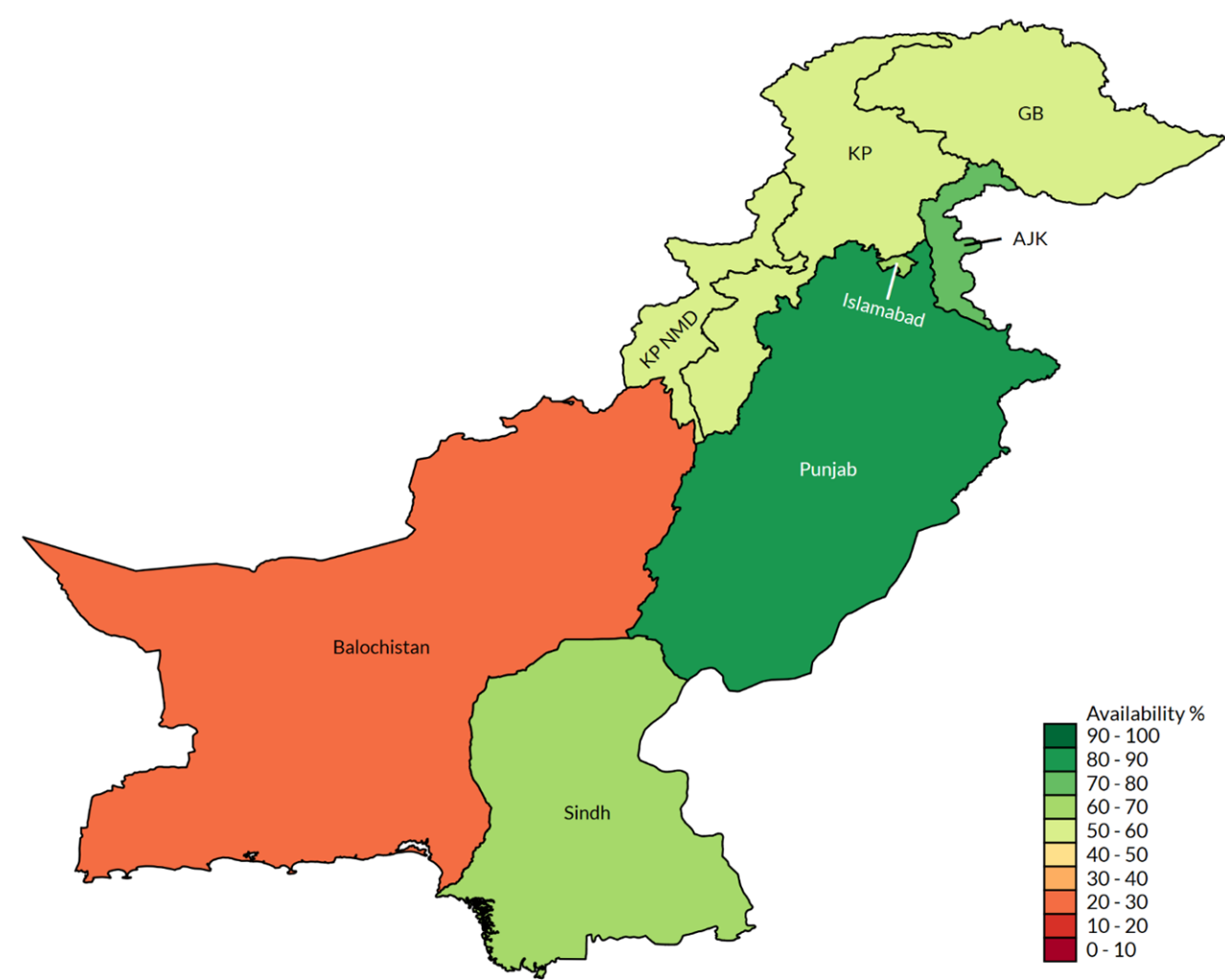
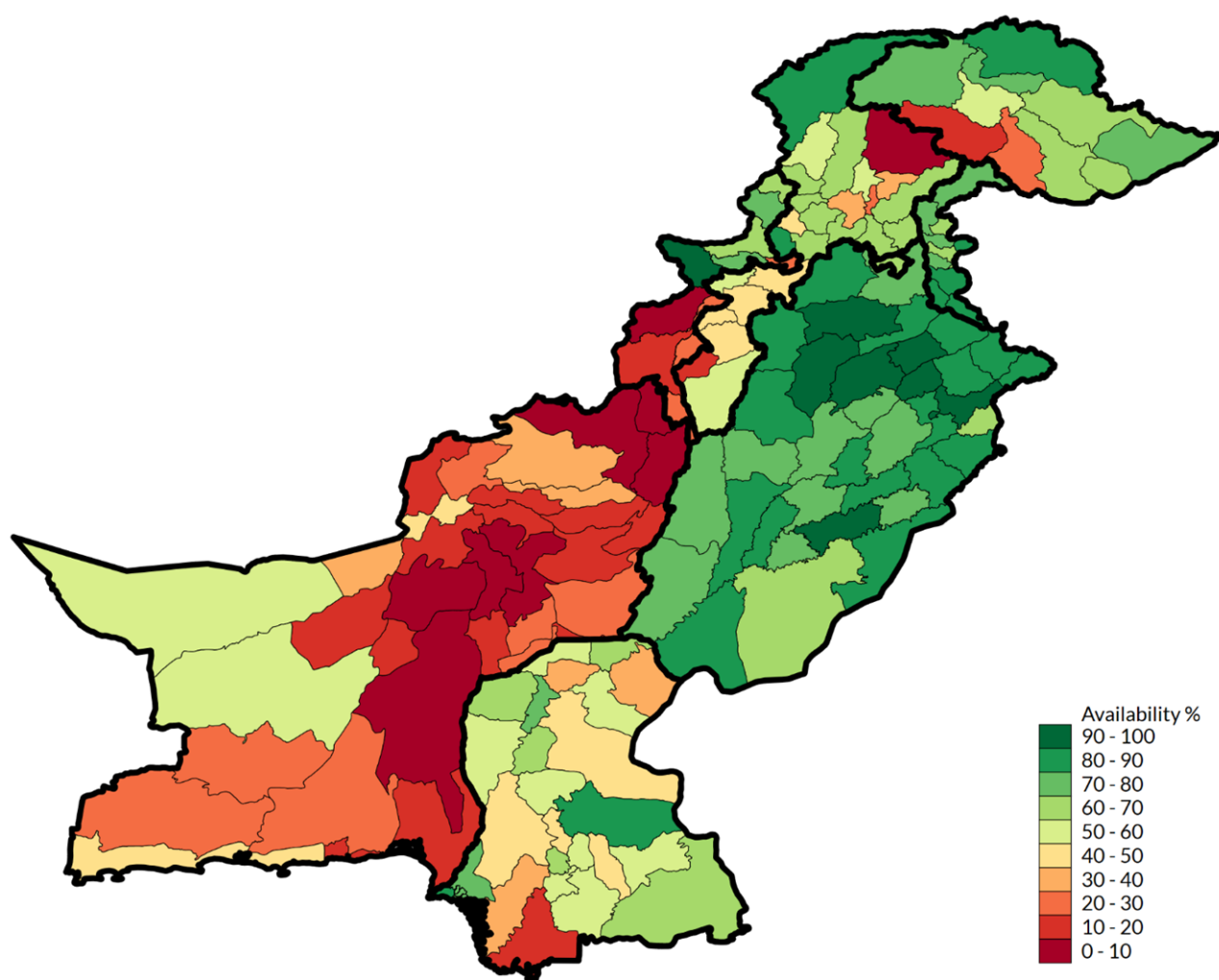


Figure 3-2. Card availability, by district, Pakistan TPVICS 2022



Note: The maps in Annex B show the names of every district. District level estimates are tabulated in Supplements 02 and 03 which are in the online folder of files accompanying this report [16].

Ever Received a Card

Some children received a card but their caregiver was not able to show it to the TPVICS interviewers. Table 3-7 and Figures 3-3 and 3-4 show the proportion of children whose caregivers reported that they had ever received a card. Comparing Tables 3-6 and 3-7, we see that the differences between the proportion who received and those who showed a card are quite substantial in some districts. The color bars in Table 3-7 show stair-step patterns of inequality by maternal education and wealth that are similar to the patterns in Table 3-6.

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Table 3-7. Ever had a card, by region and demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	96.1	87.6	83.2	63.6	88.9	74.3	90.4	97.1	83.5
Maternal Education (years)									
None	94.0	83.8	77.8	60.3	86.1	78.0	85.5	95.3	74.1
Primary (1-5)	97.3	89.7	89.1	72.8	87.9	59.1	94.1	98.1	73.7
Middle (6-8)	97.4	92.1	88.1	79.9	77.3	54.4	94.7	97.5	91.6
Secondary (9-10)	97.6	92.9	86.6	76.9	83.5	54.1	94.8	97.3	94.4
Higher (11 and above)	96.9	92.9	88.5	70.6	95.2	75.8	94.1	97.6	93.3
Sex									
Boys	96.1	87.1	83.1	63.3	90.6	73.2	90.1	97.1	84.0
Girls	96.2	88.1	83.2	63.9	87.2	75.7	90.9	97.2	83.0
Wealth									
Lowest	93.0	81.8	64.2	51.8	97.0	73.9	78.2	93.6	72.8
Second	94.5	84.1	78.4	65.3	95.6	79.9	85.4	96.8	79.5
Middle	95.1	87.5	83.0	67.2	84.5	69.4	89.1	97.2	90.5
Fourth	96.2	89.7	87.1	71.3	82.0	64.9	92.8	97.4	90.8
Highest	97.0	91.9	87.4	76.6	90.3	69.3	94.7	97.2	94.8
Area									
Urban	95.7	89.3	86.3	73.2	94.5		92.0	95.4	85.3
Rural	96.4	85.5	82.4	60.2	83.1		89.5	97.5	83.1
N	23,253	23,500	16,532	24,629	1,450	5,711	95,075	7,411	5,433
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is a population estimate that incorporates survey weights.									

Figure 3-3. Ever had a card, by region, Pakistan TPVICS 2022

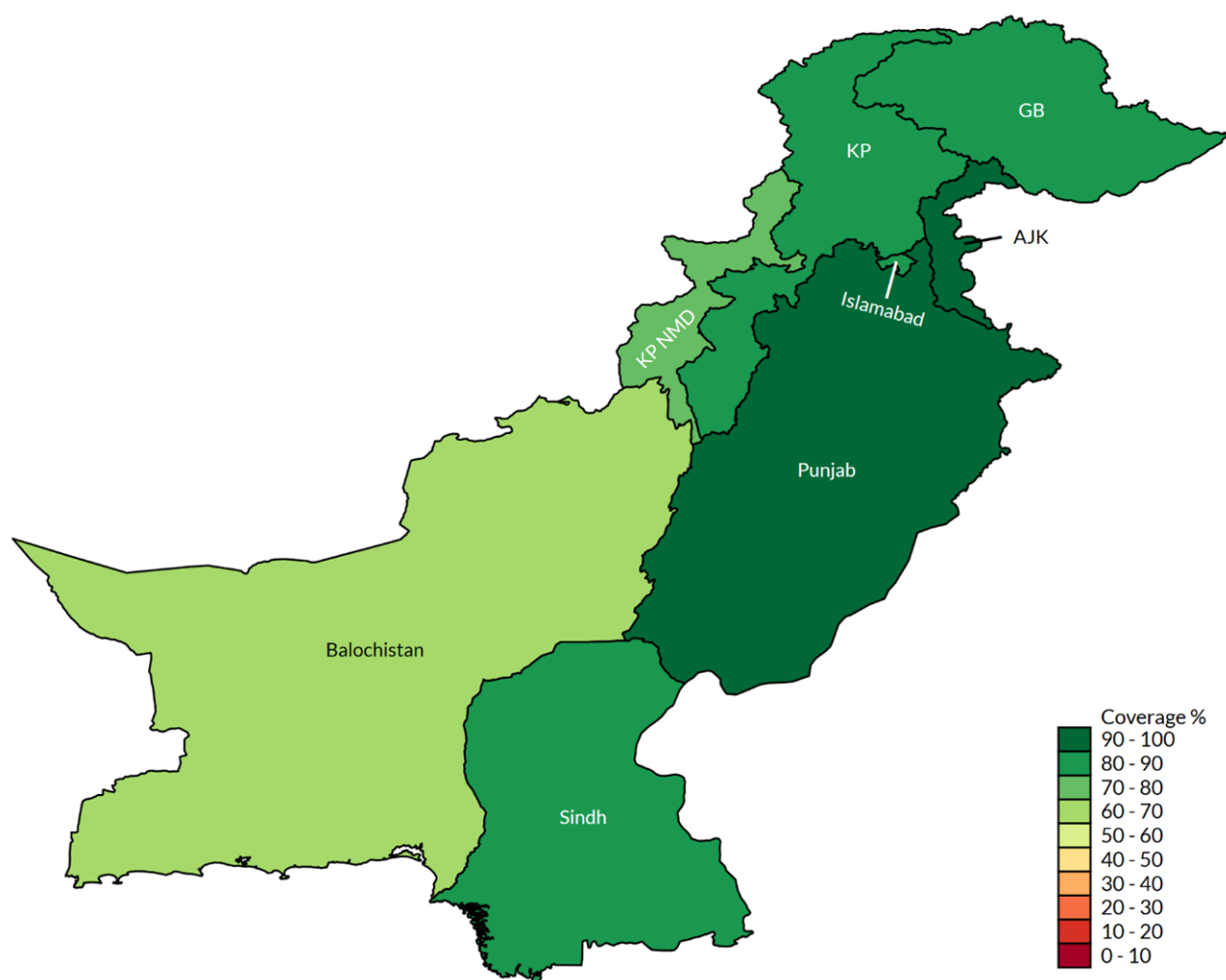
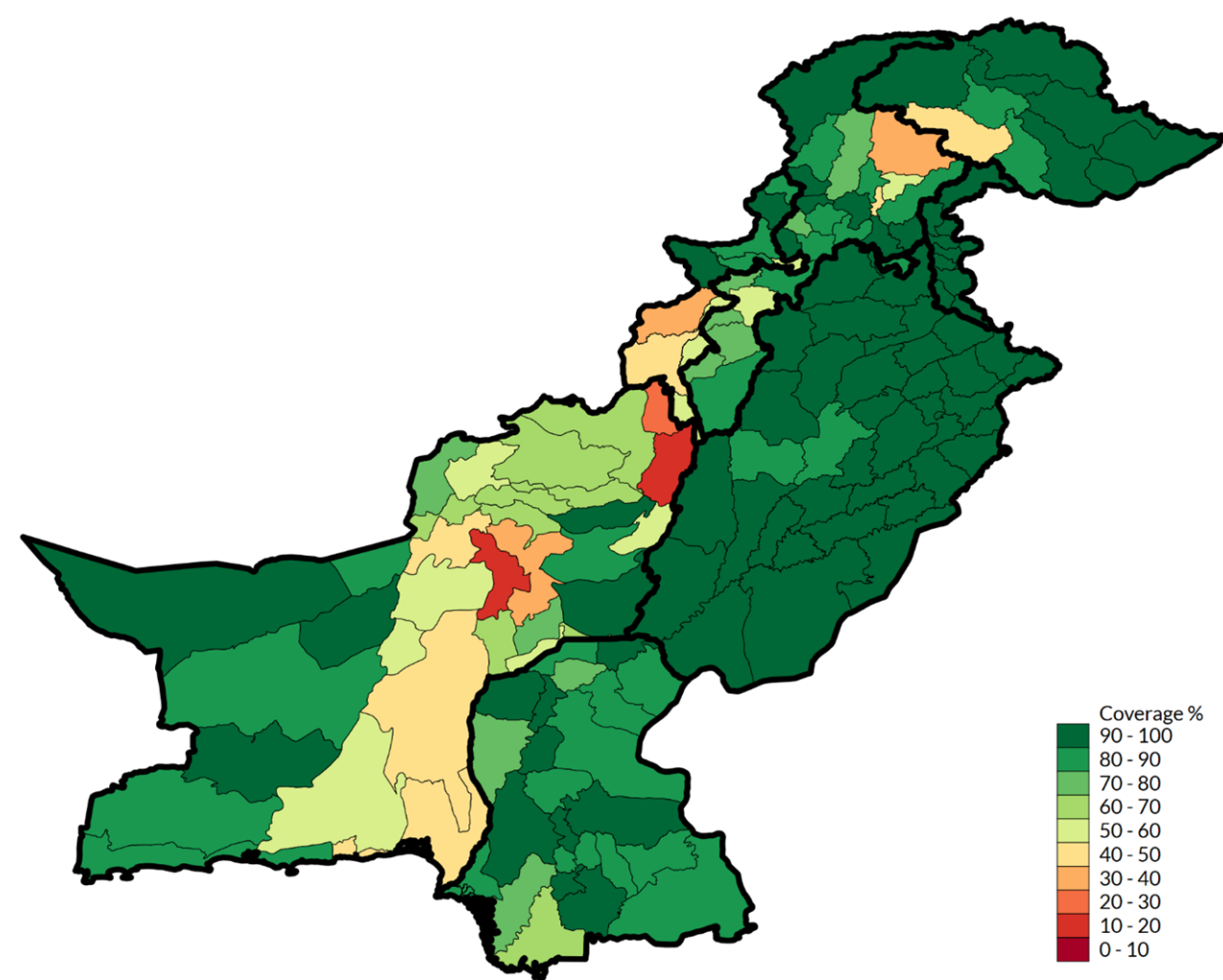


Figure 3-4. Ever had a card, by district, Pakistan TPVICS 2022



Vaccination Card Date Data Quality and Imputation of Missing Vaccination Evidence

It is encouraging that TPVICS interviewers viewed cards for children representing 71% of all children aged 12-23 months in Pakistan. This section reports on the face validity of the relationships between dates on individual cards. If the dates are appropriately ordered, we proceed with date-related analyses. If a large portion of dates were clearly of poor quality, we would pause and have doubts about the quality of data from home-based records in the TPVICS dataset.

VCQI analyzed Round 2 data for 107,919 children aged 12-23 months. Of those, 60,062 (55.7%) showed a card. The cards had an average of 17 dose dates each. Of the 1,022,991 vaccination dates recorded from cards, 481 (0.05%) were nonsensical dates 9,133 (0.89%) were earlier than the child's earliest possible vaccination date, and 1,980 (0.19%) were after the survey interview date. With dates for doses in a series, 7,369 (0.72%) were out of order and 4,098 (0.40%) consecutive doses held the same dates. Overall, 96.5% of the vaccination dates were sensible, fell within the proper date range, and passed all data quality checks. Dates that failed a quality check were replaced with tick marks so the suspicious dates would not

contaminate VCQI analyses of age-at-vaccination.

Furthermore, VCQI imputed missing vaccination evidence in the form of tick marks for 2,356 doses where the card showed evidence of a later dose in a series (e.g., PCV3), but was missing evidence for one or more earlier doses (e.g., PCV1 or PCV2). VCQI imputed tick marks for those earlier doses and the child received crude coverage credit not only for the later dose that was recorded on the card, but also for all the earlier doses in that same dose series. (By series we mean Penta1-3, OPV1-3, PCV1-3, Rota1-2, and MCV1-2.)

There is not an extensive set of data quality statistics to compare with, but 96.5% of dates with face validity is encouraging, so the dates are assumed here to be useful for determining the age at which children with cards were vaccinated, and useful for summarizing the performance of Pakistan's EPI program.

Additional information about data quality is provided in Supplement 04.

Vaccination Coverage and Timeliness

VCQI produces Vaccination Coverage and Timeliness Charts (VCTCs) that graphically portray card availability, vaccination coverage by dose⁹, timeliness by dose, dropout by dose series, and the portion of vaccination evidence that comes from dates on cards versus evidence that comes from caregiver recall. Each VCTC shows data for a single group of respondents, usually arranged by geographic stratum. Figure 3-5 is a VCTC for Pakistan (excluding AJK & GB). Figure 3-6 through Figure 3-13 are VCTCs for each province and region. Each of those figures is accompanied by a table (Table 3-8 - Table 3-18) that quantifies the percent of respondents in each category of timeliness for each dose. Additional information about vaccination coverage and timeliness at the national, province/region, and district levels is provided in Supplement 05a and 05b.

Observations from Figure 3-5

First, most of the evidence of vaccination in this survey comes from dates on HBRs. Cards were seen for respondents representing 71% of the population of children aged 12-23 months. And of the dates on the cards, 96.5% passed the quality tests and were usable for assessing timeliness of vaccination. Thus, most of the evidence for most doses came from cards and may be used to document the timeliness of each dose. In other words, most of the evidence appears in the deeply saturated colors to the left of the vertical gray 'Showed HBR' line.

Crude coverage of the birth doses and the doses scheduled to be delivered at age 6 weeks (OPV1, Penta1, PCV1, Rota1) is quite high, with OPV1 being slightly higher than the other 6-week doses, probably because

⁹ Note that the doses OPWC1, OPWC2, and OPWC3 mean that the child had evidence of receiving at least 1, 2, or 3 OPV doses, respectively, if we include evidence not only from the HBR and from caregiver recall of routine immunization doses received, but if we also include evidence of caregiver recall of doses received in polio campaigns. The letters 'WC' stand for with campaign dose evidence. By way of contrast, the coverage for OPV1-OPV3 only count evidence from the child's HBR and from the caregiver's recollection of OPV doses received via the routine immunization or EPI programme.

caregivers mix evidence of OPV vaccination campaigns with their recollections of doses received via routine immunization delivery mechanisms. The OPVWC doses, where we explicitly include evidence of both routine and campaign doses, are the doses with highest coverage, exceeding even the coverage for BCG. There is dropout evident in every dose series. For OPV, 91.7% received the first dose but only 85.4% received OPV3. A survey-weighted estimate of OPV1 to 3 dropout is, then, $(91.7-85.4)/(91.7) = 6.9\%$. We might say that 6.9% of children who began the OPV1-3 series had not finished it by the time of the survey.

Figure 3-5. Vaccination coverage and timeliness, Pakistan (excluding AJK & GB), Pakistan TPVICS 2022

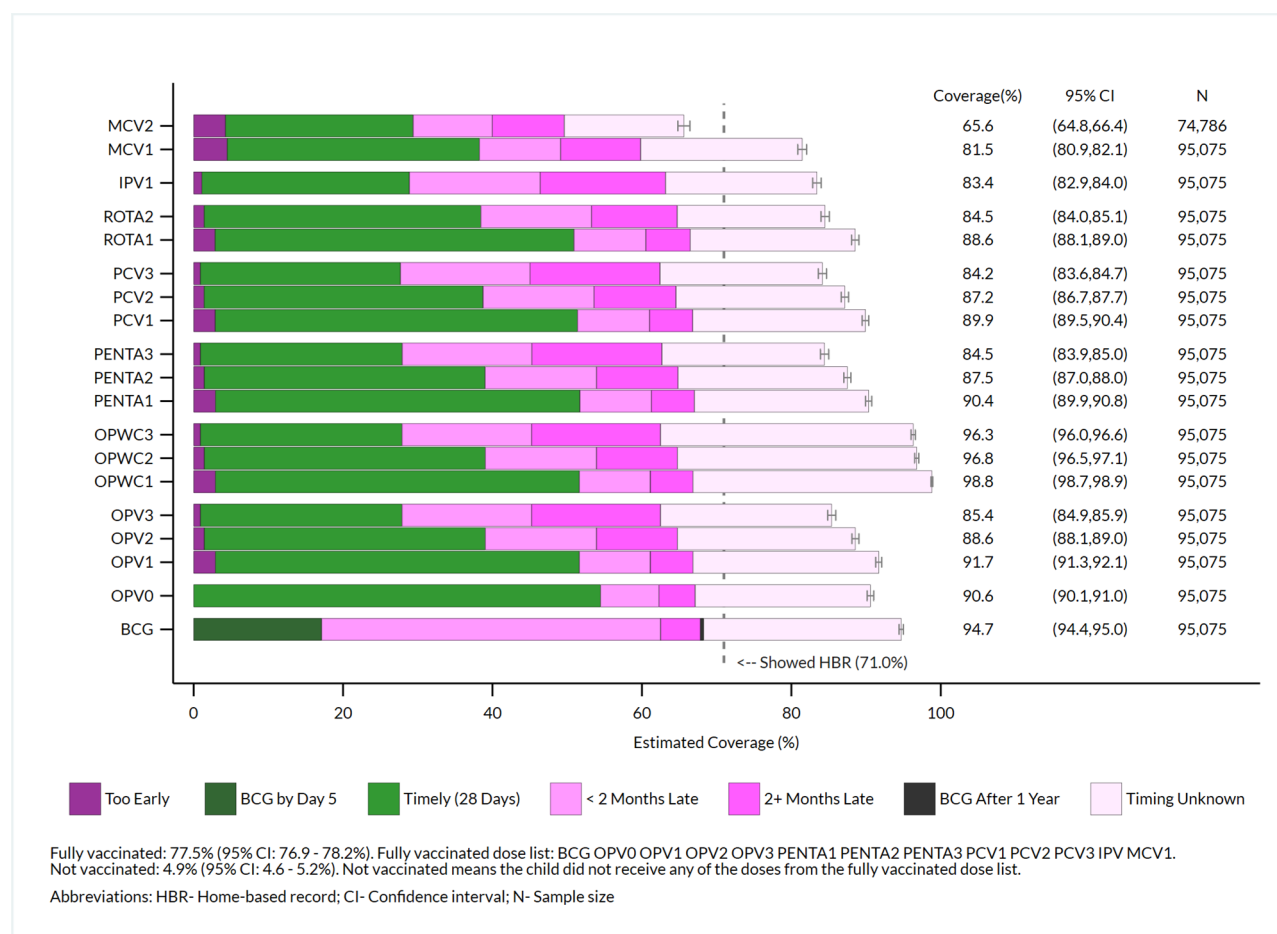


Table 3-8. Vaccination coverage bar segment lengths (%), Pakistan (excluding AJK & GB), Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	4.3	25.1	10.6	9.6	16.0
MCV1	4.5	33.8	10.9	10.7	21.6
IPV	1.1	27.8	17.5	16.8	20.3
ROTA2	1.4	37.0	14.8	11.5	19.8
ROTA1	2.9	48.0	9.6	5.9	22.1
PCV3	0.9	26.8	17.4	17.4	21.8
PCV2	1.4	37.3	14.9	11.0	22.6
PCV1	2.9	48.5	9.6	5.8	23.1
PENTA3	0.9	27.0	17.4	17.4	21.8
PENTA2	1.4	37.6	14.9	10.9	22.7
PENTA1	2.9	48.8	9.6	5.8	23.3
OPWC3	0.9	27.0	17.3	17.3	33.8
OPWC2	1.4	37.6	14.9	10.8	32.1
OPWC1	2.9	48.7	9.5	5.7	32.0
OPV3	0.9	27.0	17.3	17.3	22.9
OPV2	1.4	37.6	14.9	10.8	23.8
OPV1	2.9	48.7	9.5	5.7	24.9
OPV0	0.0	54.5	7.8	4.8	23.5
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	17.1	45.4	5.3	0.4	26.4

While dropout is evaluated by looking at the tips of the bars and seeing that they are shorter for later doses, it is also informative to look at the portion of doses that are timely (given within 28 days of the age when they are due) for earlier and later doses. In each dose series we note that the green portion of the bar, which represents timely doses, is longest for the first dose and notably shorter for the last dose. Similarly, in each series, the dark pink portion of the bar, which represents doses given 2+ months late is shortest for the first dose and substantially longer for the last dose. A large portion of children in this sample received their vaccinations one or more months late and a very notable portion received the later doses in the schedule very late.

Orientation to VCQI VCTCs

1. The coverage estimates portrayed in VCTCs use survey weights and account for the complex sample design.
2. Each bar estimates the % of children in the geographic stratum with evidence of receiving the dose.
3. The estimates combine evidence from a HBR or card and caregiver recall.
4. Each figure indicates the % of respondents who showed an HBR.
5. The color-saturated portion of each bar, to the left of the vertical HBR line, summarizes what we know about timeliness, based on the children's dates of birth and vaccination dates.
6. The light pink portion at the far right of each bar summarizes the % who received the dose for whom timeliness is not known – primarily because that evidence comes from caregiver recall, or in some cases from an illegible or nonsensical date on the HBR.
7. Note that you can easily perceive the degree of dropout by noting how the bars for later doses are shorter than those for early doses.
8. All the doses except BCG use the same color scale in the legend.
9. BCG uses two additional colors: timely if received by age 5 days (dark green) and egregiously late if received after age 1 year (black).
10. Each bar includes a 2-sided 95% survey adjusted Wilson type confidence interval.
11. Each figure is accompanied by a table that documents the precise length of the segments of the bar.
12. Footnotes document the % of children fully vaccinated with the doses the child should receive in the first year of life (excluding rotavirus vaccine) and the % of children not vaccinated with any of those doses.

Province and Regional Results

Figure 3-6. Vaccination coverage and timeliness: Punjab, Pakistan TPVICS 2022

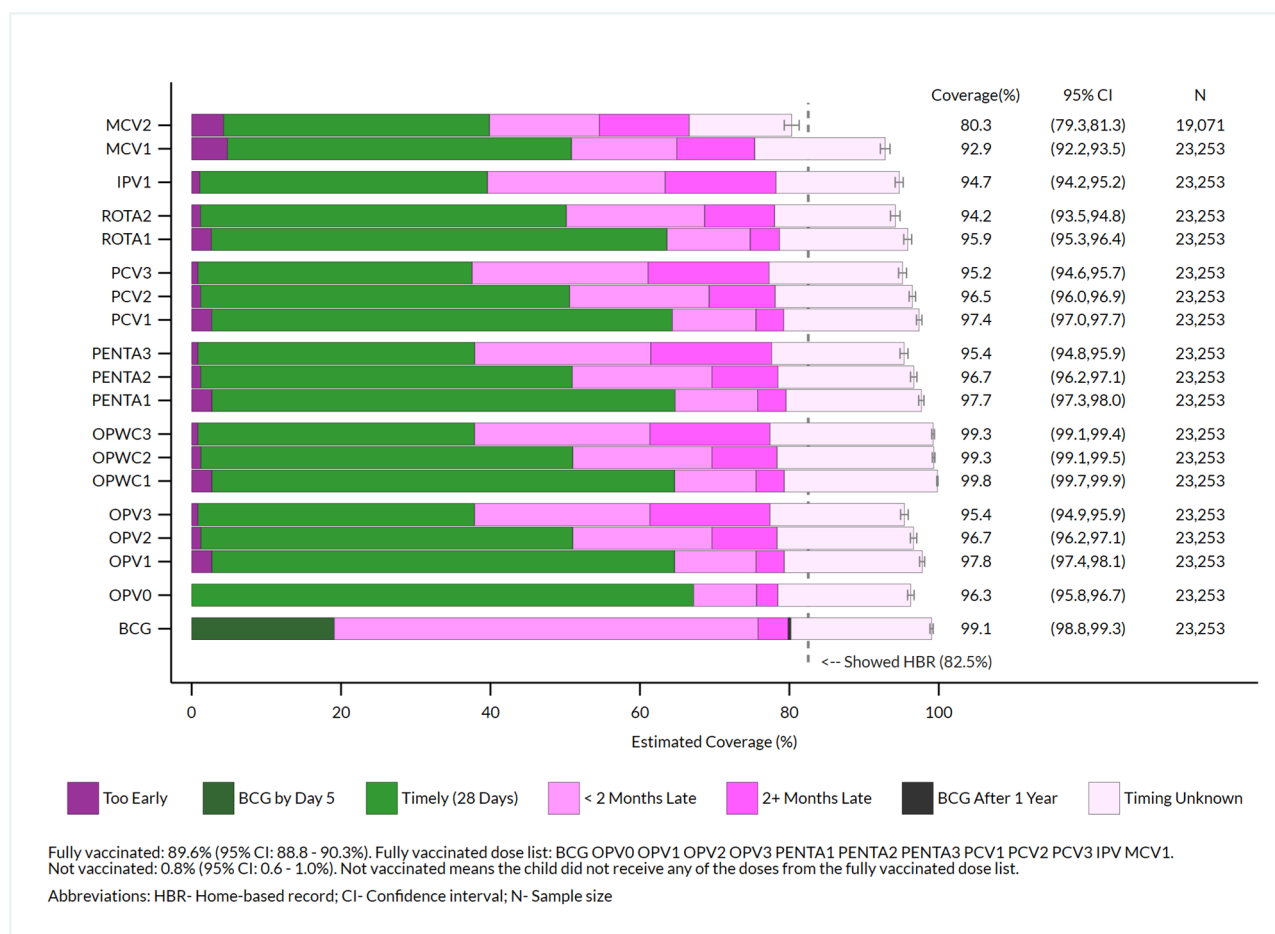


Table 3-9. Vaccination coverage bar segment lengths (%), Punjab, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	4.3	35.6	14.7	12.0	13.8
MCV1	4.8	46.0	14.1	10.4	17.5
IPV	1.1	38.5	23.8	14.8	16.5
ROTA2	1.2	49.0	18.5	9.4	16.2
ROTA1	2.6	61.0	11.1	3.9	17.2
PCV3	0.8	36.7	23.5	16.2	17.9
PCV2	1.2	49.4	18.7	8.8	18.4
PCV1	2.7	61.7	11.2	3.7	18.1
PENTA3	0.8	37.1	23.5	16.2	17.7
PENTA2	1.2	49.7	18.7	8.8	18.2
PENTA1	2.7	62.0	11.0	3.8	18.1
OPWC3	0.8	37.0	23.5	16.1	21.9
OPWC2	1.2	49.8	18.6	8.7	21.0
OPWC1	2.7	61.9	10.9	3.8	20.5
OPV3	0.8	37.0	23.5	16.1	18.0
OPV2	1.2	49.8	18.6	8.7	18.3
OPV1	2.7	61.9	10.9	3.8	18.5
OPV0	0.0	67.2	8.4	2.9	17.8
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	19.1	56.8	4.0	0.4	18.8

Figure 3-7. Vaccination coverage and timeliness: Sindh, Pakistan TPVICS 2022

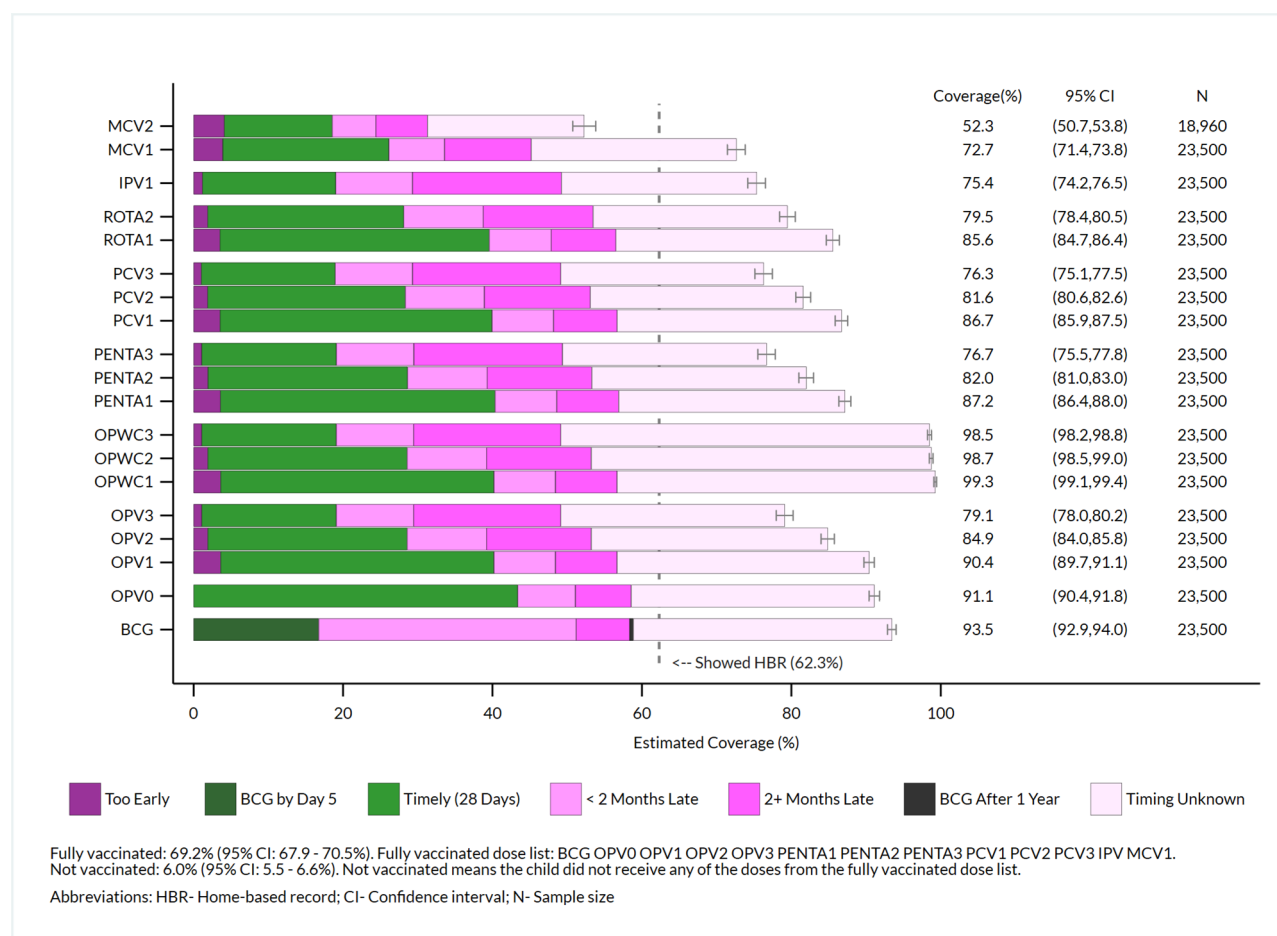


Table 3-10. Vaccination coverage bar segment lengths (%), Sindh, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	4.1	14.4	5.8	6.9	21.0
MCV1	3.9	22.2	7.5	11.6	27.5
IPV	1.2	17.8	10.3	19.9	26.1
ROTA2	1.9	26.2	10.6	14.7	26.0
ROTA1	3.5	36.0	8.3	8.7	29.1
PCV3	1.0	17.9	10.3	19.9	27.2
PCV2	1.9	26.5	10.6	14.2	28.5
PCV1	3.5	36.4	8.2	8.5	30.1
PENTA3	1.1	18.0	10.4	19.9	27.3
PENTA2	1.9	26.7	10.7	14.0	28.7
PENTA1	3.6	36.7	8.3	8.3	30.3
OPWC3	1.1	18.0	10.4	19.7	49.4
OPWC2	1.9	26.7	10.6	14.0	45.5
OPWC1	3.6	36.6	8.2	8.2	42.6
OPV3	1.1	18.0	10.4	19.7	30.0
OPV2	1.9	26.7	10.6	14.0	31.7
OPV1	3.6	36.6	8.2	8.2	33.8
OPV0	0.0	43.4	7.7	7.5	32.6
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	16.7	34.5	7.2	0.5	34.6

Figure 3-8. Vaccination coverage and timeliness: Balochistan, Pakistan TPVICS 2022

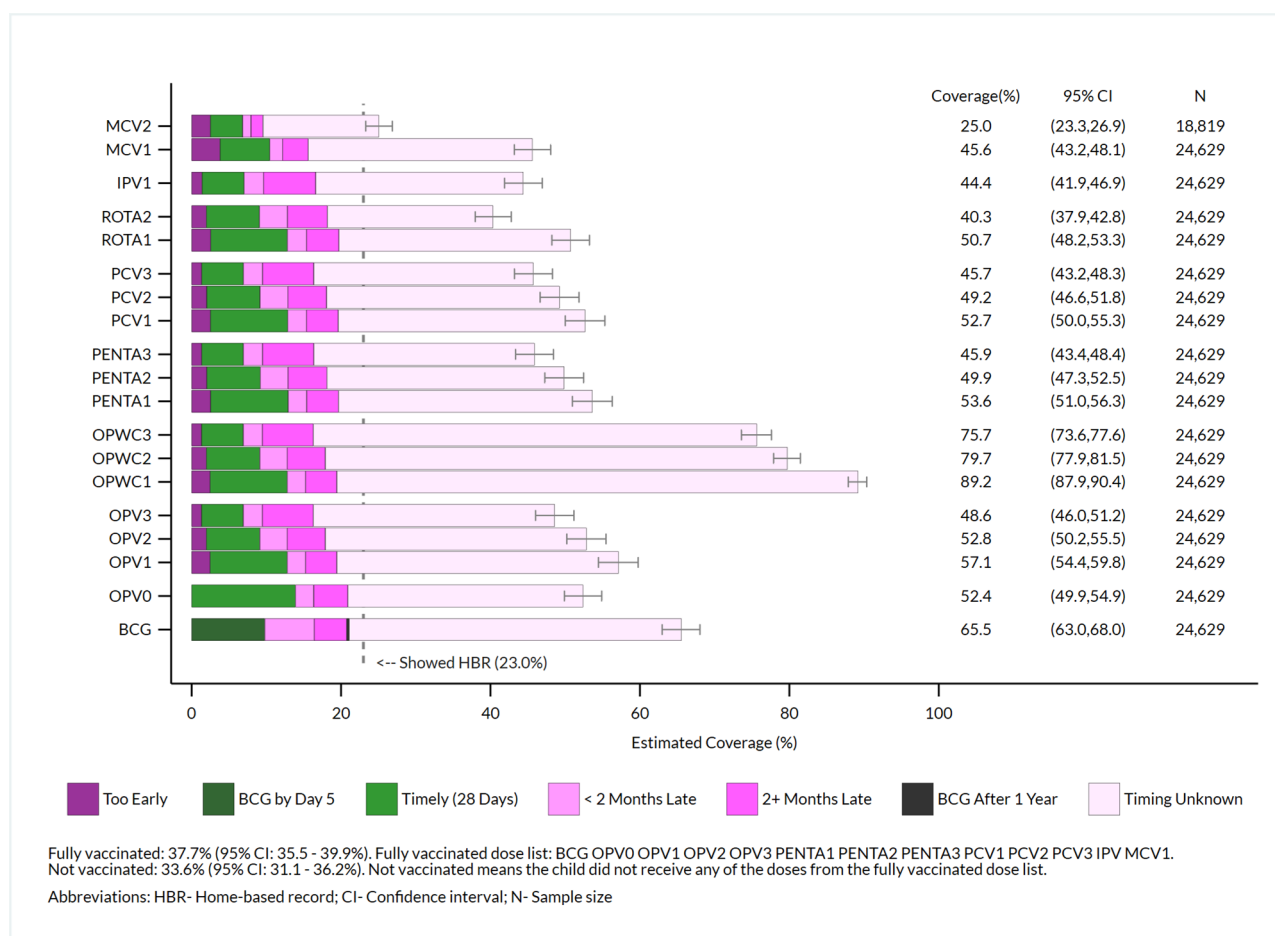


Table 3-11. Vaccination coverage bar segment lengths (%), Balochistan, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	2.5	4.3	1.1	1.6	15.5
MCV1	3.8	6.6	1.7	3.4	30.0
IPV	1.4	5.6	2.6	7.0	27.8
ROTA2	2.0	7.1	3.7	5.4	22.2
ROTA1	2.5	10.3	2.6	4.3	31.0
PCV3	1.3	5.6	2.6	6.9	29.4
PCV2	2.0	7.1	3.7	5.2	31.2
PCV1	2.5	10.4	2.5	4.2	33.1
PENTA3	1.3	5.6	2.6	6.9	29.5
PENTA2	2.0	7.2	3.7	5.2	31.8
PENTA1	2.5	10.4	2.5	4.3	34.0
OPWC3	1.3	5.6	2.6	6.8	59.4
OPWC2	2.0	7.1	3.7	5.1	61.9
OPWC1	2.5	10.3	2.5	4.2	69.8
OPV3	1.3	5.6	2.6	6.8	32.3
OPV2	2.0	7.1	3.7	5.1	35.0
OPV1	2.5	10.3	2.5	4.2	37.7
OPV0	0.0	13.9	2.4	4.6	31.5
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	9.8	6.6	4.3	0.3	44.5

Figure 3-9. Vaccination coverage and timeliness: Islamabad, Pakistan TPVICS 2022

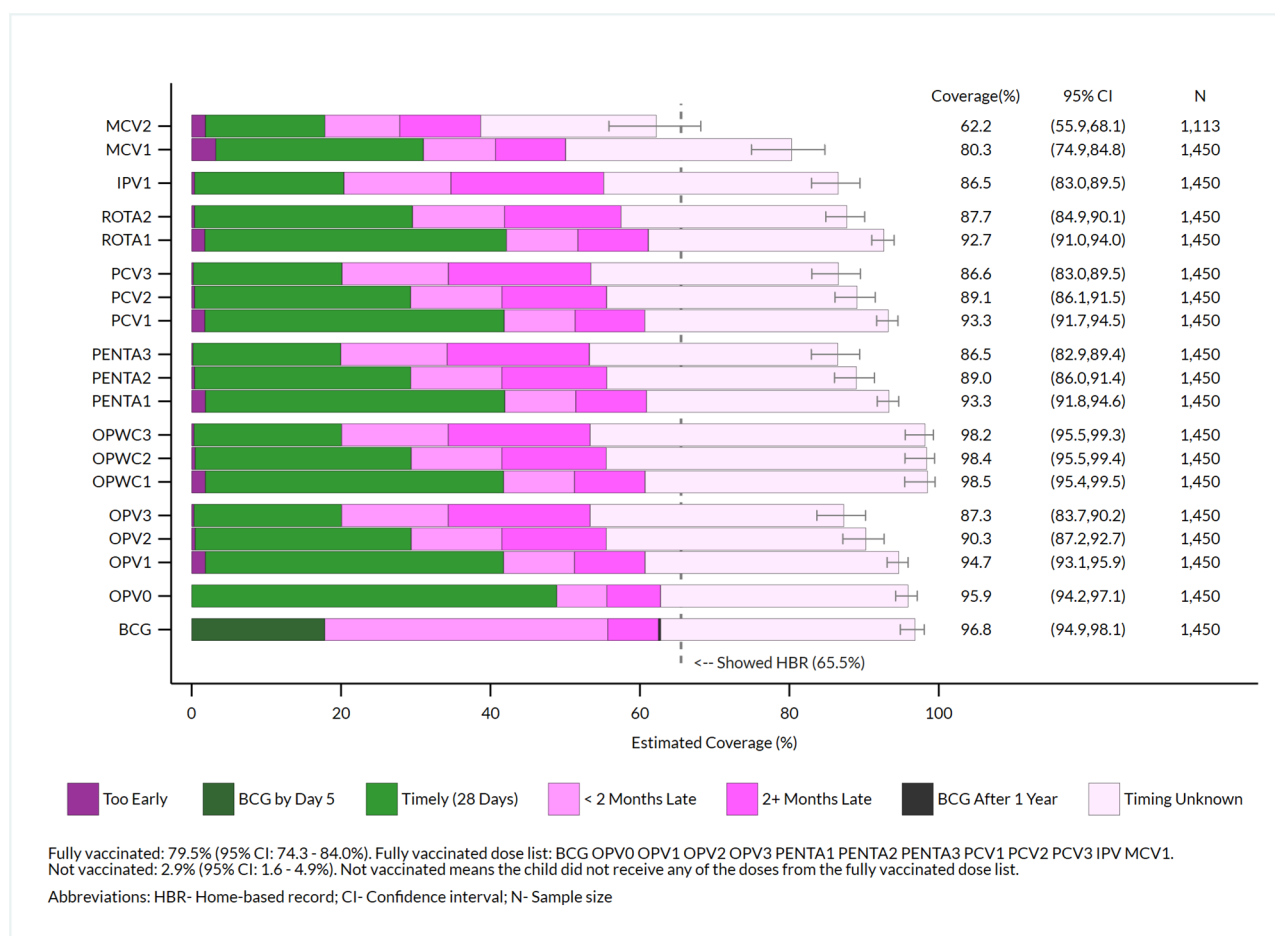


Table 3-12. Vaccination coverage bar segment lengths (%), Islamabad, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	1.8	16.0	10.0	10.8	23.5
MCV1	3.2	27.8	9.6	9.4	30.3
IPV	0.4	20.0	14.3	20.5	31.4
ROTA2	0.4	29.2	12.3	15.6	30.2
ROTA1	1.8	40.4	9.6	9.4	31.5
PCV3	0.3	19.9	14.2	19.1	33.2
PCV2	0.4	28.9	12.2	14.0	33.5
PCV1	1.8	40.1	9.5	9.3	32.6
PENTA3	0.2	19.8	14.2	19.0	33.3
PENTA2	0.4	28.9	12.2	14.1	33.4
PENTA1	1.8	40.1	9.5	9.5	32.5
OPWC3	0.3	19.8	14.3	19.0	44.9
OPWC2	0.5	28.9	12.1	14.0	42.9
OPWC1	1.8	39.9	9.5	9.4	37.8
OPV3	0.3	19.8	14.3	19.0	34.0
OPV2	0.5	28.9	12.1	14.0	34.8
OPV1	1.8	39.9	9.5	9.4	34.0
OPV0	0.0	48.9	6.7	7.2	33.2
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	17.8	37.9	6.8	0.3	34.0

Figure 3-10. Vaccination coverage and timeliness: Khyber Pakhtunkhwa, Pakistan TPVICS 2022

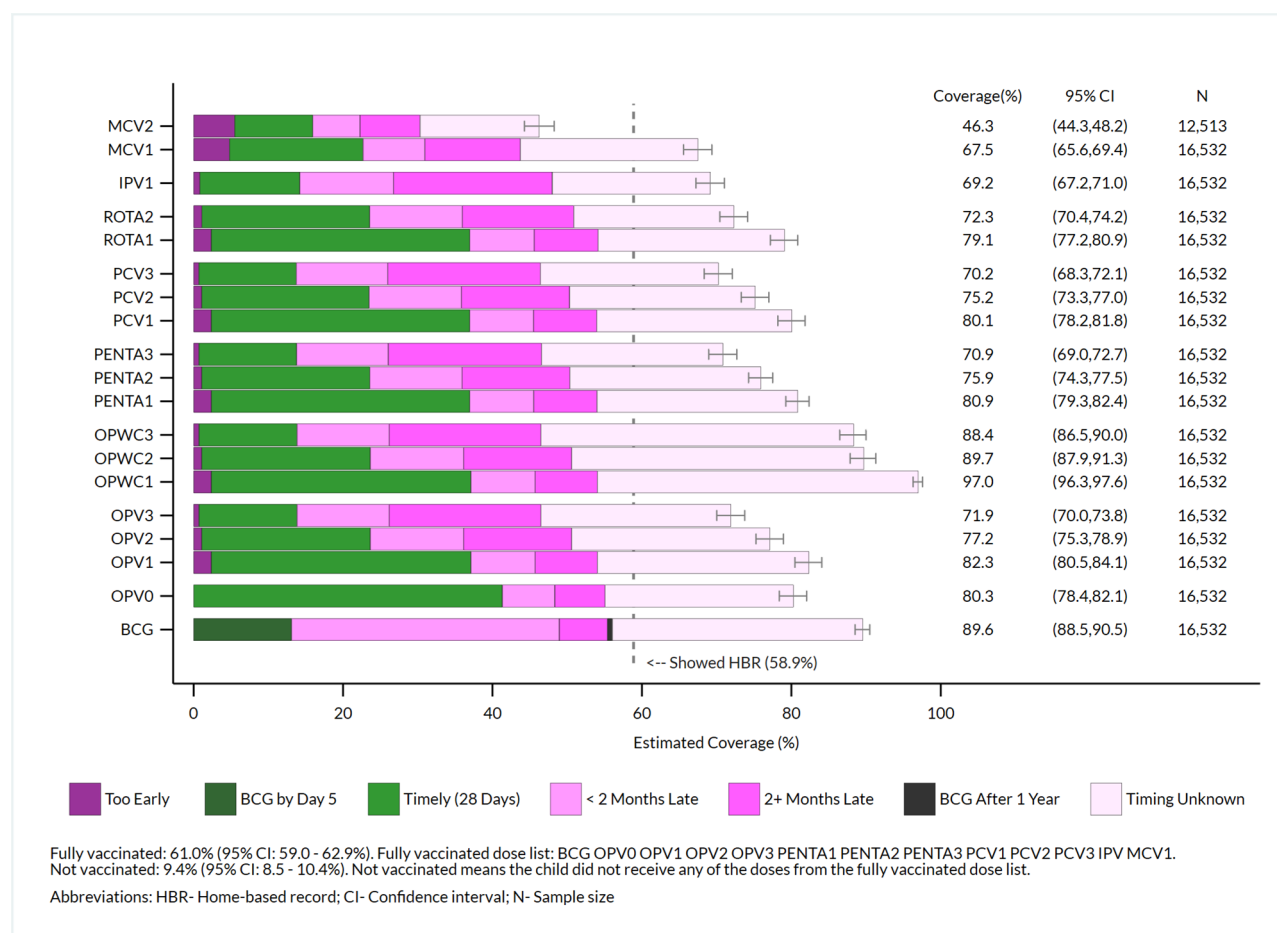


Table 3-13. Vaccination coverage bar segment lengths (%), Khyber Pakhtunkhwa, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	5.5	10.5	6.3	8.0	16.0
MCV1	4.8	17.9	8.3	12.8	23.8
IPV	0.8	13.4	12.6	21.2	21.2
ROTA2	1.1	22.5	12.4	14.9	21.5
ROTA1	2.3	34.6	8.6	8.6	25.0
PCV3	0.7	13.0	12.2	20.4	23.8
PCV2	1.1	22.4	12.3	14.5	24.9
PCV1	2.3	34.6	8.5	8.5	26.1
PENTA3	0.7	13.1	12.3	20.5	24.3
PENTA2	1.1	22.5	12.3	14.4	25.6
PENTA1	2.4	34.6	8.6	8.5	26.9
OPWC3	0.7	13.1	12.3	20.3	41.9
OPWC2	1.1	22.6	12.5	14.5	39.1
OPWC1	2.4	34.8	8.6	8.3	43.0
OPV3	0.7	13.1	12.3	20.3	25.4
OPV2	1.1	22.6	12.5	14.5	26.6
OPV1	2.4	34.8	8.6	8.3	28.3
OPV0	0.0	41.3	7.0	6.7	25.2
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	13.1	35.8	6.4	0.6	33.5

Figure 3-11. Vaccination coverage and timeliness: KP-NMD, Pakistan TPVICS 2022

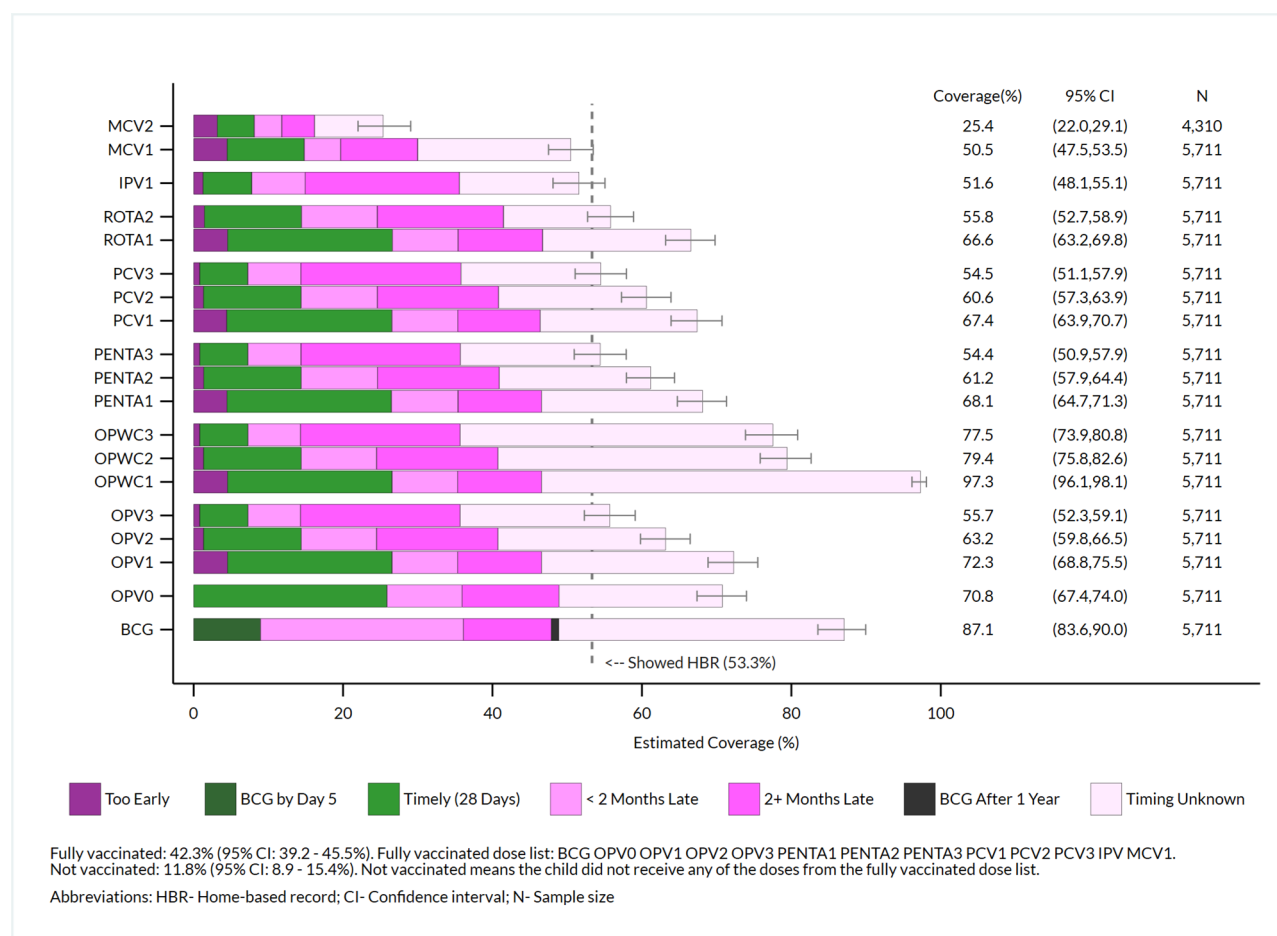


Table 3-14. Vaccination coverage bar segment lengths (%), KP-NMD, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	3.2	4.9	3.7	4.4	9.2
MCV1	4.5	10.3	4.9	10.3	20.5
IPV	1.3	6.5	7.2	20.6	16.0
ROTA2	1.4	13.0	10.1	16.9	14.4
ROTA1	4.5	22.1	8.8	11.3	19.9
PCV3	0.8	6.4	7.1	21.4	18.7
PCV2	1.3	13.1	10.2	16.2	19.8
PCV1	4.4	22.1	8.8	11.0	21.0
PENTA3	0.8	6.4	7.1	21.3	18.8
PENTA2	1.4	13.0	10.2	16.3	20.3
PENTA1	4.5	22.0	8.9	11.2	21.6
OPWC3	0.8	6.5	7.0	21.4	41.9
OPWC2	1.3	13.1	10.1	16.3	38.7
OPWC1	4.5	22.0	8.8	11.2	50.7
OPV3	0.8	6.5	7.0	21.4	20.1
OPV2	1.3	13.1	10.1	16.3	22.5
OPV1	4.5	22.0	8.8	11.2	25.7
OPV0	0.0	25.9	10.1	13.0	21.9
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	8.9	27.2	11.8	1.0	38.2

Figure 3-12. Vaccination coverage and timeliness: Azad Jammu and Kashmir, Pakistan TPVICS 2022

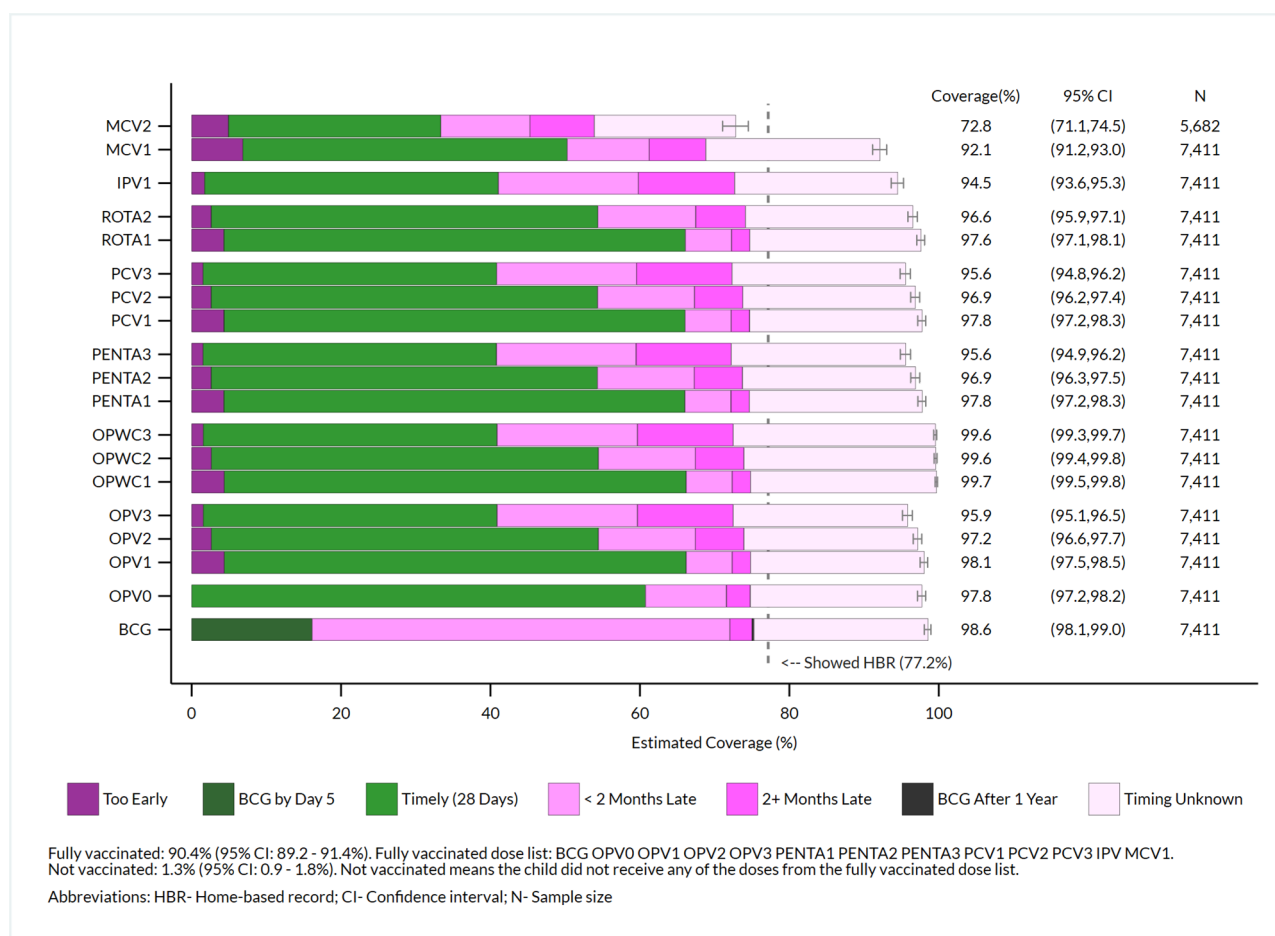


Table 3-15. Vaccination coverage bar segment lengths (%), Azad Jammu and Kashmir, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	4.9	28.4	11.9	8.6	18.9
MCV1	6.9	43.4	11.0	7.6	23.3
IPV	1.7	39.3	18.7	12.9	21.8
ROTA2	2.6	51.8	13.1	6.7	22.4
ROTA1	4.3	61.8	6.2	2.5	22.9
PCV3	1.5	39.3	18.7	12.8	23.2
PCV2	2.6	51.7	13.0	6.5	23.1
PCV1	4.3	61.7	6.2	2.5	23.1
PENTA3	1.5	39.3	18.7	12.7	23.4
PENTA2	2.6	51.7	13.0	6.4	23.2
PENTA1	4.3	61.7	6.2	2.5	23.2
OPWC3	1.6	39.3	18.8	12.8	27.1
OPWC2	2.6	51.8	13.0	6.5	25.7
OPWC1	4.4	61.8	6.2	2.5	24.9
OPV3	1.6	39.3	18.8	12.8	23.4
OPV2	2.6	51.8	13.0	6.5	23.3
OPV1	4.4	61.8	6.2	2.5	23.3
OPV0	0.0	60.7	10.8	3.2	23.0
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	16.1	55.9	3.0	0.2	23.3

Figure 3-13. Vaccination coverage and timeliness: Gilgit-Baltistan, Pakistan TPVICS 2022

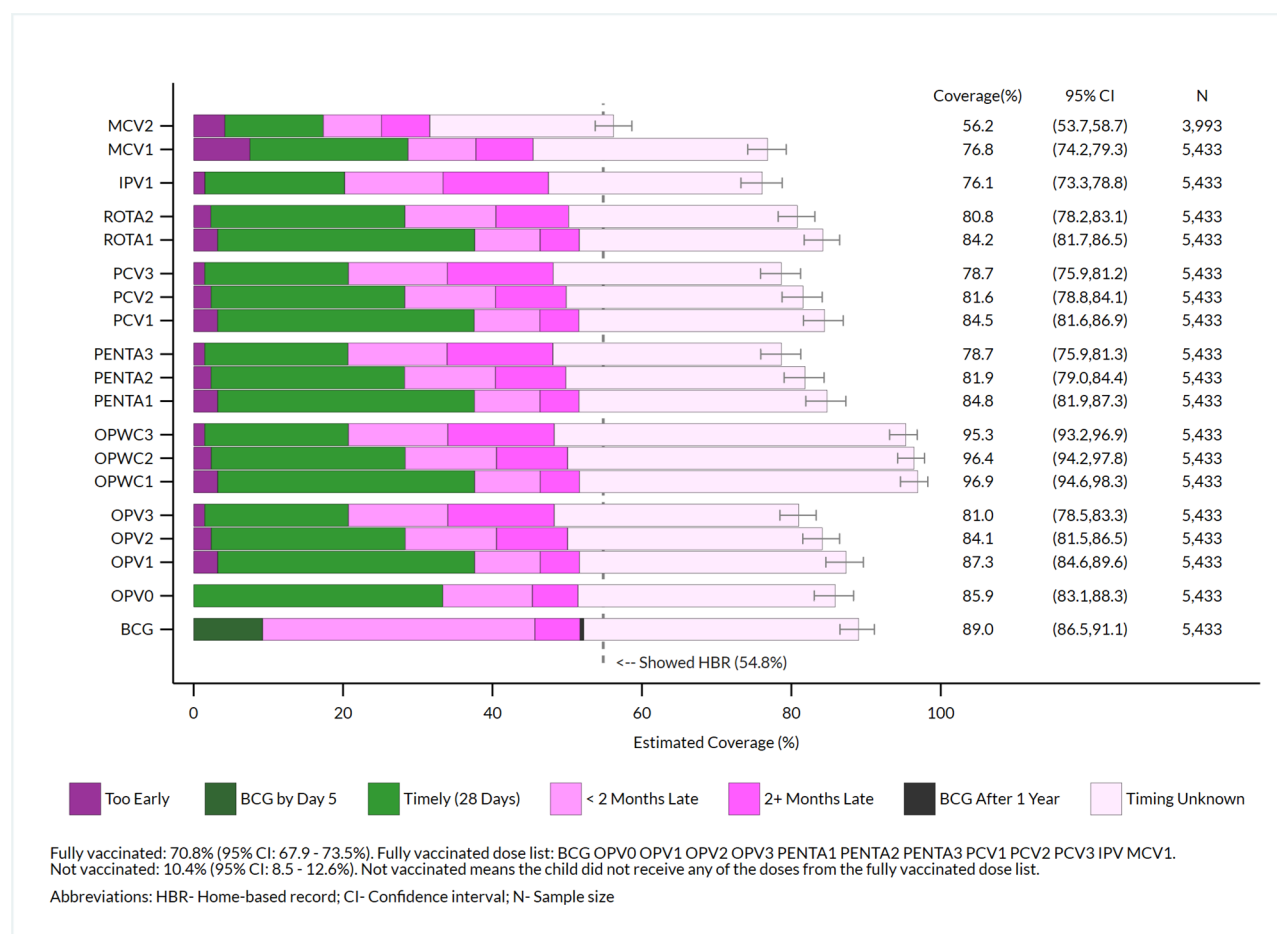


Table 3-16. Vaccination coverage bar segment lengths (%), Gilgit-Baltistan, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	4.2	13.2	7.8	6.5	24.6
MCV1	7.5	21.1	9.1	7.7	31.4
IPV	1.5	18.7	13.2	14.1	28.6
ROTA2	2.3	26.0	12.2	9.7	30.6
ROTA1	3.2	34.4	8.7	5.3	32.6
PCV3	1.5	19.2	13.3	14.2	30.6
PCV2	2.3	25.9	12.1	9.5	31.7
PCV1	3.2	34.4	8.8	5.2	32.9
PENTA3	1.5	19.2	13.2	14.2	30.6
PENTA2	2.3	25.9	12.2	9.4	32.0
PENTA1	3.2	34.4	8.8	5.2	33.2
OPWC3	1.5	19.2	13.3	14.2	47.1
OPWC2	2.3	26.0	12.2	9.5	46.4
OPWC1	3.2	34.4	8.8	5.3	45.3
OPV3	1.5	19.2	13.3	14.2	32.8
OPV2	2.3	26.0	12.2	9.5	34.1
OPV1	3.2	34.4	8.8	5.3	35.7
OPV0	0.0	33.4	12.0	6.1	34.5
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	9.2	36.4	6.1	0.5	36.8

District Level Examples

There are 152 district level VCTCs in Supplement 05a in the online folder that accompanies this report [16]. Figures 3-14 and 3-15 show two examples: Bahawalpur District in Punjab and Gwadar District in Balochistan. It is evident that TPVICS card availability varied substantially from province to province and from district to district. In Bahawalpur District, card availability was high and vaccination coverage was very high. Note, however, the higher proportion of children who received later doses 2+ months late as compared to the earlier doses, and the substantially smaller set of children who received later doses within a month of when they should have. Many fewer cards were seen in Gwadar District than in Bahawalpur District. Dropout from dose 1 to dose 3 in each 3-dose series is higher in Gwadar. The feature of more children receiving the later doses 2 or more months late is evident, also, even in the comparatively small amount of data from cards in Gwadar. When we compare back to the R1 report, we note that in Round 2, more cards were seen in both of these districts than in Round 1, but the overall feature of later doses being given with more delay than earlier doses is evident in both districts in both rounds of the survey.

Figure 3-14. Vaccination coverage and timeliness: Bahawalpur District, Punjab, Pakistan TPVICS 2022

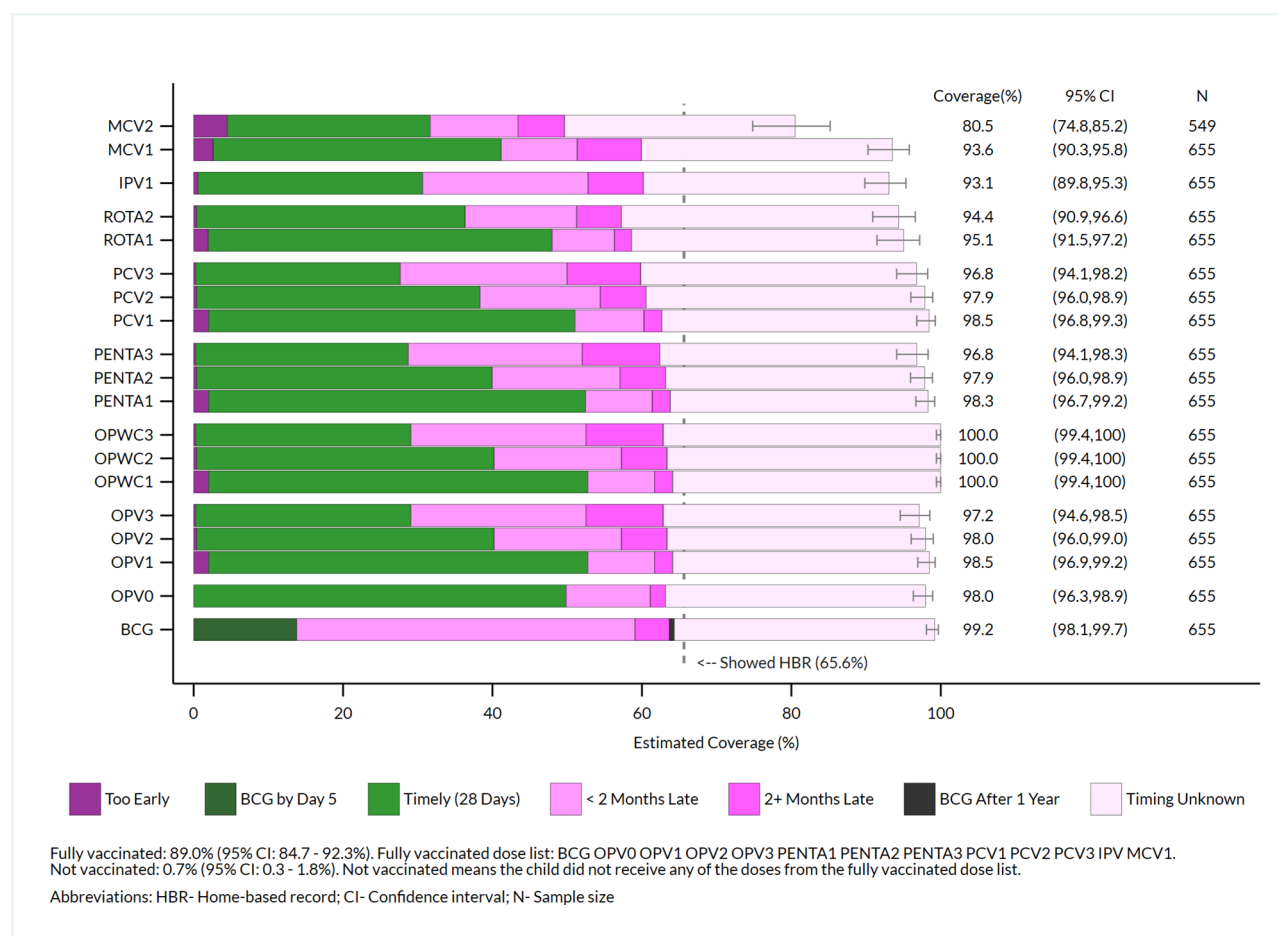


Table 3-17. Vaccination coverage bar segment lengths (%), Bahawalpur District, Punjab, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	4.5	27.2	11.7	6.2	30.9
MCV1	2.6	38.6	10.2	8.6	33.6
IPV	0.6	30.0	22.1	7.4	32.9
ROTA2	0.4	35.9	14.9	6.0	37.1
ROTA1	1.9	46.0	8.3	2.3	36.5
PCV3	0.3	27.4	22.3	9.8	36.9
PCV2	0.4	37.9	16.1	6.1	37.4
PCV1	2.0	49.1	9.2	2.4	35.8
PENTA3	0.3	28.5	23.3	10.4	34.4
PENTA2	0.4	39.5	17.1	6.1	34.7
PENTA1	2.0	50.5	8.9	2.4	34.5
OPWC3	0.3	28.8	23.4	10.3	37.2
OPWC2	0.4	39.8	17.1	6.1	36.6
OPWC1	2.0	50.8	8.9	2.4	35.9
OPV3	0.3	28.8	23.4	10.3	34.3
OPV2	0.4	39.8	17.1	6.1	34.6
OPV1	2.0	50.8	8.9	2.4	34.4
OPV0	0.0	49.9	11.2	2.0	34.9
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	13.8	45.3	4.6	0.7	34.9

Figure 3-15. Vaccination coverage and timeliness: Gwadar District, Balochistan, Pakistan TPVICS 2022

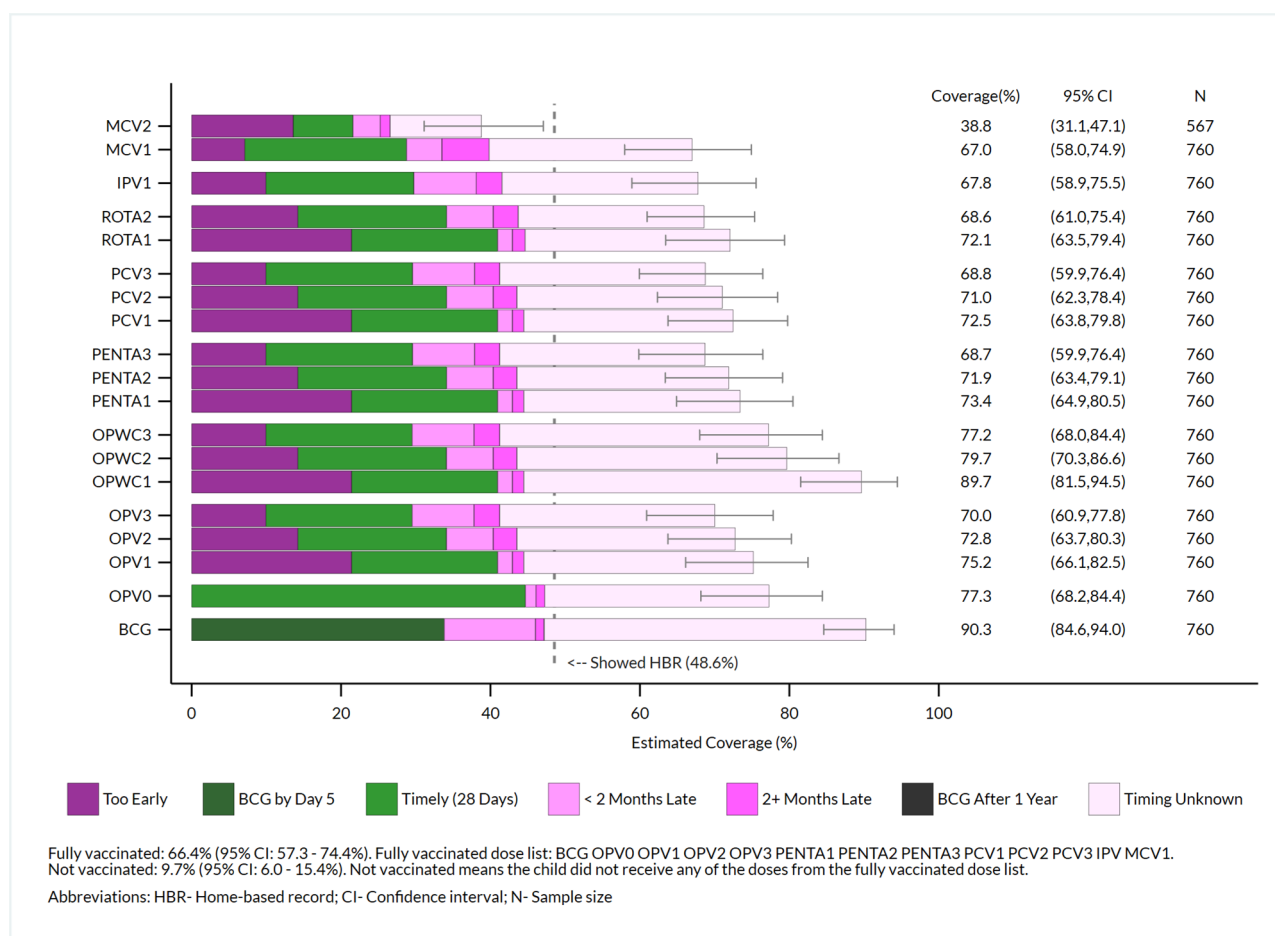


Table 3-18. Vaccination coverage bar segment lengths (%), Gwadar District, Balochistan, Pakistan TPVICS 2022

Vaccines	Too Early	Timely (28 days)	< 2 Months Late	2+ Months Late	Timing Unknown
MCV2	13.6	8.0	3.6	1.3	12.2
MCV1	7.1	21.6	4.7	6.3	27.2
IPV	9.9	19.8	8.4	3.4	26.3
ROTA2	14.2	19.9	6.2	3.3	24.9
ROTA1	21.4	19.5	2.0	1.7	27.5
PCV3	9.9	19.6	8.3	3.4	27.5
PCV2	14.2	19.9	6.2	3.2	27.5
PCV1	21.4	19.5	2.0	1.5	28.0
PENTA3	9.9	19.6	8.3	3.4	27.5
PENTA2	14.2	19.9	6.2	3.2	28.4
PENTA1	21.4	19.5	2.0	1.5	29.0
OPWC3	9.9	19.6	8.3	3.4	36.0
OPWC2	14.2	19.9	6.3	3.2	36.2
OPWC1	21.4	19.5	2.0	1.5	45.2
OPV3	9.9	19.6	8.3	3.4	28.8
OPV2	14.2	19.9	6.3	3.2	29.3
OPV1	21.4	19.5	2.0	1.5	30.8
OPV0	0.0	44.7	1.4	1.2	30.0
	BCG by Day 5	< 2 Months Late	2+ Months Late	After 1 Year (BCG only)	Timing Unknown
BCG	33.8	12.2	1.1	0.0	43.1

Crude Coverage

The 2018 World Health Organization *Vaccination Coverage Cluster Survey: Reference Manual* defines *crude vaccination coverage* to mean that a caregiver provides some evidence that the child received the dose – either a documented source like a date from a home-based vaccination record or anecdotal evidence based on the caregiver’s recollection of the child’s vaccination history [5]. Crude coverage is the proportion of children who have any evidence of having received the dose, and it is contrasted with *valid vaccination coverage* which means not only that the evidence is from a documented source, but also that the child was age-eligible for the dose and, in the case of dose series, that at least a minimum acceptable intradose interval had passed since the date when the child received the earlier dose.

In addition to VCTCs, crude coverage is documented for every dose in tables and maps and bar charts in the online folder of files that accompany this report [16]. Table 3-19, Table 3-20, and Table 3-21 document crude coverage of Penta1, Penta3, and MCV1, respectively, by region and demographic categories. They are accompanied by Figures 3-16 to 3-21 which document regional and district level coverage using maps. Additional information about crude coverage at the national, province/region, and district levels are provided in Annex C and Supplements 02, 03, 05, 06, 07, 08, and 09, 13, 14, and 15.

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Table 3-19. Crude coverage of Penta1, by region and demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	97.7	87.2	80.9	53.6	93.3	68.1	90.4	97.8	84.8
Maternal Education (years)									
None	95.8	82.2	73.6	49.0	81.1	71.2	84.1	96.1	73.8
Primary (1-5)	98.3	89.6	84.2	73.8	88.5	58.7	94.1	97.1	72.0
Middle (6-8)	98.4	91.3	89.0	72.8	95.6	63.3	95.5	98.0	93.8
Secondary (9-10)	98.6	93.4	87.0	75.1	97.4	38.6	95.6	98.0	96.4
Higher (11 and above)	99.3	96.0	90.5	59.8	97.3	68.8	96.1	99.0	98.0
Sex									
Boys	97.8	87.2	81.1	52.9	94.2	66.4	90.3	98.0	85.0
Girls	97.6	87.2	80.6	54.5	92.5	70.4	90.7	97.6	84.6
Wealth									
Lowest	93.8	79.3	56.6	40.6	85.9	63.9	74.4	93.4	69.3
Second	96.7	86.0	71.9	53.9	92.8	74.2	84.4	96.0	82.2
Middle	96.7	86.3	80.9	56.5	85.6	67.8	88.6	97.3	92.7
Fourth	97.4	89.7	86.2	64.3	92.1	56.6	93.2	98.0	96.2
Highest	98.7	92.3	87.4	72.0	94.4	59.0	96.0	98.7	95.4
Area									
Urban	97.3	89.2	86.5	63.2	93.7		92.5	97.0	87.6
Rural	97.9	84.8	79.5	50.3	92.9		89.2	98.0	84.2
N	23,253	23,500	16,532	24,629	1,450	5,711	95,075	7,411	5,433
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is a population estimate that incorporates survey weights.									

Figure 3-16. Crude coverage of Penta1, by region, Pakistan TPVICS 2022

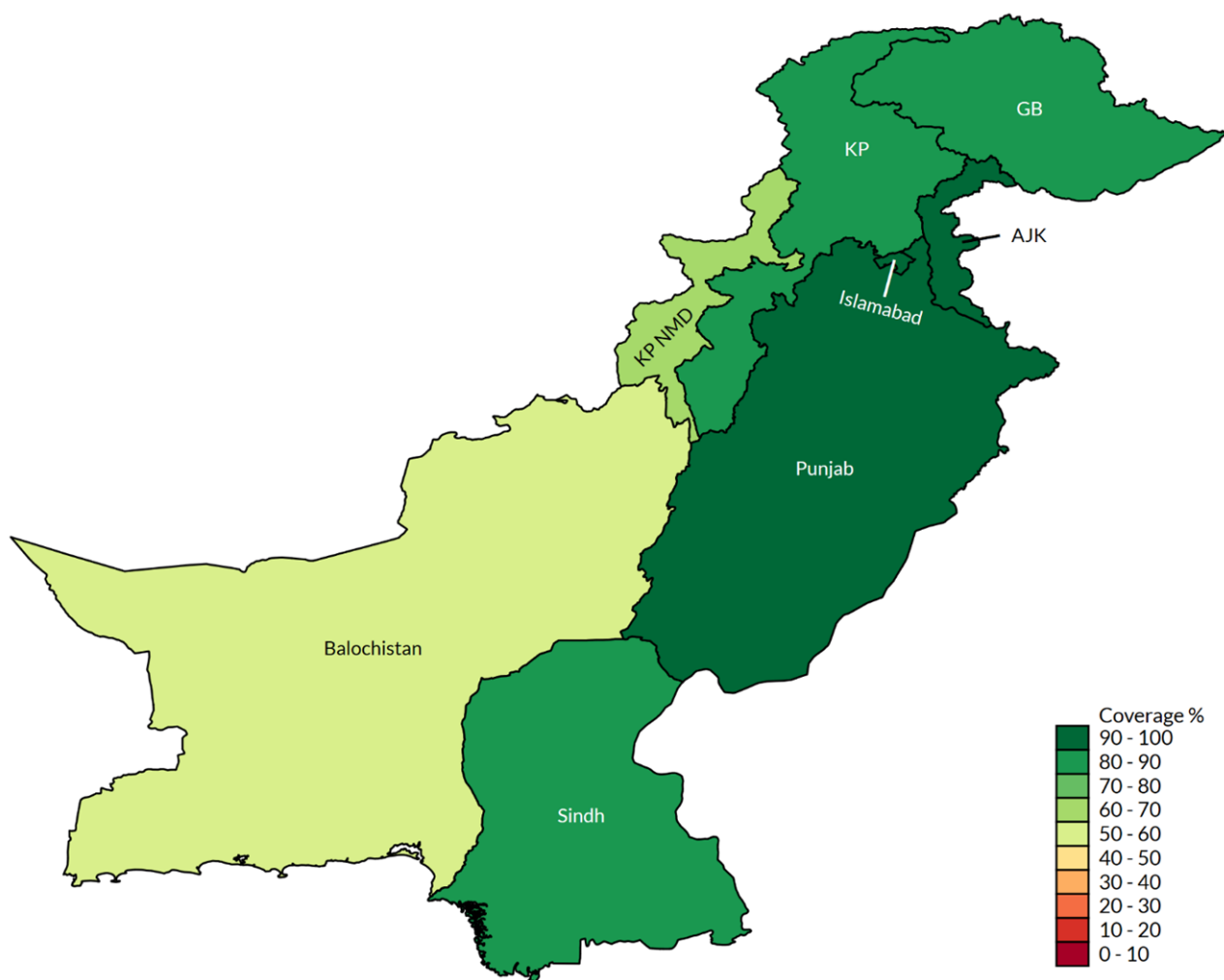
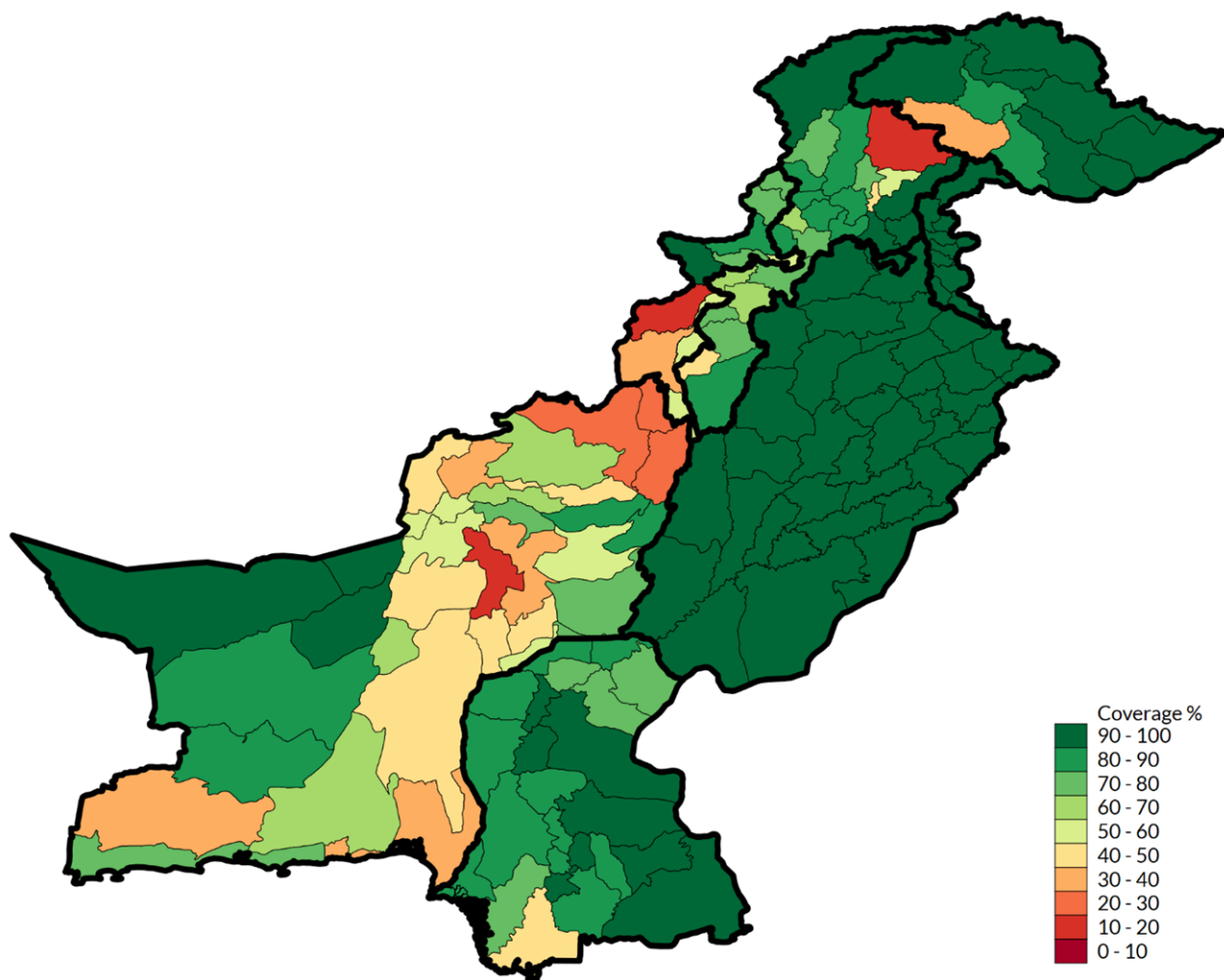


Figure 3-17. Crude coverage of Penta1, by district, Pakistan TPVICS 2022



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Table 3-20. Crude coverage of Penta3, by region & demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	95.4	76.7	70.9	45.9	86.5	54.4	84.5	95.6	78.7
Maternal Education (years)									
None	92.8	70.5	61.8	40.8	62.8	57.3	76.3	92.3	64.9
Primary (1-5)	96.6	78.3	72.7	64.1	83.9	41.9	89.2	94.7	66.2
Middle (6-8)	95.9	81.2	80.7	68.1	76.9	53.6	91.1	96.0	88.1
Secondary (9-10)	97.2	84.9	81.0	66.0	94.0	32.8	91.9	96.1	92.8
Higher (11 and above)	96.8	88.3	83.5	55.9	95.6	51.2	91.8	97.6	94.8
Sex									
Boys	95.5	76.8	71.3	45.5	88.3	53.8	84.5	96.0	80.0
Girls	95.3	76.6	70.3	46.3	84.7	55.3	84.8	95.2	77.4
Wealth									
Lowest	90.8	68.8	44.5	34.6	42.2	47.9	65.4	90.3	60.6
Second	94.5	74.5	59.3	45.8	54.6	60.2	76.8	93.1	76.7
Middle	94.8	74.6	70.2	48.0	73.4	55.2	82.4	94.8	87.0
Fourth	95.4	77.1	76.7	55.1	85.6	46.8	87.7	95.9	92.4
Highest	96.0	84.3	79.6	63.2	89.7	53.8	91.7	97.0	89.1
Area									
Urban	93.3	78.3	77.9	55.0	85.5		85.5	93.8	79.6
Rural	96.6	74.8	69.2	42.7	87.6		84.1	96.0	78.5
N	23,253	23,500	16,532	24,629	1,450	5,711	95,075	7,411	5,433
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is a population estimate that incorporates survey weights.									

Figure 3-18. Crude coverage of Penta3, by region, Pakistan TPVICS 2022

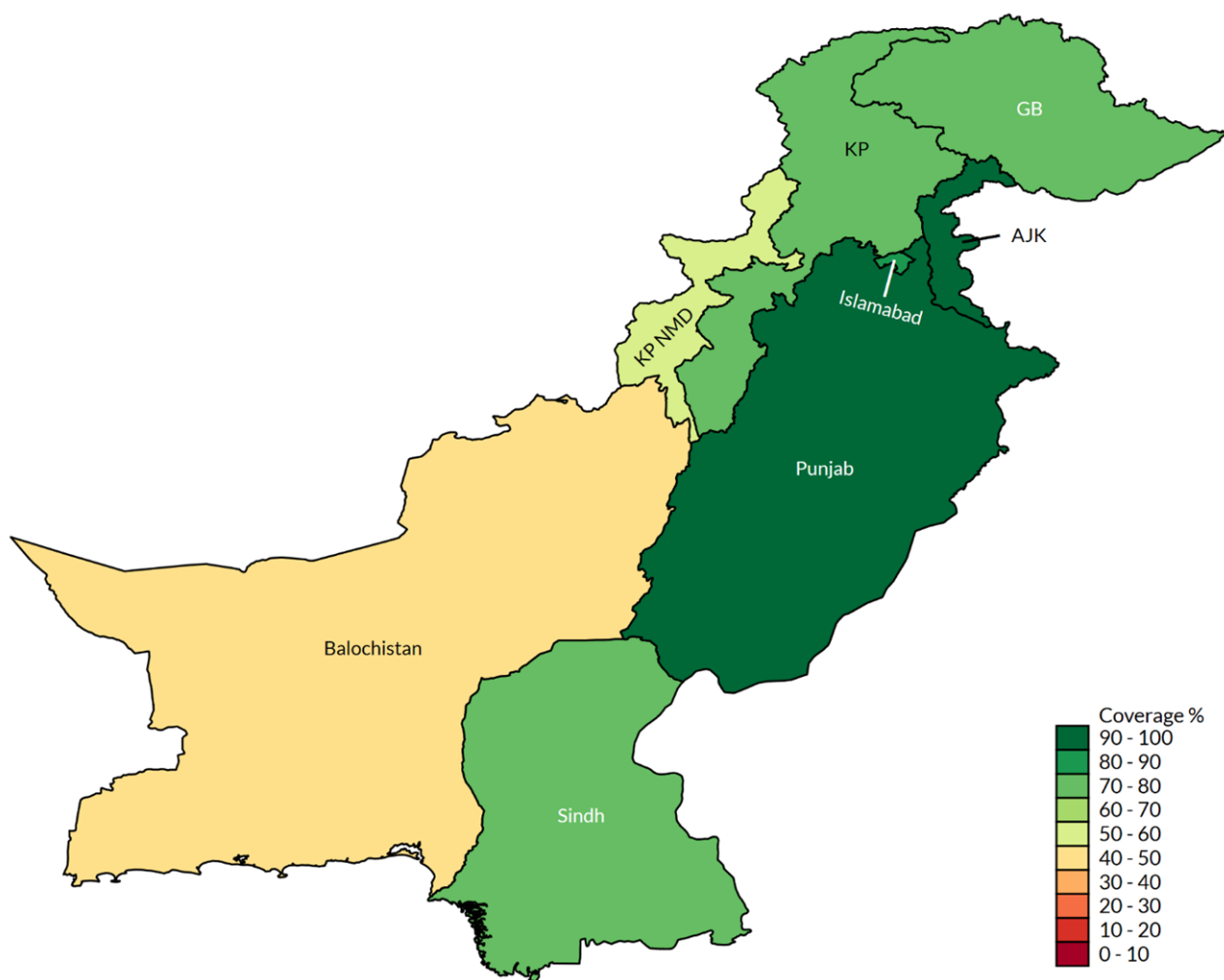
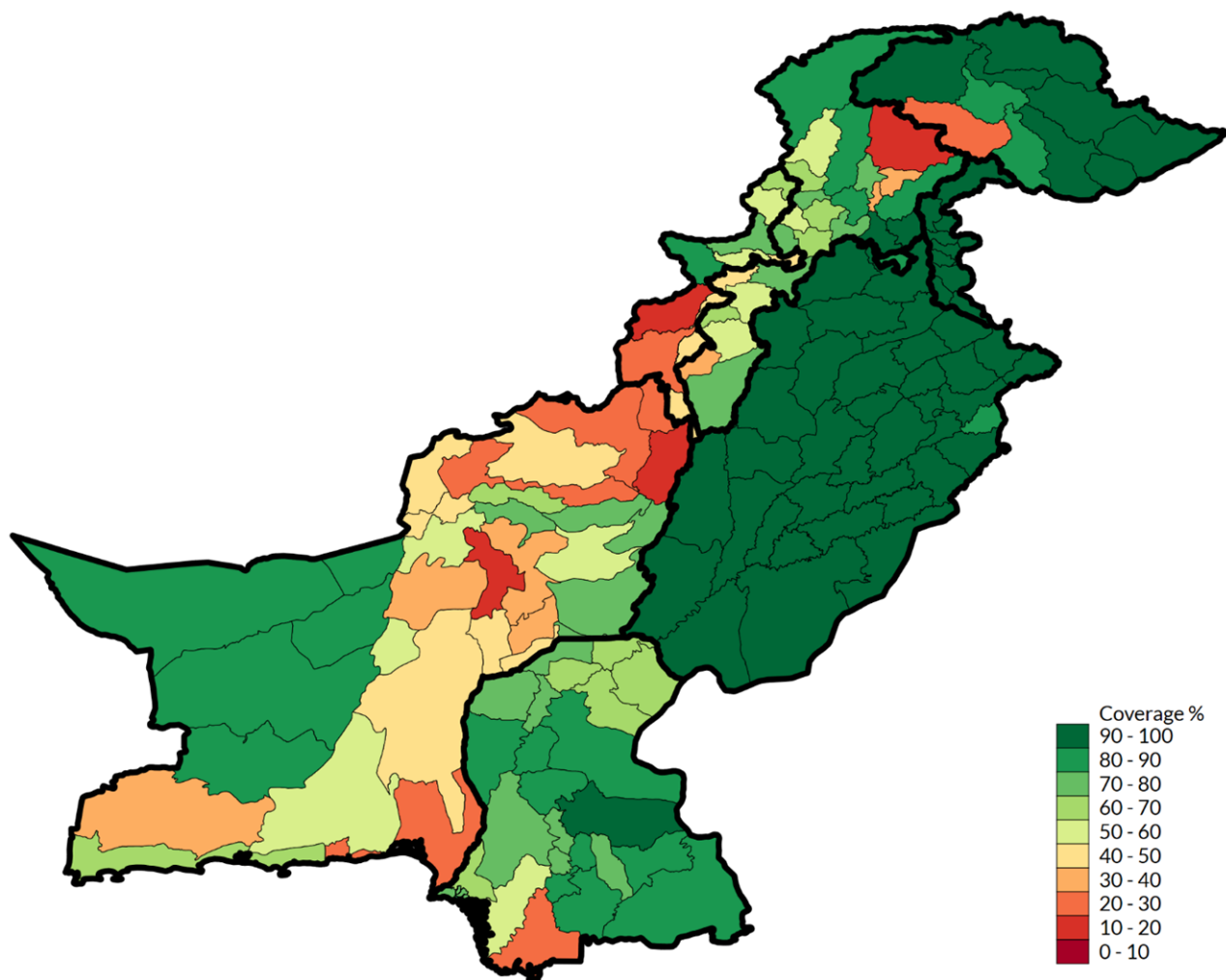


Figure 3-19. Crude coverage of Penta3, by district, Pakistan TPVICS 2022



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Table 3-21. Crude coverage of MCV1, by region and demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	92.9	72.7	67.5	45.6	80.3	50.5	81.5	92.1	76.8
Maternal Education (years)									
None	90.1	65.5	59.2	40.9	55.4	52.1	73.0	87.0	64.9
Primary (1-5)	94.8	74.0	68.2	62.9	71.9	42.0	86.5	91.2	63.8
Middle (6-8)	94.0	79.1	75.2	68.0	72.2	55.9	88.8	93.1	83.9
Secondary (9-10)	94.4	82.7	78.0	63.7	85.2	33.1	89.2	93.0	88.2
Higher (11 and above)	93.9	85.4	79.5	54.4	92.2	49.3	88.8	94.8	92.5
Sex									
Boys	93.0	72.6	68.2	45.4	80.9	50.2	81.5	92.7	78.3
Girls	92.8	72.7	66.7	45.9	79.7	50.8	81.8	91.6	75.2
Wealth									
Lowest	88.4	63.8	42.6	34.8	35.2	47.4	62.0	83.7	64.1
Second	92.0	66.6	56.9	44.6	46.6	54.4	72.6	89.1	72.8
Middle	92.3	70.1	67.1	48.3	63.9	48.5	79.3	90.1	83.7
Fourth	92.9	74.2	71.9	55.4	74.1	46.6	84.7	92.8	88.2
Highest	93.6	82.0	76.5	62.3	84.9	61.4	89.2	94.4	88.7
Area									
Urban	89.6	75.6	76.3	53.1	80.0		82.3	88.7	77.6
Rural	94.8	69.1	65.4	43.0	80.6		81.2	92.9	76.7
N	23,253	23,500	16,532	24,629	1,450	5,711	95,075	7,411	5,433
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is a population estimate that incorporates survey weights.									

Figure 3-20. Crude coverage of MCV1, by region, Pakistan TPVICS 2022

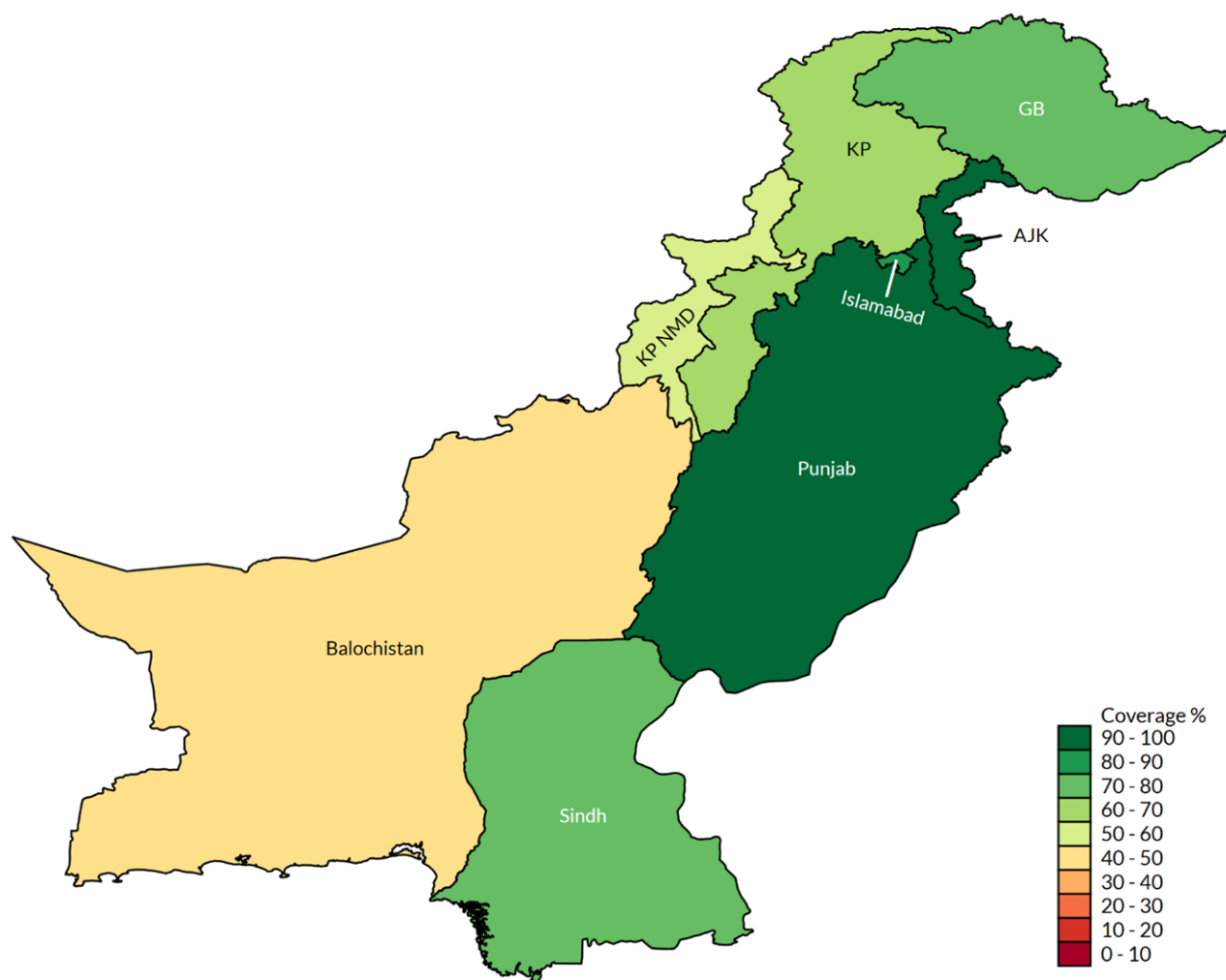
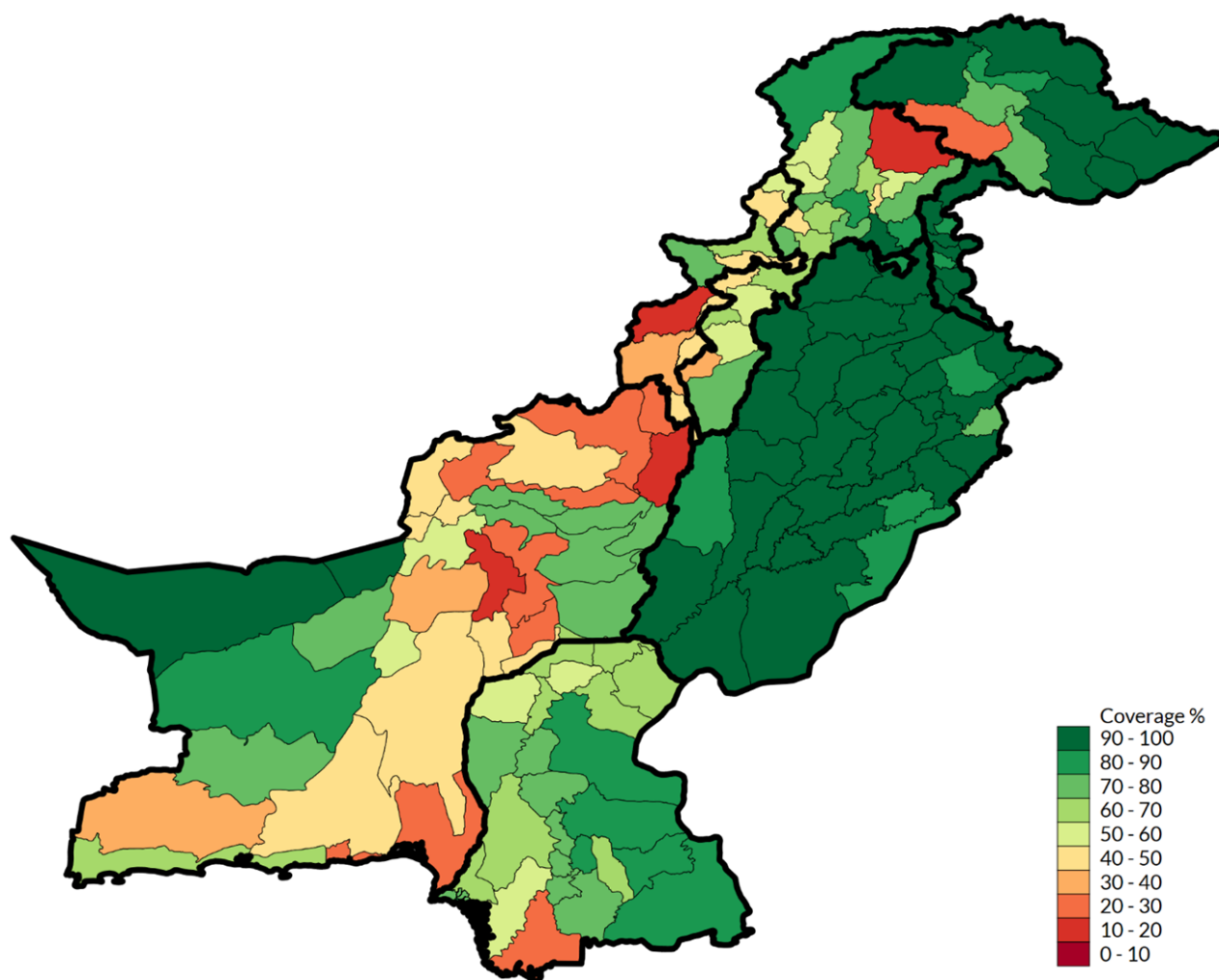


Figure 3-21. Crude coverage of MCV1, by district, Pakistan TPVICS 2022



Dropout

A child who receives the first dose in a series but had not received the last dose by the time of the survey might be said to have *dropped out* of the vaccination program before completing the full course of scheduled doses. Dropout is visually evident in VCQI's vaccination coverage and timeliness charts earlier in this report: the bars representing coverage of later doses are typically shorter than bars for early doses.

As with other coverage indicators, there are several traditions for how to calculate and report dropout. It is quite common to report a weighted estimate of coverage using this equation:

$$\text{Dropout} = \frac{(\text{Early dose weighted coverage \%} - \text{Later dose weighted coverage \%})}{\text{Early dose weighted coverage \%}}$$

$$\text{e.g., Penta Dropout} = \frac{(\text{Penta1 coverage \%} - \text{Penta3 coverage \%})}{\text{Penta1 coverage \%}}$$

The numeric outcome is the percentage of children who began the series who did not go on to complete it. In this report, dropout is reported as an unweighted measure in accordance with VCQI's convention for

indicators whose denominator is a subset of children in the dataset.

Dropout =

$$\frac{(\# \text{ of children who receive the earlier dose} - \# \text{ of children who receive the earlier and later doses})}{\# \text{ of children who receive the earlier dose}}$$

In the VCQI analyses, dropout is summarized for Penta1-3, OPV1-3, PCV1-3, Rota1-2, MCV1-2, BCG-MCV1, and Penta1-MCV1 using tables, maps, and figures. Broadly speaking, the dropout among first year of life (1YL) dose results look quite similar for all dose pairs, so only one 1YL pair is summarized in the body of the report: Table 3-22 and Figures 3-22 and 3-23 document dropout from Penta1 to Penta3 – and the remainder are documented thoroughly in the supplemental materials. Dropout from MCV1 to MCV2 is higher than dropout among 1YL doses; the report summarizes this pattern in Table 3-23 and Figures 3-24 and 3-25. Note in the dropout tables there is a characteristic stair-step pattern among colored bars that is common across outcomes in this report, indicating poorer outcomes for children whose mothers are poorly educated or whose families are poor.

Additional information about dropout is provided in Supplements 02, 06, 07, 08, and 09.

Table 3-22. Dropout from Penta1 to Penta3, by region and demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	1.8	12.5	13.3	11.0	7.3	21.0	9.4	2.2	5.5
Maternal Education (years)									
None	2.5	14.6	17.8	12.1	24.4	20.4	12.0	3.8	8.9
Primary (1-5)	1.2	11.1	13.5	10.0	8.3	30.7	6.6	2.3	3.9
Middle (6-8)	1.8	10.0	10.0	4.7	11.4	16.7	4.9	1.9	5.9
Secondary (9-10)	1.1	9.3	8.6	11.8	5.0	22.4	5.0	1.9	3.1
Higher (11 and above)	1.6	7.1	6.9	6.2	2.4	23.7	4.5	1.2	2.7
Sex									
Boys	1.7	12.5	13.1	10.7	7.6	19.5	8.5	2.0	4.7
Girls	1.9	12.5	13.4	11.4	7.0	22.8	8.7	2.4	6.3
Wealth									
Lowest	3.3	15.2	20.3	10.4	50.0	22.9	13.3	3.1	7.6
Second	2.3	13.1	17.4	13.0	31.3	22.1	11.6	2.4	5.2
Middle	1.7	12.5	13.7	10.3	17.5	18.7	8.7	2.4	4.9
Fourth	1.5	12.7	12.3	9.1	11.0	14.9	6.8	2.3	3.2
Highest	1.7	8.6	8.3	11.3	4.7	11.9	4.7	1.6	6.8
Area									
Urban	3.0	11.9	12.3	12.0	8.5		9.0	3.6	8.3
Rural	1.4	12.9	13.4	10.8	5.6		8.5	2.0	5.1
N	22,754	20,107	12,423	14,706	1,359	3,804	75,153	7,255	4,887
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of children who received the earlier dose and was old enough to have received the second dose.									

Figure 3-22. Dropout from Penta1 to Penta3, by region, Pakistan TPVICS 2022

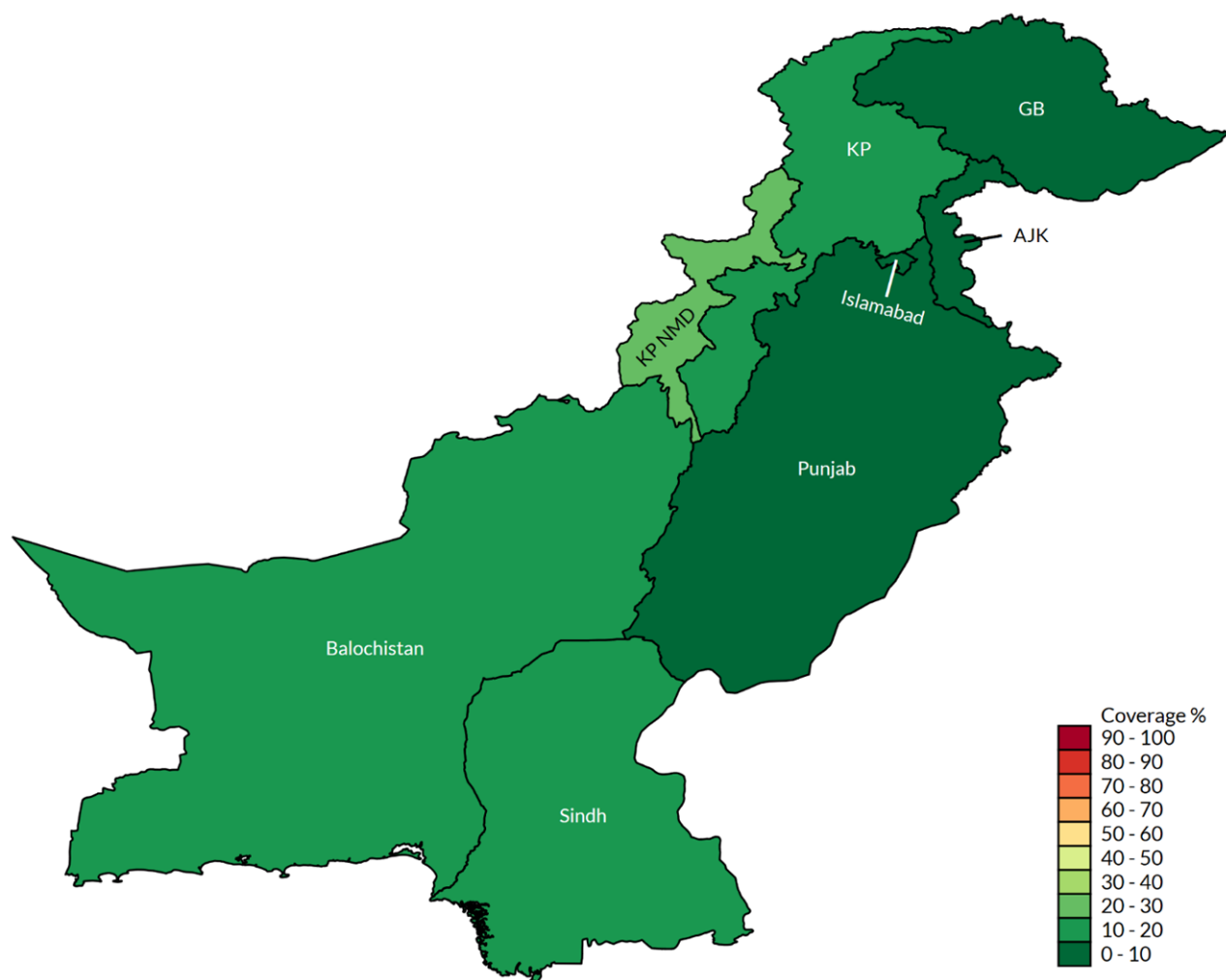
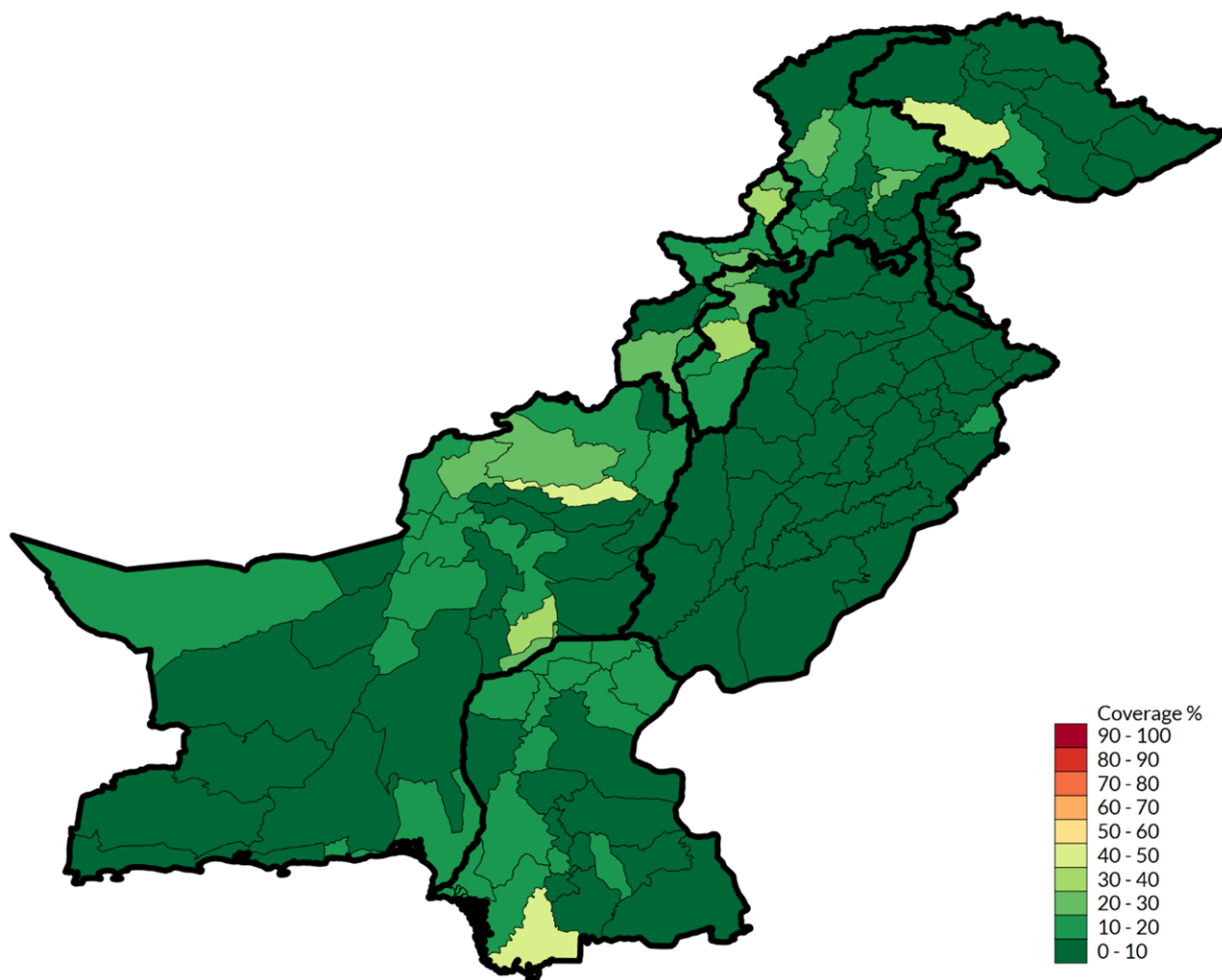


Figure 3-23. Dropout from Penta1 to Penta3, by district, Pakistan TPVICS 2022



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Table 3-23. Dropout from MCV1 to MCV2, by region and demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	12.5	29.5	37.0	42.8	29.2	48.7	28.2	21.7	27.0
Maternal Education (years)									
None	12.9	30.1	43.6	44.9	41.0	47.7	32.6	25.9	30.6
Primary (1-5)	11.6	29.5	33.7	30.7	27.1	66.3	22.0	21.6	25.5
Middle (6-8)	11.6	30.0	32.7	27.2	28.6	59.3	21.0	18.2	27.1
Secondary (9-10)	12.5	29.4	32.6	40.8	27.2	46.2	22.6	21.2	22.5
Higher (11 and above)	13.2	27.0	29.1	46.3	27.9	47.9	25.2	20.7	25.7
Sex									
Boys	12.2	30.1	36.9	43.5	31.3	47.5	28.1	21.4	26.2
Girls	12.7	29.0	37.1	41.8	27.2	50.3	27.1	21.9	27.8
Wealth									
Lowest	13.7	30.3	45.2	50.2	50.0	47.1	37.2	28.1	30.9
Second	12.9	29.3	43.8	42.3	25.0	52.2	33.4	27.7	27.3
Middle	12.5	28.4	40.6	37.9	35.9	45.2	28.2	21.7	23.0
Fourth	11.9	30.2	35.4	38.3	31.4	46.0	24.1	22.1	28.7
Highest	12.7	29.1	27.2	42.3	28.4	48.9	20.5	17.0	26.8
Area									
Urban	17.1	30.7	31.0	43.0	26.6		27.6	22.1	30.2
Rural	11.0	28.6	37.9	42.7	32.7		27.6	21.6	26.6
N	18,111	13,747	8,198	10,286	934	2,213	53,489	5,317	3,400
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of children who received the earlier dose and was old enough to have received the second dose.									

Figure 3-24. Dropout from MCV1 to MCV2, by region, Pakistan TPVICS 2022

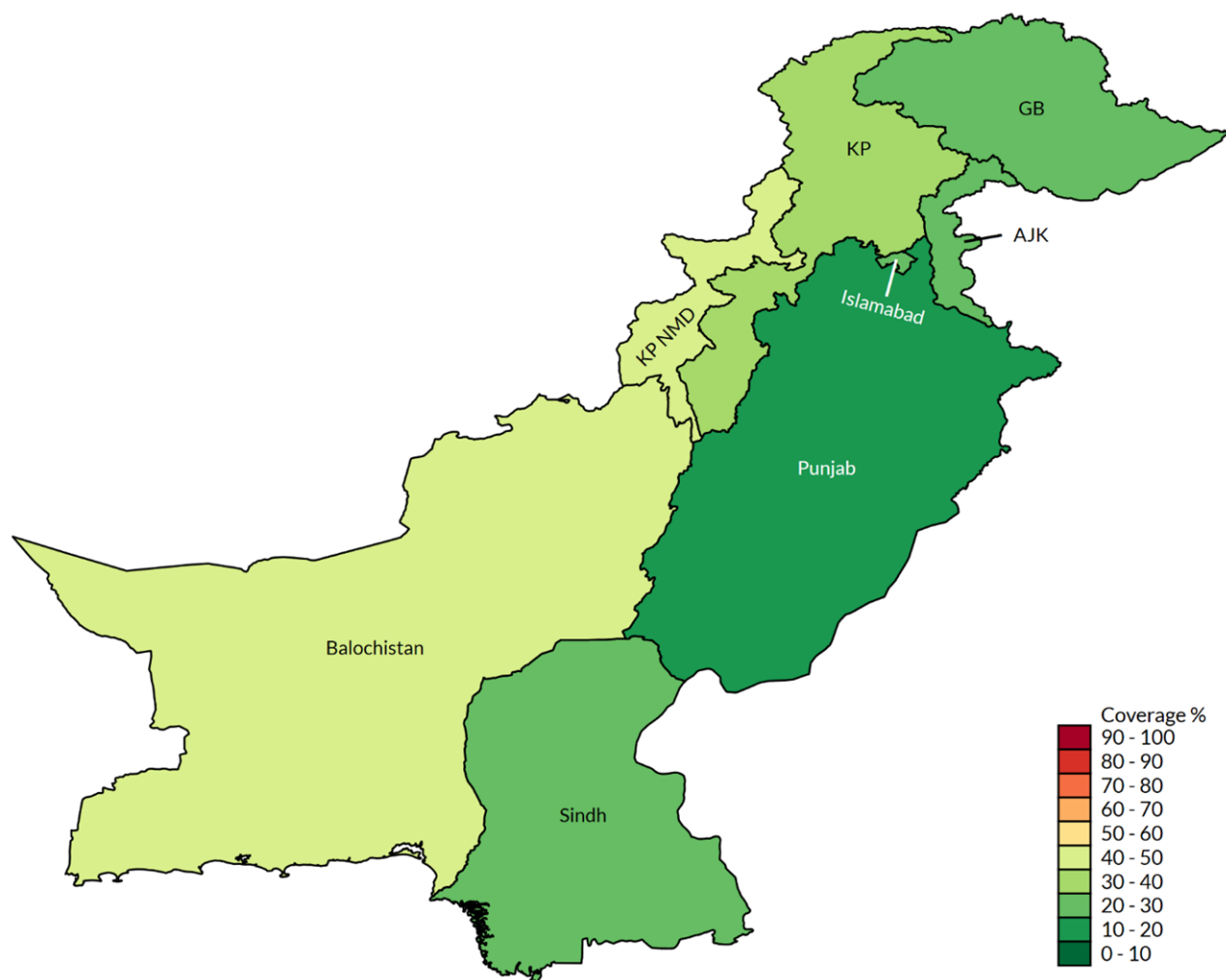
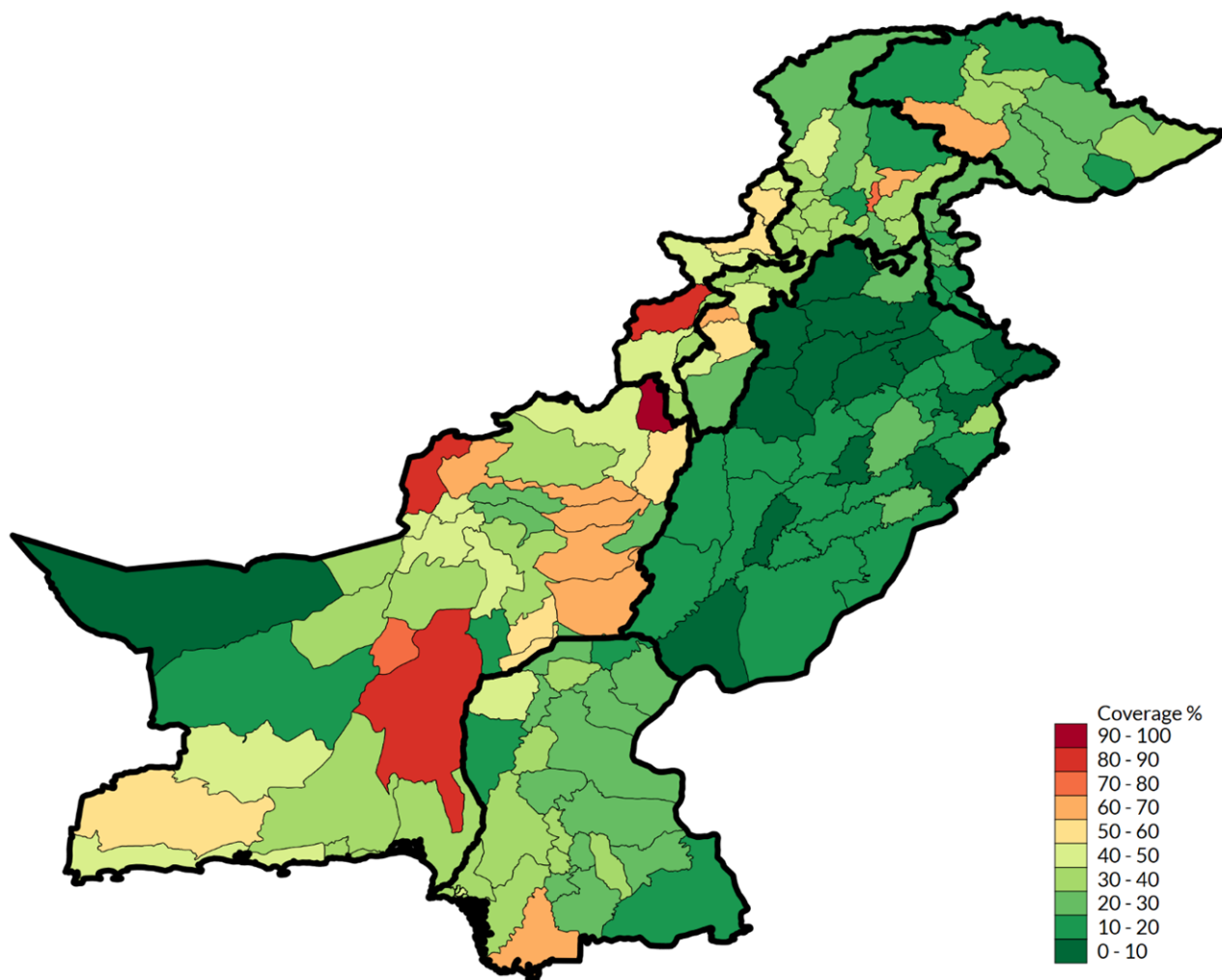


Figure 3-25. Dropout from MCV1 to MCV2, by district, Pakistan TPVICS 2022



Fully Vaccinated Children

The concept of the *fully vaccinated child* can be defined in different ways and sometimes different definitions yield different results. For purposes of comparison across countries and across time, it is common to report the percentage of children who receive all eight of the classic EPI doses (BCG, OPV1-3, DTP1-3 [or Penta1-3], and MCV1). In cases like Pakistan's, where many additional doses have been added to the national schedule, a more relevant outcome is the proportion of children who receive all of the doses due in the first year of life (1YL). But when the newest dose is still quite new and there have been challenges with either uptake or the supply chain, it is common to report the proportion of children who have received all the 1YL doses except the vaccine that was added to the schedule most recently.

In this section of the report, results are reported for a single definition. In Table 3-24 and Figures 3-26 and 3-27, the child is considered to be fully vaccinated if they received all the doses due in the first year of life according to Pakistan's 2020 EPI schedule except the rotavirus vaccine (the vaccine most recently added to the EPI schedule).

Additional information about fully vaccinated children is provided in Supplements 02, 03, 05, 06, 07, 08, 09, 10, 13, 14, and 15.

Table 3-24. Fully vaccinated, by region & demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	89.6	69.2	61.0	37.7	79.5	42.3	77.5	90.4	70.8
Maternal Education (years)									
None	85.4	62.1	51.4	33.3	54.3	44.5	68.0	84.3	56.8
Primary (1-5)	92.0	70.8	62.8	55.4	70.9	34.5	83.2	89.8	57.7
Middle (6-8)	91.1	77.0	68.1	59.0	71.2	41.5	85.4	91.7	76.6
Secondary (9-10)	92.1	78.6	73.5	54.5	84.2	25.3	86.2	91.3	84.5
Higher (11 and above)	91.9	81.9	74.5	44.4	91.8	39.4	85.9	93.2	88.6
Sex									
Boys	89.9	69.0	61.7	37.7	80.8	42.4	77.6	90.8	72.8
Girls	89.3	69.5	60.3	37.7	78.3	42.2	77.8	89.9	68.7
Wealth									
Lowest	81.7	60.5	35.4	27.2	35.2	39.6	57.0	83.0	53.9
Second	87.9	63.9	49.3	35.2	46.6	43.9	67.6	86.3	69.0
Middle	87.9	67.5	59.9	39.3	60.2	42.8	74.5	87.9	78.7
Fourth	89.7	70.8	65.7	48.9	73.4	41.9	81.1	91.1	82.1
Highest	91.1	77.8	71.3	57.5	84.2	45.0	86.1	93.1	81.7
Area									
Urban	86.6	71.8	68.5	45.3	79.4		78.6	87.4	71.0
Rural	91.3	66.2	59.2	35.1	79.7		77.1	91.0	70.7
N	23,253	23,500	16,532	24,629	1,450	5,711	95,075	7,411	5,433
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is a population estimate that incorporates survey weights.									

Figure 3-26. Fully vaccinated – All 1YL doses except Rota, by region, Pakistan TPVICS 2022

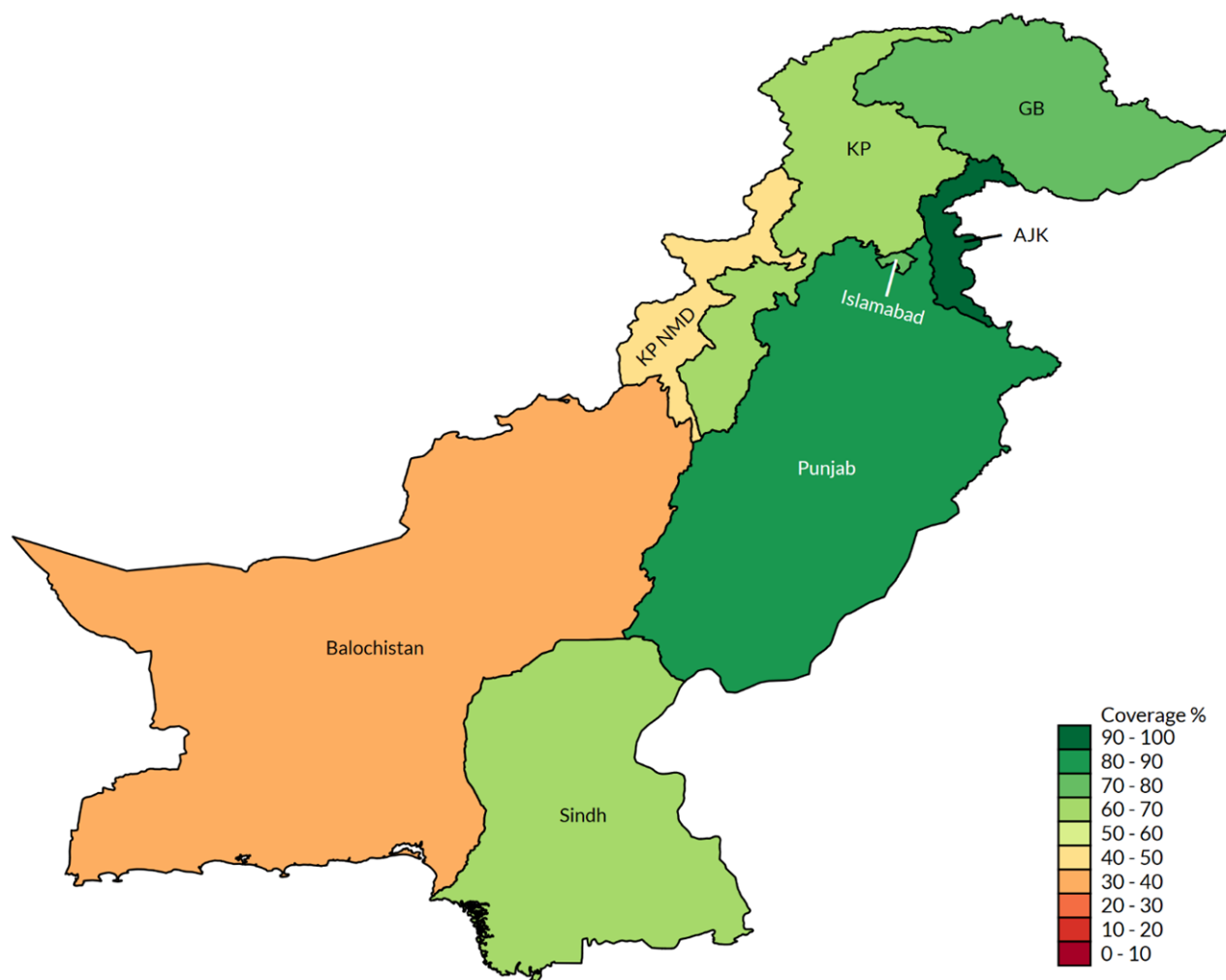
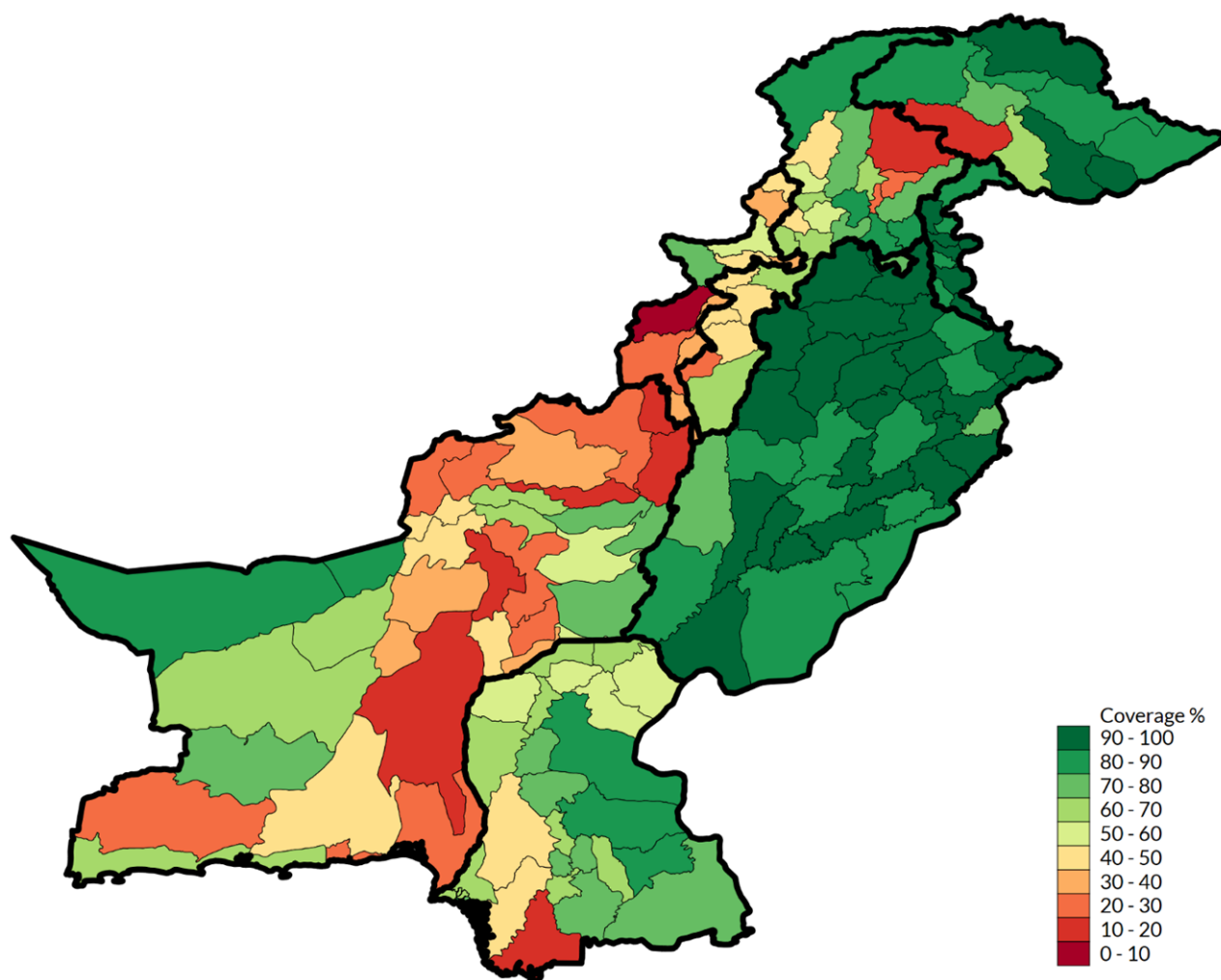


Figure 3-27. Fully vaccinated – All 1YL doses except Rota, by district, Pakistan TPVICS 2022



Zero-Dose Children

Table 3-25 and Figures 3-28 and 3-29, summarize the proportion of children who are considered not to be vaccinated (or *zero-dose*) because they received none of the doses due in the first year of life according to Pakistan's 2020 EPI schedule. (Rotavirus vaccine, the newest vaccine in Pakistan's EPI schedule, is excluded from the analysis, but only one child out of 107,919 analyzed in the Round 2 survey had evidence of receiving rotavirus vaccine and no other vaccines.)

Additional information about zero-dose (unvaccinated) children is provided in Supplements 02, 03, 05, 06, 07, 08, 09, 10, 13, 14, and 15.

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Table 3-25. Not vaccinated or Zero-Dose, by region & demographic category (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	0.8	6.0	9.4	33.6	2.9	11.8	4.9	1.3	10.4
Maternal Education (years)									
None	1.5	9.1	13.9	37.1	9.9	11.4	8.7	2.5	17.2
Primary (1-5)	0.5	3.6	6.4	20.1	7.1	13.2	2.3	1.6	24.6
Middle (6-8)	0.8	3.0	4.9	13.5	0.0	22.7	2.0	1.4	4.9
Secondary (9-10)	0.4	1.8	5.6	17.7	0.0	12.8	1.5	0.9	1.7
Higher (11 and above)	0.1	1.4	4.1	29.4	0.8	6.8	1.8	0.7	0.9
Sex									
Boys	0.8	6.1	9.2	34.0	2.0	11.4	5.0	1.3	10.0
Girls	0.8	5.9	9.6	33.1	3.7	12.3	4.7	1.3	10.8
Wealth									
Lowest	2.2	10.9	25.9	46.6	1.5	15.9	15.3	6.1	18.6
Second	1.4	7.9	13.7	34.0	0.0	8.0	8.7	1.9	13.6
Middle	1.4	6.1	10.3	27.5	8.1	13.0	5.8	1.6	5.7
Fourth	0.8	4.0	6.4	24.8	2.7	12.8	2.9	1.3	2.3
Highest	0.4	2.8	4.5	17.9	2.7	8.7	1.5	0.5	2.3
Area									
Urban	1.1	4.4	6.4	25.5	2.3		3.4	1.9	8.8
Rural	0.6	7.9	10.1	36.4	3.5		5.7	1.2	10.7
N	23,253	23,500	16,532	24,629	1,450	5,711	95,075	7,411	5,433
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is a population estimate that incorporates survey weights.									

Figure 3-28. Not vaccinated or Zero-Dose – Child received none of the 1YL doses, by region, Pakistan TPVICS 2022

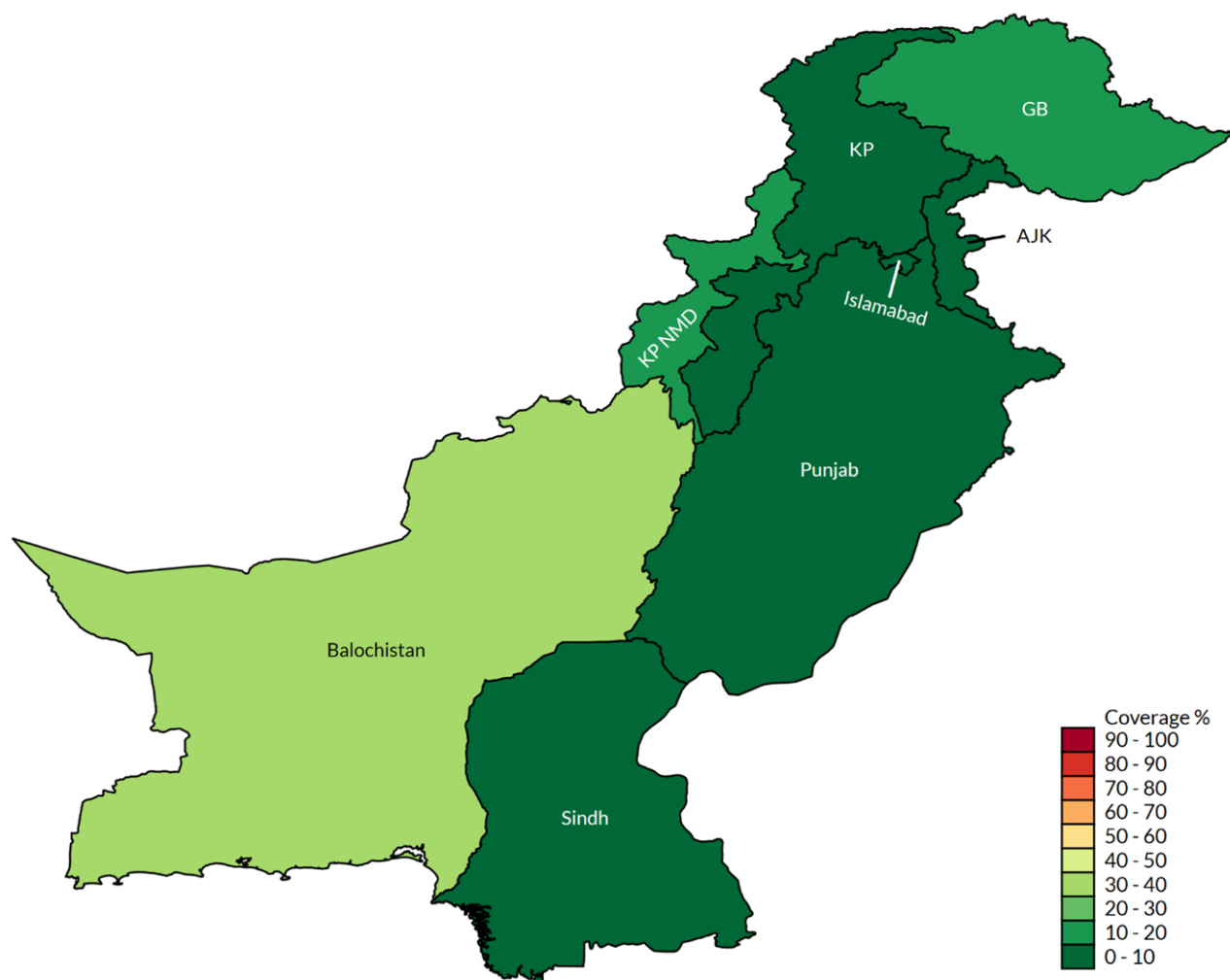
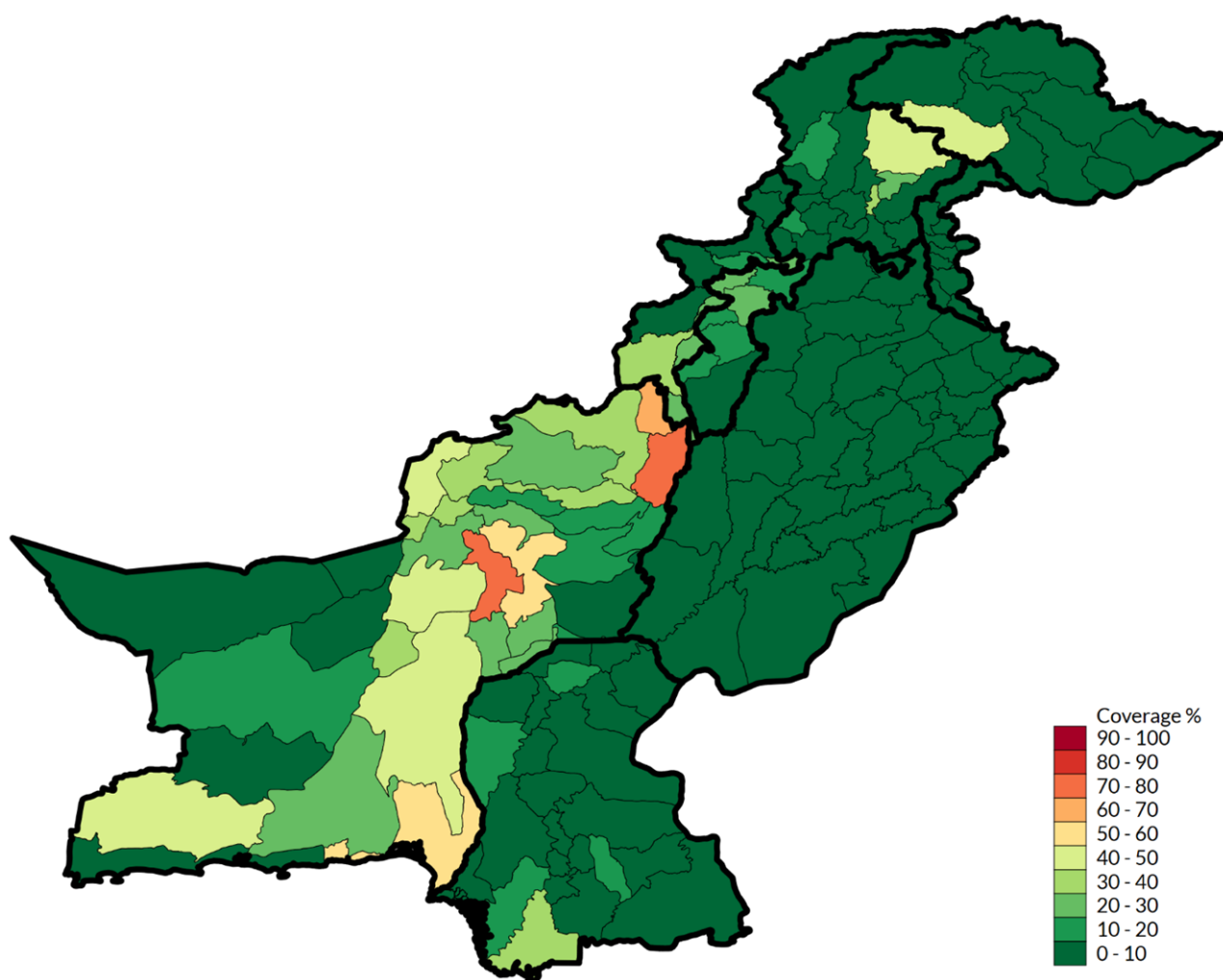


Figure 3-29. Not vaccinated or Zero-Dose – Child received none of the 1YL doses, by district, Pakistan TPVICS 2022



Documented Intra-Dose Intervals

To maximize the probability that doses in a series result in a biological response of immunity, the doses should be spaced at least four weeks apart. If the spacing is shorter than four weeks, the later doses are not considered to be valid doses. If the spacing is notably longer than four weeks, then the child has spent unnecessary time under-protected against the vaccine-preventable diseases. VCQI assessed the dates on vaccination cards and classified children as having 1YL intradose intervals that were < 4 weeks (too short), 4-8 weeks (appropriate), or > 8 weeks (too long). The results are documented for Penta, OPV, PCV, and Rota in the supplements, but the results are very similar across doses, so only results for Penta intradose intervals are reported in the body of this report. Table 3-26, Table 3-27, and Table 3-28, show the proportion of Penta intradose intervals that are too short (< 4 weeks), appropriate (4-8 weeks), and too long (> 8 weeks), respectively. Figures 3-30 and 3-31 show the proportion of Penta2 to Penta3 intervals that are > 8 weeks. Note the stair-step patterns in Table 3-27 and Table 3-28 that indicate poorer outcomes (fewer children with intervals 4-8 weeks and more children with intervals > 8 weeks) for children from poor families and whose mothers have fewer years of education.

Additional information about intra-dose intervals is provided in Supplements 02, 06, 07, 08, and 09.

Table 3-26. Penta intradose intervals from HBR that are < 4 weeks (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	3.0	3.0	3.3	7.1	2.4	3.8	3.4	1.5	3.1
Maternal Education (years)									
None	3.1	3.3	3.6	6.8	2.7	3.7	3.6	1.5	3.5
Primary (1-5)	3.0	4.0	3.2	11.0	4.6	5.0	3.4	0.8	4.4
Middle (6-8)	3.0	2.2	3.4	8.5	0.9	2.2	2.9	1.7	2.3
Secondary (9-10)	3.1	2.5	2.8	7.2	1.9	5.6	2.8	1.5	3.3
Higher (11 and above)	2.6	2.1	2.8	5.9	2.3	4.1	2.6	1.8	2.5
Sex									
Boys	3.0	3.1	3.3	7.5	2.6	4.2	3.3	1.3	3.2
Girls	3.0	3.0	3.1	6.8	2.2	3.4	3.1	1.7	3.1
Wealth									
Lowest	2.5	3.6	3.8	5.9	9.5	4.8	3.9	1.5	4.4
Second	3.0	3.7	3.6	6.9	0.0	4.0	3.7	1.5	3.5
Middle	3.1	3.1	3.8	8.6	1.6	2.8	3.6	1.6	3.0
Fourth	3.0	3.0	3.0	8.1	3.7	1.2	3.1	1.6	2.0
Highest	3.0	2.2	2.7	4.0	2.1	1.5	2.6	1.2	0.0
Area									
Urban	2.4	2.7	2.1	6.6	2.1		2.7	1.6	2.0
Rural	3.2	3.4	3.4	7.3	2.7		3.4	1.5	3.3
N	36,790	21,972	13,966	7,735	1,595	4,484	86,542	10,765	5,915
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of Penta1-to-2 and Penta2-to-3 intervals that were calculable from dose dates on HBRs.									

Table 3-27. Penta intradose intervals from HBR that are 4-8 weeks (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	85.2	71.6	68.9	69.0	78.3	63.3	76.5	87.9	80.7
Maternal Education (years)									
None	84.1	67.2	64.4	64.5	67.6	63.0	72.2	84.4	74.3
Primary (1-5)	84.6	69.7	67.7	75.3	69.6	57.2	79.2	88.1	81.2
Middle (6-8)	84.9	75.3	71.4	76.2	87.3	45.6	81.7	88.2	82.3
Secondary (9-10)	86.0	78.1	74.6	71.7	80.5	72.8	82.5	88.6	80.9
Higher (11 and above)	88.0	81.3	74.6	80.8	80.2	68.1	84.0	89.8	87.4
Sex									
Boys	85.5	71.2	69.1	68.2	77.7	63.5	77.7	88.2	80.9
Girls	85.0	71.9	68.9	69.7	79.0	63.1	78.0	87.6	80.4
Wealth									
Lowest	83.8	63.4	63.3	58.5	52.4	59.7	66.4	81.6	72.1
Second	84.0	66.7	66.1	69.0	69.2	61.5	72.6	82.6	77.3
Middle	84.1	69.3	67.7	71.4	69.8	68.4	77.2	88.6	85.1
Fourth	84.6	74.6	69.6	73.8	75.6	73.1	80.3	88.7	87.2
Highest	86.5	79.4	73.1	75.1	79.7	83.1	83.5	90.0	88.2
Area									
Urban	84.7	75.8	72.5	70.6	78.9		79.1	88.3	81.7
Rural	85.4	67.4	68.5	68.5	77.5		77.4	87.9	80.5
N	36,790	21,972	13,966	7,735	1,595	4,484	86,542	10,765	5,915
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of Penta1-to-2 and Penta2-to-3 intervals that were calculable from dose dates on HBRs.									

Table 3-28. Penta intradose intervals from HBR that are > 8 weeks (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	11.8	25.4	27.8	23.9	19.3	32.9	20.1	10.6	16.2
Maternal Education (years)									
None	12.8	29.5	32.0	28.7	29.7	33.3	24.2	14.1	22.2
Primary (1-5)	12.4	26.3	29.1	13.7	25.8	37.8	17.4	11.1	14.5
Middle (6-8)	12.1	22.5	25.2	15.3	11.8	52.2	15.4	10.1	15.4
Secondary (9-10)	10.9	19.4	22.6	21.1	17.6	21.6	14.7	9.9	15.8
Higher (11 and above)	9.4	16.6	22.6	13.3	17.5	27.8	13.4	8.4	10.1
Sex									
Boys	11.5	25.7	27.6	24.3	19.7	32.3	19.0	10.5	15.9
Girls	12.0	25.1	28.0	23.5	18.8	33.5	18.9	10.7	16.5
Wealth									
Lowest	13.7	33.0	32.9	35.6	38.1	35.5	29.7	16.9	23.5
Second	13.0	29.6	30.3	24.1	30.8	34.5	23.7	15.9	19.2
Middle	12.8	27.6	28.5	20.0	28.6	28.8	19.2	9.8	11.9
Fourth	12.4	22.4	27.4	18.1	20.7	25.7	16.6	9.7	10.8
Highest	10.5	18.4	24.2	20.9	18.2	15.4	13.9	8.8	11.8
Area									
Urban	12.9	21.5	25.4	22.8	19.0		18.2	10.1	16.3
Rural	11.4	29.2	28.1	24.2	19.8		19.2	10.6	16.2
N	36,790	21,972	13,966	7,735	1,595	4,484	86,542	10,765	5,915
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of Penta1-to-2 and Penta2-to-3 intervals that were calculable from dose dates on HBRs.									

Figure 3-30. Penta2 to Penta3 intradose intervals from HBR that are > 8 weeks, by region, Pakistan TPVICS 2022

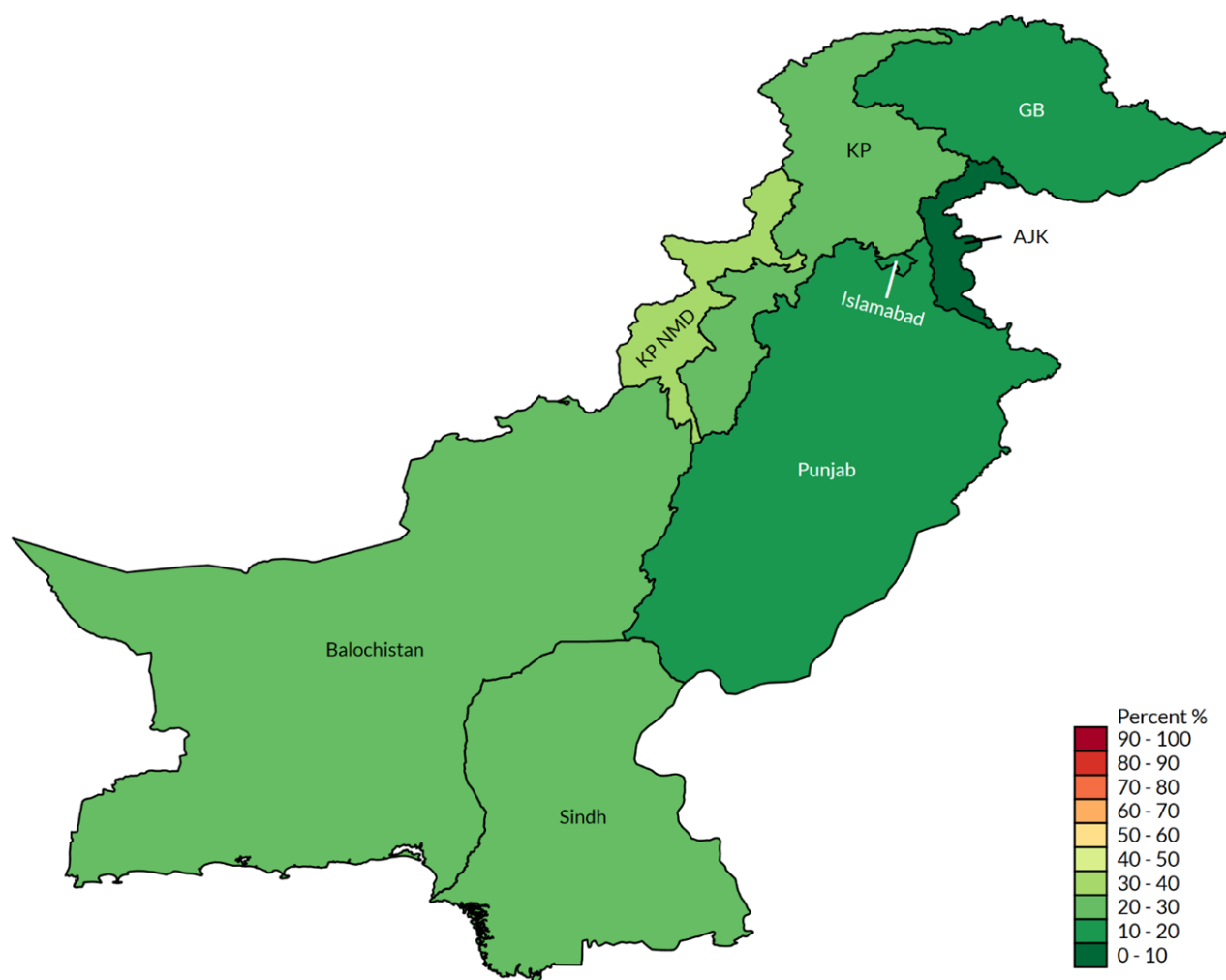
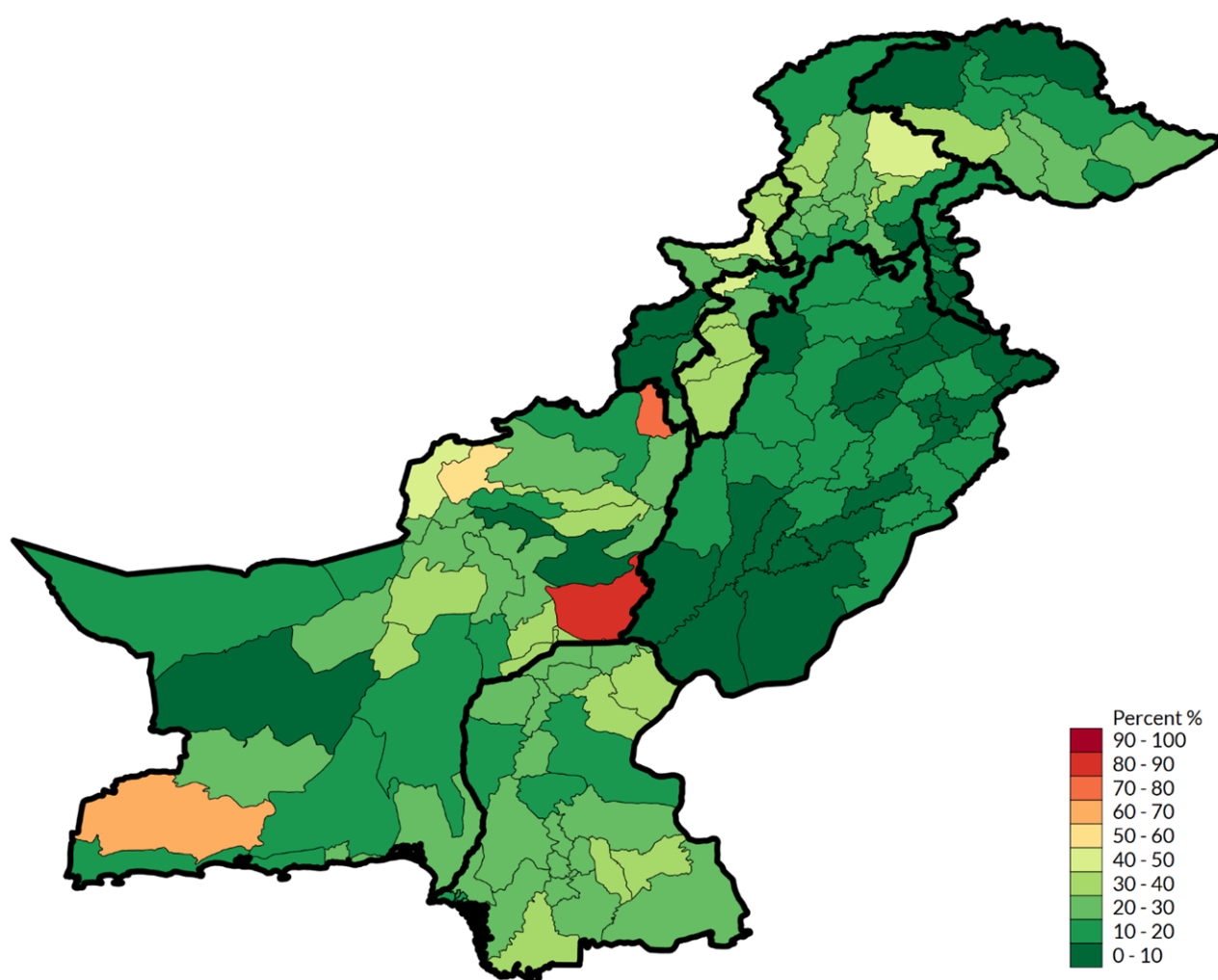


Figure 3-31. Penta2 to Penta3 intradose intervals from HBR that are > 8 weeks, by district, Pakistan TPVICS 2022



Missed Opportunities for Simultaneous Vaccination (MOSV)

A *missed opportunity for vaccination (MOV)* is when a child has contact with the health system and does not receive all the vaccine doses for which s/he is eligible on that day. A *missed opportunity for simultaneous vaccination (MOSV)* is when a child receives a vaccine but does not receive all the vaccine doses for which s/he is eligible on that day. VCQI uses dates from vaccination cards to assess what proportion of documented vaccination visits result in MOSVs and what proportion of children experience MOSVs.

MOSV¹⁰ analyses are described in some detail in the WHO 2018 *Vaccination Coverage Cluster Survey: Reference Manual* and in a recent 2021 peer-reviewed publication [5], [6]. MOSVs are often summarized in two ways: analysis of the proportion of vaccination visits that include one or more MOSVs and analysis of

¹⁰ The term MOV has been used for several decades and the term MOSV is new, having been introduced in the aforementioned 2021 paper. In earlier documents, authors use the phrase MOVs to mean both the broader category of MOVs that happen in any health system contact, and to mean the more specific category of MOVs that occur at vaccination visits. Because the only health system contact dates that VCQI can know are the dates from the vaccination card, all of VCQI's analyses are of MOSVs, even if some VCQI documentation uses the older phrase: MOVs.

the proportion of children who experience MOSVs during one or more vaccination visits.

MOSV: Visit-Based Analyses

Table 3-29, Figure 3-32, and Figure 3-33 summarize the proportion of vaccination visits documented on cards in which a MOSV occurred. These data are quite encouraging. Fewer than 20% of all vaccination visits include a MOSV. That is to say that on more than 80% of documented vaccination visits, the health facility staff correctly assessed which doses the child should receive and administered them all. Note in the table that MOSVs tend to occur in a higher percentage of visits by children from poor families and children with less educated mothers.

Additional information about MOSVs is provided in Supplements 02, 06, 07, 08 and 09.

Table 3-29. Vaccination visits with MOSV for any dose (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	12.3	19.5	20.8	22.5	13.1	30.0	17.1	8.5	14.9
Maternal Education (years)									
None	13.7	22.4	25.9	26.3	22.8	30.5	20.7	11.5	20.8
Primary (1-5)	12.0	19.2	19.5	17.1	19.6	26.0	14.4	10.2	11.6
Middle (6-8)	12.0	14.6	17.8	11.2	13.6	24.5	12.7	9.1	14.3
Secondary (9-10)	11.7	15.5	15.1	21.0	9.6	32.5	12.6	6.8	13.1
Higher (11 and above)	10.3	14.4	16.5	14.1	11.1	25.8	11.9	6.5	10.9
Sex									
Boys	12.0	19.7	20.6	21.6	12.7	28.6	15.9	8.4	14.4
Girls	12.5	19.2	21.1	23.7	13.6	31.6	16.3	8.6	15.5
Wealth									
Lowest	14.9	26.2	29.3	26.8	28.8	32.4	24.9	15.2	21.1
Second	13.9	20.8	25.1	24.3	18.9	30.8	20.4	14.5	17.4
Middle	13.2	19.5	21.4	21.5	24.0	27.1	16.5	9.5	12.1
Fourth	12.7	17.6	20.2	18.1	14.2	25.3	14.2	7.0	10.1
Highest	11.0	15.2	15.9	19.2	12.2	15.0	12.1	5.9	9.9
Area									
Urban	11.3	17.0	17.0	21.8	13.6		14.7	7.6	14.2
Rural	12.5	21.9	21.5	22.7	12.5		16.6	8.6	15.0
N	106,102	59,093	36,826	19,056	4,455	11,580	237,112	28,643	15,187
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of vaccination visits documented with dates on HBRs where the child was eligible for at least one dose.									

Figure 3-32. Vaccination Visits with MOSV For Any Dose, (%), by region, Pakistan TPVICS 2022

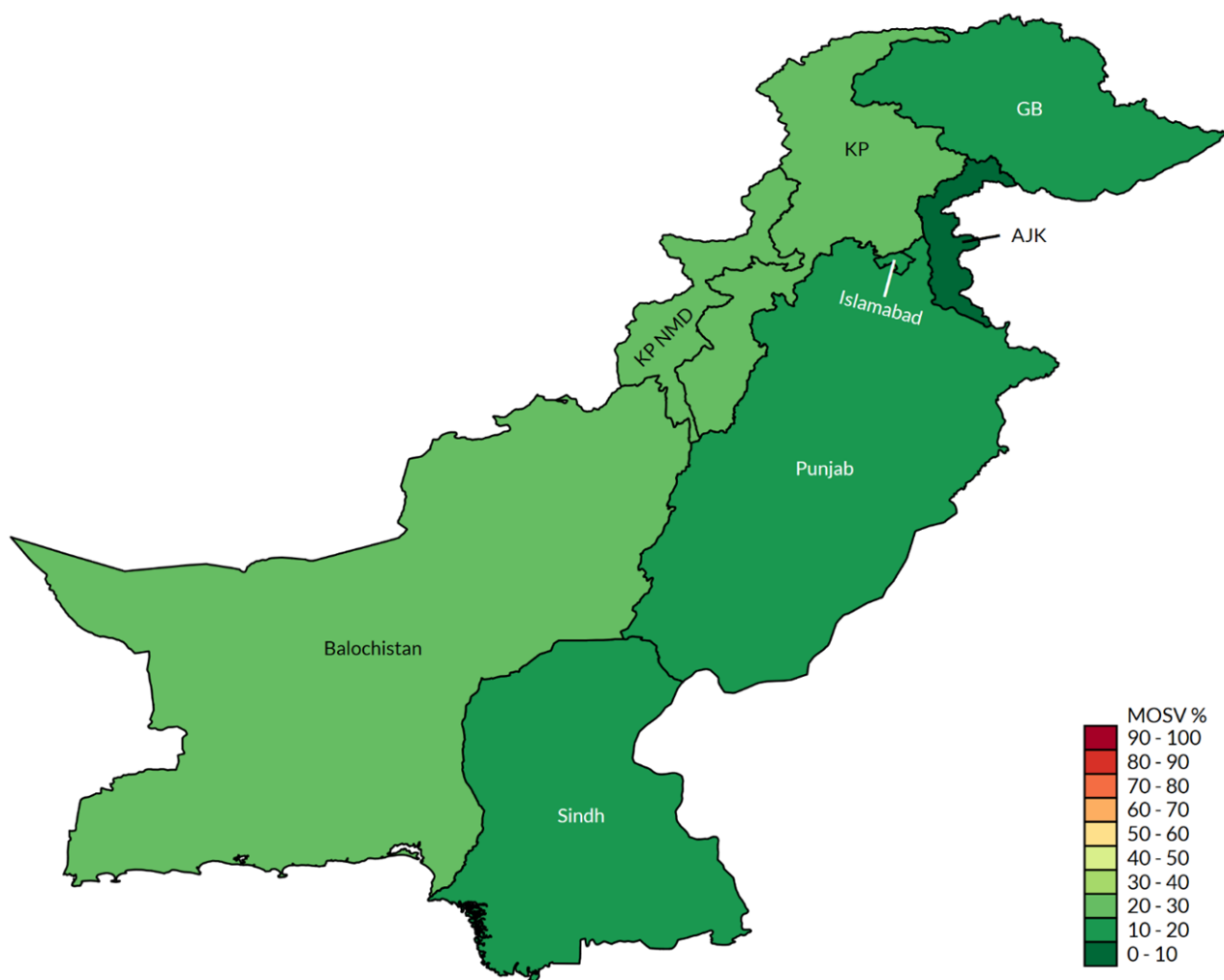
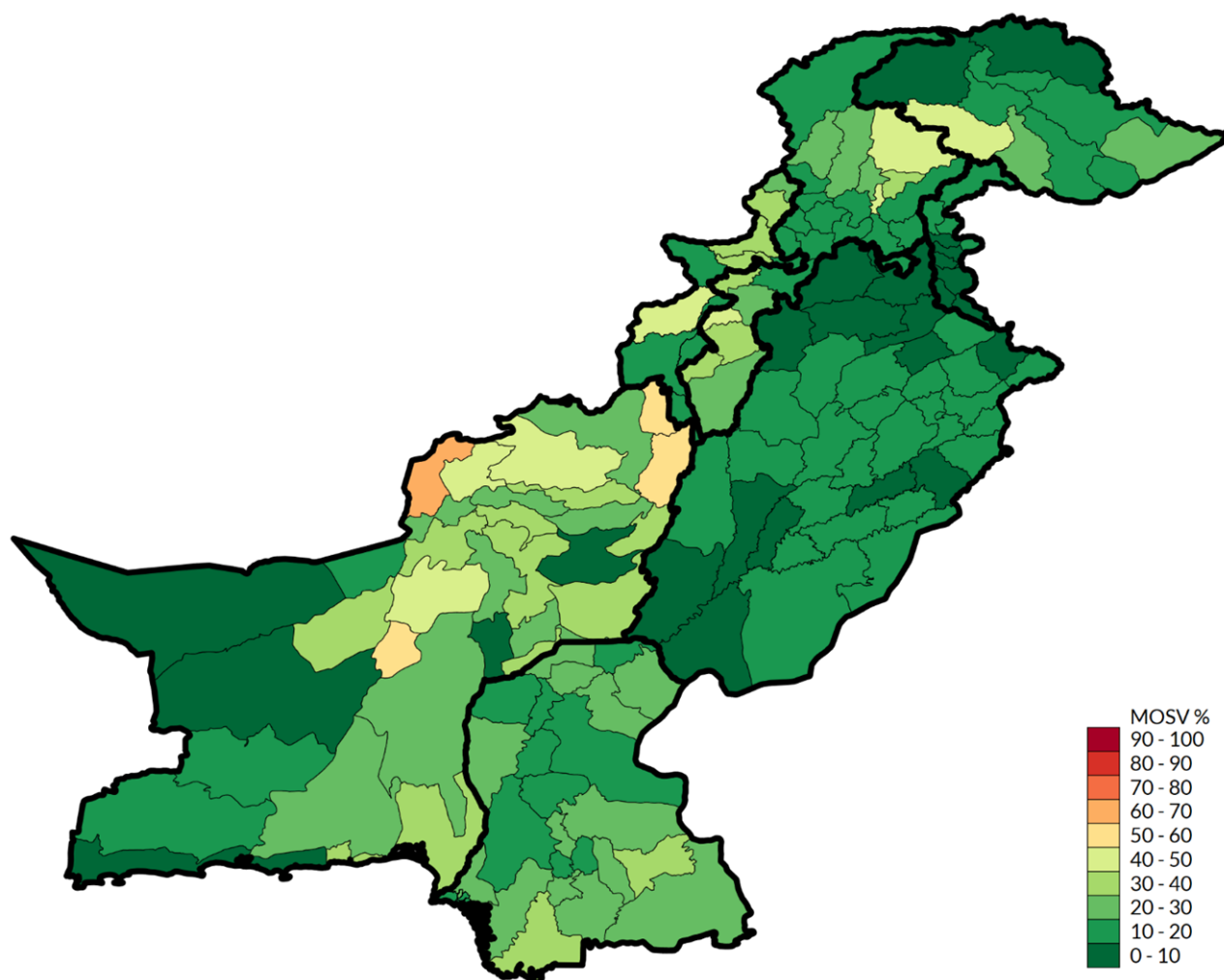


Figure 3-33. Vaccination Visits with MOSV For Any Dose, (%), by district, Pakistan TPVICS 2022



MOSV: Child-Based Analyses

Table 3-30 summarizes the proportion of children who experienced one or more MOSVs by region and by demographic characteristics. Given that MOSVs are quite rare, occurring in fewer than 1 in every five visits, it is surprising to see that a high proportion of children experience MOSVs: more than half the children in the provinces excluding AJK and GB experienced at least one MOSV, with nearly one in three in AJK (30.3%) and nearly half (45.1%) in GB. Figures 3-34 and 3-35 show that outcome on a map by district. Even in districts where nearly all the children are fully vaccinated (see Figure 3-27), a notable proportion experienced one or more MOSVs.

Figure 3-36 illustrates the interesting point that MOSVs are quite rare for most of the doses in the first year of life except IPV, for which MOSVs were very common and MCV1, for which there were more MOSVs (particularly in Balochistan) than for other doses. The explanation for this phenomenon relates to timeliness. The vaccination coverage and timeliness charts earlier in the report illustrated with pink bar segments that a notable portion of children received their 6-week doses (Penta1, OPV1, PCV1, Rota1) one or more months late and an even larger proportion received their 10-week doses (Penta2, OPV, PCV2,

Rota2) more than one month late, meaning that they received the 10-week doses after they were 14 weeks of age.

However, IPV is due at 14 weeks of age and was usually not administered with those 10-week doses (or even sometimes the 6-week doses) that were being administered at age 14+ weeks. Instead, the vaccinators delayed the IPV dose and administered it later, with the other doses scheduled for 14 weeks (Penta3, OPV3, PCV3). Penta, OPV, and PCV are doses in a series and it is correct to wait at least four weeks after the 10-week doses before administering the series doses due at 14-weeks. In contrast, IPV is not in a dose series, and biologically and immunologically, it could be administered at the first visit after the child is 14 weeks of age, even if that meant administering it with the doses that were scheduled for 6 or 10 weeks of age.

Thus, two factors work together to produce these IPV MOSVs: first, quite a few children receive their 6- and 10-week doses late – sometimes so late that they are being administered after the child has reached the age of 14 weeks. And second, Pakistan’s vaccinators are very consistent about administering IPV at the same time as Penta3, OPV3, and PCV3. Thus, many children spend extra weeks without the protection provided by IPV. Table 3-31 summarizes the proportion of children with vaccination cards and vaccination visits after age 14 weeks who experienced one or more MOSVs for IPV.

Furthermore, most of the children who receive 6-week and 10-week doses after the age of 14 week go on to later receive the 14-week doses, including IPV, but some do not. Some children who had a vaccination visit after the age of 14 weeks failed to receive IPV and then dropped out, never receiving Penta3, OPV3, PCV3, Rota2, or IPV.

When a child experiences an MOSV and then receives the dose at a later visit, we say that it was a *corrected MOSV*. When the child has not received the dose at the time of the vaccination coverage survey, we call it an *uncorrected MOSV*. Table 3-32 summarizes the proportion of IPV MOSVs that were uncorrected at the time of the TPVICS survey interview. Note that in some provinces children were less likely to have the MOSV corrected – meaning that they had not yet received the protection of IPV even though they have received at least one vaccine after the age of 14 weeks – if they were from a poor family or had a mother with fewer years of education.

Table 3-33 documents that in Pakistan, excluding AJK and GB, 43.4% of the 2,843 children who experienced an MOSV for MCV1 had an uncorrected MOSV; they had not received MCV1 by the time of the TPVICS survey.

Table 3-34 documents the proportion of visits when the child was experiencing their first MOSV for IPV, so the first vaccination visit after they were 14 weeks old, and what percent of those vaccination visits included receiving a valid dose of Penta1 (due at 6 weeks), what percent of those first IPV MOSV visits included receiving a valid dose of Penta2 (due at 10 weeks), and what percent included receiving a valid

dose of Penta3. One-fourth (23.9%) of the 24,453 children who experienced an IPV MOSV were receiving their 6-week dose of Penta1 at a vaccination visit where they were 14+ weeks old. Two-thirds (65.5%) were receiving their 10-week dose of Penta2. Only 1% of children with IPV MOSVs were receiving the 14-week dose of Penta3 at the IPV MOSV visit (perhaps due to oversight or due to stock-out of IPV).

The situation with MCV1 is similar to IPV. There were 3,350 children with MOSVs for MCV1. Table 3-34 documents that at the first visit with an MCV1 MOSV (so the child would have been 9+ months old) 19.4% of those children were just receiving their 6-week Penta1 dose, and 23.7% were receiving a valid Penta2 and 38.4% were receiving their valid 14-week Penta3 dose. Even though the child was more than 9 months old, in those instances, the vaccinators also did not administer the MCV1 dose for which the child was eligible.

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Table 3-30. Children aged 12-23m who experienced one or more MOSVs for any dose (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	45.9	53.1	56.3	49.8	43.4	63.4	51.0	30.3	45.1
Maternal Education (years)									
None	49.4	58.1	62.4	54.6	55.8	64.6	55.8	39.8	55.6
Primary (1-5)	46.3	54.7	54.2	43.4	57.6	57.9	47.8	33.8	39.5
Middle (6-8)	45.6	44.3	54.8	31.1	39.7	61.9	43.8	32.0	44.4
Secondary (9-10)	44.6	44.6	48.3	48.9	36.1	60.7	42.1	25.4	41.6
Higher (11 and above)	39.4	41.9	49.1	34.8	40.0	55.7	39.0	24.1	36.2
Sex									
Boys	45.5	53.7	56.6	48.5	42.8	61.6	48.5	29.8	44.5
Girls	46.2	52.5	56.0	51.2	44.1	65.5	48.9	30.8	45.8
Wealth									
Lowest	51.1	63.6	66.0	61.9	52.2	65.0	61.1	50.0	53.1
Second	49.7	56.1	60.4	51.7	45.5	63.5	54.5	44.9	51.6
Middle	48.8	56.9	57.2	45.1	71.1	62.8	49.8	32.3	40.0
Fourth	48.2	49.3	56.1	41.0	43.7	59.5	46.1	26.8	33.6
Highest	41.7	43.0	48.9	47.2	41.4	42.1	41.2	22.7	35.6
Area									
Urban	42.2	47.0	50.4	50.2	43.3		45.0	29.2	43.0
Rural	47.0	59.0	57.2	49.7	43.6		49.9	30.4	45.4
N	19,445	13,494	8,648	4,956	949	3,123	50,615	5,715	3,274
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of children who had one or more vaccination dates on their HBR when they were age eligible for a dose.									

Figure 3-34. Children aged 12-23m who experienced one or MOSVs for any dose, by region, Pakistan TPVICS 2022

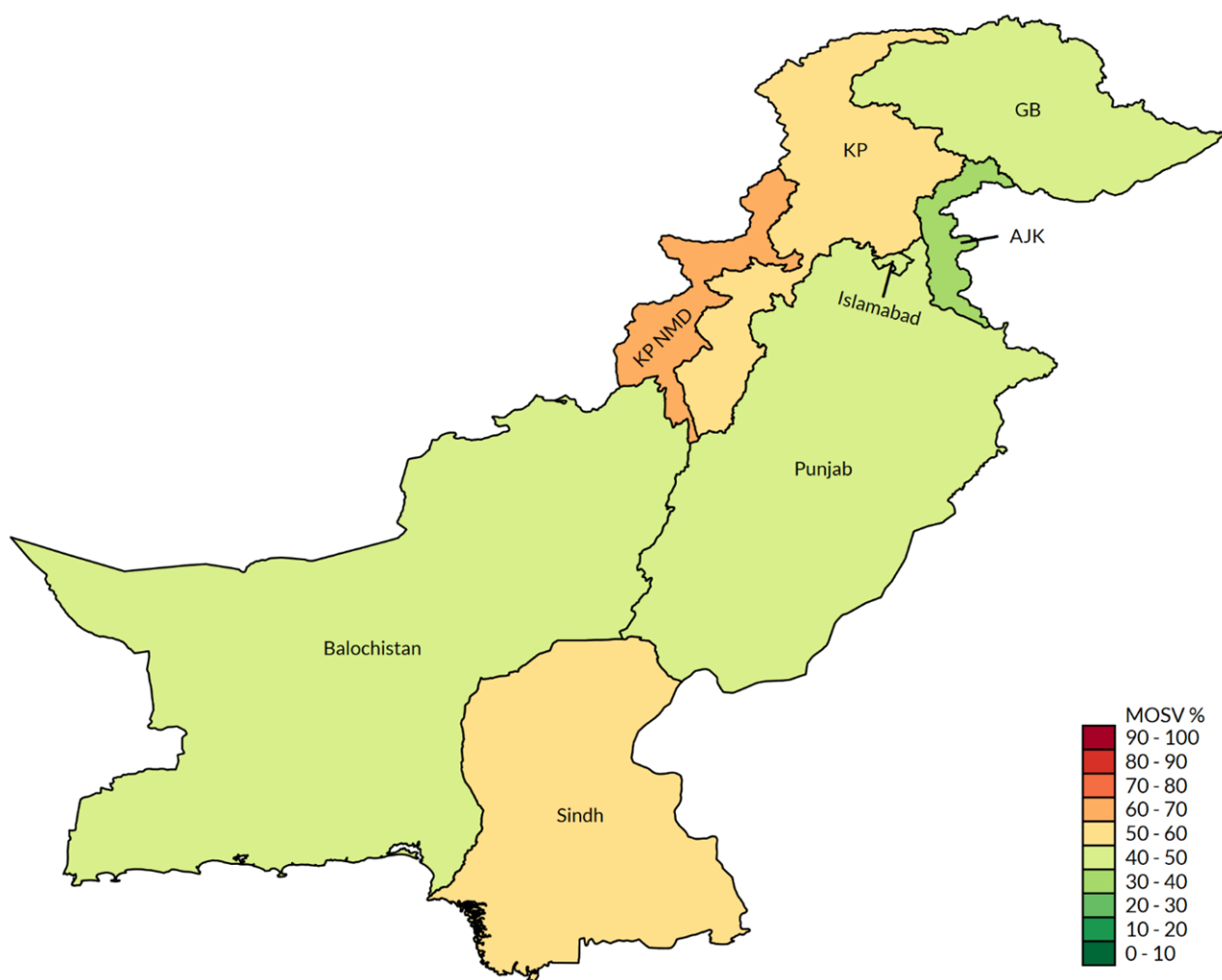


Figure 3-35. Children aged 12-23m who experienced one or MOSVs for any dose, by district, Pakistan TPVICS 2022

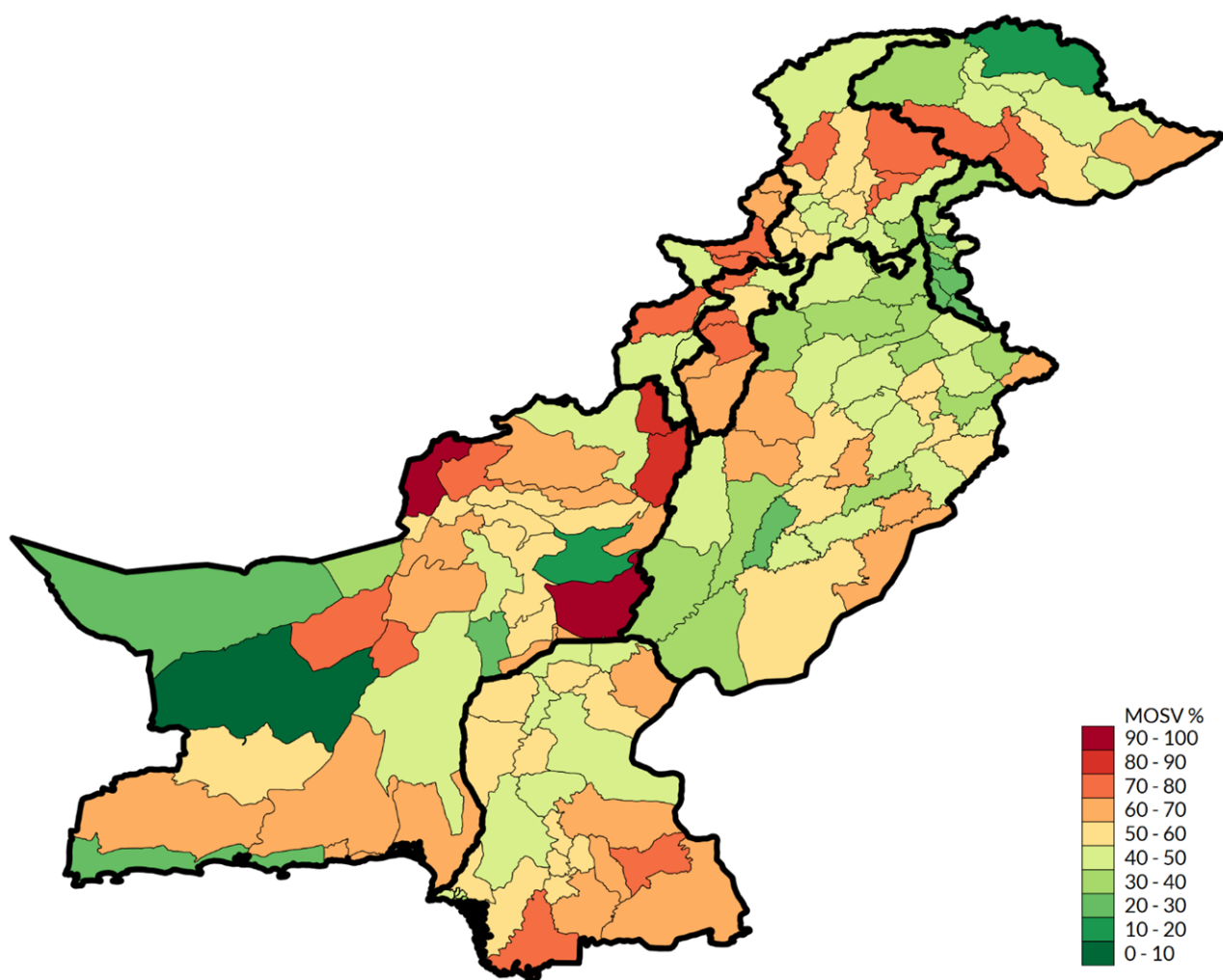


Figure 3-36. Children aged 12-23m who experienced one or MOSVs, by dose, by district, Pakistan TPVICS 2022

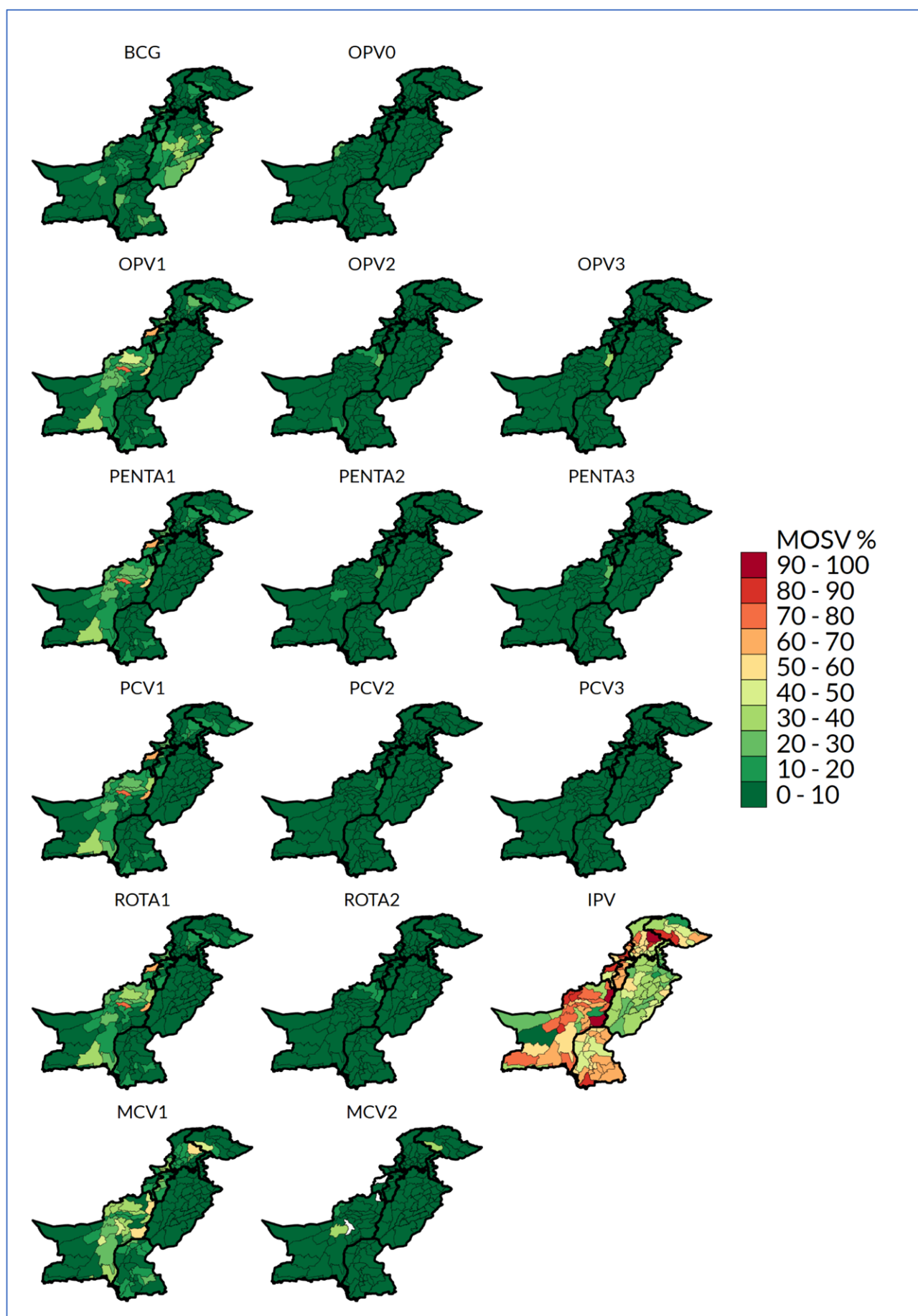


Table 3-31. Children aged 12-23m who experienced one or MOSVs for IPV (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	33.7	54.2	57.2	54.6	43.7	68.3	47.0	29.0	45.9
Maternal Education (years)									
None	35.7	61.0	64.3	62.1	61.5	69.4	54.4	38.7	57.7
Primary (1-5)	35.1	55.7	55.8	45.6	63.3	67.6	42.9	33.5	40.7
Middle (6-8)	33.6	43.4	55.9	32.3	42.9	68.6	38.4	30.8	45.5
Secondary (9-10)	32.2	44.1	48.3	51.2	34.9	64.7	37.1	24.3	42.2
Higher (11 and above)	29.8	39.4	48.0	33.4	38.7	59.7	34.8	22.1	35.9
Sex									
Boys	33.5	54.9	57.8	53.2	43.6	65.8	45.1	28.4	44.6
Girls	33.9	53.4	56.5	56.2	43.7	71.3	45.2	29.7	47.3
Wealth									
Lowest	38.0	66.4	68.2	66.8	71.4	70.7	62.4	47.2	56.1
Second	35.6	59.0	61.2	56.2	55.6	69.2	53.7	45.5	52.2
Middle	35.6	58.0	58.7	51.1	77.8	66.3	47.0	30.8	40.1
Fourth	35.5	51.0	56.7	45.3	48.5	63.5	41.4	25.3	34.0
Highest	31.0	41.6	49.0	49.7	40.5	33.3	35.2	21.4	36.2
Area									
Urban	34.5	47.6	50.3	55.5	44.3		43.0	28.0	45.3
Rural	33.5	60.4	58.2	54.4	42.9		45.9	29.2	46.0
N	18,606	11,775	7,774	4,122	854	2,601	45,732	5,400	3,012
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of children who had one or more vaccination dates on their HBR when they were age eligible for IPV1.									

Table 3-32. Percent of children with MOSVs for IPV that were uncorrected (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	2.7	17.8	19.9	25.6	15.8	30.4	15.6	5.4	11.8
Maternal Education (years)									
None	3.6	17.7	24.3	28.2	43.1	30.5	18.9	6.9	15.0
Primary (1-5)	1.5	16.6	18.2	16.4	8.0	36.6	10.0	4.9	6.4
Middle (6-8)	1.9	18.7	13.8	13.1	18.5	22.9	8.9	5.3	14.4
Secondary (9-10)	2.1	19.9	13.6	16.7	11.9	31.8	10.3	4.5	9.2
Higher (11 and above)	3.3	17.6	14.8	19.4	7.3	26.3	11.0	4.7	8.7
Sex									
Boys	2.5	17.7	19.9	24.9	14.3	29.9	14.6	5.0	10.1
Girls	2.8	18.0	19.9	26.3	17.4	30.9	15.0	5.9	13.6
Wealth									
Lowest	2.5	16.8	25.5	19.6	60.0	31.4	18.6	5.3	10.8
Second	3.2	16.5	24.1	34.2	60.0	30.9	19.5	5.2	12.2
Middle	2.7	15.3	19.0	24.3	28.6	30.1	14.6	5.9	11.3
Fourth	2.5	20.8	19.4	21.9	20.0	24.5	12.6	5.1	12.3
Highest	2.8	19.4	15.4	25.1	11.4	9.1	10.2	5.6	16.0
Area									
Urban	4.3	20.5	19.1	26.8	17.8		16.2	9.9	21.5
Rural	2.2	15.8	20.0	25.3	13.1		14.3	4.9	10.5
N	6,276	6,383	4,443	2,251	373	1,777	21,503	1,568	1,382
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of children who had at least one MOSV for IPV1.									

Table 3-33. Percent of children with MOSVs for MCV1 that were uncorrected (%), Pakistan TPVICS 2022

	Punjab	Sindh	Khyber Pakhtunkhwa	Balochistan	ICT Islamabad	KP - NMD	Total*	AJK	GB
Overall	23.6	40.2	46.5	43.7	49.1	60.5	43.4	29.6	31.2
Maternal Education (years)									
None	29.7	41.2	47.9	45.3	61.1	58.0	44.8	27.0	31.9
Primary (1-5)	16.9	38.6	40.6	52.2	28.6	72.7	37.5	38.5	50.0
Middle (6-8)	15.4	32.5	51.4	9.1	25.0	40.0	31.7	33.3	42.9
Secondary (9-10)	14.3	38.6	40.0	40.0	83.3	75.0	36.6	26.3	15.8
Higher (11 and above)	32.4	39.1	48.6	35.9	38.9	76.7	42.4	25.0	33.3
Sex									
Boys	24.4	39.6	47.5	38.4	50.0	63.0	41.9	25.8	27.0
Girls	22.9	40.7	45.5	49.8	48.3	57.9	42.9	33.3	35.5
Wealth									
Lowest	21.4	37.6	46.5	32.9	57.1	59.4	40.9	0.0	29.4
Second	26.7	46.2	54.5	51.2	50.0	59.7	49.6	35.9	32.4
Middle	19.6	39.4	42.3	46.9	100.0	63.2	41.9	34.6	28.0
Fourth	23.6	41.1	45.6	44.6	55.6	69.6	41.0	30.6	30.0
Highest	25.0	39.0	45.0	53.3	44.1	33.3	37.5	21.4	100.0
Area									
Urban	36.3	39.9	42.9	46.4	50.0		41.1	38.9	40.0
Rural	18.6	40.4	46.9	43.1	47.8		42.8	28.2	30.0
N	322	1,043	802	467	53	403	3,090	135	125
* Excludes respondents from Azad Jammu and Kashmir and Gilgit-Baltistan									
KP results exclude KP-NMD. KP-NMD is almost entirely rural.									
Color bars are scaled so that 100% would fill the entire cell with color.									
This is an unweighted indicator.									
N is the number of children who had at least one MOSV for MCV1.									

Table 3-34. Doses of Penta received during MOSVs for IPV and MCV1, Pakistan TPVICS 2022

	MOSVs for:	
	IPV	MCV1
N Children with MOSV	24,453	3,350
Received Valid 6-week Dose of Penta1 at MOSV Visit (%)	23.9%	19.4%
Received Valid 10-week Dose of Penta2 at MOSV Visit (%)	65.5%	23.7%
Received Valid 14-week Dose of Penta3 at MOSV Visit (%)	1.0%	38.4%
Received Valid 6- or 10- or 14-week Dose of Penta at MOSV Visit (%)	90.4%	81.5%

Changes in Coverage from Round 1 to Round 2

Vaccination coverage did change between survey Round 1 in 2020-21 and Round 2 in 2022. Table 3-35 portrays the changes at the province and region levels; most changes were modest. Blank cells represent quantities whose changes were not statistically significant. For most of the outcomes pictured, a negative change means that the outcome got worse and a positive change means the outcome improved. The exception is % of children who were zero dose. For that outcome, a negative change marks an improvement and is colored green. The largest changes in the table are improvements in the percent of children who received OPV, counting evidence of campaign doses (OPWC) in KP-NMD and Balochistan, Islamabad, and Sindh. There were also double-digit improvements in BCG and OPV0 coverage in KP-NMD and in MCV2 in Balochistan. There are detailed tables showing changes at the district level in Supplements 13 and 14, some of which are larger in magnitude (both positive and negative) than the province level changes shown here.

Figure 3-37 to Figure 3-44 show crude coverage results from Round 1 (green [bottom line]) and Round 2 (blue [top line]). Dose-related data are arranged from bottom-to-top following the order of Pakistan's vaccination schedule. Each coverage estimate is accompanied by a two-sided survey-adjusted Wilson 95% confidence interval. The top of each figure summarizes the proportion of respondents who showed an HBR and the proportions who were fully-, partially-, or not-vaccinated. If any outcome changed from Round 1 to Round 2 by a magnitude that was statistically significant¹¹, then the figure includes a star symbol (★) at the far right and an arrow to indicate whether the Round 2 estimate was significantly higher (▲) or lower (▼) than the Round 1 estimate. The figures in the body of the report show outcomes at the province and region levels. Supplement 13 includes a corresponding figure for every district.

¹¹ In this context, the phrase *statistically significant* means that the p-value for a 2-sided Rao-Scott survey-adjusted chi-squared test was < 0.05.

Table 3-35. Statistically significant changes in coverage outcomes from TPVICS Round 1 to Round 2

		Punjab	Sindh	Khyber Pakhtunkhwa	KP-NMD	Balochistan	Islamabad	Total (Excluding AJK & GB)	Gilgit-Baltistan	AJK
	Showed HBR	1.7	12.3		12.9	4.0		4.8		
	Fully-vaccinated		7.9	-7.5			8.6	1.0		
	Zero dose			-1.4	-22.4			-0.6	6.5	
15 months	MCV2	4.1	7.0	-6.5	-5.1	11.6		4.4	-4.3	-4.1
9 months	MCV1		5.5	-5.6				1.0	-4.4	
14 weeks	IPV1			-6.7				-0.8	-7.7	-1.4
	PCV3		4.8	-3.5		3.7		1.4		
	PENTA3		3.5	-3.4		3.7		1.0	-3.5	
	OPV3		4.2	-3.4			6.9	1.2	-3.8	2.8
	OPWC3	2.2	13.5	4.8	18.3	23.1	12.8	6.8	6.7	4.6
10 weeks	ROTA2	-1.4	3.3	-5.4		-6.0		-0.8		-0.9
	PCV2		2.4	-4.1	6.9				-4.8	-1.0
	PENTA2		2.3	-3.9	7.2		-3.5		-4.9	-1.0
	OPV2	-0.7	3.5	-3.4	8.1				-6.1	
	OPWC2	0.9	10.9	4.1	19.7	23.0	10.2	5.3	3.4	1.2
6 weeks	ROTA1	-1.7		-4.1	7.3			-1.2		
	PCV1	-0.8		-3.9	8.4				-4.9	-0.8
	PENTA1	-0.6		-3.7	8.4				-5.2	-0.8
	OPV1	-0.8	1.3	-4.3	10.7	-6.0		-0.7	-7.7	-0.8
	OPWC1	0.9	7.8	8.9	34.8	25.2	2.6	5.3		0.7
Birth	OPV0	-2.2		-5.6	12.5	-5.6		-1.9	-7.9	-1.0
	BCG		1.0	1.5	23.6			0.9	-4.6	

Empty cells indicate that the change from Round 1 to Round 2 was not statistically significant.

Green indicates improvement from Round 1 to Round 2; red indicates decline.

For Zero dose, an increase is a decline in performance, so is colored red and a decrease is an improvement, so is colored green.

The number in the cell represents the number of % points increase or decrease, rounded to the nearest integer for simplicity of display

The color bars are scaled so that a 100% improvement or decline would fill half the cell with color.

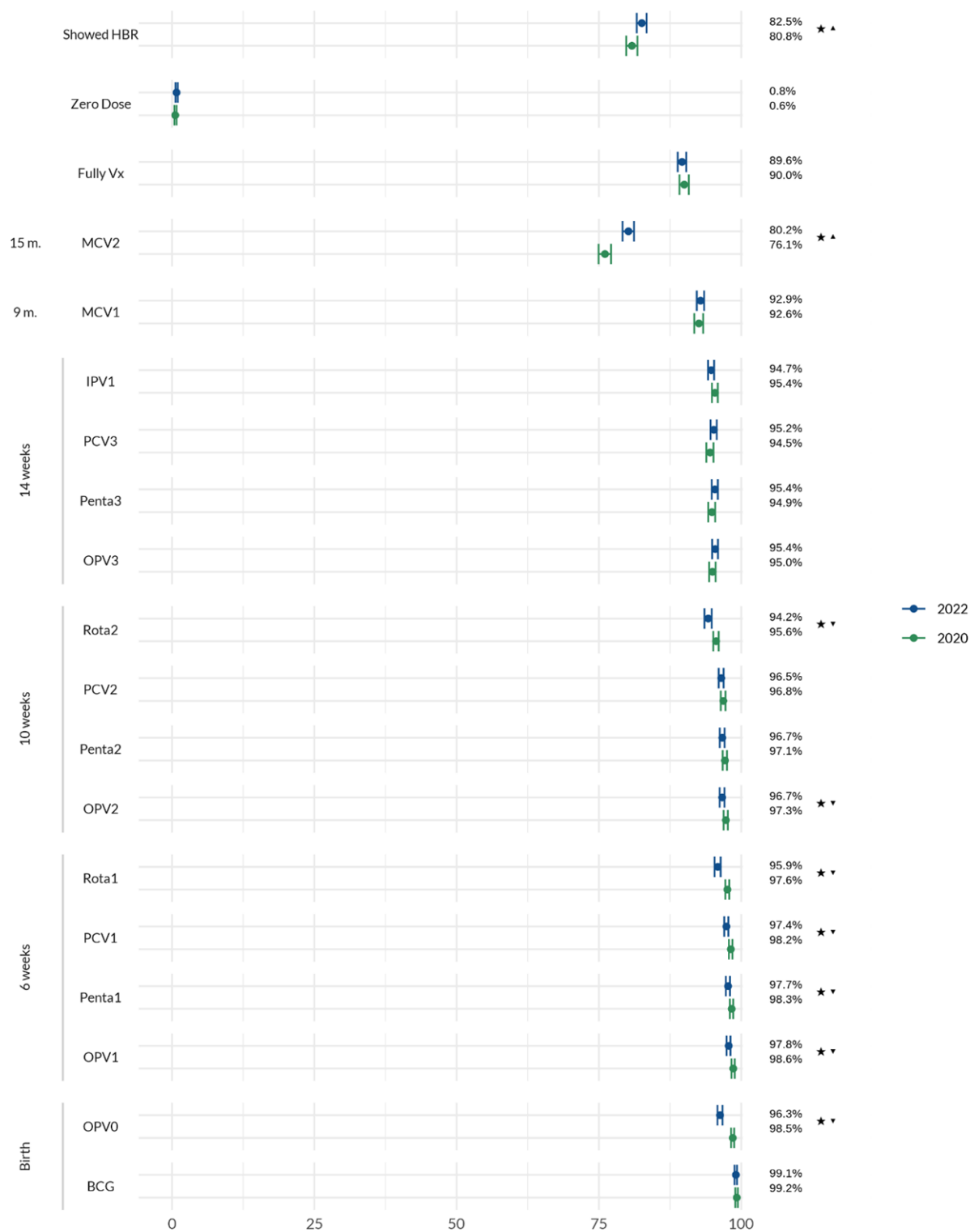
OPWC means oral polio virus including evidence of campaign doses (WC means With Campaign).

OPV means oral polio virus received via the RI programme, excluding campaign doses.

Fully-vaccinated means the child had evidence of receiving all the doses due in the first year of life (excluding Rota).

Zero-dose means the child did not have evidence of receiving any of the doses due in the first year of life (excluding Rota).

Figure 3-37. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), Punjab

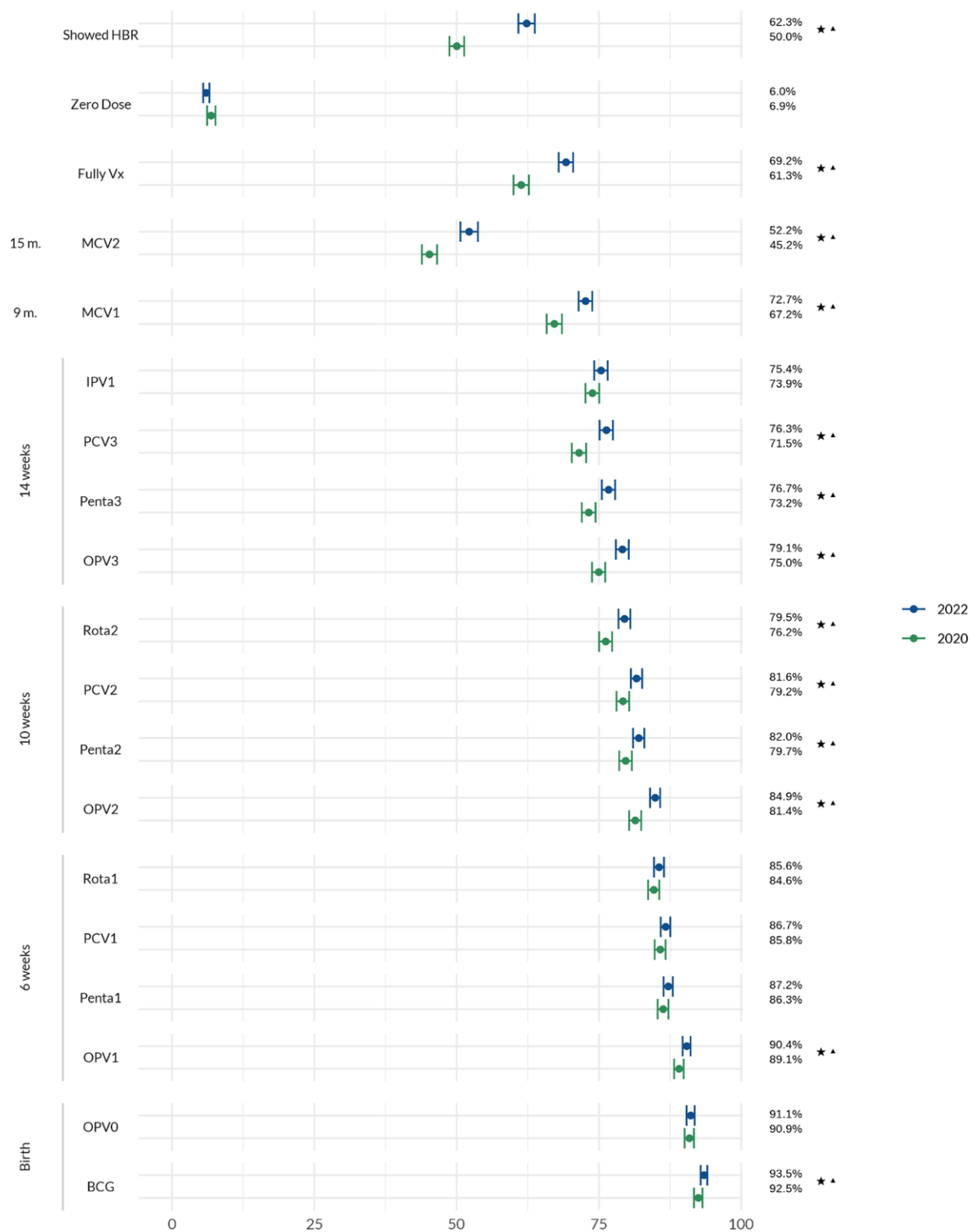


Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

Figure 3-38. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), Sindh

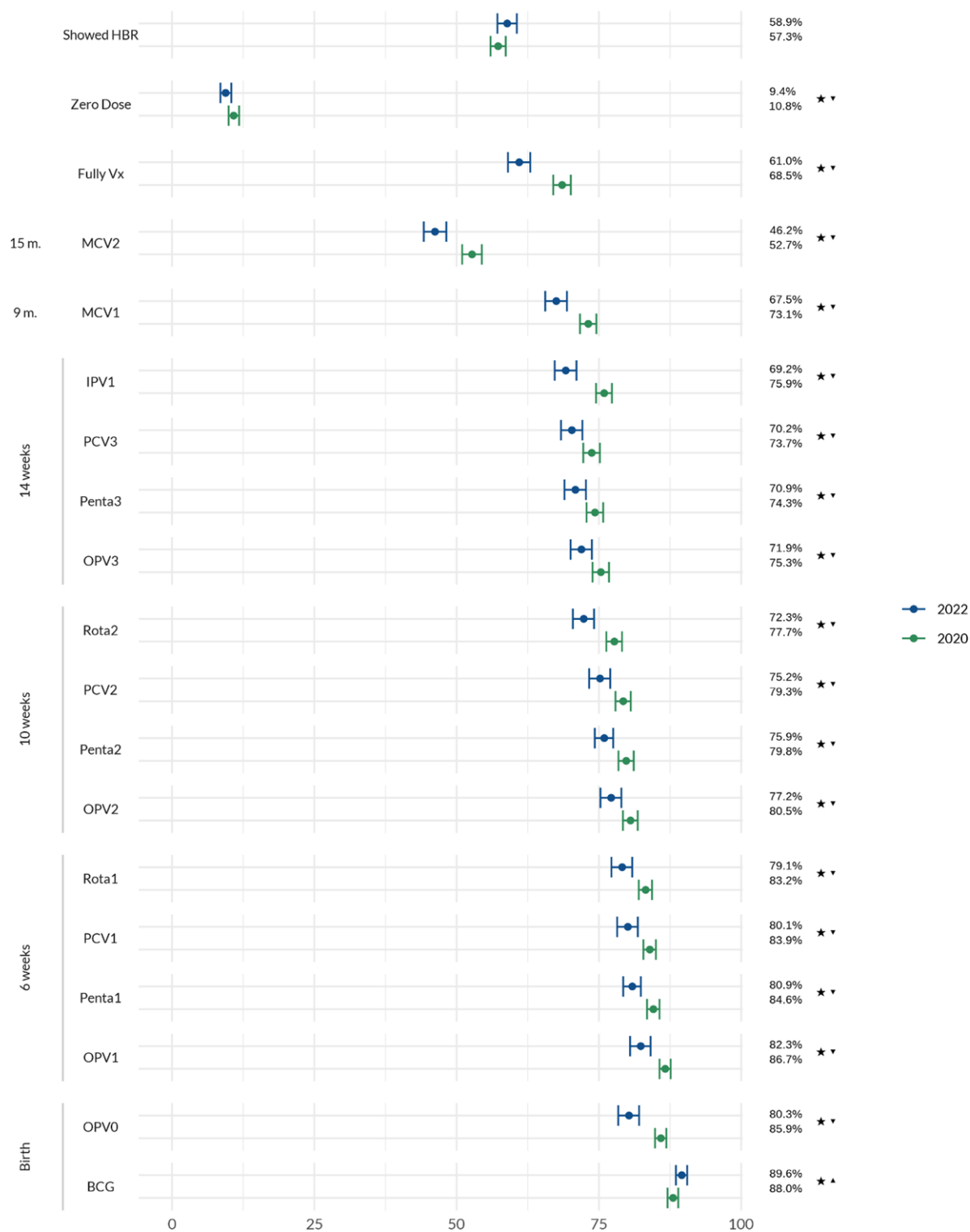


Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

Figure 3-39. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), KP

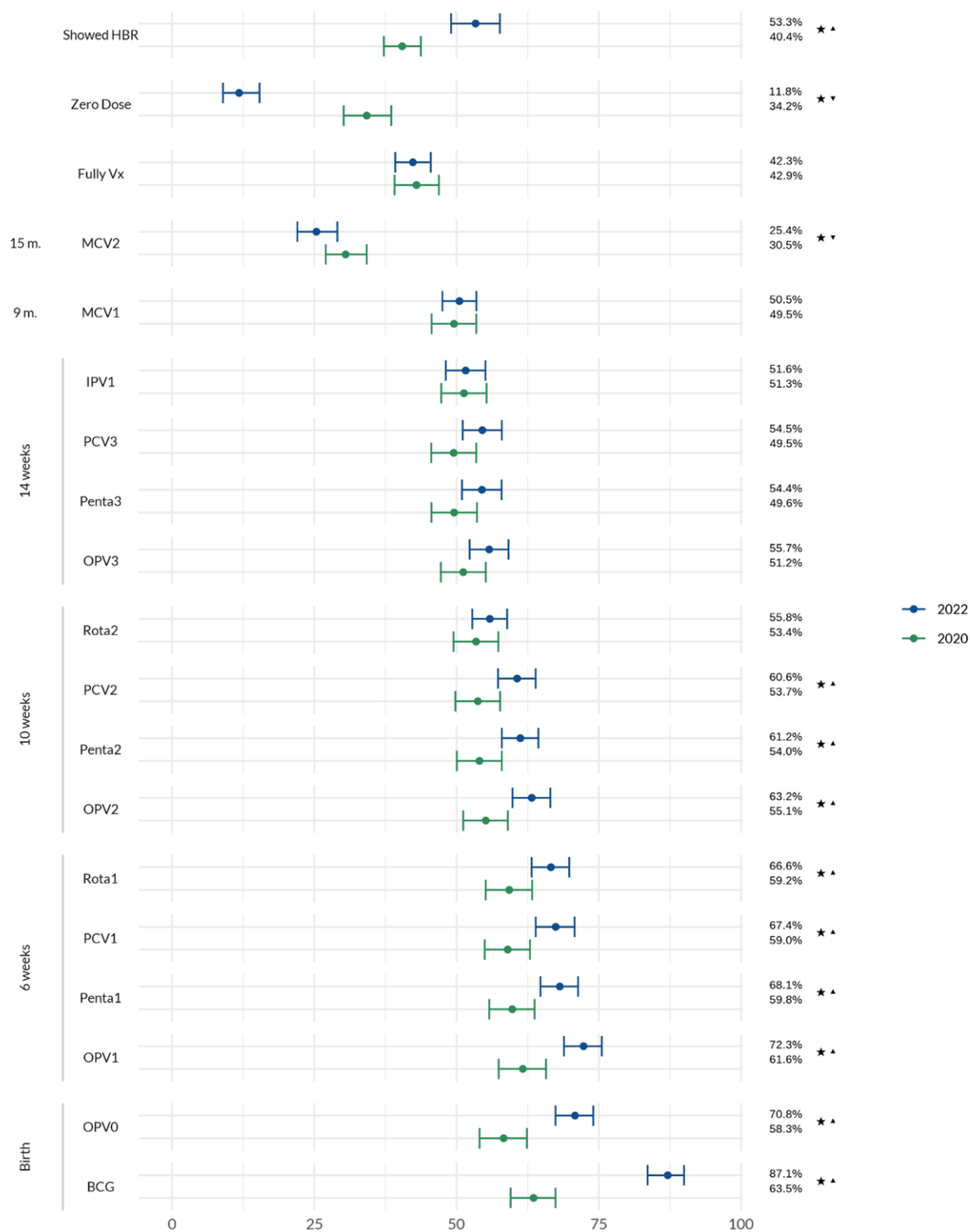


Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

Figure 3-40. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), KP-NMD

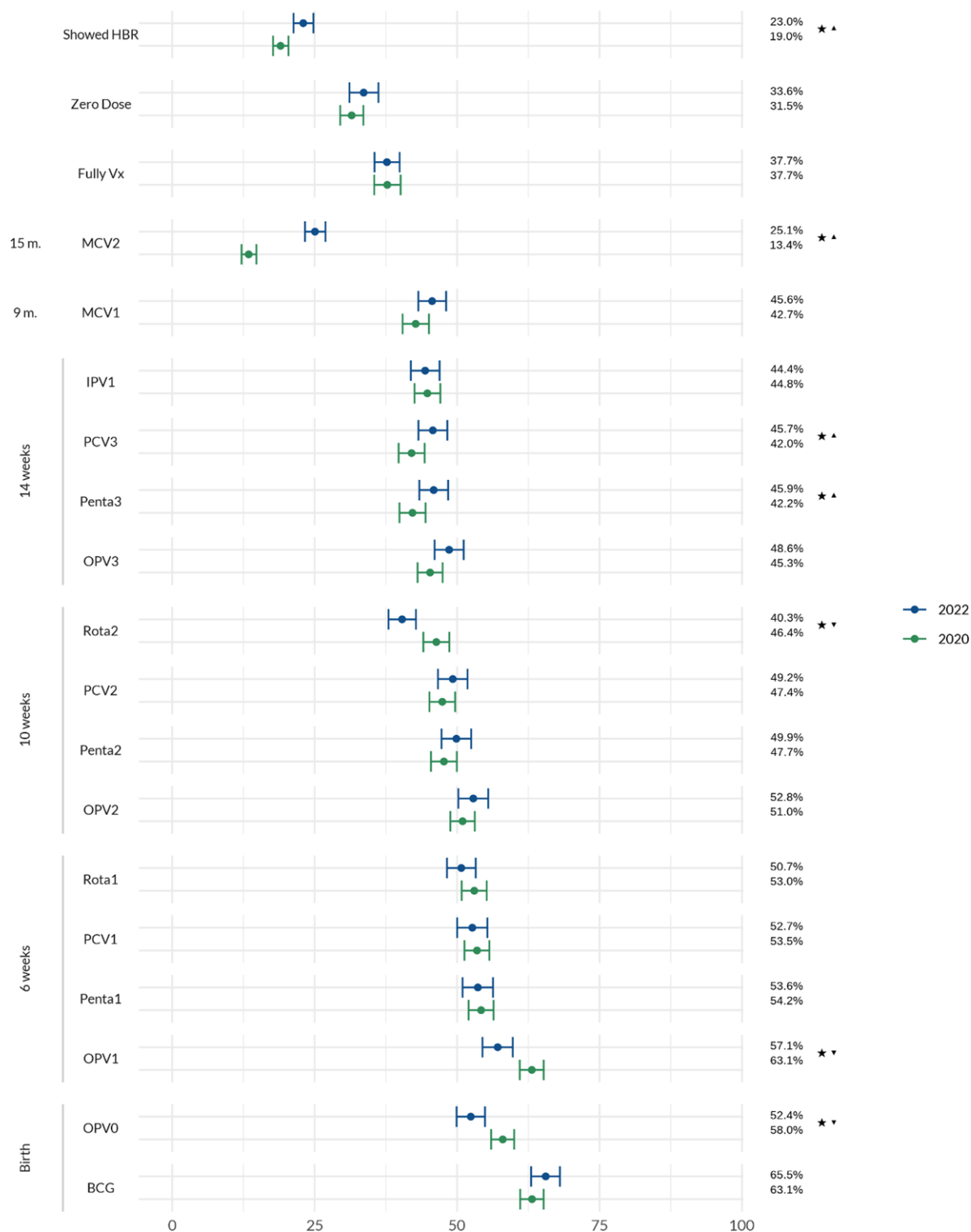


Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

Figure 3-41. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), Balochistan

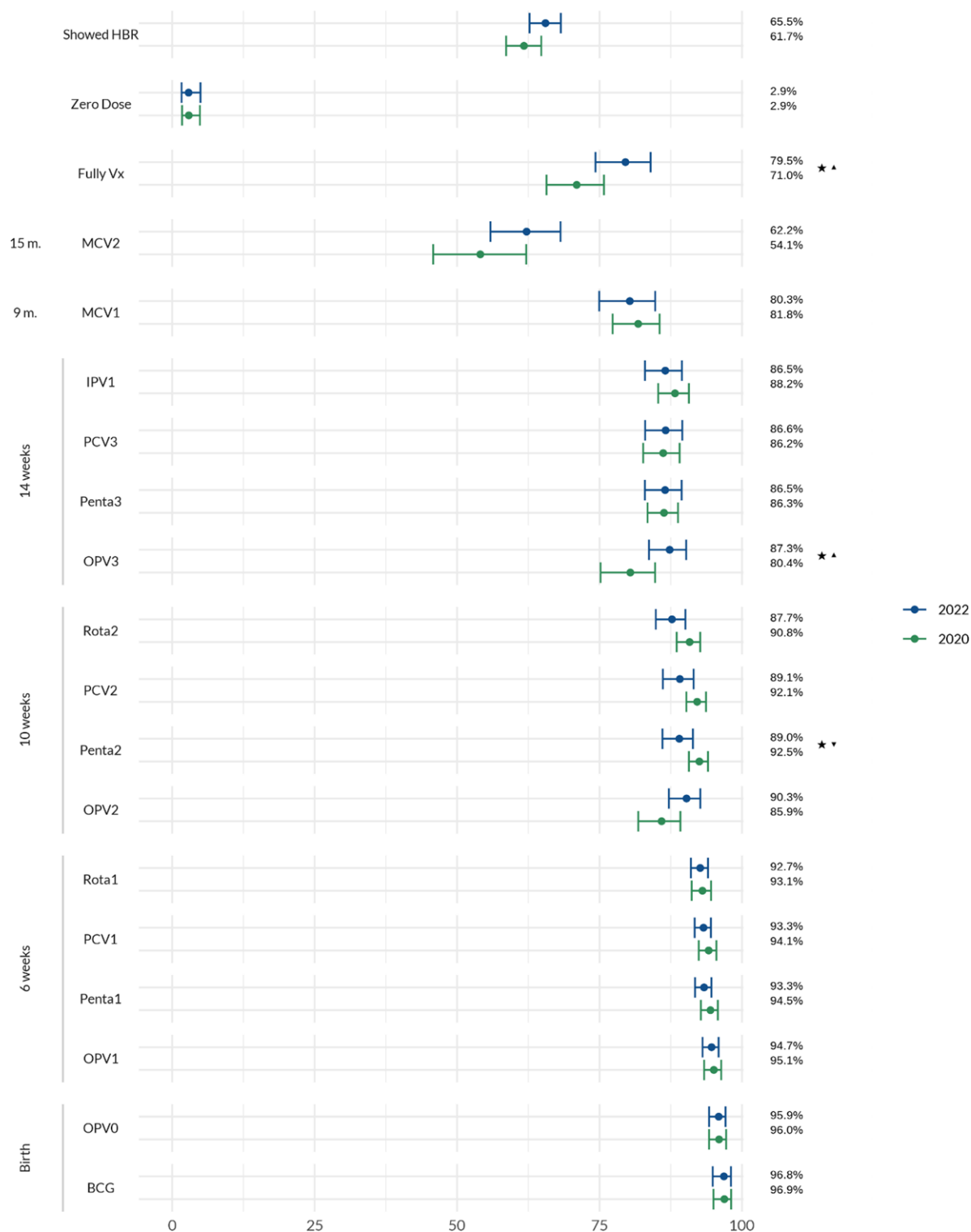


Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

Figure 3-42. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), Islamabad

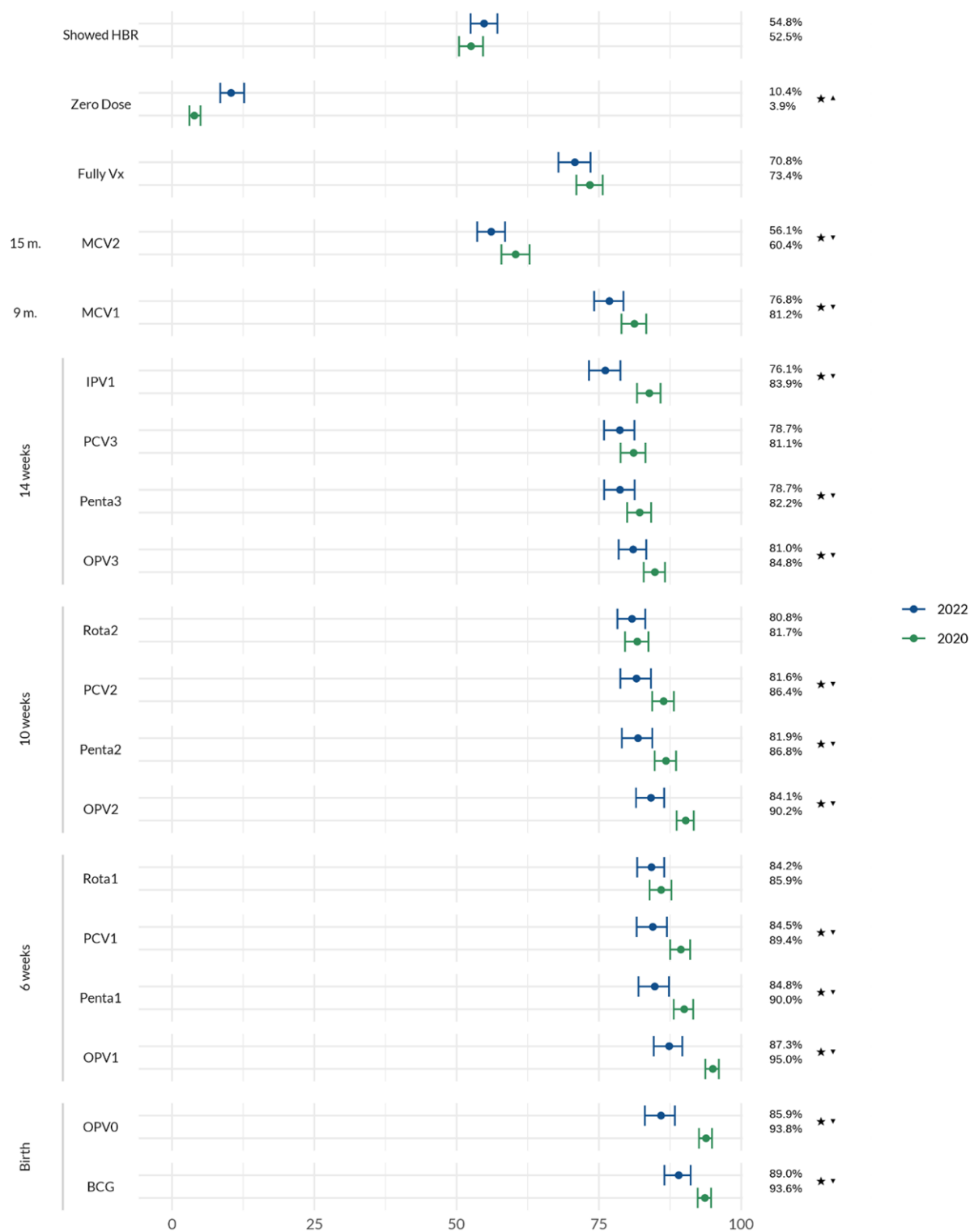


Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

Figure 3-43. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), GB

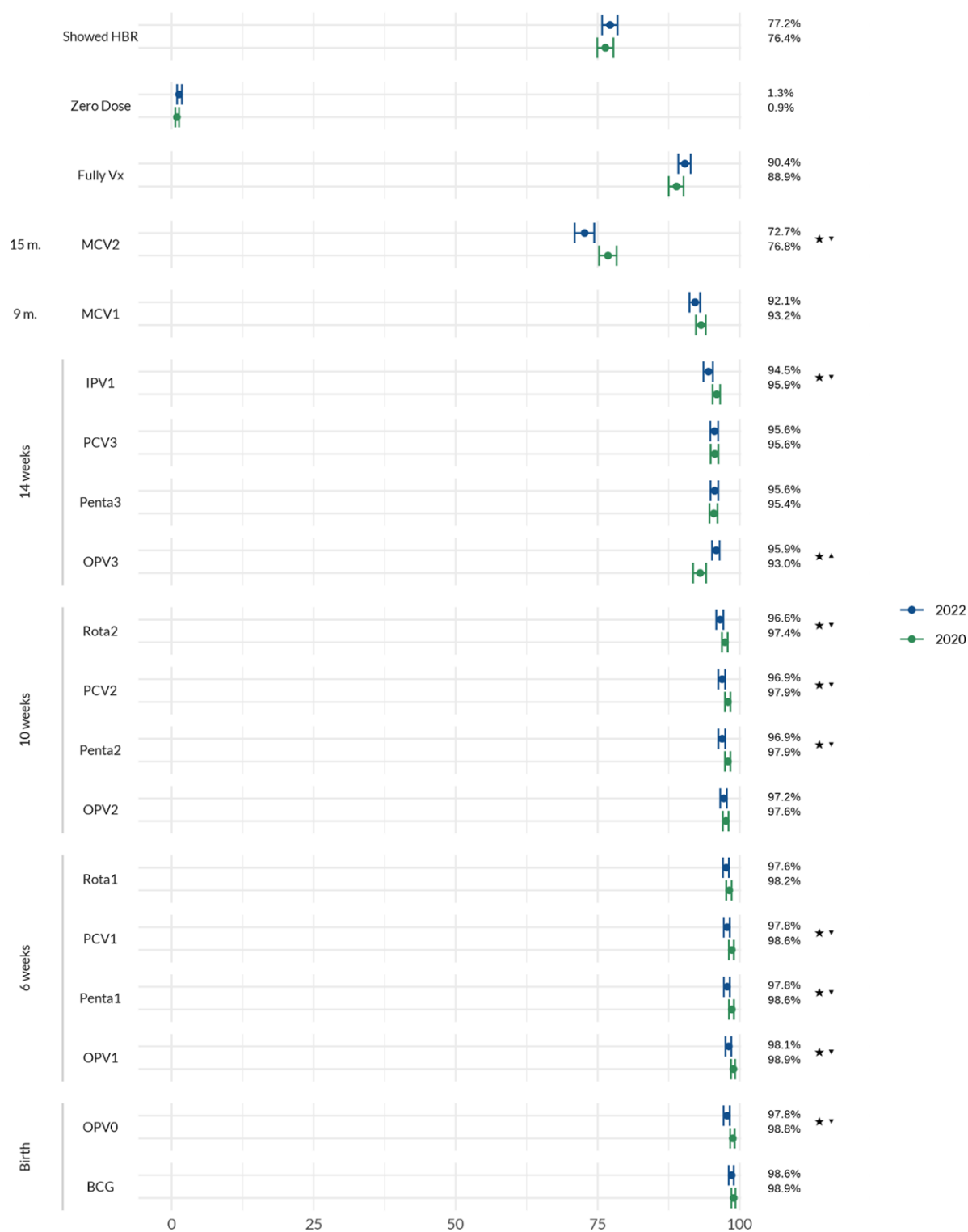


Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

Figure 3-44. Vaccination coverage outcomes, TPVICS Round 1 (2020) and Round 2 (2022), AJK



Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Not vaccinated means the child did not receive any of the doses from the fully vaccinated dose list.

Stars indicate statistically significant differences ($p < 0.05$). Arrows beside stars indicate whether the Round 2 estimate is significantly higher or lower than the Round 1 estimate.

4.0 Discussion

The 2020-21 and 2022 Pakistan TPVICS surveys are the largest vaccination coverage surveys ever conducted in Pakistan: largest in terms of respondents aged 12-23 months (N=110,790 and 108,089, respectively) and largest in terms of number of administrative strata for which to summarize vaccination program performance (N=152 districts and N=8 subnational strata). To thoroughly document all vaccination coverage indicators for each stratum would take many hundreds of pages. In lieu of exhaustive documentation of all vaccination coverage indicators, this report provides an overview of available results intended to inspire and inform dialog with vaccination stakeholders in Pakistan. There are notable increases in coverage and notable declines in different districts between these two surveys. District-level handouts are being shared with immunization program staff and we expect those to spark a round of questions that can be further investigated with the TPVICS Round 1 and Round 2 datasets.

While we have highlighted some features in the outcomes that caught our attention, we expect that persons familiar with Pakistan's immunization challenges and successes and interventions and investments will find other informative features as they explore this report and the online tables and maps and figures that accompany it.

To recap some points briefly:

1. The datasets are representative of children aged 12-23 months at the time of the surveys.
2. Vaccination evidence for half or more of the children in the datasets come from photos of home-based vaccination records (HBRs), also known as *vaccination cards*.
3. After incorporating survey weights, the children with vaccination cards represent two-thirds of Pakistan's children aged 12-23m at the time of the Round 1 survey and 71% in Round 2.
4. Of the more than 750,000 dates transcribed from those ~55,000 cards in Round 1, and of the more than one million dates transcribed from more than 60,000 cards in Round 2, over 96% passed VCQI's data quality tests for expected relationships among dates.
5. Vaccination coverage indicators are summarized in tables, maps, and figures and results are stratified by geographic strata as well as demographic subgroups.
6. Vaccination coverage varies from very high in Punjab to very low in Balochistan. Individual indicators are tabulated and portrayed in figures for every district in the online files that accompany this report and accompany the Round 1 report.
7. Twenty percent of the doses with dates documented on cards were received more than two months late. and as the children got older they received more and more doses more than two months late.

8. Most tables with outcomes summarized by demographic category in this report show evidence of poorer outcomes among children of poorly educated mothers and children of poorer families. The education and wealth variables each have five levels and in many cases the color bars show monotonic stair-step evidence of correlation between the outcomes and those simple measures of socioeconomic status. This dataset could form the basis for careful follow-up multivariable logistic regression to calculate adjusted odds ratios of various outcomes, accounting for several family and respondent characteristics that were measured in the survey.
9. There is little evidence of disparity in outcomes between boys and girls, and where it was found, its magnitude was modest¹².
10. In Round 2, 40 of the 96 urban versus rural statistical hypothesis test comparisons were statistically significant. Two-thirds of the significant differences documented better outcomes among urban respondents. The other one-third documents better outcomes among rural respondents⁸.
11. In both rounds, the data from cards indicates that in more than 80% of documented vaccination visits, the vaccinators gave the child all the doses for which s/he was eligible.
12. Missed opportunities for simultaneous vaccination (MOSVs) were observed for about half the children who showed vaccination cards. Most of the MOSVs were for IPV. When children received either (Penta1/OPV1/PCV1/Rota1) or (Penta2/OPV2/PCV2/Rota2) after the age of 14 weeks, the vaccinators often did not also administer IPV, although they could have.¹³ In Round 2, MOSVs were observed for IPV1 for about 45% of children who showed cards. Of those who experienced IPV MOSVs, 85% did receive the dose at a later vaccination visit. We say that their MOSV was corrected. But 15% did not have any record or recollection of receiving the dose at a later visit. At the time of the survey, their IPV MOSV was still uncorrected.
13. MOSVs were observed for MCV1 for about 7.5% of Round 2 children who showed vaccination cards, and at the time of the MCV1 MOSV, most of those children were also just receiving doses due at 6- or 10- or 14-weeks even though they were more than 9 months old. Where MOSVs were observed, the vaccinators also did not administer MCV1 with the other doses. Of those with MOSVs for MCV1, 57% went on to receive it at a later visit and 43% had not received MCV1 by the time of the survey.
14. Changes in coverage from Round 1 to 2 at the provincial and regional levels were mostly modest with some consistent statistically significant declines in KP and GB and modest improvements in Sindh and KP-NMD. Some of the changes at the district level were of larger magnitude: some

¹² Details are listed in the accompanying file named Supplement 10.

¹³ We note here that this outcome is not limited to Pakistan. We also see a predominance of IPV MOSVs in the 2018 DHS in Nigeria and the 2021 UNICEF MICS-NICS in Nigeria.

districts saw notable gains and some had consistent and notable decline in their outcomes; they are documented using maps in Annex C and with confidence interval figures in Supplement 13.

The online supplement files that accompany this report hold many hundreds of pages. They each have interesting features. If a reader looks at only two of those files, we recommend:

- 1) Supplement 05a – Vaccination coverage and timeliness charts for every province, region, and district. Those figures provide a lot of information in a small number of pages.
- 2) Supplement 06 – Maps of most outcomes for all districts. When reviewing the many maps, the reader will notice an overall pattern of excellent outcomes in Punjab, poor outcomes in Balochistan and KP-NMD, and a mix of good and poor outcomes elsewhere. (But note from the coverage and timeliness charts that even in Punjab where coverage is high, many doses are administered late, and note that the map of IPV1 MOSVs indicates many Punjabi children experience MOSVs for IPV1.)

If any sections of this report raise questions in the reader's mind, we would be happy to have a discussion and either point them toward the appropriate part of a supplement that might shed light on the question or formulate a plan to query the survey microdata or results datasets. If any of the supplements are confusing or overwhelming, we would be happy to schedule a videoconference to give a guided tour of what is available and to discuss what else might be possible. Finally, if it would be helpful to assemble province-specific or region-specific subsets of tables and figures, we can give advice on where to find what is wanted or assist with assembling curated subsets of the VCQI output. Please do not hesitate to contact Dale Rhoda with questions. (E-mail: Dale.Rhoda@biostatglobal.com)

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Annex A. Sample Design and Survey Weights – (Same as Annex A from Round 1 Report)

Government of Pakistan
Pakistan Bureau of Statistics
Sample Design Section
Islamabad

Subject: **WRITE UP OF SAMPLE DESIGN FOR THIRD PARTY VERIFICATION IMMUNIZATION COVERAGE SURVEY-2020**

Ministry of National Health Services, Regulation and Coordination Islamabad (MONHSRC) in collaboration with Agha Khan University (AKU), Karachi and with the technical support of Pakistan Bureau of Statistics (PBS) being National Statistical Office (NSO) and custodian of sampling frame carried out district based Third Party Verification Immunization Coverage Survey (TPVICS) 2020. The basic aim of the survey was to verify the progress reported by Provincial Expanded Program of Immunization (EPI) in agreement with the Federal EPI and to provide additional data on indicators that measure service delivery performance and demand side issues impacting immunization coverage rate in Pakistan.

1. OBJECTIVES OF TPVICS: The details of the primary and secondary objectives of the survey are as under:

Primary Objectives: To verify progress reported by provincial EPI programs, in agreement with Federal EPI, on four out of the ten Disbursement Linked–Indicators (DLIs) under the NISP.

- DLI 1: Percentage of children aged between 12-23 months in each province who are fully immunized.
- DLI 3: Percentage of districts in each province reporting at least 80% coverage of Penta3 immunization in children between 12-23 months of age.
- DLI 8: Percentage of children under two years of age with vaccination cards available in each project province and,
- DLI 10: Percentage of children aged 12 to 23 months in each targeted city who are fully immunized.

Secondary Objectives: The secondary objectives are to provide additional data on indicators that measure demand-side issues impacting immunization coverage rate in Pakistan such as:

- Estimate the differences in immunization coverage across different wealth quintiles,
- Determine the coverage of BCG, four doses of OPV, three doses of DTP-HepB-Hib pentavalent vaccine, three doses of Pneumococcal conjugate vaccine (PCV10).
- Assess the sources of vaccinations; reasons for not vaccinations; vaccination card availability.
- Assess the coverage by urban/rural residency, sex of the child, level of maternal education, and household living standards.
- Ascertain the reasons for the lack of utilization of vaccination services across the country.
- Determine the coverage at provincial and national levels.

2. UNIVERSE

The universe of the survey consists of household-based population in all urban and rural areas of four provinces of Pakistan, including Islamabad, Azad Jammu & Kashmir (AJ&K) and Gilgit-Baltistan (GB).

The cantonment areas being restricted areas have been excluded from the scope of the survey.

3. SAMPLING FRAME

Updated Sampling frame of Population & Housing Census 2017 used for the Survey. PBS has divided the whole country into small compact areas called enumeration blocks (E.Bs) comprising of 200-250 houses on an average, having digitized maps containing prominent landmarks within the boundaries of these blocks.

3A. Urban Areas

Each city/town has been divided into a number of small compact areas called Enumeration Blocks (EBs). Each enumeration block consists of on average 200 to 250 houses with well-defined boundaries recorded in the prescribed forms and maps thereof along with physical features available within the blocks.

3B. Rural Areas

The Rural Areas Frame consists of list of enumeration blocks (E.Bs) where an enumeration block can be either a whole village or part of a village. There EBs is called as Primary Sampling Units (PSUs).

Each PSU of Urban and Rural areas has well defined geographical boundaries described on a specified form along with map.

Total number of enumeration blocks/PSUs of 2017-Population & Housing Census is given below:

Table A-1. Number of enumeration blocks in the 2017 Pakistan Population & Housing Census

Sr.no	NAME OF PROVINCE	NO OF BLOCKS		
		RURAL	URBAN	TOTAL
1	Khyber Pakhtunkhuwa (KP)	18,356	3,221	21,577
2	Punjab	60,048	26,958	87,006
3	Sindh	17,223	21,916	39,139
4	Balochistan	8,386	1,826	10,212
5	KP-NMD	4,184	43	4,227
6	Islamabad	787	727	1,514
	Total	108,984	54,691	163,675
7	Azad Jammu & Kashmir (AJ&K)*	3,496	526	4,022
8	Gilgit-Baltistan (GB)*	1,098	148	1,246
	Total	4,594	674	5,268
	Grand Total	113,578	55,365	168,943

*According to the constitution of Pakistan, Pakistan constitutes of four provinces, Islamabad Capital Territory (ICT) whereas Gilgit-Baltistan & Azad Jammu & Kashmir are two independent territories. Therefore, whenever estimates or results of Pakistan are prepared, Gilgit-Baltistan & Azad Jammu & Kashmir are never

covered. These two territories are treated separately and their results/reports are published separately. Similarly, here TPVICS estimates of Pakistan level will not cover Azad Jammu & Kashmir and Gilgit-Baltistan.

4. SAMPLE SIZE ESTIMATION

- **Estimated Immunization Coverage:** Several variable i.e. full Immunization, doses of DTP-HepB-Hib, Polio, Measles used to estimated sample size. The most conservative estimate of 50% coverage had been considered for districts with coverage <80% and 80% for districts with coverage of >80%. Three data sources EPI data 2018, MICS 2018 and NNS 2018 of Immunization Coverage variable used and minimum value among these have taken as prevalence indication against each district.
- **Precision:** Absolute precision of $\pm 5.5\%$ at district level used.
- **Design Effect:** design effect of 2.5 was used.
- **Sample Size:** The total of 8786 PSUs covering 114,218 households was estimated.

Formula used for sample size calculations:-

$$n = \frac{Deff * 4 * r * (1-r)}{d^2 * RR * pb * hh}$$

Where each component of the above formula is defined as in Table A-2:

Table A-2. Components of sample size equation

Sr.no	Component	Value	Source
1	t= Level of Significance= 95%	1.96	
2	r= Prevalence indicator or variable under reference = stunting (moderate) 12-23 months old children,		Minimum value taken from three sources i.e. EPI, NNS & MICS
3	Deff = Design Effect	2.5	
4	RR= Response Rate	95%	
5	d= margin of error to be tolerated at 95% level of confidence, defined as <u>absolute</u> margin of error	5.5%	Provided by AKU, Karachi
6	“Pb” is the Proportion of Children (12-23 months) in population upon which the indicator, r is based	2.7%	1. value provided by AKU, Karachi 2. Used fixed value for all districts
7	h= Average Household Size	(value for each district used)	value taken from 2017 Population & Housing Census
8	N= Total number of estimated households		

5. STRATIFICATION PLAN

Urban and Rural Domains

Each administrative district in four Provinces, Azad Jammu & Kashmir, and Gilgit-Baltistan has been treated as independent and explicit stratum. Urban and Rural part of an administrative district have been considered urban and rural domain respectively.

6. SAMPLE SIZE ALLOCATION

Keeping in view the variability for the characteristics for which estimates are to be prepared, population distribution and main objectives of the survey, an estimated sample of 8786 PSUs (enumeration blocks) comprising of 114,218 households (13 households per PSUs) has been selected from the sampling frame covering all districts is considered to be appropriate.

The detailed district wise sample size allocation is at annex, whereas Province wise sample size allocation is given below:

Table A-3. Sample PSU allocation by province or region

SR.NO	NAME OF PROVINCE	SAMPLE PSUs		
		RURAL	URBAN	Total
1	Khyber Pakhtunkhuwa	1693	160	1853
2	Punjab	1382	457	1839
3	Sindh	1055	801	1856
4	Balochistan	1792	320	2112
5	Islamabad	49	64	113
TOTAL		5971	1802	7773
7	Azad Jammu and Kashmir	509	71	580
8	Gilgit-Baltistan	382	51	433
TOTAL		891	122	1013
GRAND TOTAL		6882	1924	8786

7. DROPPED AREAS

Province and district wise summary of Dropped PSUs/Blocks is given below:-

Table A-4. Dropped PSUs

Some PSUs were not reachable during Round 1 of the survey.

Name of Province/Area	S.No	Name of District/Agency	No of PSUs
Balochistan	01	Jhal Magsi	01
	02	Kalat	03
	03	Kharan	02
	04	Khuzdar	02
	05	Killa Saifullah	02
	06	Lasbela	01
	07	Pishin	01
	08	Ziarat	06
Khyber Pakhtunkhwa	09	Batagram	08
Sindh	10	Thatta	01
Total			27

The detailed summary of remaining 8759 PSUs is given below:

Table A-5. TPVICS PSU allocation by province and urban/rural

Sr.no	NAME OF PROVINCE/AREA	RURAL	URBAN	TOTAL
1	Khyber Pakhtunkhwa	1,685	160	1,845
2	Punjab	1,382	457	1,839
3	Sindh	1,054	801	1,855
4	Balochistan	1,774	320	2,094
5	Islamabad	49	64	113
	TOTAL	5,944	1,802	7,746
6	Azad Jammu and Kashmir	509	71	580
7	Gilgit-Baltistan	382	51	433
	TOTAL	891	122	1,013
	GRAND TOTAL	6,835	1,924	8,759

8. SAMPLE DESIGN

A two-stage stratified sample design has been adopted for this survey.

i. Selection of Primary Sampling Units (PSUs)

Sample PSUs from each stratum have been selected with probability proportionate to size method (PPS) where total numbers of households within a PSU have been considered as measure of size (MOS) for all sample PSUs.

ii. Selection of Secondary Sampling Units (SSUs)

Based on specialized household listing undertaken in respect of each sampled PSU by the Field Staff of Agha Khan University Karachi, thirteen (13) households have been selected from rural and urban PSUs adopting systematic random sampling technique with a random start.

iii. Sampling Weights

Two stage sampling weights have computed for the survey based on selection probabilities, separately for each sampling stage and for each cluster (i.e. EB), briefly explained below;

P_{1hi} : first stage sampling probability of the i^{th} cluster in h^{th} stratum

P_{2hi} : second stage sampling probability within i^{th} cluster (households selection)

Overall probability of selection of a household in i^{th} cluster of h^{th} stratum is

$$P_{hi} = P_{1hi} * P_{2hi}$$

First stage selection probability computed using sampling frame information as explained below;

n_h : Number of clusters selected in h^{th} stratum,

N_{hi} : Total number of households in a cluster as per sampling frame

N_{hi}^* : Total number of households in h^{th} stratum as per sampling frame

The probability of selection of i^{th} cluster in the survey is calculated as

$$P_{1hi} = n_h * N_{hi} / N_{hi}^*$$

P_{2hi} : Second stage selection probability computed using field information provided by AKU, Karachi as explained below:

M_{hi} : The number of households listed during households listing operation in i^{th} cluster and h^{th} stratum

m_{hi} : Number of households selected within the cluster (here 13 households)

$$P_{2hi} = m_{hi} / M_{hi}$$

Two stage sampling weight (w_t) is the reciprocal of the overall selection probability by which a household is selected in the sample,

$$w_t = 1/P_{hi}$$

or

$$w_t = \frac{1}{P_{1hi} * P_{2hi}}$$

Adjustment of non- response Households:-

Household non-response adjustment factor is computed as given below:-

$$R_{hh} = \text{Total number of households completed} / \text{Total number of households found}$$

Two stage sampling weights with households non response adjustment is

$$W_{t\ hh} = W_t / R_{hh}$$

Final note #1: Per e-mail clarification with the Pakistan Bureau of Statistics, the weights are adjusted to align with the 2017 Population & Housing Census (population proportion). However, it is pertinent to mention here, that sampling weights are not post stratified with respect to households and ages. Further, the weights could be used to calculate total population, total households, and proportions as well.

Final note #2: For the VCQI analysis, the weights were all adjusted by a fixed multiplicative factor to make the sum of weights for the TPVICS 12-23m respondents equal to the number of children aged 12-23m in the analysis. Thus, the sum of weights in these analyses may not be used to estimate total population or total households, but may be used to estimate proportions. It would be possible to re-scale (or un-adjust) the weights and repeat the analyses if there were an analytic goal of estimating totals.

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Annex B. Maps Showing District Names

Figure B-1. Districts in Azad Jammu and Kashmir



Figure B-2. Districts in Balochistan



Figure B-3. Districts in KP-NMD



Figure B-4. Districts in Gilgit-Baltistan



Figure B-5. Islamabad is a single health district

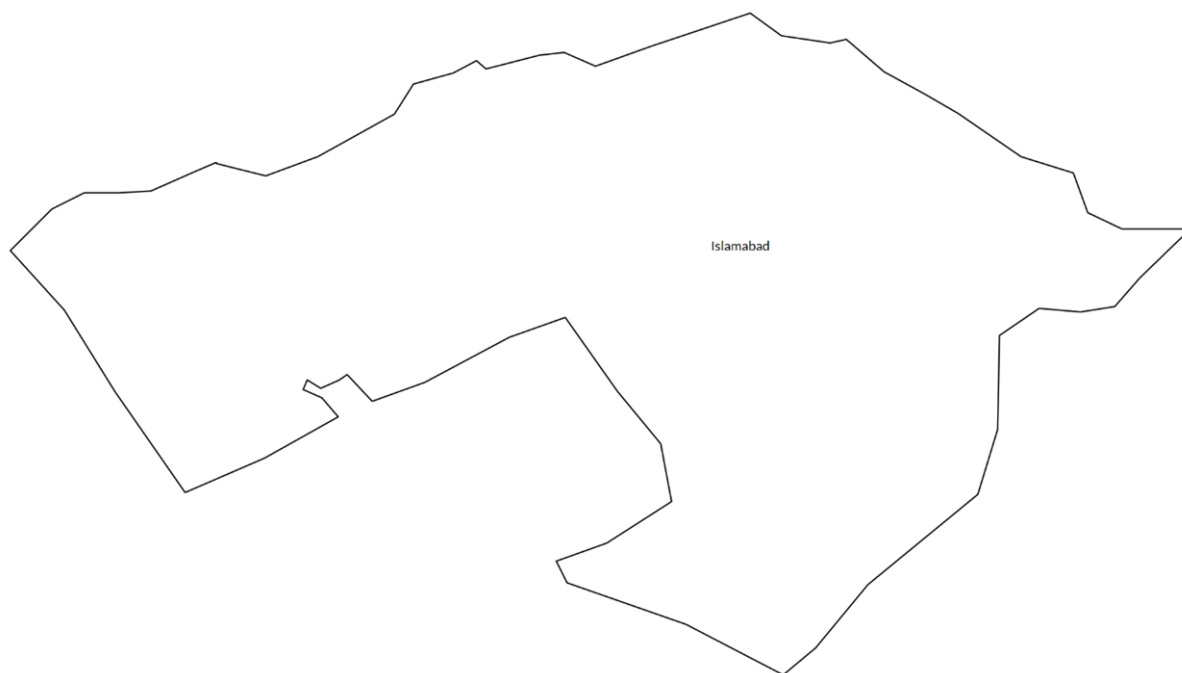


Figure B-6. Districts in Khyber Pakhtunkhwa



Figure B-7. Districts in Punjab



Figure B-8. Districts in Sindh



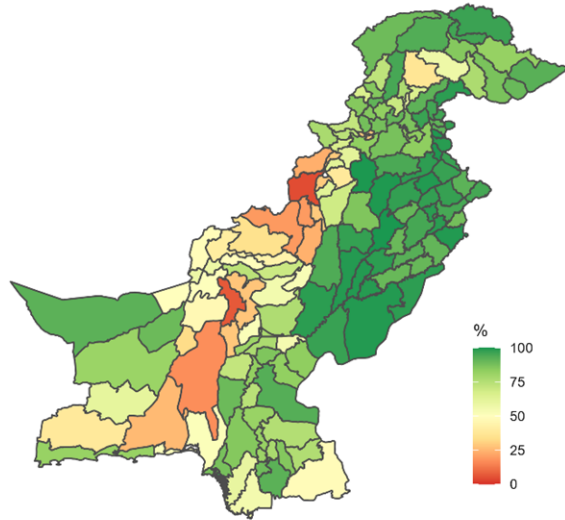
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Annex C. Maps Showing Changes from Round 1 to Round 2

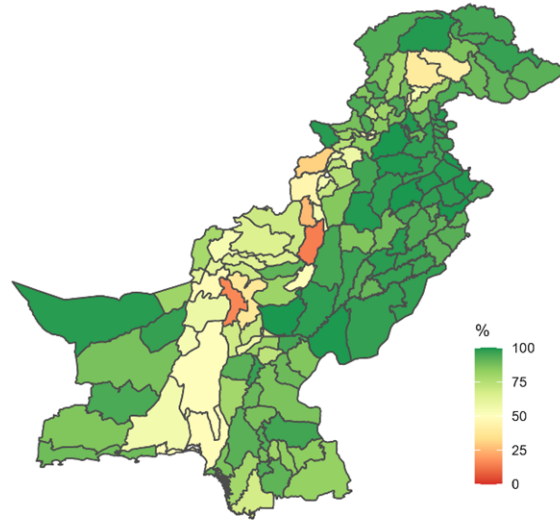
These district-level maps show TPVICS outcomes for Round 1 and Round 2 and show where the outcomes improved or declined by at least 5 percentage points.

Figure C-1. Child ever had a card, TPVICS Rounds 1 (2020) and 2 (2022)

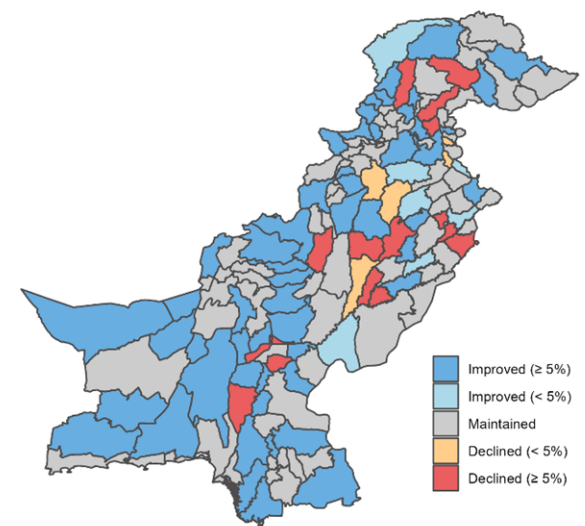
Ever Had an RI Card
TPVICS 2020



Ever Had an RI Card
TPVICS 2022



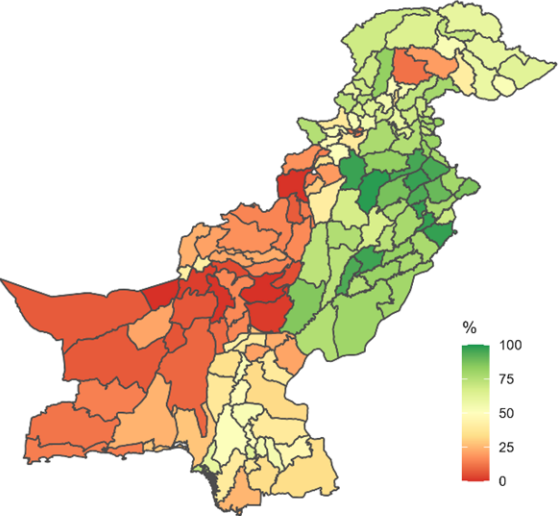
Ever Had an RI Card
TPVICS 2020 to 2022 Changes



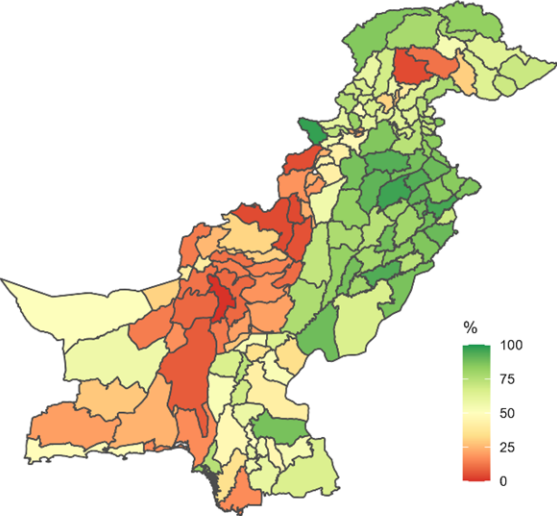
'Maintained' means there was no significant change ($p < 0.05$) in the outcome from 2020 to 2022.

Figure C-2. Respondent showed a card, TPVICS Rounds 1 (2020) and 2 (2022)

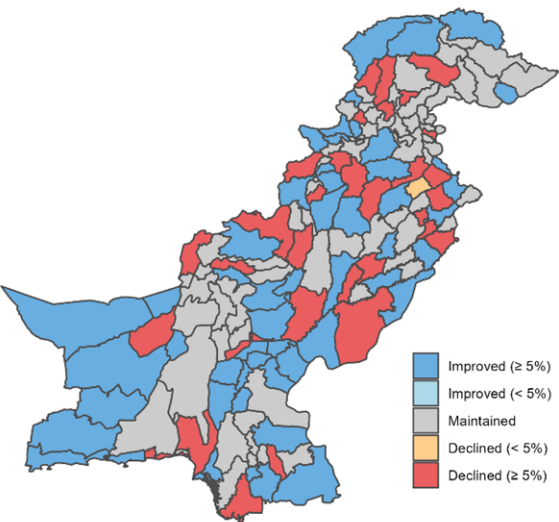
Had Card
TPVICS 2020



Had Card
TPVICS 2022

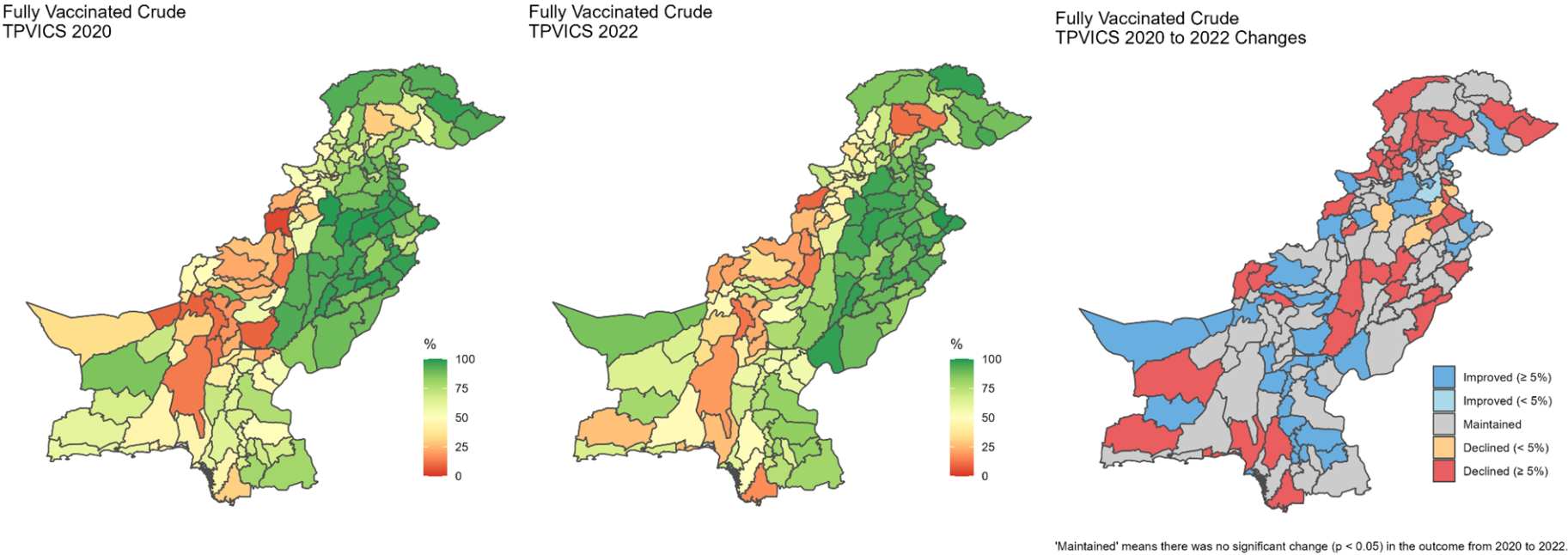


Had Card
TPVICS 2020 to 2022 Changes



'Maintained' means there was no significant change ($p < 0.05$) in the outcome from 2020 to 2022.

Figure C-3. Child was fully vaccinated, TPVICS Rounds 1 (2020) and 2 (2022)

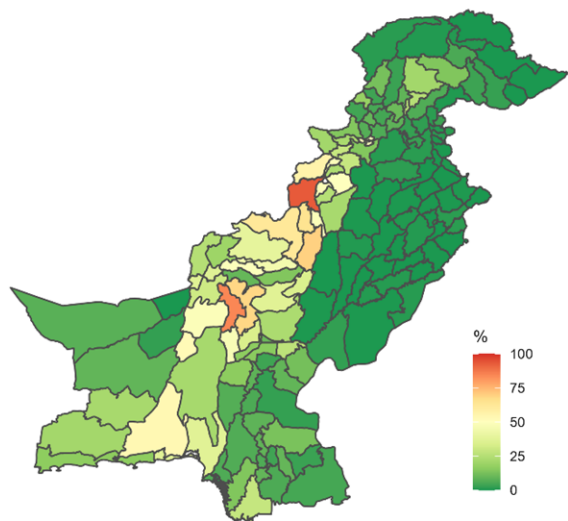


'Maintained' means there was no significant change ($p < 0.05$) in the outcome from 2020 to 2022.

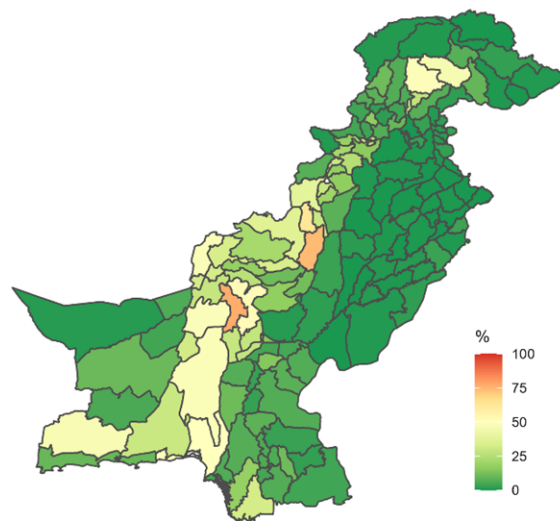
Fully vaccinated dose list: BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Figure C-4. Child was not vaccinated, TPVICS Rounds 1 (2020) and 2 (2022)

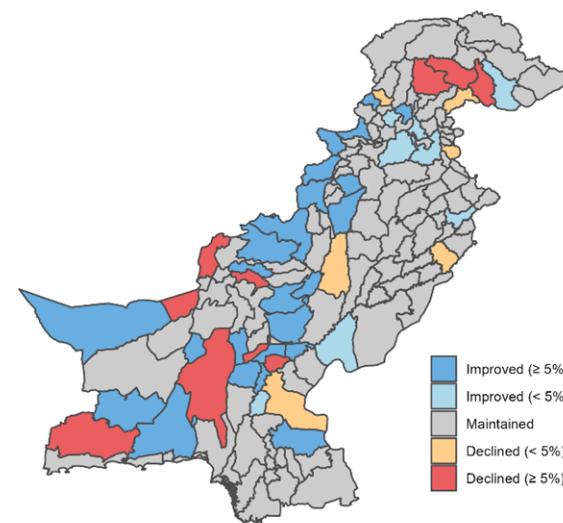
Not Vaccinated Crude
TPVICS 2020



Not Vaccinated Crude
TPVICS 2022



Not Vaccinated Crude
TPVICS 2020 to 2022 Changes



'Maintained' means there was no significant change ($p < 0.05$) in the outcome from 2020 to 2022.

Not vaccinated: did not receive any of BCG, OPV0, OPV1-3, Penta1-3, PCV1-3, IPV1, MCV1.

Figure C-5. Child showed evidence of receiving BCG, TPVICS Rounds 1 (2020) and 2 (2022)

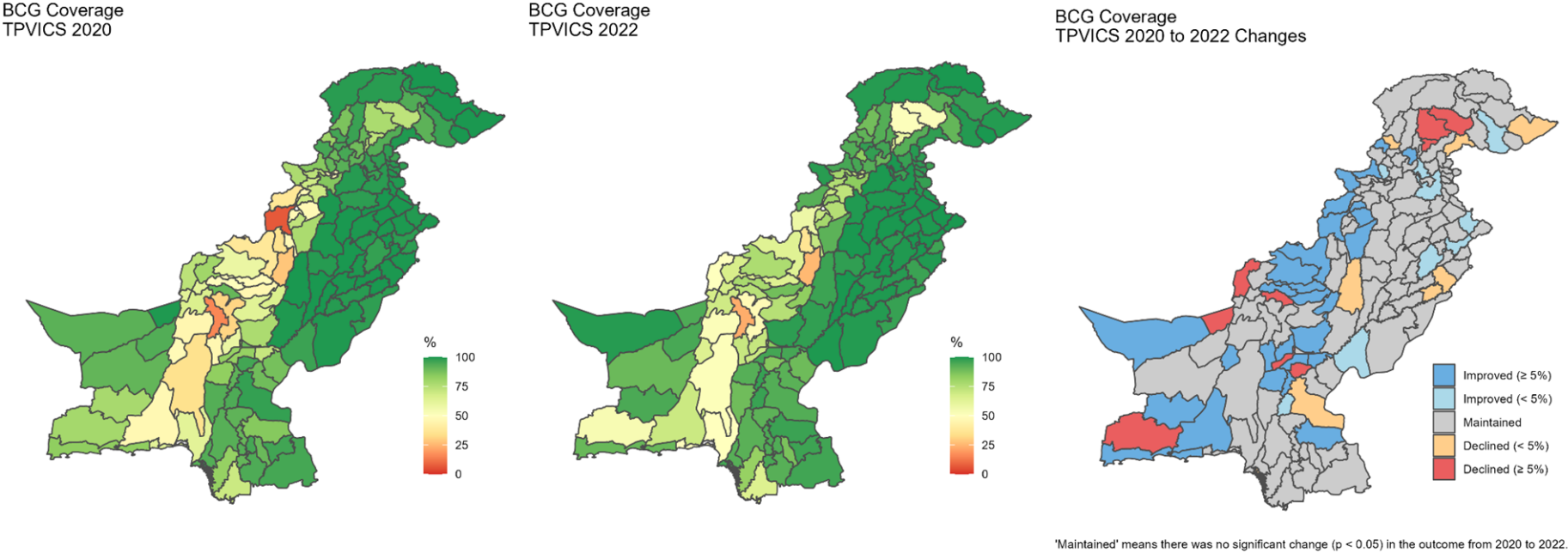


Figure C-6. Child showed evidence of receiving OPV0, TPVICS Rounds 1 (2020) and 2 (2022)

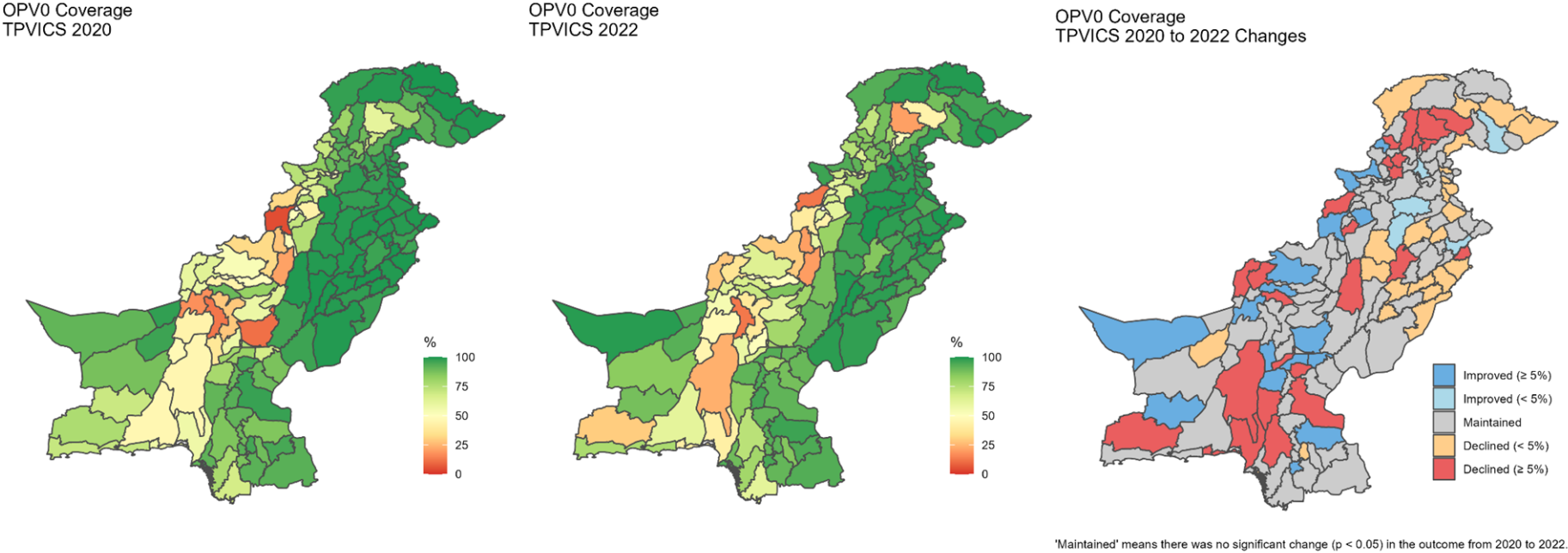
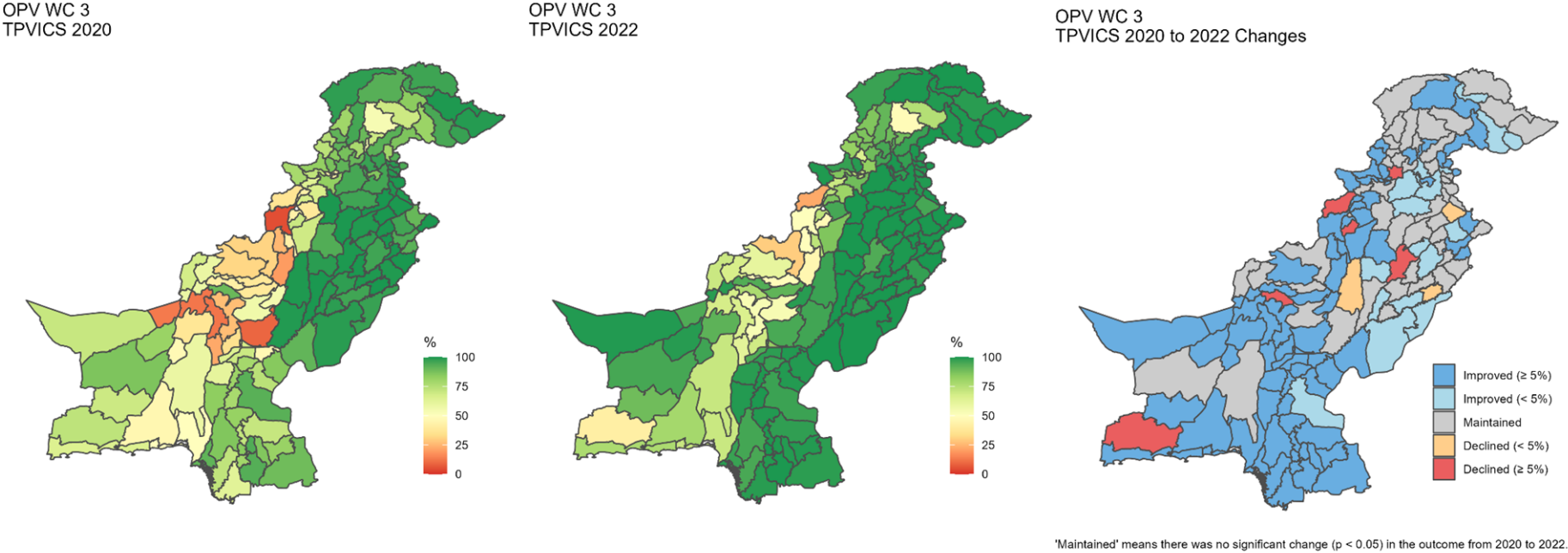


Figure C-7. Child showed evidence of receiving OPWC3, TPVICS Rounds 1 (2020) and 2 (2022)



WC = with campaigns. OPV WC coverage calculations include Polio campaign doses.

Figure C-8. Child showed evidence of receiving OPV3, TPVICS Rounds 1 (2020) and 2 (2022)

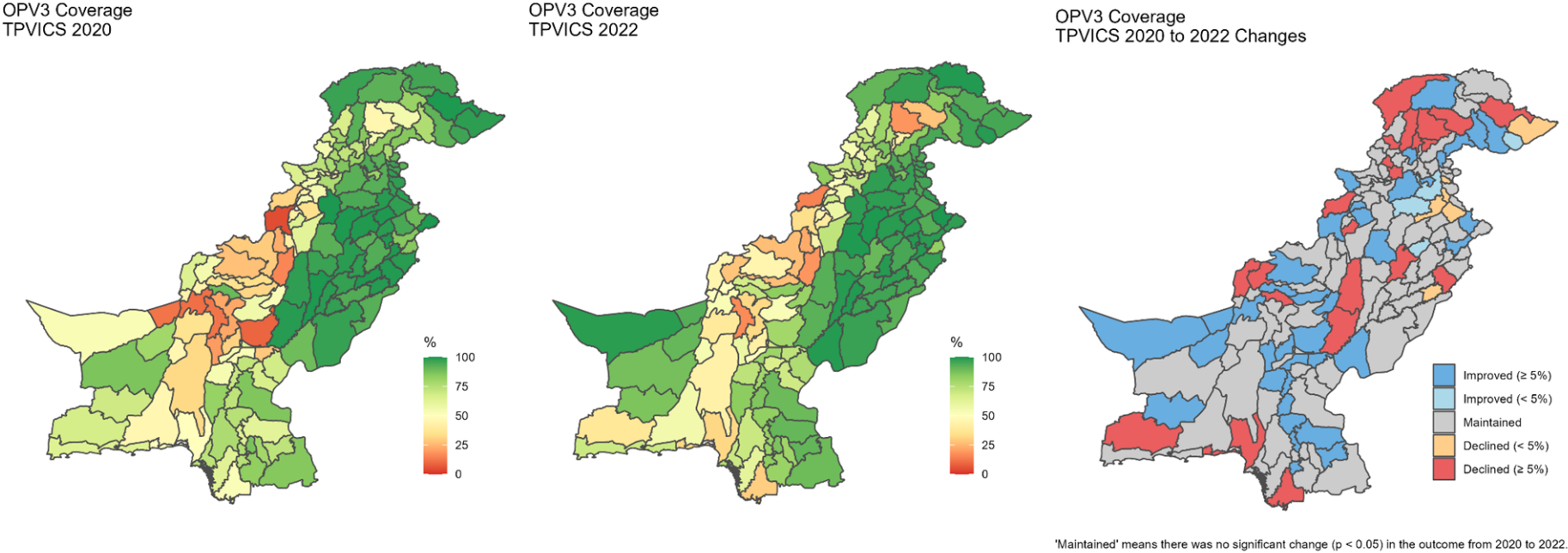


Figure C-9. Child showed evidence of receiving Penta1, TPVICS Rounds 1 (2020) and 2 (2022)

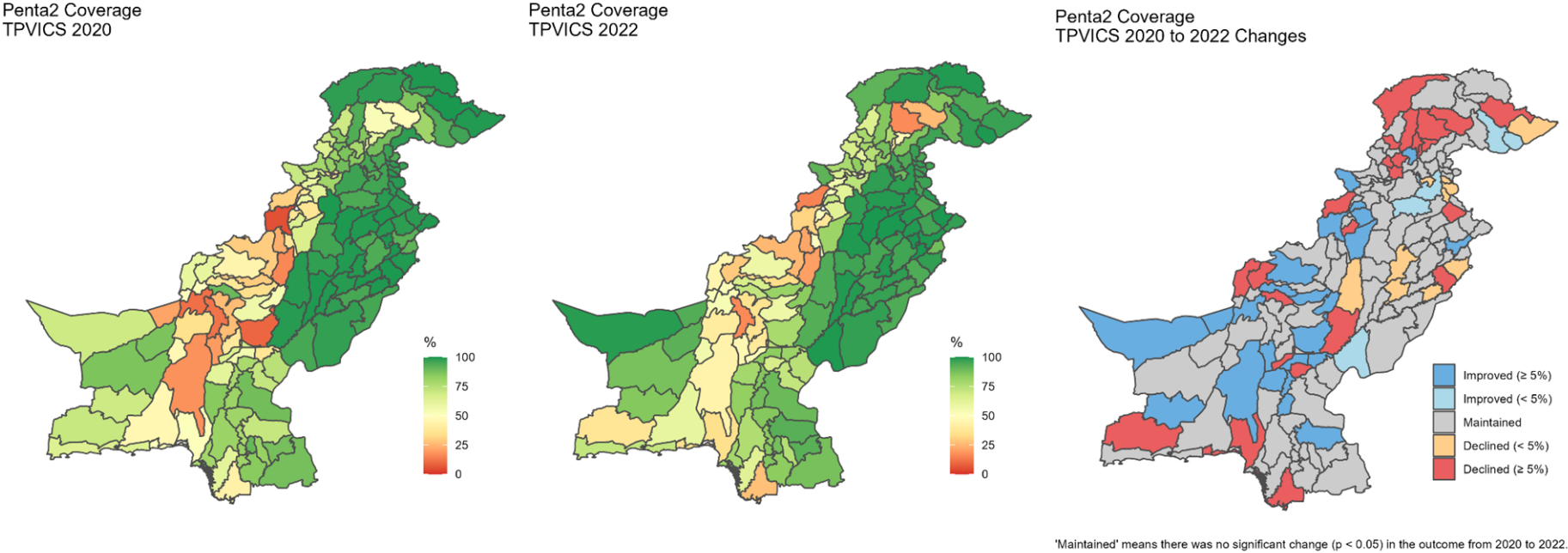


Figure C-10. Child showed evidence of receiving Penta3, TPVICS Rounds 1 (2020) and 2 (2022)

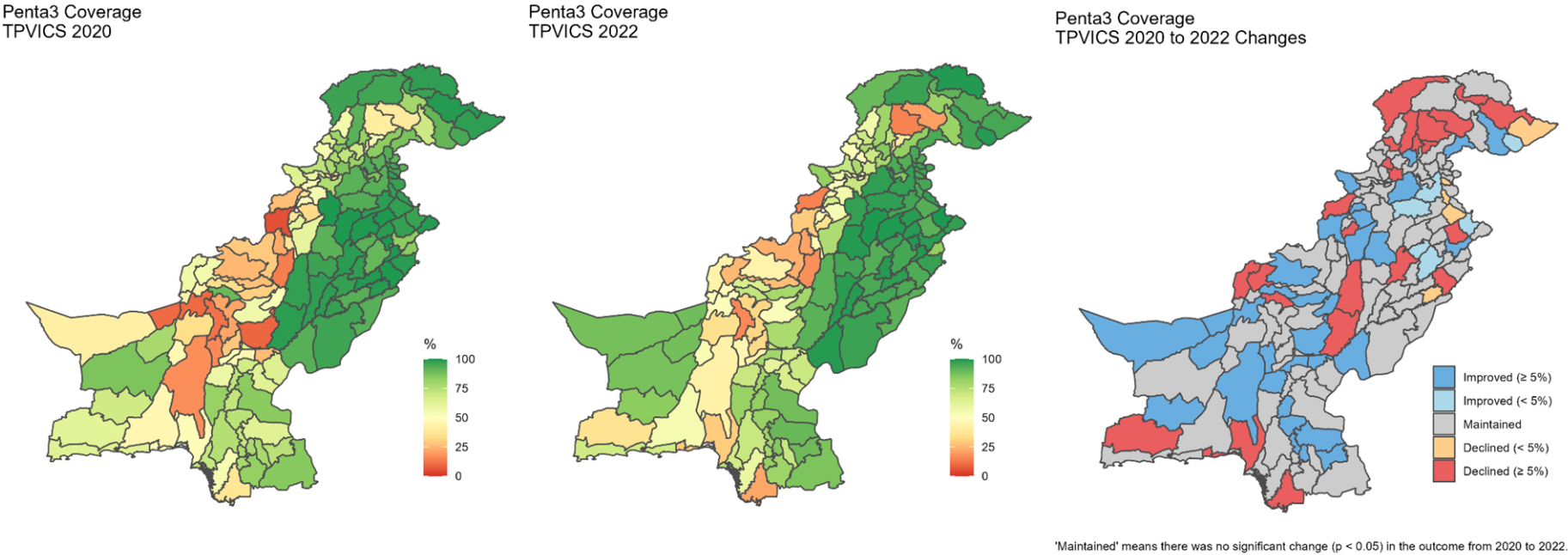


Figure C-11. Child showed evidence of receiving PCV3, TPVICS Rounds 1 (2020) and 2 (2022)

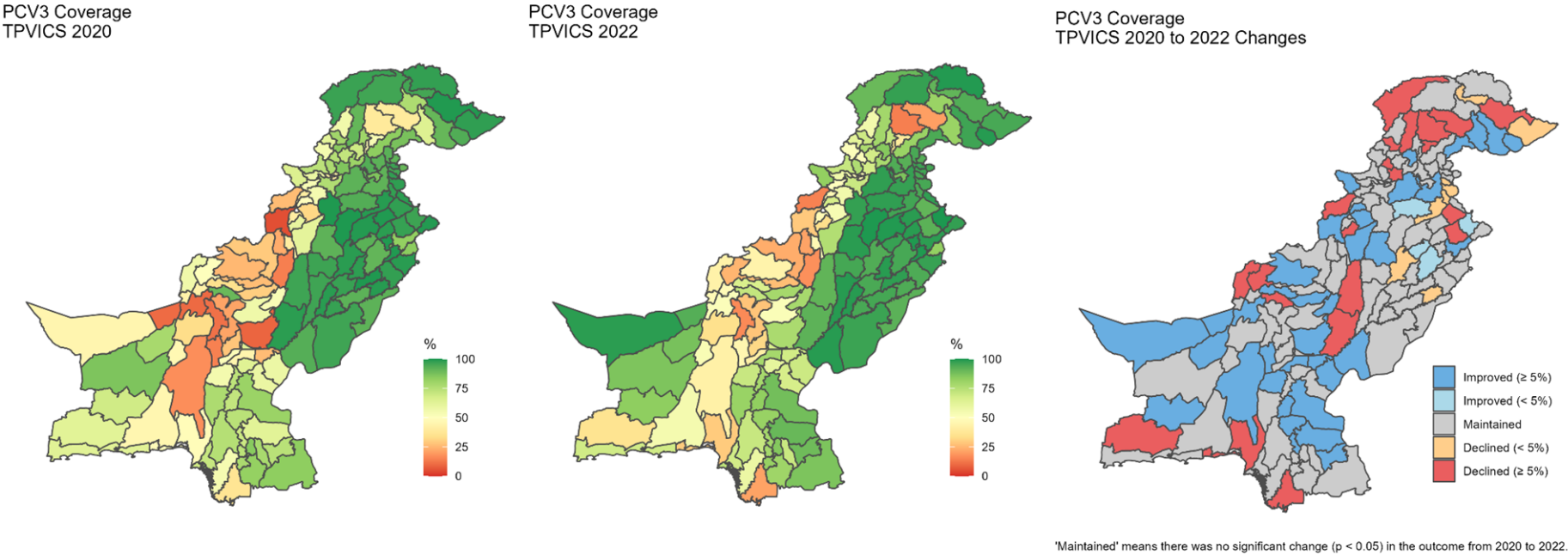


Figure C-12. Child showed evidence of receiving IPV, TPVICS Rounds 1 (2020) and 2 (2022)

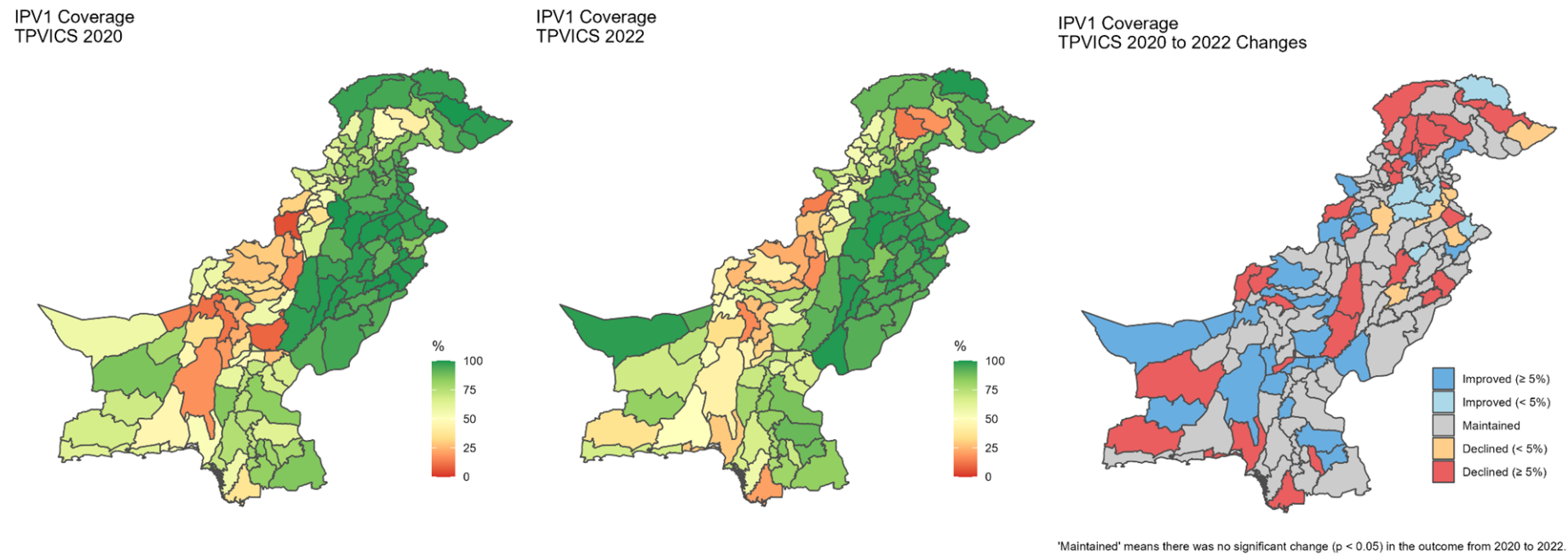


Figure C-13. Child showed evidence of receiving MCV1, TPVICS Rounds 1 (2020) and 2 (2022)

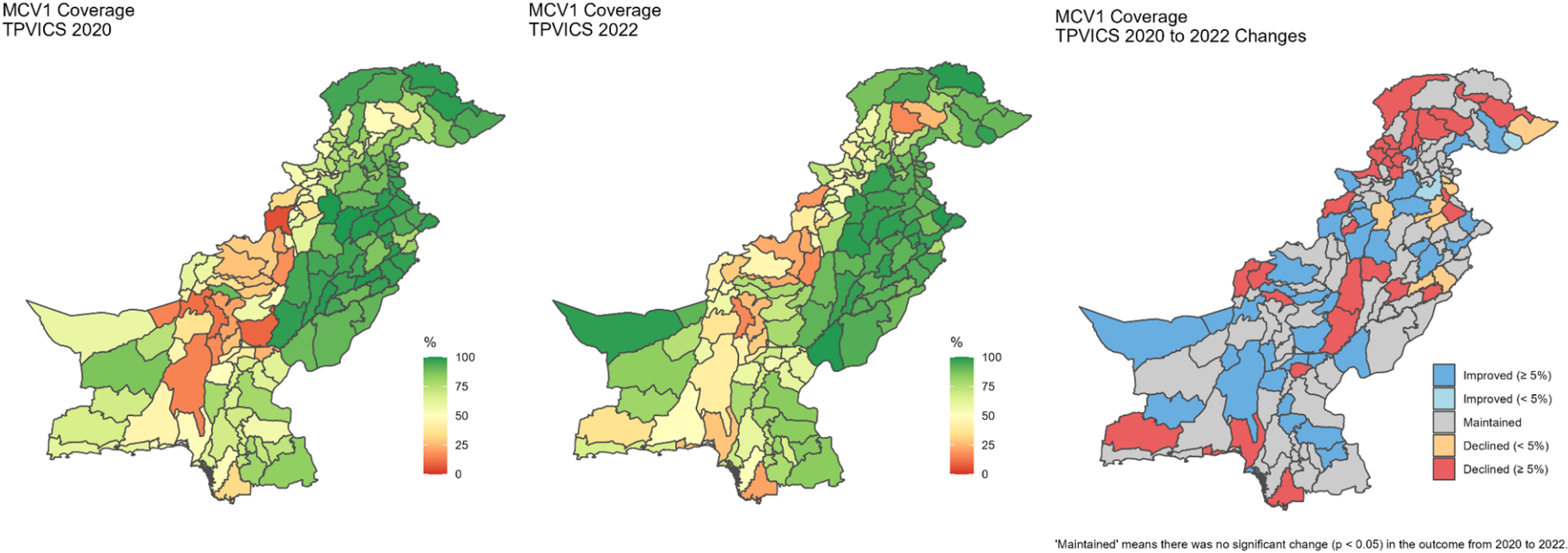


Figure C-14. Child showed evidence of receiving MCV2, TPVICS Rounds 1 (2020) and 2 (2022)

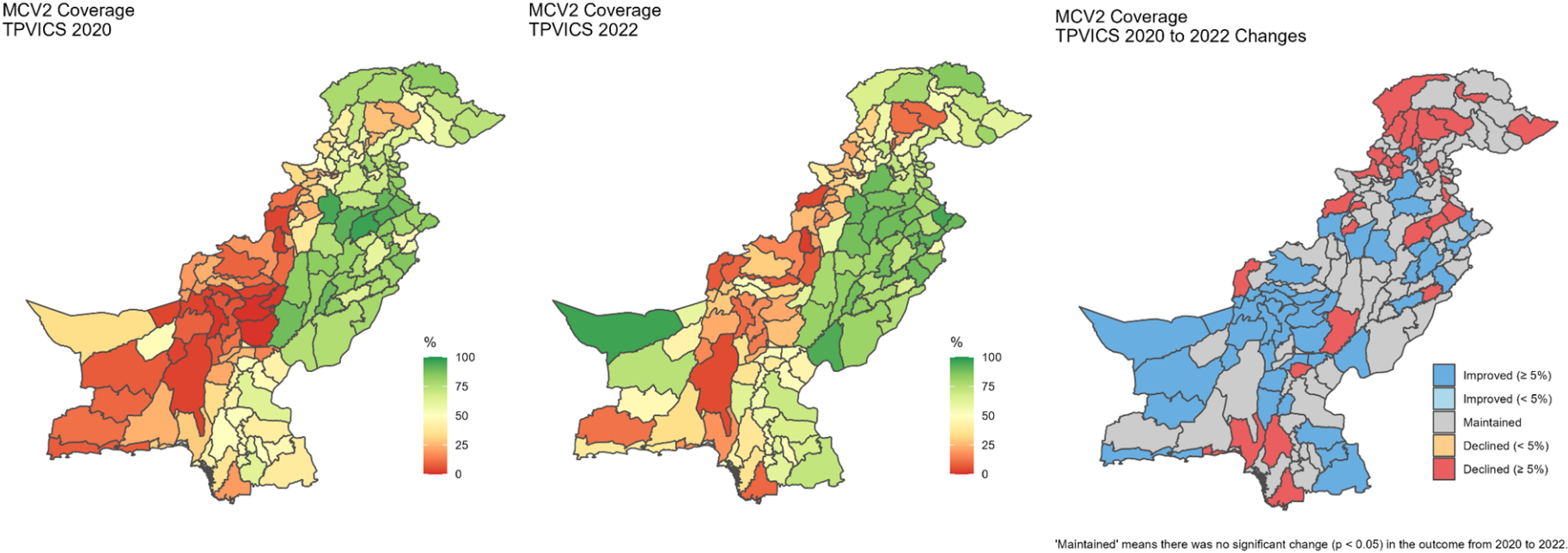


Figure C-15. Child showed evidence of receiving Rota1, TPVICS Rounds 1 (2020) and 2 (2022)

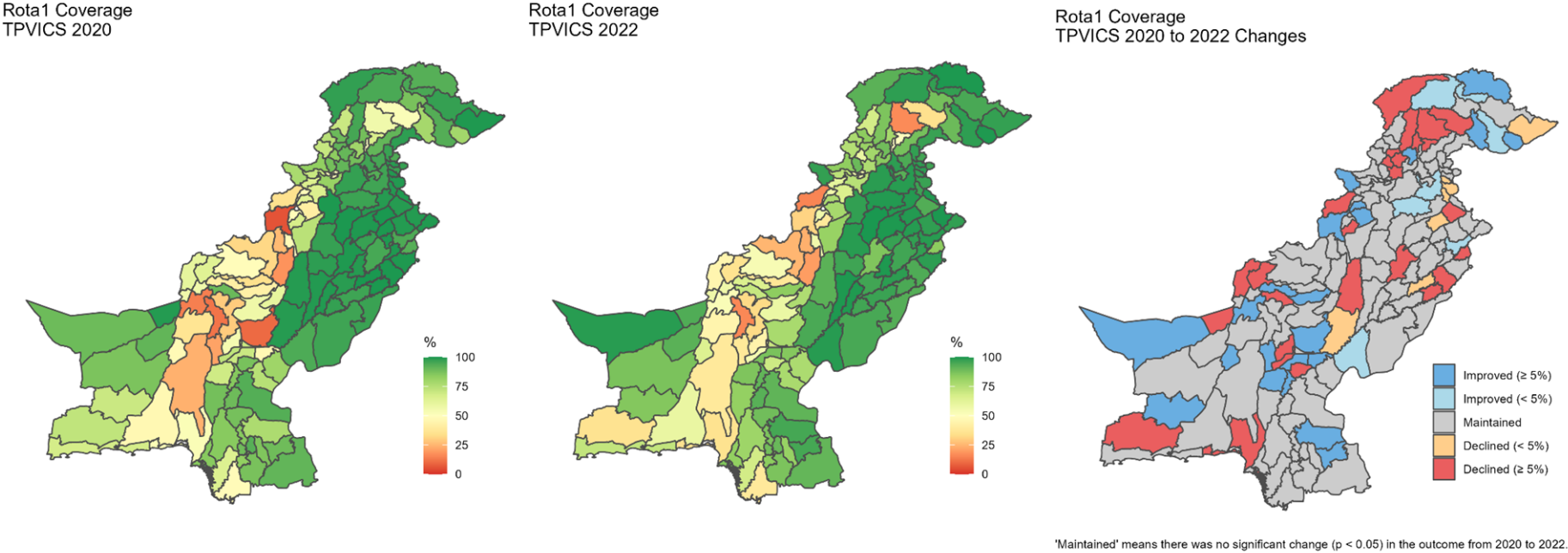


Figure C-16. Child showed evidence of receiving Rota2, TPVICS Rounds 1 (2020) and 2 (2022)

