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Multidimensional Poverty of Housing Quality: A Spatial Analysis for Districts of Pakistan

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Abstract: An increase in living standards and housing quality is impossible without improving the housing quality. Housing quality provides many aspects of shelter and peace of mind. The present study used the quality of housing as an indicator of living standards and explored the deprivation in housing quality based on internal and external dimensions. These dimensions include indicators representing internal and external conditions, public provisions of the housing facilities available to the community, and users' perceptions of these facilities. For all this, we aim to create an index of multidimensional poverty for the quality of housing using the Alkire and Foster methodology (AF). The analysis is carried out for the Pakistan Social and Living Standards Measurement (PSLM) data, 2019-20. Regional decomposition of the index with spatial analysis is another study contribution. Regional decomposition of the index is the strength of the study.

1. Introduction

The global population is living in a shelter called a "flat" or "house". The shelter is also important for living, along with clothing and food requirements. The wellbeing of the individuals is subject to improvements in these. In addition to providing shelter, housing has an important bearing on work performance, educational attainment, national health, and the upbringing of the children (Bielestein, 1973). In developing countries like Pakistan, the unavailability of housing facilities for a low-income population group is an issue that is becoming swear with the addition of shortfall every year. According to Hussain (2007), Pakistan experienced an increase of 400,000 urban units' shortfall in Pakistan every year.

Similarly, the Human Rights Commission of Pakistan (2005) stated that over 60,000 people slept out in the open sky throughout the year in Lahore (the second largest city in Pakistan). According to the report, similar numbers are observed in other big cities in Pakistan. Along with the

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shortage of housing facilities, the quality of living standards in the existing houses is another issue.

Providing adequate housing facilities is an integral part of any meaningful economic development program. In recent years, different private housing authorities have provided quality housing in Pakistan. However, Cowasjee (2004) reported that the building control authorities violated the bylaws of private and cooperative building societies. Continuous violations of bylaws have contributed to the gradual transformation of cities into a jungle of low-quality housing without considering the negative effects on the environment and the citizens of the city. Many studies reported that low housing quality is associated with many stresses, deprivations, and infectious diseases (Loring, 1964; Martin, 1967; Mitchel, 1971; Bashir, 2002; Krieger & Higgins, 2002; Cattaneo et al., 2009; Irfan et al., 2017; Bah et al., 2018).

Studies have revealed that Pakistan, in general, and big cities, in particular, are experiencing problems related to low governance for housing policy, old housing standards, and no special consideration for housing quality. The quality of a house can be measured through the house's structure, facilities available in the house, and locality. Another factor contributing to the low quality of housing in the urban region is rapid urbanization. United Nations-Habitat (2007) reported that due to this high urbanization rate, the developing world's urban population will reach approximately six billion people by the end of 2050. This increase in population will put pressure on the existing housing supply, which may result in expensive and compromised housing facilities.

The term 'housing deficit' is repeatedly used in policy papers, academic papers, and newspaper articles. In academic literature, housing deficit can be divided into two categories: quantitative and qualitative. A quantitative housing deficit refers to a numerical shortfall in housing units. On the other hand, qualitative housing deficit refers to households living in sub-standard houses based on the locality of the houses, access to basic services, and condition of housing units (Bouillon, 2012; Bah *et al*., 2018; World Bank, 2020, Saiz et al., 2022). The present study intends to estimate the qualitative housing deficit.

Physical housing features, like the type of construction, location, habitation density level, and services available in the house, are significantly important. The study considers problems related to housing quality in different regions of Pakistan. The study measures an index for housing quality through deprivation scores related to the house's structure, deprivation scores related to facilities available in the house, and deprivation scores related to the locality of the house. Along with this, the study aims to estimate the determinants of high-quality housing.

Following the section of the introduction, section 2 presents the reviewed literature, section 3 presents the issues related to data and methodology and discusses in detail the construction of a multidimensional poverty index for housing, section 4 presents the results and their discussion, and section 5 presents the conclusion of the study.

2. Review of Literature

The standards for the definition of qualitative housing deficit vary significantly. Many studies used population density, deficiencies in infrastructure, and houses built with inadequate materials. Along with these aspects, studies extended the definition by adding other aspects such as telephone coverage (Lora et al., 2000), insecurity of tenure (UN-Habitat and UN-OHCHR, 2019), location and accessibility to markets (Acolin & Green, 2017). Table 1 presents indicators used by various studies for qualitative housing deficit.

Another way to estimate the qualitative housing deficit is through the households' satisfaction with their homes. A perception-based survey is conducted by Gallup (2021). The results based on the survey highlighted differences across countries regarding satisfaction levels. This indicates that the housing market varies across the world.

The estimates of the quality of housing very much depend upon the definition chosen for the analysis. A recent study analyzing the qualitative housing deficit in Peru (World Bank et al., 2021) shows that the housing deficit is equivalent to 23 percent of Peru's existing housing stock. The deficit could rise to 68 percent when a stricter definition of housing

adequacy is used for the analysis. Tusting et al. (2019) analyzed the improvement in housing quality between 2000 and 2015 in Sub-Saharan Africa. The authors reported an improvement in housing quality from 11 to 23 percent. On the other hand, in a recent study, Brown et al. (2020) assessed the home environments for protection from COVID-19 in developing countries. The study shows that to protect from the virus, 90 percent of the global poor are unable to comply with recommendation by the WHO fully.

The literature indicates that housing quality significantly affects socioeconomic outcomes, including education, health, social belonging, emotional wellbeing, political participation, job creation, and economical attainment (Thomson et al., 2009; World Health Organisation, 2018). Studies established a positive link between piped water and life satisfaction and improvements in overall wellbeing (Kremer et al., 2011; Devoto et al., 2012). Studies indicate that piped water helped to reduce diarrhea prevalence and mortality in young children (Jamison et al., 1993; Jalan & Ravallion, 2003; Galiani et al., 2005; Nabassaga et al., 2019).

Table 1: Indicators for the qualitative housing deficit

Reference	Indicators
Abdul-Rahman et al. (1998)	1. Layout of the flat (living area, kitchen, bathroom, bedrooms, balcony). 2. Workmanship (installation of ceiling, door, window, tiling, painting, plumbing work, electric wiring) 3. Garbage Collection System. 3. Environmental Conditions (air quality, noise traffic congestion). 4. Appearance/design 5. Internal Conditions (lighting, ventilation, and temperature). 6. Accessibility (shops, school, market, parking plots, playground/park).
Department of Housing and Urban Development (2004)	1. Sanitary facilities; 2. Food preparation and refuse disposal; 3. Space and security; 4. Thermal environment; 5. Illumination and electricity; 6. Structure and materials; 7. Interior air quality; 8. Water supply; 9. Lead-based paint; 10. Access; 11. Site and neighborhood; 12. Sanitary conditions; 13. Smoke detectors
Scotland Housing Quality Standards (2007)	1. Above the tolerable standard; 2. Free from serious disrepair; 3. Energy efficient; 4. Modern facilities; 5. Healthy, safe, and secure.
Housing Corporation England (2007)	1. Internal environment (size, layout, service provision); 2. Sustainability; 3. External environment (building for life)

Building Research Establishment, London (2007)	1. Exterior architecture; 2. Internal fabric finishes; 3. Electrical design systems; 4. Summertime overheating; 5. Sustainability; 6. Site planning; 7. Outer material; 8. Sourcing of repairable items; 9. Visual environment; 10. Maintainability; 11. Interior design; 12. External and internal details; 13. Air quality; 14. Space planning; 15. Junction detail; 16. Heating comfort
Chohan et al. (2015)	1. Architecture and site planning; 2. Structure; 3. Construction; 4. Building Services 5. Health safety & security; 6. Users' comfort; 7. Maintenance; 8. Sustainability
UN-Habitat (2016)	1. Access to improved water; 2. Access to improved sanitation facilities, 3. Sufficient living area, 4. Structural quality/durability of the housing unit, 5. Security of tenure
Tusting et al. (2019)	1. Quality of water and sanitation; 2. Sufficient living area; 3. Durable construction
World Bank (2021)	1. Access to improved water; 2. Access to improved sanitation; 3. Adequate living space; 4. Durable material and good structural quality; 5. Security of Tenure; 6. Access to electricity; 7. Access to clean cooking

Similarly, other studies established the positive impact of improved sanitation and health outcomes, especially in children (Duflo et al., 2015). Durable structure quality has positively affected overall health and adult welfare and negatively affected child mortality (Cattaneo et al., 2009; Bah et al., 2018). Studies reported the negative effects of overcrowding on health (Bashir, 2002; Krieger & Higgins, 2002; Cattaneo et al., 2009; Irfan et al., 2017). The overcrowding also causes the underdevelopment of children because of a lack of privacy (Goux & Maurin, 2005; Evans, 2006).

Several studies tried to estimate housing poverty or housing inadequacy, or housing quality in Pakistan (Sandhu, 1972; Ashfaq, 1974; Chhattari, 1978; Farooq, 1978; Zaki, 1981; Cowasjee, 2004; Hussain, 2007; Chohan et al., 2015; Ijaz & Rashid, 2015). These studies used one or a few indicators for the deprivation in housing quality. None of these studies tried to estimate housing quality at the district level. Based on the reviewed literature, several gaps emerge. The present study contributes to the existing literature in several ways. First, it provides a detailed review of existing literature on methods of estimating poverty in housing quality. Second, the study proposes a new method to estimate multidimensional poverty in housing quality. Third, it adds to the literature that estimates multidimensional poverty for Pakistan, its provinces, rural and urban regions, and its districts.

Fourth, the study decomposes the multidimensional poverty in housing in Pakistan to determine the contribution of different regions and dimensions. Fifth, mapping of the estimates of multidimensional poverty is carried out in the paper for spatial analysis.

3. Methodology

The term standard of living is observed in the scientific and common language. Because of its use in multiple disciplines, there are many definitions of standards of living. According to Czeslaw and Leszek (1999), the standard of living is represented by the degree to which human needs are satisfied, which results from the consumption of material goods and services and from using the amenities of both the natural and social environment.

The present study analyzed the multidimensional poverty for housing quality in districts of Pakistan by measuring, decomposing, and representing on a geographical map to conduct the spatial analysis. Section 3.1 presents the steps involved in measuring multidimensional poverty for housing quality. Section 3.2 discusses the procedure for decomposing the multidimensional poverty index of housing quality.

3.1. Measure of Multidimensional Poverty for Housing Quality

Various studies used aggregation of different adequacy dimensions to measure housing quality (see Table 1). The present study used ten dimensions to measure multidimensional poverty in housing quality. The Alkire-Foster method developed by Alkire and Foster (2011) measures the multidimensional poverty index for housing quality. Steps, based on the Alkire-Foster method, for the estimation of MPI for the quality of housing in Pakistan and its districts are as under:

Step 1 - Unit of Analysis: The present study used household as the unit of analysis to estimate the multidimensional poverty in housing quality for the district of Pakistan.

Step 2 & 3 - Dimensions & Indicators: Based on the literature on housing quality, the present study used ten dimensions to calculate the MPI for

housing quality. Overall, twenty indicators are used for these dimensions. Detail of these dimensions and indicators is presented below:

- **D_1 – own:** Ownership of the house;
- **D_2 – den:** Population Density (ratio of HHS and number of rooms); The study used overcrowding (more than three people occupying a room; UN-Habitat, 2007)
- **D_3 – inf:** Structure of the house (material used in floor, walls, and roof);
- **D_4 – ene:** Modern energy sources availability (fuel for cooking, heating, lighting);
- **D_5 – dwa:** Drinking Water Availability (Drinking water source, Time takes to get the water, the distance of the water source, Sufficient availability of water);
- **D_6 – wcw:** Water for Cooking and Washing (Water source for cooking and washing);
- **D_7 – toa:** Toilet Availability (Flush Available, Sharing toilet with a non-member of the household);
- **D_8 – gco:** Garbage Collection System (Garbage collection facility at home, Time required to dispose of the garbage);
- **D_9 – mcs:** Availability of Modern Communication Services (Availability of internet or landline at home);
- **D_{10} – cln:** Cleanliness inside the home (Place for hand washing in the house)

$$x_{ij} \subset \mathbb{R} \quad \forall \quad i = 1,2,\dots,n \quad \& \quad j = 1,2,\dots,d \tag{1}$$

Where x_{ij} represents indicator x in dimension j for household i.

Step 4 & 5 – Deprivation Cutoffs & Calculate deprivation in each dimension: For the identification, if the household is poor or not poor, we set the threshold, also called as "poverty line" or "deprivation cutoff (Z_j). A household is said to be poor or deprived in any indicator if $x_{ij} < Z_j$, otherwise, they are categorized as non-poor or not deprived. The deprivation cutoffs are summarized in vector Z. We assign a "deprivation status score" g_{ij} to each household in each dimension based on their deprivation status. Here, g_{ij} is equal to 1 if household i is deprived in

dimension j. If household i is not deprived in dimension j then g_{ij} is equal to 0.

$$g_{ij} = \begin{cases} 1 & x_{ij} < Z_j \\ 0 & otherwise \end{cases} \quad (2)$$

Figure 1 presents the deprivation of the household in case of the availability of a toilet in the house. Figure 2 presents the deprivation of the household in case of the availability of a clean water facility. The household is considered non-poor in this dimension if the government does not provide water or it is not accessible within a short time or distance. Similarly, deprivation in other dimensions is determined, and a value of 1 is assigned if deprived and 0 otherwise. Likewise,

Step 6 – Weights to each dimension: Normalized weights w_j to each dimension of housing quality d_j is assigned.

$$w_j > 0 \qquad \sum_{j=1}^{d} w_j = 1 \quad (3)$$

Step 7 – Weighted sum of deprivation status scores: Weighted sum of deprivation status scores of each household in all dimensions d are used to identify whether the household is poor or not poor. An overall "deprivation score" for each household i is computed by adding the deprivation status scores of all dimensions, each multiplied by their corresponding weights.

$$c_i = \sum_{j=1}^{d} w_j \, g_{ij} \qquad c_i \in [0,1] \quad (4)$$

To calculate the MPI for housing quality, the present study used equal weights for each of its ten dimensions.

Step 8 – Poverty cut–off and identification of poor: The poverty cutoff "k" reflects the minimum deprivation score a household must be suffering simultaneously to be considered poor. In the literature, there are three approaches to setting the poverty cutoff. The union approach identifies

people as multidimensionally poor if they experience at least one measured deprivation. For the union approach, according to Atkinson (2003), poverty cutoff "$0 < k \leq \min\{w_1, w_2, \ldots, w_d\}$" The intersection approach identifies as poor only those households who are deprived in all the indicators simultaneously. For the intersection approach, the poverty cutoff is $k = 1$. The Alkire-Foster method uses a dual cutoff approach, which sets a poverty line 'k' that can range between 1 and a total number of indicators included in the measure. Poverty cutoff k is set to identify the poor. A household is said to be poor if $c_i \geq k$. Otherwise, the household is identified as non-poor. Like Alkire and Foster (2011), the present study used conventional cutoffs of 33.33% and 66.66% to identify the poor.

$$P_i = \begin{cases} 1 & c_i \geq k \\ 0 & otherwise \end{cases} \quad (5)$$

Where, P_i represents the poverty of a household i having a value of 1 if the household is multidimensionally poor and 0 otherwise.

Step 9 – Head Count Index for housing quality (H): Head Count Index for housing quality (H) is obtained by dividing the number of poor people (n_P) with the total population (N).

$$H = \frac{n_P}{N} \quad (6)$$

H is a useful measure, but it does not increase if a household becomes more deprived in any dimension, nor can dimensions break it down to analyze how poverty differs among groups. For this reason, we used an adjusted multidimensional poverty index.

Step 10 – Average Poverty Gap (A): According to the focus Axiom, while measuring poverty, the focus should remain only on those identified as poor. The average poverty gap is the average number of deprivations a poor household suffers in terms of housing quality. It is calculated by adding the proportion to each person's total deprivations and dividing it by the total number of poor persons. Simply put, it is the average of the deprivation

scores among the poor only. This also reflects the intensity of poverty. Technically, this enables us to obtain the censored deprivation score vector $c(k)$ from c, such that $c_i(k) = c_i$ if $c_i \geq k$. Otherwise, $c_i(k) = 0$.

$$A = \frac{1}{n_P}\sum_{i=1}^{n} c_i(k) \quad (7)$$

Step 11 – Adjusted Multidimensional Poverty Index for Housing Quality (M_0): Adjusted Multidimensional Poverty Index M_0 for housing, quality is calculated as the product of two components: the share of the population who are multidimensionally poor or multidimensional headcount ratio (H), and the average of the deprivation scores among the poor only, or the intensity of poverty (A).[1] Technically, this can be written as:

$$M_0 = MPI = H \times A = \frac{n_P}{N} \times \frac{1}{n_P}\sum_{i=1}^{n} c_i(k) \quad (8)$$

Equation (8) indicates that a reduction in M_0 for housing quality is possible either by reducing H or by reducing A. If the reduction in M_0 occurs simply by reducing the number of people who are marginally poor in living standards, then H decreases and A may not. On the other hand, if a reduction in M_0 occurs by reducing the deprivation of the poorest of the poor, then A decreases, but H may not. M_0 can also be obtained as the average of censored deprivation scores.

$$M_0 = \frac{1}{n}\sum_{i=1}^{n} c_i(k) \quad (9)$$

[1] Adjusted Head Count Ratio (M_0) can be calculated with ordinal as well as cardinal data. However, cardinal data are required to calculate Adjusted Poverty Gap (M_1) and Adjusted Squared Poverty Gap (M_1). In the present study, we have only ordinal data for indicators of the housing quality.

The present used the above-stated procedure to calculate the multidimensional poverty in housing quality for overall Pakistan, provinces of Pakistan, rural-urban regions of Pakistan, and districts of Pakistan.

3.2. Decomposition of M_0

Adjusted Multidimensional Poverty index for housing quality can be decomposed into different regions. This is possible because the entire population can be divided into m mutually exclusive and collectively exhaustive groups. In this case, M_0 can be expressed as the weighted average of the M_0 values of m subgroups, where weights are their respective population shares. We denote the population, achievement matrix, and the adjusted headcount ratio of subgroup s by n^s, X^s, and $M_0(X^s)$, respectively. Consequently, the overall M_0 can be expressed as:

$$M_0 = MPI = \sum_{s=1}^{m} \frac{n^s}{n} M_0(X^s) \quad (10)$$

This subgroup decomposability helps us to understand the contribution of different subgroups to overall poverty (contribution of provinces to overall multidimensional housing poverty of Pakistan, contribution of rural and urban regions to overall multidimensional housing poverty of Pakistan, contribution of districts to overall multidimensional housing poverty of Pakistan). Here, we can observe that the contribution of a subgroup to overall multidimensional poverty of housing quality depends on the poverty level of the subgroup and its population share.

Further, we can decompose the multidimensional poverty in housing to see the contribution of each indicator to overall poverty. For this, first, the censored headcount ratio of an indicator (h_j) is obtained as the proportion of the population which is multidimensionally poor and is simultaneously deprived in the indicator in question. By property, M_0 can be expressed as an average of the censored headcount ratios of indicators according to their relative weights.

$$M_0 = MPI = \sum_{j=1}^{d} W_j \, h_j = \sum_{j=1}^{d} W_j \left[\frac{1}{n} \sum_{i=1}^{n} g_{ij}(k) \right] \quad (11)$$

Where, $g_{ij}(k) = g_{ij}$ if $c_i \geq k$. Otherwise, $g_{ij}(k) = 0$. Then the contribution of indicator j (ϕ_j) to M_0 can be written as:

$$\phi_j = W_j \frac{h_j}{MPI} = W_j \frac{h_j}{M_0} \quad (12)$$

The present study decomposed the contribution of each dimension in the overall multidimensional housing poverty of Pakistan, the overall multidimensional housing poverty of rural and urban regions, and the overall multidimensional housing poverty of districts of Pakistan.

Data from the Pakistan Social and Living Standard Measurement (PSLM) survey for 2019-20 issued by the Pakistan Bureau of Statistics (PBS) is used for empirical analysis. The PSLM survey is district representative and contains data from 160654 households.[2] Figure 3 presents the geographical boundaries of the provinces and districts of Pakistan. Gilgit-Baltistan, Azad Kashmir, and India-administered Kashmir are not part of the analysis because of the unavailability of the data.

Figure 4 presents the population share of each district of Pakistan. Districts shaded with light yellow indicate a low level of population share, whereas districts shaded with dark green indicate a high level of population share. Districts of Punjab relatively have more population share compared to districts of Khyber Pakhtunkhwa (KP), Sindh, and Balochistan. According to PSLM 2019-20, 53.4 percent of the households are from Punjab, 26.5 percent are from Sindh, 14.6 percent are from KP, and 5.5 percent are from Balochistan.

4. Results

Households' decision about housing is not about the shelter but also about providing comfort to them and their family members. For this, a house should have some basic level of facilities. The availability of these facilities

[2] List of the districts is provided in Appendix A.

defines the quality of housing. The housing quality across all Pakistan regions is not the same. The present study calculated the multidimensional poverty index for housing quality across different regions of Pakistan.

Figure 4 presents the MPI for housing quality in Pakistan and its provinces. Multidimensional poverty in housing is highest in Balochistan, followed by KPK, Punjab, and Sindh. Likewise, the adjusted multidimensional poverty index is highest for Balochistan, followed by KPK, Sindh, and Punjab. The ranking of deprivation in housing across provinces is the same as the estimates of income poverty across these provinces (In 2018-19, poverty at the national level stood at 21.5%, whereas in Balochistan, it was estimated at 40.7%, KPK 27%, Sindh 24.6%, and Punjab 16.3%).

On the other hand, looking at the contribution of the provinces to national poverty, the contribution is highest for Punjab, followed by Sindh, KPK, and Balochistan. This is because of the high population shares of Punjab and Sindh in the overall population of Pakistan. The ranking of these provinces for multidimensional poverty is the same when a cutoff of 0.6666 is used. This indicates that multidimensional poverty is highest for Balochistan, but its contribution to the multidimensional poverty of Pakistan is very low. On the other hand, multidimensional poverty is lowest for Punjab, while its contribution to Pakistan's multidimensional poverty is highest compared to other provinces.

Comparing multidimensional poverty in the housing of rural and urban regions of Pakistan, more than 80% of the households are multidimensionally poor in rural regions, and 38% of the urban regions are multidimensionally poor. The ranking for rural and urban regions of Pakistan is the same for the adjusted multidimensional poverty index. Looking at the contribution of these regions in multidimensional poverty for housing quality in Pakistan, the contribution is highest for rural regions, whereas it is lowest for urban regions. The results reveal that infrastructure development and availability of services in houses are highest for urban regions and lowest for rural regions.

Looking at the contribution of various dimensions in the multidimensional poverty of housing, the structure of the house (inf), along with the

availability of modern energy (ene) and modern communication services (mcs), contributes the highest in the multidimensional poverty. On the other hand, ownership of the house (own) and water for cooking and washing (wcw) contributes less to the multidimensional poverty of housing. The ranking of contributions of these dimensions is the same for all the provinces. This indicates that contributors to multidimensional energy poverty across provinces of Pakistan are more or less the same. Likewise, if we see the contributions of these dimensions in multidimensional poverty of housing for rural and urban regions, the results are the same except for the availability of modern energy resources and ownership of the house. The availability of modern energy resources is better in urban areas than in rural areas. So, this dimension contributes less to adjusted multidimensional housing poverty in urban areas than in rural areas. On the other hand, in rural areas, most households have their own houses. So, this dimension contributes less to adjusted multidimensional housing poverty in rural areas than in urban areas.

In the end, the study presents the results of MPI for housing at district levels. Most of Balochistan and Southern Punjab districts showed a high level of MPI for housing. With the infrastructure development in recent years, Gwadar showed a low level of MPI for housing. Districts of central and upper Punjab and some districts of KPK showed a low level of MPI for housing. Districts of KPK having a border with Afghanistan showed a high level of MPI for housing. The federal capital of Pakistan and all the provincial capitals showed better housing quality standards measured through MPI for housing. Districts with high population share also appeared as high contributors to MPI for housing in Pakistan.

Conclusion:

Improving housing living standards in Pakistan is a complex and multifaceted issue that requires a comprehensive approach. The provision of services by the government, like modern energy resources, water for cleaning and cooking, and modern communication services, add to the quality of housing. The present study highlighted some of the housing

challenges confronted by districts of Pakistan. The study provided an estimate of deficiencies in housing quality through the MPI for housing.

The study concludes that housing conditions in crowded cities of Pakistan are not proper, and there are weak housing policies. Among provinces, Balochistan faced a high level of deficiency in housing quality. As expected, housing quality in rural regions is worse than in urban regions. Further, housing quality is not the same across all the districts of Pakistan, and each dimension contributes differently to MPI for different districts. This indicates that the Pakistan Housing Authority should make policies that can assure the quality of housing in each dimension. Rather than focusing on housing ownership, the authority should also pay attention to the availability of the services like sources of modern energy, water for drinking, washing, and cleaning, toilet facility, garbage collection system, and availability of modern communication systems. The provision of these housing facilities will not only improve living standards but also improve environmental quality and help make economic growth sustainable.

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Figure 1: Deprivation in Toilet Facility

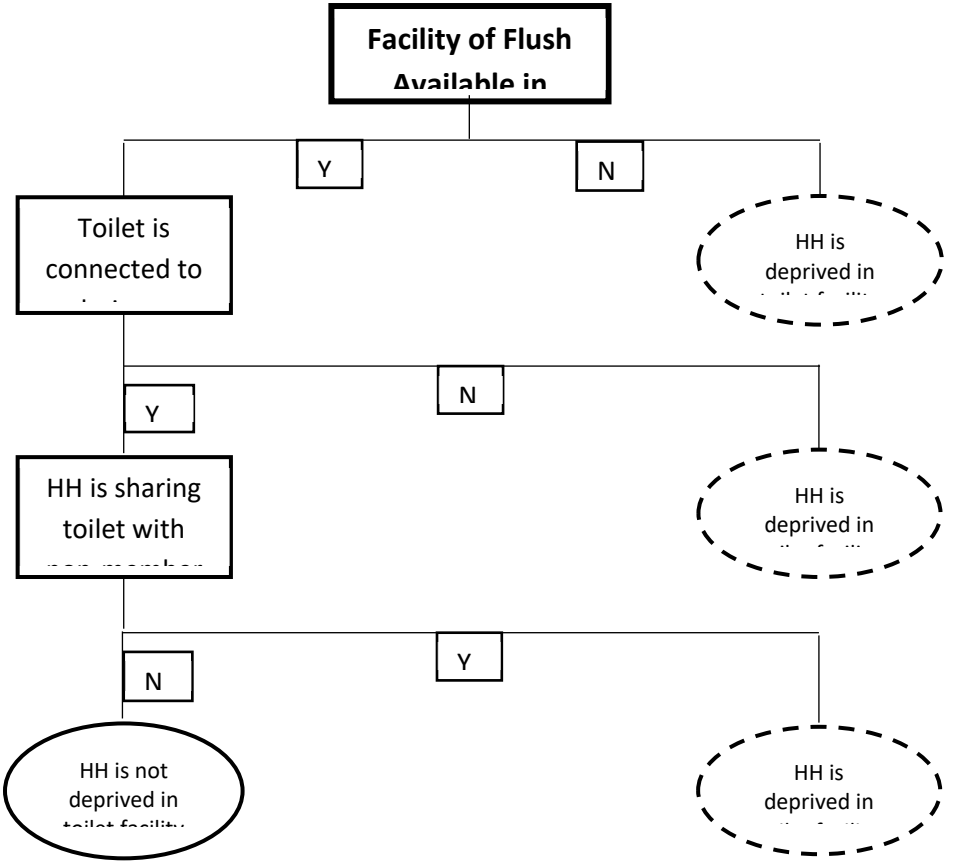


Figure 2: Deprivation in Drinking Water Facility

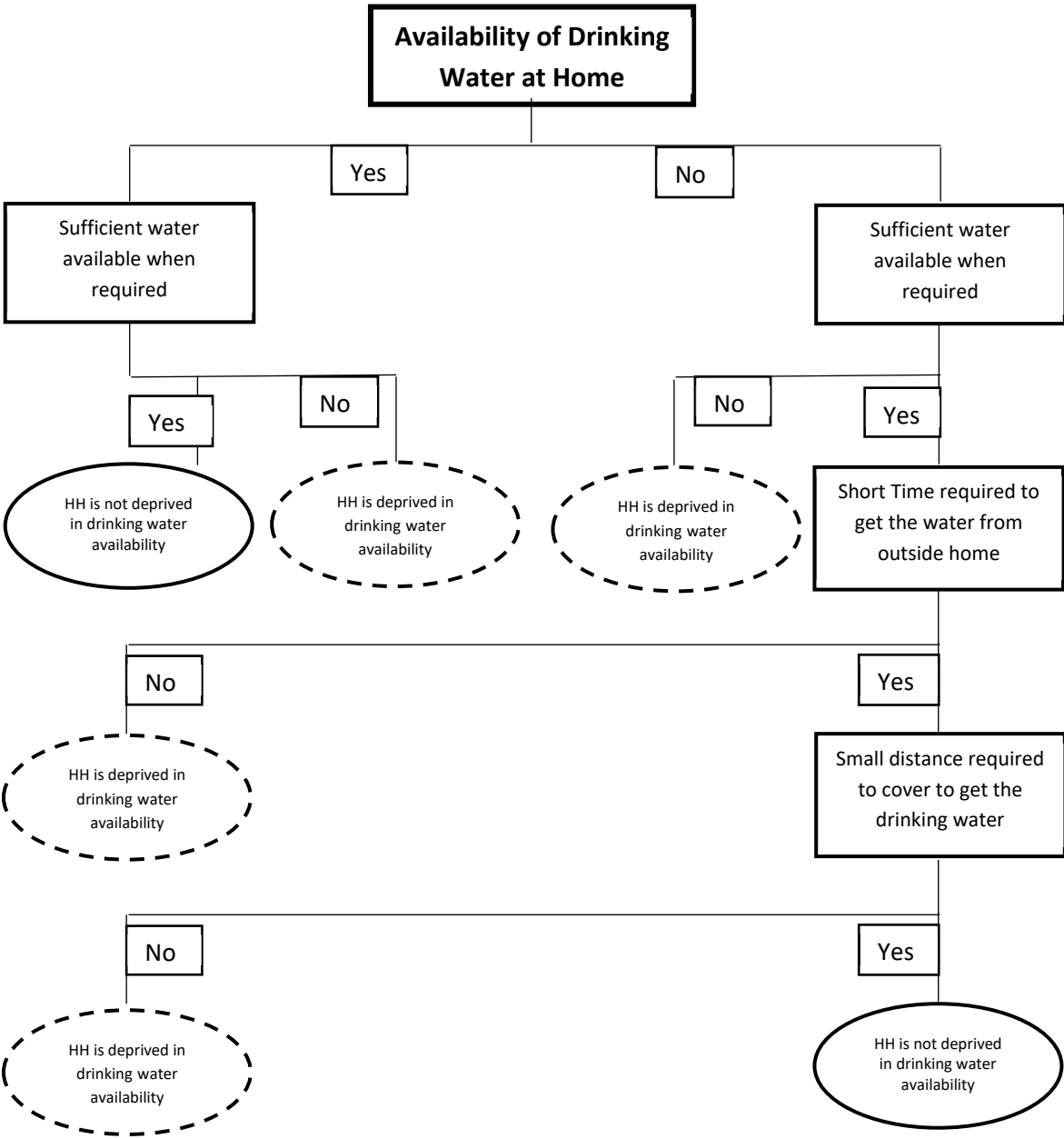

Availability of Drinking Water at Home
Yes
No
Sufficient water available when required
Sufficient water available when required
Yes
No
No
Yes
HH is not deprived in drinking water availability
HH is deprived in drinking water availability
HH is deprived in drinking water availability
Short Time required to get the water from outside home
No
Yes
HH is deprived in drinking water availability
Small distance required to cover to get the drinking water
No
Yes
HH is deprived in drinking water availability
HH is not deprived in drinking water availability

Figure 3: Boundaries of Districts and Provinces of Pakistan

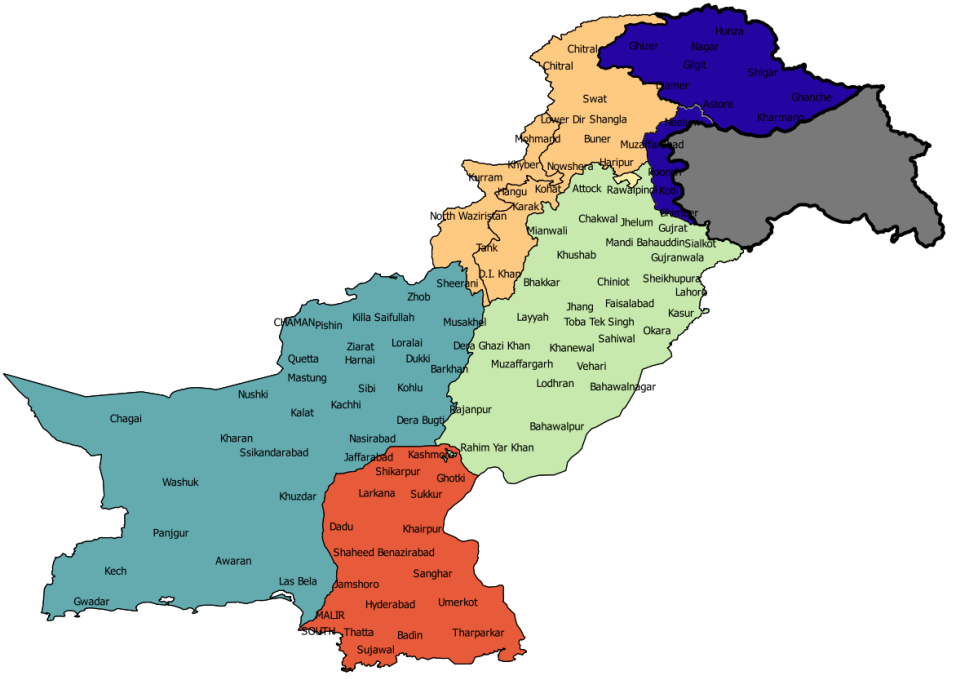


Figure 4: Population Share (PS) of Districts of Pakistan

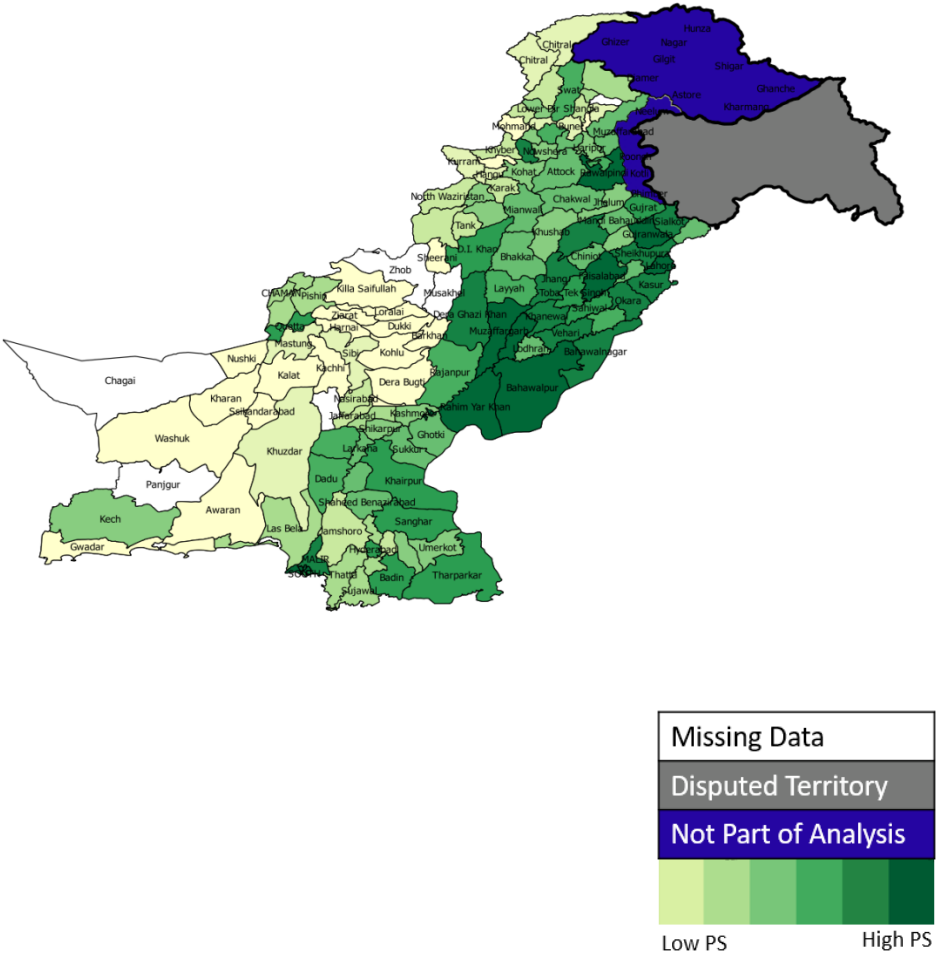


Figure 4: MPI for quality of housing for Pakistan and its provinces

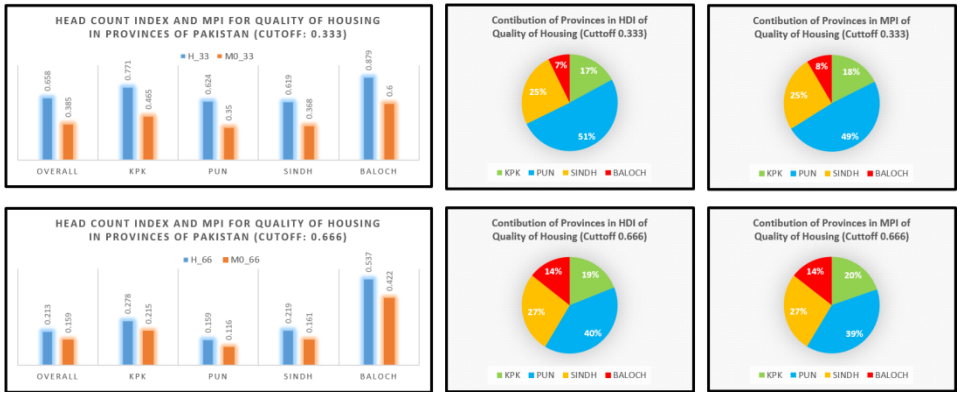


Figure 5: MPI for Quality of Housing for Pakistan and its rural-urban regions

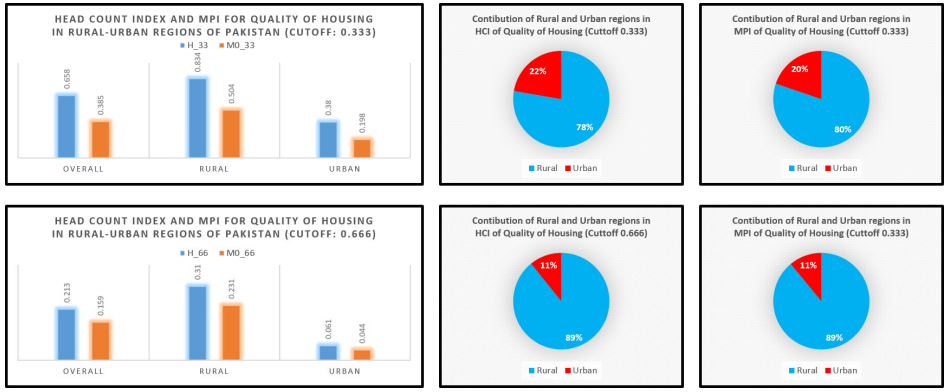


Figure 6: Contribution to MPI for Quality of Housing by each dimension

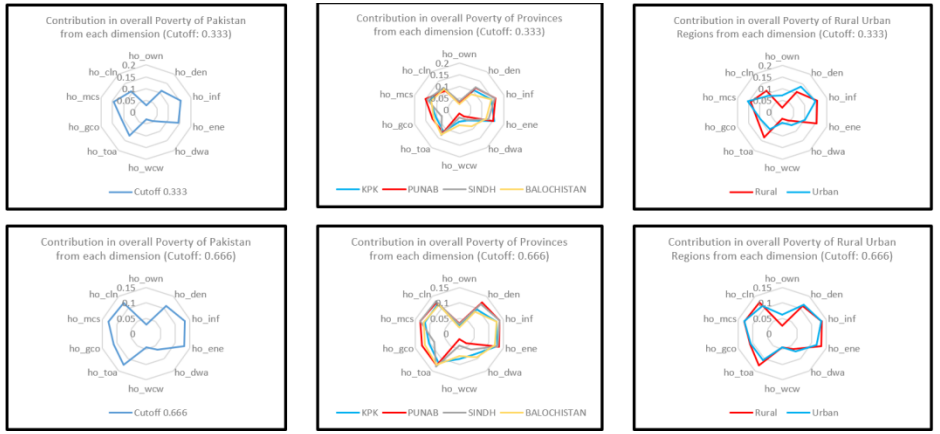
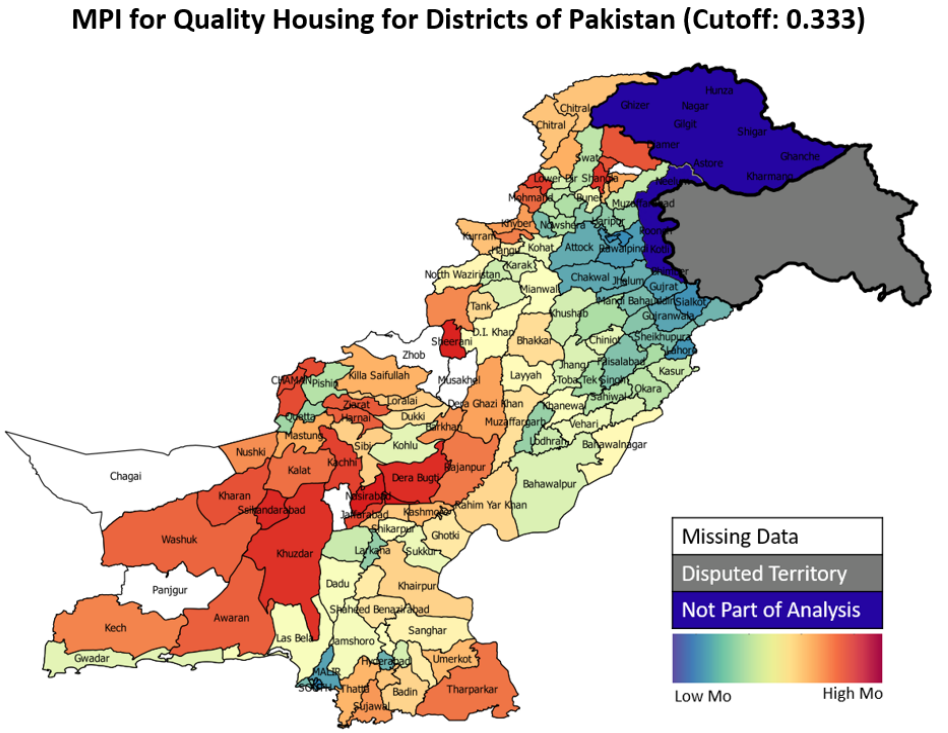


Figure 7: MPI for Quality of Housing for Districts of Pakistan using cutoffs 33.33%



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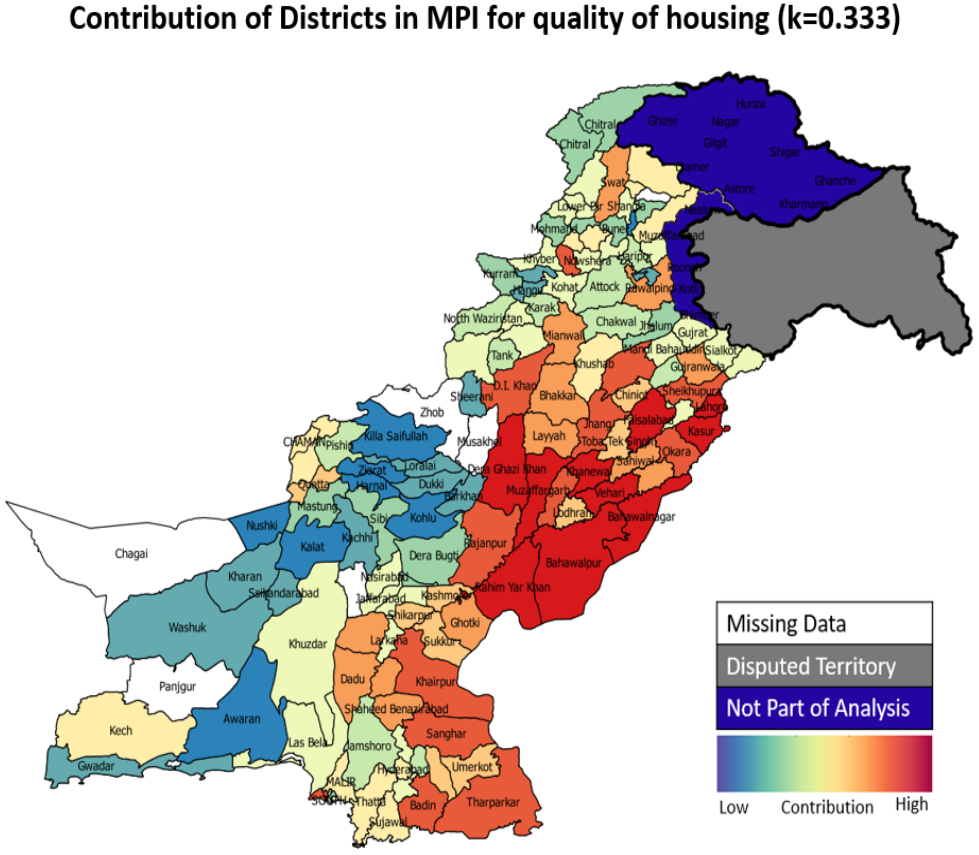

Appendix A: List of Districts

1	Islamabad				
Punjab					
2	Attock	14	Sialkot	26	Vehari
3	Rawalpindi	15	Gujranwala	27	Sahiwal
4	Jhelum	16	Sheikhupura	28	Bahawalnagar
5	Chakwal	17	Lahore	29	Bahawalpur
6	Gujrat	18	Kasur	30	Rahim Yar Khan
7	Mianwali	19	Okara	31	Pakpattan
8	Bhakar	20	Rajanpur	32	Narowal
9	Sargodha	21	Dera Ghazi Khan	33	Lodhran
10	Khushab	22	Layyah	34	Mandi Bahauddin
11	Faisalabad	23	Muzaffargarh	35	Hafizabad

12	Toba Tek Singh	24	Multan	36	Nankana Sahib
13	Jhang	25	Khanewal	37	Chiniot
Sindh					
38	Jacobabad	46	Badin	54	Kambar
39	Sukkur	47	Sanghar	55	Jamshoro
40	Shikarpur	48	Tharparkar	56	Kashmore
41	Larkana	49	Thatta	57	Matiari
42	Shaheed Benazirabad	50	Naushahro Feroze	58	Tando Allah Yar
43	Khairpur	51	Mirpur Khas	59	Tando Muhammad Khan
44	Dadu	52	Ghotki	60	Sujawal
45	Hyderabad	53	Umerkot	61	Karachi (Central)
Khyber Pakhtunkhwa					
62	Chitral	71	Kohat	80	Lakki Marwat
63	Lower Dir	72	Karak	81	Tank
64	Swat	73	Bannu	82	Batagram
65	Malakand	74	Dera Ismail Khan	83	Shangla
66	Kohistan	75	Nowshera	84	Hangu
67	Mansehra	76	Charsadda	85	Upper Dir
68	Abbottabad	77	Swabi	86	Tor Ghar
69	Mardan	78	Haripur		
70	Peshawar	79	Buner		
Balochistan					
87	Quetta	97	Khuzdar	107	Dera Bugti
88	Pishin	98	Kharan	108	Mastung
89	Loralai	99	Lasbela	109	Awaran
90	Zhob	100	Gwadar	110	Ziarat
91	Chagai	101	Panjgur	111	Sharani
92	Sibi	102	Jhal Magsi	112	Jaffarabad
93	Nasirabad	103	Killa Saifullah	113	Kech
94	Bolan	104	Killa Abdullah	114	Harnai
95	Kohlu	105	Musakhel	115	Washuk
96	Kalat	106	Barkhan	116	Noshki