



**OPHI**  
Oxford Poverty & Human  
Development Initiative



# Measuring Multidimensional Poverty **in Yemen**

December 2023



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# ACRONYMS

ICT	Information and Communications Technology
IDP	Internally Displaced Person
MPI	Multidimensional Poverty Index
OPHI	Oxford Poverty and Human Development Initiative
SDGs	Sustainable Development Goals
UNDP	United Nations Development Programme
YHDS	Yemen Human Development Survey

# FOREWORD

This report represents a significant contribution to measuring and monitoring Yemen's progress in achieving the Sustainable Development Goals, specifically the first goal and target 1.2, on reducing "at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions" by 2030.

The report is Yemen's first on the calculation of the sub-national Multidimensional Poverty Index (MPI) based on the 2021 Yemen Human Development Survey. It covers the sub-national level (representative regions), urban and rural areas of Al Bayda, Ta'iz, Hadramawt, Shabwah, Aden, Lahj, Ma'rib, Al Maharah and Ad Dali' governorates. A detailed breakdown by MPI indicators for each group makes the report a powerful policy tool to benchmark progress and inform planning and policy design.

We hope that the report will guide policy decisions to accelerate multidimensional poverty reduction, including through allocating resources to target the poorest groups and/or regions with the largest numbers of vulnerable people, based on recommendations to reduce multidimensional poverty for each group.

By providing important information to national and international stakeholders to support people living in poverty in Yemen, this report offers an example for fragile and crisis-affected countries. We hope it is useful to design and implement MPIs that can help guide the reduction of poverty and deprivation in other contexts of conflict.

Zena Ali Ahmad

UNDP Yemen Resident Representative



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# EXECUTIVE SUMMARY

The Sustainable Development Goals (SDGs) call for a multidimensional measure of poverty to complement monetary poverty analysis and present a more comprehensive picture. Specifically, SDG target 1.2 aims to “reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.”

This report presents the national Multidimensional Poverty Index (MPI) for Yemen. It was developed to capture key aspects of deprivation for individuals and households. The MPI is the product of a collaboration between the United Nations Development Programme (UNDP) and the Oxford Poverty and Human Development Initiative (OPHI) to capture the most crucial deprivations faced by people in Yemen.

## Multidimensional poverty

The national MPI for Yemen is based on the Alkire-Foster method of multidimensional poverty measurement. It uses the results of the 2021 Yemen Human Development Survey (YHDS) and comprises six dimensions (education, health, child and maternal health, services, living standards and employment) and 17 indicators.

The dimensions and indicators capture deprivations for individuals and households. Indicators were computed at the household level, assuming that all household members equally share achievements and deprivations. Statistical tests were performed to validate the measure’s robustness and the significance of findings at the national level and for governorates.

The YHDS included a sample of 1,681 households. It was the first face-to-face, representative household survey since the onset of conflict in Yemen. It aimed to provide a detailed overview of welfare, food security and human development indicators, and to enable intrahousehold analysis. Data were collected between April and September 2021, including on education, health, employment status and living conditions in areas under the Internationally Recognized Government (Southern Yemen). The survey provided regionally representative data on Al Bayda, Ta’iz, Hadramawt, Shabwah, Aden, Lahj, Ma’rib, Al Maharah and Ad Dali’ governorates.

## Results

Results indicated that 82.7 percent of people were living in multidimensional poverty, or more than 8 in every 10 people based on the regions surveyed. The intensity of poverty, or the average number of deprivations faced by multidimensionally poor people, was 46.7 per cent. On average, a poor person experienced more than 45 percent of possible weighted deprivations. The national MPI, which is the product of the incidence (percentage of people living in multidimensional poverty) and intensity (average number of deprivations faced by poor people) of multidimensional poverty, was 0.386. Multidimensionally poor people faced on average 38.6 percent of all possible deprivations, if all individuals were multidimensionally poor and deprived on all indicators.

Poverty tended to be higher in rural areas (89.4 percent) than urban areas (68.9 percent). Ad Dali’ and Al Bayda had the highest incidence of multidimensional poverty. An estimated 40 percent of multidimensionally poor people lived in Ta’iz governorate, which has a large population.

Nationally, years of schooling and sanitation were the two indicators with the largest censored headcount ratios,<sup>1</sup> with more than 70 percent of the population deprived on these indicators and multidimensionally poor. In terms of the percentage contribution of each of the 17 indicators to the national MPI, the largest contributors were years of schooling (17.1 percent), followed by cooking fuel (9.1 percent) and sanitation (8.1 percent).

Female-headed households had a lower incidence of multidimensional poverty than male-headed households but the difference was not significant. Households where the head was divorced had a lower incidence of multidimensional poverty compared to other households. By contrast, households where the male head was married to more than one wife had higher levels. The intensity of their poverty was also greater. The incidence of poverty among people living in smaller households was 64.4 percent, compared to 86.4 percent and 91.1 percent for people living in households with five to nine members or more than nine members, respectively. Finally,

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<sup>1</sup> The percentage of people who are deprived on each indicator and are multidimensionally poor.

households with members with disabilities had higher levels of multidimensional poverty than households without members with disabilities (86.4 percent compared to 81.2 percent).

### **Conclusion and recommendations**

Yemen's internal conflict has had a deeply negative impact on the living standards of individuals and households. The country faces high levels of poverty and deprivation, and multiple challenges in guaranteeing access to basic services and opportunities. Deprivations in years of schooling and sanitation are among the worst, with more than 70 percent of the population deprived on these indicators. Important differences between rural and urban areas and governorates reflect how some areas are more affected by ongoing conflict, higher barriers to services or a lack of services altogether. This report recommends establishing a poverty reduction strategy that addresses inadequate access to basic services and enhances economic opportunities.





## Chapter 1 Introduction

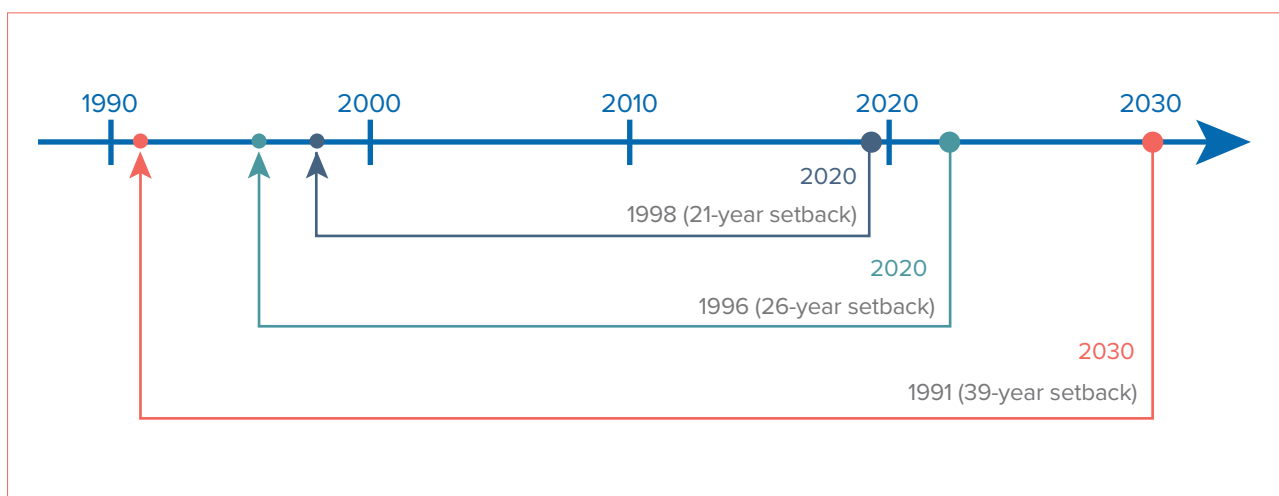
*Photo: UNDP Yemen. Selling fish in Aden, Yemen.*

## 1.1 COUNTRY CONTEXT

Even before armed conflict escalated in 2015, development in Yemen was under strain. A country of 30 million people, in 2011 it ranked 154th on the Human Development Index, 138th on extreme poverty, 147th on life expectancy and 172nd on educational attainment, and was in the World Bank's low-middle-income category. It did not achieve any of the Millennium Development Goals and likely will not achieve any of the SDGs by 2030 due to the ongoing crisis.

Conflict has stalled and reversed development and imposed devastating costs, with nearly 250,000 people killed by fighting as well as through a lack of access to food, health services and infrastructure. Of the dead, 60 percent are children under age 5. The long-term impacts place the conflict in Yemen as among the most destructive since the end of the Cold War. It has already set human development back by more than 20 years, a trend set to worsen, as measured by the Human Development Index (Figure 1).

*Figure 1. End of conflict in 2019, 2022 and 2030, and the impact on the Human Development Index*



Source: UNDP 2020

Ongoing crisis has eroded the livelihoods of over 54 percent of the population, torn the social fabric, and weakened the resilience of people and institutions. Critical infrastructure for service delivery, including for water and sanitation, education, health, telecommunications and transportation, has been damaged or destroyed. Fragmented government institutions and the competing monetary, fiscal and economic policies of the parties to the conflict have eroded trust in national institutions. A rise in unregulated financial businesses such as local money exchanges and cash suppliers has occurred amid faltering efforts to implement economic stabilization policies. This has created costly distortions within the economy and placed extreme stress on the banking system.

With severe damage to essential social infrastructure and a lack of government capacity, service delivery has halted in many parts of the country. An adverse business climate has deterred investors, with private sector activity crippled by insecurity, import and export constraints, a lack of access to finance and skyrocketing operating costs as well as trade deficits and macroeconomic imbalances affecting fiscal and budgetary conditions.

The crisis has impacted the banking sector given the shrinking availability of hard currency. Other challenges include the existence of two central banks, two currencies and two competing monetary policies, eroding the ability of the Central Banks of Yemen to steward the economy.



Photo: UNDP Yemen. A family household.

## 1.2 POVERTY IN YEMEN

Violent conflict since 2014 has prevented implementation of the Household Budget Survey to calculate official monetary poverty statistics. The most recent survey was in 2014. It used food poverty and non-food poverty lines. The food poverty line stemmed from the valuation in riyals of a basket of food items deemed to satisfy the minimum calorific needs of the least well-off in society. The non-food poverty line valued the basic minimum needs for non-food goods and services consumed by poor people, including durable goods, housing and education. The total poverty line per person per year was estimated at YR 162,528 (around US \$750),<sup>2</sup> which is the sum of the food and non-food poverty lines (World Bank 2017).

Poverty in Yemen is widely believed to have worsened since 2014. But the precise magnitude is only ascertainable with primary data. The 2017 Yemen Poverty Notes, based on the 2014 Household Budget Survey data, showed that 49 percent of Yemen's population (13 million people) lived in monetary poverty (ibid). The level of monetary poverty varied significantly by governorate, however, which was related to the percentage of rural and urban populations, the intensity

of the conflict and access to services by households and individuals. In 2014, Sa'dah and Amran were the poorest governorates, with headcount poverty rates of 84.5 percent and 75.9 percent, respectively. Poverty incidence was lowest in Sana'a City, at 13.4 percent of the population. Aden, the second-largest city, had a headcount poverty rate of 22.2 percent. To estimate the poverty trend from 2014 to 2016, the World Bank applied microsimulation techniques using the 2014 poverty line and the change in gross domestic product during the period. The microsimulation accounted for multiple shocks, including the loss of employment, non-payment of public sector salaries, and declines in public transfers and remittances. The simulation results showed that poverty rates in 2016 ranged between 62 and 78 percent, or 17.5 million to 21 million poor people.

The most recent round of the Yemen Demographic Household Survey (DHS) took place in 2013 and covered 119,720 people; however, the violent conflict has hindered the implementation of the DHS survey used to construct the Arab MPI for Yemen. The first version of the Arab regional MPI was published in

<sup>2</sup> The exchange rate applied as of 2014 was \$1 equivalent to YR 214.

2017 (United Nations, League of Arab States, UNICEF et al 2017). It used three equally weighted dimensions (health, education and living standards) and 12 indicators. The indicators were distributed as follows:



**Education:** school attendance and years of schooling



**Health:** nutrition, child mortality and early pregnancy combined with female genital mutilation



**Living standards:** electricity, sanitation, drinking water, cooking fuel, housing, overcrowding, assets, information, mobility and livelihoods

Two cut-offs were assigned to each indicator, aiming to capture acute and moderate poverty. A poverty cut-off of 33 per cent was set to identify individuals

as poor or acutely poor. A household deprived at a rate of 33 percent or more of the weighted sum of deprivations was considered multidimensionally poor. The same poverty cut-off was used to measure acute and moderate poverty, with the main difference being the deprivation cut-off used in each indicator to define a deprived person (UNESCWA 2018). The results showed that in 2013, 30.6 percent of the population lived in acute multidimensional poverty, with moderate multidimensional poverty almost double, at 69.1 percent. Acutely poor people experienced deprivation on 56.3 percent of the weighted indicators, whereas poor people experienced deprivation on 50 percent of the indicators. The analysis revealed important differences between rural and urban areas, with an acute MPI for rural areas of 0.205 and for urban areas of 0.034, and a moderate MPI for rural areas of 0.194 and for urban areas of 0.475. Hajjah and Raymah had the highest poverty incidences in the country.

## 1.3 WHY A MULTIDIMENSIONAL POVERTY INDEX IS IMPORTANT

Yemen's devastating conflict has multiple implications for poverty, requiring a multidimensional approach to measuring it. Aside from the tragic loss of human life, wide-ranging effects include the disruption of economic activities and public services, destruction of the socioeconomic fabric and the depletion of state capacity in crucial areas such as security, service provision and revenue collection (UNICEF 2018).

The conflict has precipitated an internal displacement crisis. In 2022, nearly 4.3 million people were internally displaced (IDPs); 23 million needed humanitarian aid (UNHCR 2023). Children accounted for 20 percent of the displaced population in 2021, exposing them to infectious diseases, malnutrition, school absence and underage marriages. These challenges call for a multidimensional approach to tackling poverty and prioritizing the most urgent humanitarian needs (UNHCR 2022).

Multidimensional poverty measures have become useful tools to monitor poverty reduction over time as well as the implementation of poverty reduction strategies and other policies to improve education, health, water, sanitation and electricity, among other services and opportunities. In the SDG call for reducing poverty, indicator 1.2.2 tracks a reduction in the number of men, women and children of all ages living in poverty in all its dimensions according to national standards. This indicator invites governments to design measures to monitor multidimensional poverty in specific contexts, including measures that are disaggregated by groups and provide information on different deprivations. Currently, more than 20 countries globally have national MPIs, which guide policies, monitor poverty reduction, and provide vital information on national and local levels of deprivation.



## Chapter 2 Methodology

Photo: UNDP Yemen. Access to healthcare services.

The national MPI for Yemen was estimated using the Alkire-Foster method, discussed here in general

terms, along with the measurement design and data set used in this particular analysis.

## 2.1 ALKIRE-FOSTER METHOD

The Alkire-Foster method (Alkire and Foster 2011) is a comprehensive methodology for counting deprivation and analysing multidimensional poverty. The method builds on the Foster-Greer-Thorbecke poverty measure and considers multiple dimensions.

The Alkire-Foster method includes two steps. The first step, identification, entails selecting a set of poverty-

### 2.1.1 Identification

The first cut-off sets a deprivation threshold for each indicator, determining whether a household or person is considered deprived or non-deprived based on the respective indicator. After the cut-offs have been applied for each indicator, each person's deprivation based on all indicators is counted to calculate a deprivation score for that household or person. Weights are assigned to the indicators; these reflect a normative value judgment to assess the relative importance of a given indicator compared to other

relevant indicators and defining the deprivation cut-off for each, counting the number of deprivations that an individual or household faces, and then determining who is poor against a reasonable poverty cut-off. The second step is to aggregate this information into the adjusted headcount ratio (or MPI value), which can be decomposed and disaggregated geographically, by socioeconomic characteristics and by each indicator in the index.

### 2.1.2 Aggregation

In the aggregation step, two indices are calculated: the headcount ratio and poverty intensity. The headcount ratio (H) is the proportion of multidimensionally poor people to the total population. The headcount ratio is a useful measure of the incidence of poverty; however, it is insensitive to increases in the number of deprivations a poor person faces. A complementary measure, the intensity of poverty, can be calculated by using the

indicators in constructing the deprivation score for a household or person. As a result, the deprivation score is a weighted sum of all deprivations. The poverty cut-off is then set at a value, say 20 or 30 percent, against which the deprivation score is compared to define and distinguish multidimensionally poor people (those whose deprivation score is equal to or more than the poverty cut-off) from non-poor people (whose deprivation score falls below the poverty cut-off).

number of deprivations that poor people face. The poverty intensity (A) is the average deprivation score that multidimensionally poor people experience. The product of the poverty headcount and poverty intensity is the MPI, which 'adjusts' the headcount for the average poverty intensity that poor people experience. In summary, the MPI constitutes the headcount ratio (H) and the intensity of poverty (A) (see box below).

The headcount ratio (H) is the proportion of the population that is multidimensionally poor.

The intensity of poverty (A) reflects the proportion of the weighted indicators in which, on average, multidimensionally poor people are deprived.

The MPI combines these two aspects of poverty in the following way:

$$\text{MPI} = H \times A$$

## 2.2 STRUCTURE OF THE MEASURE

Designing a national MPI follows six main steps:

1. Define the purpose of the measure.
2. Define the unit of identification and analysis of the measure.
3. Define dimensions and indicators.
4. Define deprivation cut-offs for each indicator.
5. Define the weight of each dimension and indicator.
6. Define the poverty cut-off or poverty line.

### 2.2.1 Purpose

The purpose of the national MPI is to inform policymakers and different stakeholders about the levels of deprivation and multidimensional poverty that people face. In addition, the results will help

in monitoring poverty reduction over time and identifying regions and groups with higher levels of multidimensional poverty and deprivation.

## 2.2.2 Unit of identification and unit of analysis

The unit of identification in Yemen's national MPI is the household. It is assumed that deprivations are equally shared among household members. The unit

of analysis is the individual. Thus, all information on multidimensional poverty is read for each person.

## 2.2.3 Dimensions and indicators

Using the YHDS, a structure with six dimensions and 17 indicators was designed. Each indicator was selected based on its importance in Yemen and its capacity to provide information on levels of deprivation. Improving conditions for people and overcoming the negative consequences of the conflict require reducing these deprivations.

- **Education:** The education dimension includes two indicators: years of schooling and school attendance. The first indicator captures the minimum years of education that a member of the household should have. The second indicator captures households where at least one school-aged child is not currently attending school.
- **Health:** This dimension includes three indicators. The first, health-care access, captures deprivation in households where at least one household member who needs health services does not have access to these. This deprivation includes aspects related to the availability of services and the capacity of households to pay for services. The second indicator captures deprivation in access to medical care for people with chronic diseases, where a person diagnosed with a chronic disease cannot access medicines or appointments with doctors. This group is extremely vulnerable since a lack of health care can put their life at risk. The third indicator captures deprivation in food security. For this indicator, a household is defined as deprived if any of its members did not eat or reduced their food intake as a result of a lack of money.
- **Maternal and children health:** This dimension aims to capture indicators related to maternal and children health, with the understanding that both groups have higher vulnerabilities, and a lack of health-care facilities can increase risks of illness and death. SDG 3 calls for reducing child and maternal mortality and guaranteeing universal health coverage. The first indicator in this dimension is child vaccination, which identifies a household as deprived if at least one child younger than 5 years old has not received the DPT (diphtheria, pertussis and tetanus) vaccine. The second indicator is child mortality, which identifies a household as deprived if in the last five years at least one child has died. The third indicator identifies a household as deprived if at least one woman who has been pregnant did not receive antenatal care, or the delivery was at home and not attended by a doctor.
- **Services:** This dimension aims to capture deprivations related to access to different services such as water, sanitation, lighting and Internet connectivity. On the water indicator, a household is considered deprived if it does not have access to a clean source of water. For the sanitation indicator, a household is deprived if the sanitation of the household is not improved or is shared.<sup>3</sup> The lighting indicator defines a household as deprived if the main source of lighting is a private network, shared generator or candles, or the household has electricity but for fewer than 15 hours per day on average. Finally, the indicator on Internet connectivity identifies a household as deprived if it does not have access to a laptop/tablet or computer.
- **Living standards:** This dimension includes three indicators: cooking fuel, housing materials and overcrowding. The first indicator defines a household as deprived if the main cooking fuel is charcoal, wood, straw-leaves, animal waste or other. The second indicator, overcrowding, identifies a household as deprived if three or more people share a bedroom, while the final indicator defines a household as deprived based on poor-quality materials used for roofs, walls or floors.
- **Employment:** This dimension includes two indicators: unemployment and underemployment. The first defines a household as deprived if at least one household member of working age does not work, and the second if at least one household member who is already working is willing to work more hours.

<sup>3</sup> Given the type of questions included in the survey, it was not possible to follow the SDG definitions for the water and sanitation indicators.

## 2.2.4 Weights

The national MPI for Yemen uses nested weights, which assign an equal weight to each dimension and an equal relative weight to each indicator in a dimension. A weight of 16.6 percent was assigned to each of the six dimensions. For education and employment, the two indicators were equally weighted at 8.3 percent. For the health, maternal and child health, and living

standards dimensions, a weight of 5.5 percent was assigned to all three indicators under each. Finally, the services dimension includes four indicators with a weight of 4.1 percent each. Table 1 presents the dimensions, indicators and deprivation cut-offs included in the national MPI.

*Table 1. Dimensions, indicators, deprivation cut-offs and weights*

Dimension	Indicator	Deprived if an individual lives in a household:	Weight
Education	Years of schooling	Where at least one member older than 14 and younger than 65 has fewer than six years of education	8.3%
	School attendance	Where at least one school-aged child is not attending school	8.3%
Health	Health access	Where at least one member did not have access to health care in the last 12 months, and the reason was not that the illness was minor	5.5%
	Medical care for chronic diseases	Where at least one member who has a chronic illness does not have access to health services, no matter the reason why he/she does not have access	5.5%
	Food security	That has implemented at least one coping strategy for reducing food consumption	5.5%
Maternal and children health	Vaccination	Where at least one child has not received the DPT vaccine	5.5%
	Child mortality	Where at least one child has died in the last five years	5.5%
	Antenatal and skilled birth care	Where a woman who was pregnant in the last five years did not receive antenatal care, or the delivery was at home and not attended by a doctor or nurse	5.5%
Services	Water	Where the main source of water is an artesian well, well, wellspring or unprotected pool	4.1%
	Sanitation	Where the main toilet is an open pit, non-flushed toilet, other facility or no toilet, and is not private	4.1%
	Lightening	Where the main source of light is a private network, shared generator or candles, or the household has electricity but the average number of hours per day with power available is below 15	4.1%
	Internet	Without a computer/laptop, tablet and the household does not have Internet	4.1%
Living standards	Cooking fuel	Where the main source of cooking fuel is wood, coal/charcoal, straw-leaves, animal waste or other	5.5%
	Overcrowding	Where a room is shared by three people or more	5.5%
	Housing materials	Were the material of the walls, roof and floors is of poor quality*	5.5%
Employment	Unemployment	Where at least one member older than 14 is unemployed	8.3%
	Underemployment	Where at least one member older than 14 who is working is willing to work more hours	8.3%

Notes: \* For the floor, this would be natural soil or other; the roof would be wood and mud, metal sheets, straw/bamboo, bamboo and clay, metal sheets and clay or other; and the walls would be straw/bamboo, textiles, metal/zinc or other.



### 2.2.5 Poverty cut-off

Two kinds of threshold are used to decide whether a person is deprived and whether they are poor. The first is an indicator-specific poverty cut-off (deprivation cut-off), where a person is considered deprived on each indicator if their achievement falls below the cut-off. The second is a cross-indicator cut-off (or poverty

cut-off), which sets the minimum share of deprivations (or deprivation score) needed for a person to be considered poor. In Yemen, the poverty cut-off was set at 30 per cent; in other words, a person is deprived if they live in a household that faces deprivations on more than two dimensions.

## 2.3 DATA

The YHDS is the first face-to-face, representative household survey since the onset of conflict. Conducted by the World Bank and the Social Fund for Development, with input from UNDP, it provides a detailed overview of welfare, food security and human development indicators in Yemen, enabling intrahousehold analysis.


Data were collected between April and September 2021, and include information on education, health, employment status and living conditions under the Internationally Recognized Government (Southern Yemen). The survey provides regionally representative data on Al Bayda, Ta'iz, Hadramawt, Shabwah, Aden, Lahj, Ma'rib, Al Mahrah and Ad Dali'. A sample of 1,681 households, 16 in each of 105 enumeration areas, was selected from 1,200 enumeration areas visited by national Yemen Household Budget Survey teams in 2014.

The YHDS sample was designed in four stages. The first stage was identical to that of the 2014 Household Budget Survey, in which 1,200 enumeration areas were selected from the list of all enumeration areas generated by the 2005 Census, using probability proportional to size. The second stage selected a subset of 273 enumeration areas. The YHDS used the same 38 strata of the Household Budget Survey (region and urban/rural), and considered, as an additional, separate stratum, those districts where the ratio of incoming IDPs (as reported by the International Office for Migration) over the total population (as reported by the Central Statistical Organization) exceeded 60 percent.

In the third stage, due to difficulties in obtaining security permissions in northern areas and increased hostilities in some districts, 168 enumeration areas were inaccessible. Of the 105 enumeration areas that were accessible in areas under the Internationally Recognized Government, four had to be replaced with reserve enumeration areas once fieldwork began due to the ongoing security situation.

The fourth stage involved listing all households within the enumeration areas. Households were sorted into those with and without IDPs based on the following question: "How many members of the current household have moved here because of the conflict?" Eight IDP households and eight non-IDP households were then randomly selected with equal probability from each group. This created an additional strata of IDP and non-IDP households.

The YHDS collected data on 17 distinct modules, including: dwelling characteristics, health, education, food security, displacement, coping strategies and access to social protection. Some modules gathered data at the household level; others collected detailed information on members of the household. The response rate was 95 percent, which was relatively high considering insecurity and the extent of internal displacement. The statistics are representative of accessible parts of Southern Yemen or accessible areas under the control of the Internationally Recognized Government.



## Chapter 3 Results

*Photo: UNDP Yemen. Community initiatives to produce COVID-19 PPE.*

This chapter presents the results of the MPI for Yemen based on the YHDS 2021, starting with the national MPI as well as the poverty rate and intensity among poor people.<sup>4</sup> It then details disaggregated results by geographic regions—rural and urban areas, and nine

governorates. A third section discusses robustness tests for the choice of weights and the poverty cut-off, followed by an analysis of age groups and other household characteristics.

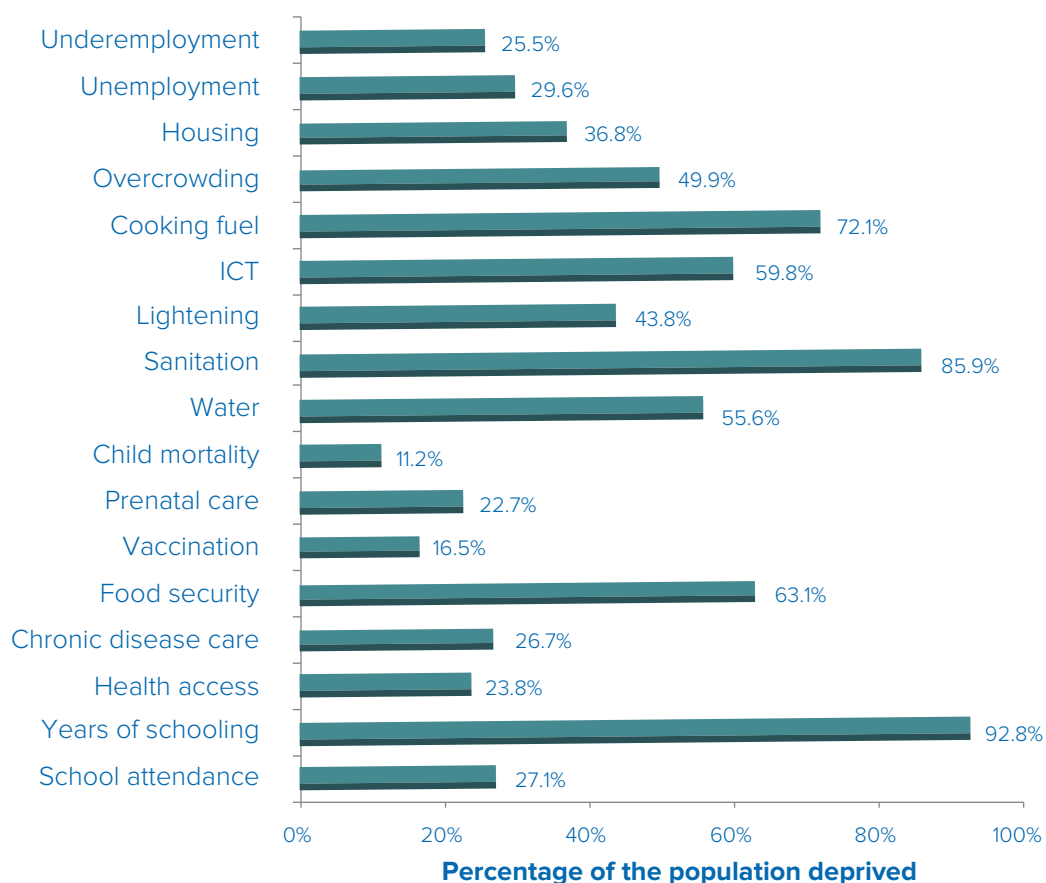
## 3.1 NATIONAL RESULTS

### 3.1.1 Uncensored headcount ratios

Uncensored headcount ratios present the percentage of people living in households deprived on each of the indicators. In Yemen, years of schooling and sanitation are the two indicators with the highest percentages of people deprived. More than 85 percent of people live in a household where at least one person aged 14 to 65 does not have six years of education or more,

or in a household where the main toilet is an open pit, non-flushed toilet, other facility or no toilet, and is not private. The indicators with the lowest levels of deprivation are child mortality, with 11.2 percent of the population deprived on this indicator, and vaccination, with a deprivation level of 16.5 percent (Figure 2).

Figure 2. Uncensored headcount ratios, 2021



Source: Authors' calculations based on data from the YHDS 2021.

### 3.1.2 Incidence, intensity and the MPI

Table 2 shows the results of the national MPI for Yemen for 2021 as well as the incidence of poverty (the proportion of people identified as multidimensionally poor, H) and the intensity of poverty (the average

proportion of weighted indicators in which poor people are deprived, A). The incidence of multidimensional poverty is 82.7 percent. Since this estimate is based on a sample, it has a margin of error. Thus, Table 2

<sup>4</sup> The national results represent regions where the survey is representative, therefore, Southern Yemen or accessible areas under the control of the Internationally Recognized Government.

also presents a 95 percent confidence interval, which means that the true multidimensional poverty headcount ratio is between 81.4 and 83.9 percent. The average intensity of poverty, which reflects the share of deprivations each poor person experiences on average, is 46.7 percent. That is, each poor person is, on average, deprived on nearly one and a

half dimensions. Finally, the national MPI for Yemen, which is calculated by multiplying the incidence and intensity of poverty, has a value of 0.386. This means that multidimensionally poor people experience 38.6 percent of the total deprivations that would be experienced if all individuals were deprived on all indicators at the same time.

**Table 2. Poverty incidence, intensity and the MPI, 2021**

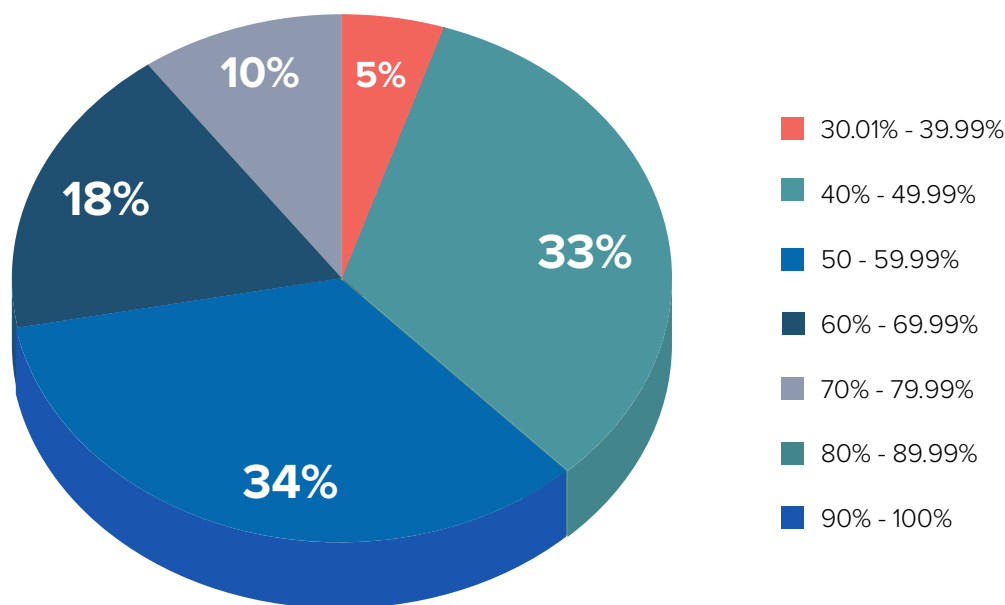
Poverty cut-off (k)	Index	Value	Confidence interval (95%)	
k value=30%	MPI	0.386	0.379	0.394
	Headcount ratio (H)	82.7%	81.4%	83.9%
	Intensity (A)	46.7%	46.2%	47.2%

*Source: Authors' calculations based on data from the YHDS 2021.*

Figure 3 depicts the distribution of the intensity of poverty among poor people. One third (33 percent) of all individuals are in the lowest intensity band, which is between 30.1 and 40 percent of the weighted sum of indicators, while 67 percent of poor people have deprivation scores of less than 50 percent of the

weighted sum of indicators. This suggests that further progress in reducing multidimensional poverty could be made quite easily, as most poor people are very near the poverty line. More than 20 percent of multidimensionally poor people face deprivation in more than 60 percent of the weighted sum of indicators, however.

**Figure 3. Intensity gradient among poor people, 2021**



*Source: Authors' calculations based on data from the YHDS 2021.*

## 3.2 DISAGGREGATION BY RURAL AND URBAN AREAS AND NINE GOVERNORATES

To better understand the distribution of poverty, this report now disaggregates levels by rural and urban areas, and by region. Table 3 shows the national MPI and the incidence and intensity of poverty by urban and rural areas. As can be seen, the poverty headcount ratio is higher in rural areas than in urban ones—at 89 and 69 percent, respectively. Figure 4 compares the

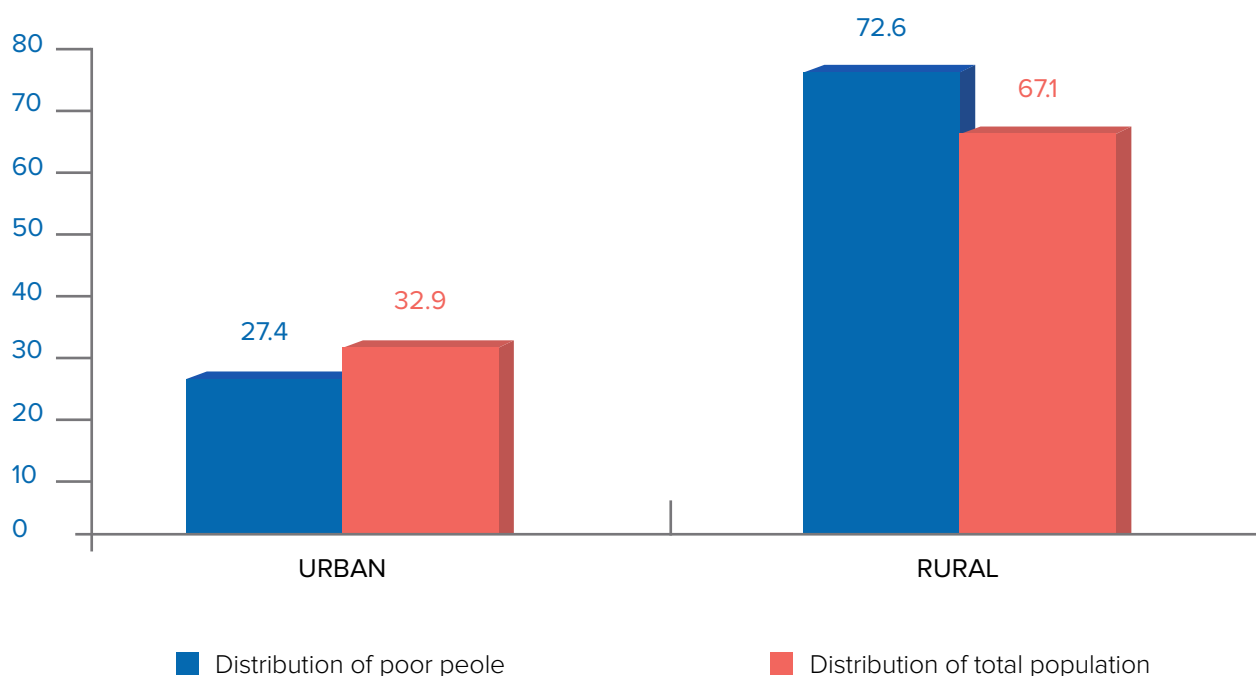
distribution of poor people and the overall population by area. The distribution between rural and urban areas is similar to the distribution of the overall population in both areas; however, rural areas have a higher number of multidimensionally poor people. While rural areas are home to 67.1 percent of the total population, they hold 72.6 percent of multidimensionally poor people.

Table 3. Multidimensional poverty by rural and urban areas, 2021

Index	Urban			Rural				
	Population share (percentage)	Value	Confidence interval (95%)		Population share (percentage)	Value	Confidence interval (95%)	
MPI		0.294	0.285	0.303		0.431	0.422	0.441
Headcount ratio (H)	32.9	68.9%	66.9%	70.9%	67.1	89.4%	87.8%	90.9%
Intensity (A)		42.7%	42.2%	43.1%		48.3%	47.6%	48.9%

Source: Authors' calculations based on data from the YHDS 2021.

Figure 4. Distribution of poor people and the total population by rural and urban areas, 2021, percentage



Source: Authors' calculations based on data from the YHDS 2021.

Table 4 shows the estimated sub-national MPI, and the incidence and intensity of poverty by governorate. The broad pattern suggests that Al Bayda, Ad Dali' and Lahj governorates have the highest levels of

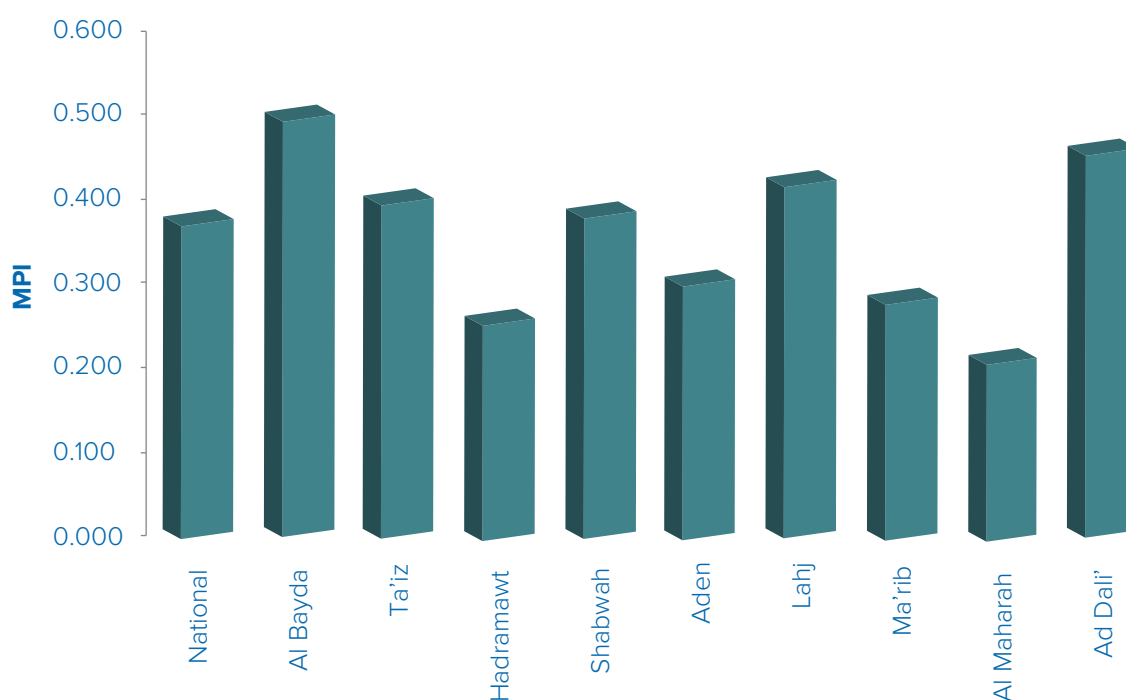
multidimensional poverty and the greatest incidences of poverty. Al Bayan has the highest intensity of multidimensional poverty. Figure 5 illustrates the MPI in each of the nine governorates.

Table 4. Multidimensional poverty by governorate, 2021

Governorate	Population share (percentage)	MPI			Headcount ratio (H, percentage)			Intensity (A, percentage)		
		Value	Confidence interval (95%)		Value	Confidence interval (95%)		Value	Confidence interval (95%)	
Sub-national (Internationally Recognized Government) <sup>1</sup>	100.0	0.386	0.379	0.394	82.7%	81.4%	83.9%	46.7%	46.2%	47.2%
Al Bayda	8.0	0.513	0.499	0.526	96.2%	94.7%	97.6%	53.3%	52.2%	54.4%
Ta'iz	38.0	0.410	0.394	0.427	86.4%	83.6%	89.3%	47.5%	46.3%	48.6%
Hadramawt	15.1	0.265	0.255	0.274	64.8%	62.6%	66.9%	40.9%	40.4%	41.4%
Shabwah	6.9	0.396	0.380	0.411	84.1%	80.9%	87.2%	47.1%	46.2%	47.9%
Aden	10.1	0.311	0.295	0.327	73.8%	70.1%	77.4%	42.2%	41.5%	42.9%
Lahj	11.6	0.432	0.420	0.443	89.4%	87.3%	91.4%	48.3%	47.7%	49.0%
Ma'rib	2.4	0.291	0.280	0.302	71.9%	69.2%	74.6%	40.5%	40.0%	41.0%
Al Mahrah	1.4	0.219	0.193	0.246	53.1%	46.8%	59.4%	41.3%	40.2%	42.4%
Ad Dali'	6.6	0.470	0.454	0.486	96.1%	94.6%	97.7%	48.9%	47.4%	50.3%

Source: Authors' calculations based on data from the YHDS 2021.

Figure 5. Sub-national MPI by governorate, 2021

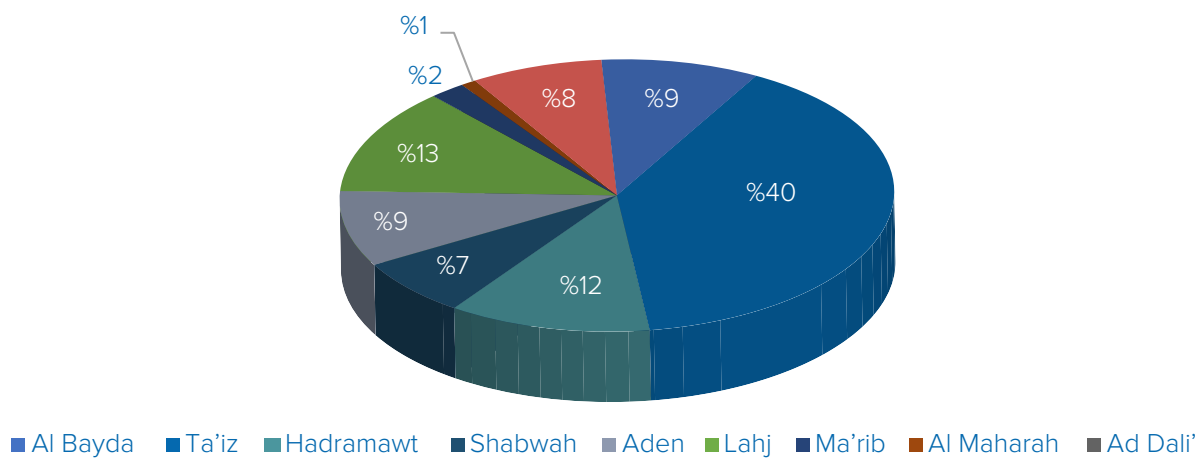


Source: Authors' calculations based on data from the YHDS 2021.

Figure 6 depicts where multidimensionally poor people live, across the nine governorates. This is important because, depending on the population size of each governorate, the total number of multidimensionally poor people changes. Poorer governorates might have lower numbers of multidimensionally poor people. Ta'iz

is home to the largest number of multidimensionally poor people at 40 percent. Although Al Bayda has the greatest incidence of multidimensional poverty, it only contributes 9 percent of all multidimensionally poor people nationally given a smaller population size in absolute numbers.

Figure 6. Distribution of people in multidimensional poverty by governorate, 2021



Source: Authors' calculations based on data from the YHDS 2021.

### 3.2.1 Censored headcount ratios

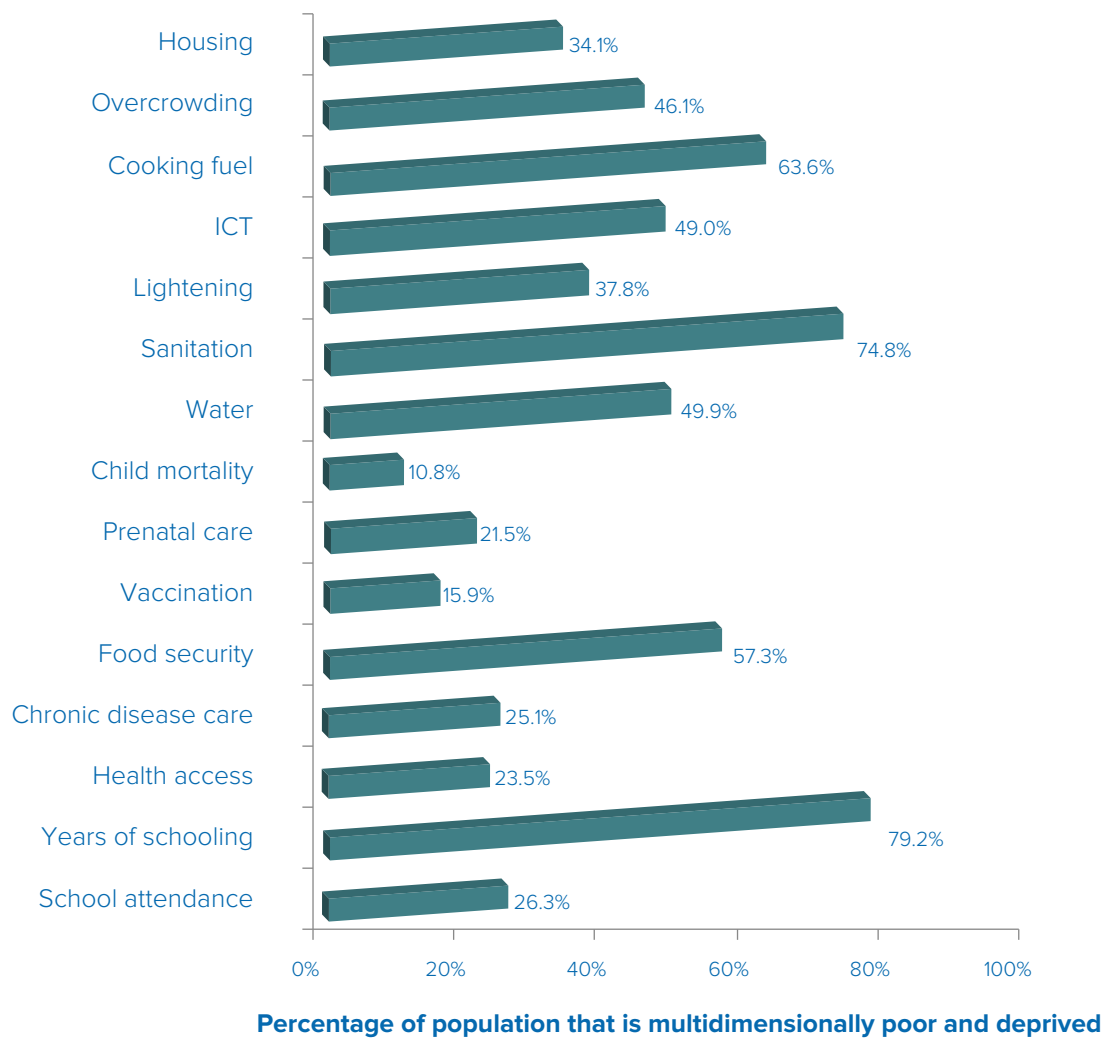
Which deprivations drive multidimensional poverty in Yemen, and how can they be reduced? To help answer these questions, the national MPI is broken down by indicator. The censored headcount ratio of an indicator represents the proportion of individuals who are multidimensionally poor and deprived on that indicator. The national MPI can also be computed as the sum of the weighted censored headcount ratios. Thus, reducing any of the censored headcount ratios reduces multidimensional poverty.

Figure 7 shows that the largest deprivation is in years of schooling; 79.2 percent of people are multidimensionally poor and live in a household where at least one person older than 14 and younger than 65 has not finished six years of education. Furthermore, 74.8 percent of people are multidimensionally poor and deprived in sanitation, while 63.6 percent are poor and deprived in cooking fuel. The indicators with the lowest censored headcount ratios are child mortality at 10.8 percent and vaccination at 15.9 percent.

Photo: UNDP Yemen. Yemenis employed through cash for work activities in Sheikh Othman.



Figure 7. Censored headcount ratios, 2021



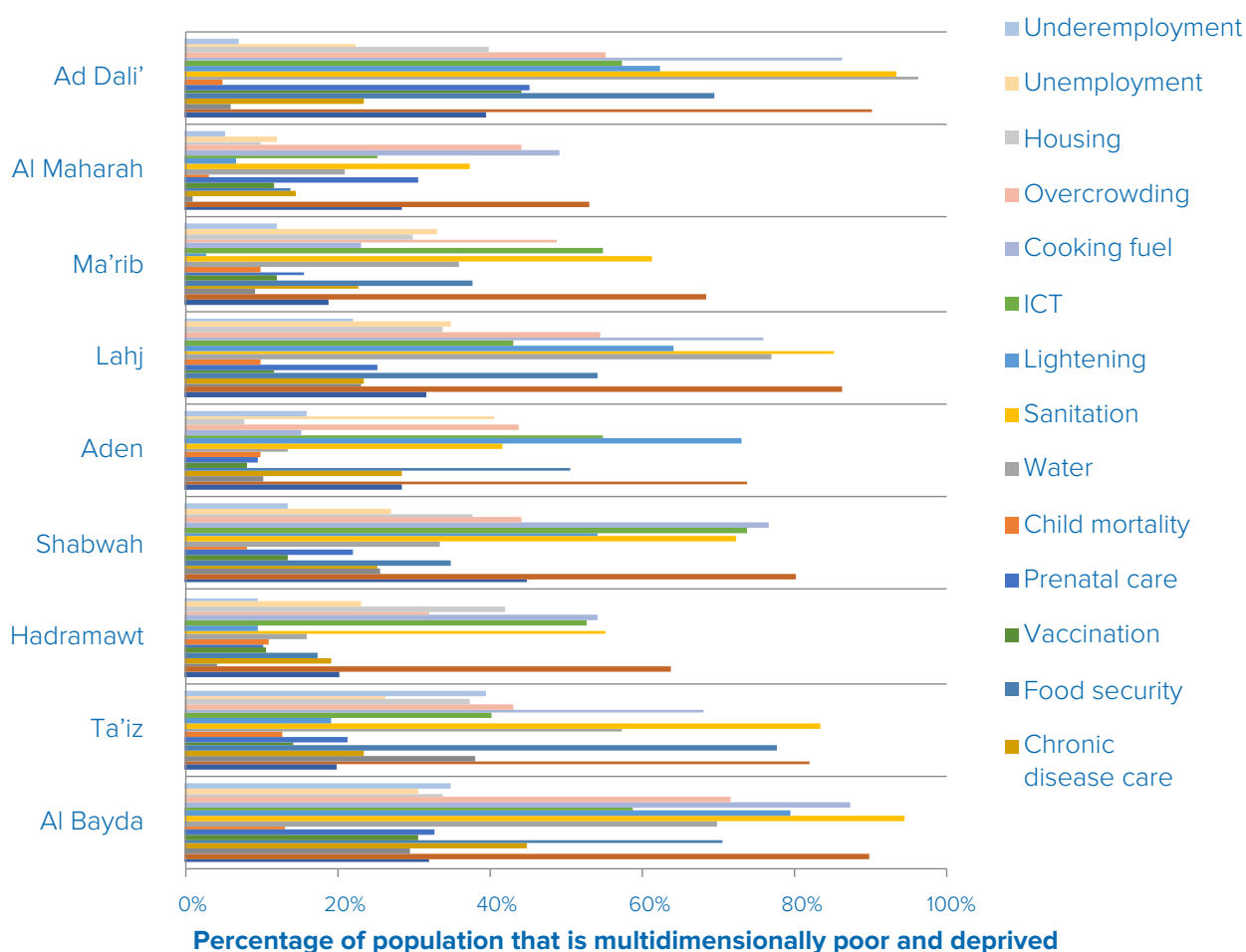
Source: Authors' calculations based on data from the YHDS 2021.

Years of schooling, sanitation and cooking fuel are the three indicators with the largest shares of people who are multidimensionally poor and deprived; child mortality and vaccination have the lowest percentages. A look at the censored headcount ratios in each of the nine governorates, however, reveals important differences. For example, 3 percent of the population

in Al Mahrah is multidimensionally poor and deprived in child mortality compared to 13 percent of the population in Al Bayda. For vaccination, we observe important differences among governorates: 8.1 percent of the population in Aden is multidimensionally poor and deprived on this indicator compared to 30.6 percent of the population in Al Bayda (Figure 8).



Figure 8. Censored headcount ratios by governorates, 2021



Source: Authors' calculations based on data from the YHDS 2021.

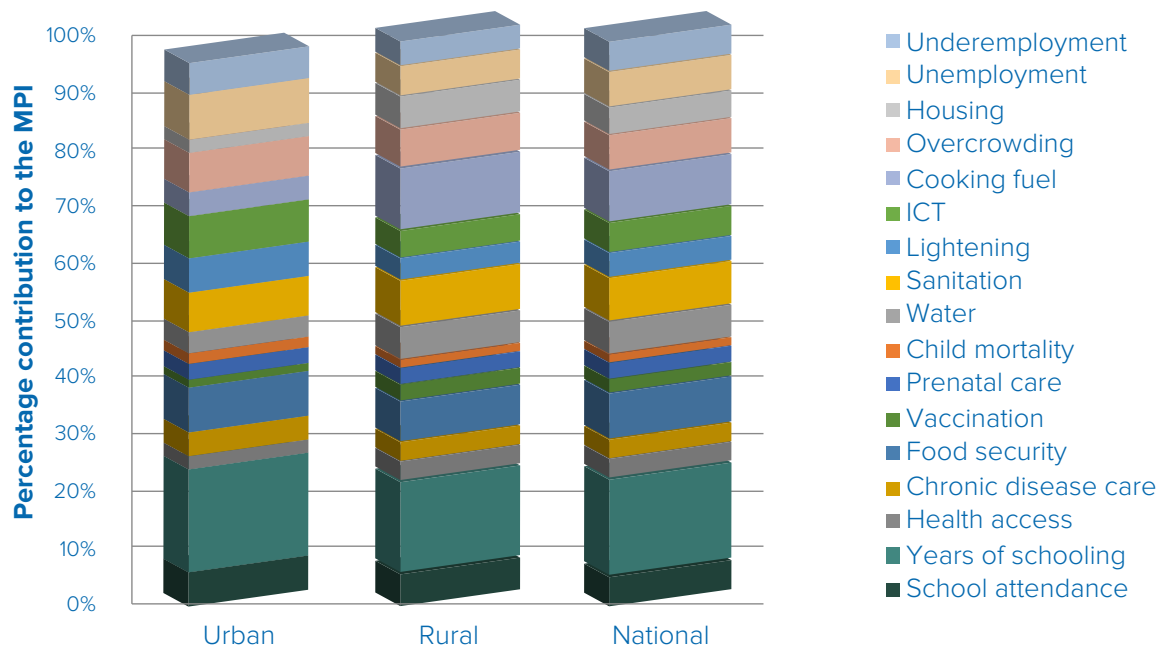
### 3.3 PERCENTAGE CONTRIBUTIONS

For a more in-depth view on multidimensional poverty, it is useful to see the percentage contribution of each of the 17 indicators to overall multidimensional poverty in both rural and urban areas. Figure 9 depicts the weighted percentage contribution<sup>5</sup> of each indicator to show the composition of multidimensional poverty in rural and urban areas. Recall that the weights for the six dimensions are the same. In terms of the percentage contribution of each indicator to the national MPI, the largest contributors are years of schooling (17.1 percent), followed by cooking fuel (9.1

percent) and sanitation (8.1 percent). Services and education make the largest contributions to the MPI (22.8 percent each), greater than living standards (20.7 percent), health (15.2 percent), employment (11.6 percent), and maternal and child health (6.9 percent). Patterns in urban and rural areas are largely similar, although years of schooling contributes relatively more to urban poverty (18.9 compared to 16.6 percent) and cooking fuel contributes relatively more to rural poverty (10.8 compared to 4.4 percent).

<sup>5</sup> The percentage contribution of each indicator to the MPI is defined as the extent to which each weighted indicator contributes to overall poverty. This is computed using the formula  $MPI = \sum_{j=1}^d w_j h_j(k)$ , where  $d$  is the number of indicators,  $w$  is the weight of each indicator, and  $h_j$  is the censored headcount ratio of each indicator.

Figure 9. Percentage contribution of each indicator to rural, urban and national MPI, 2021

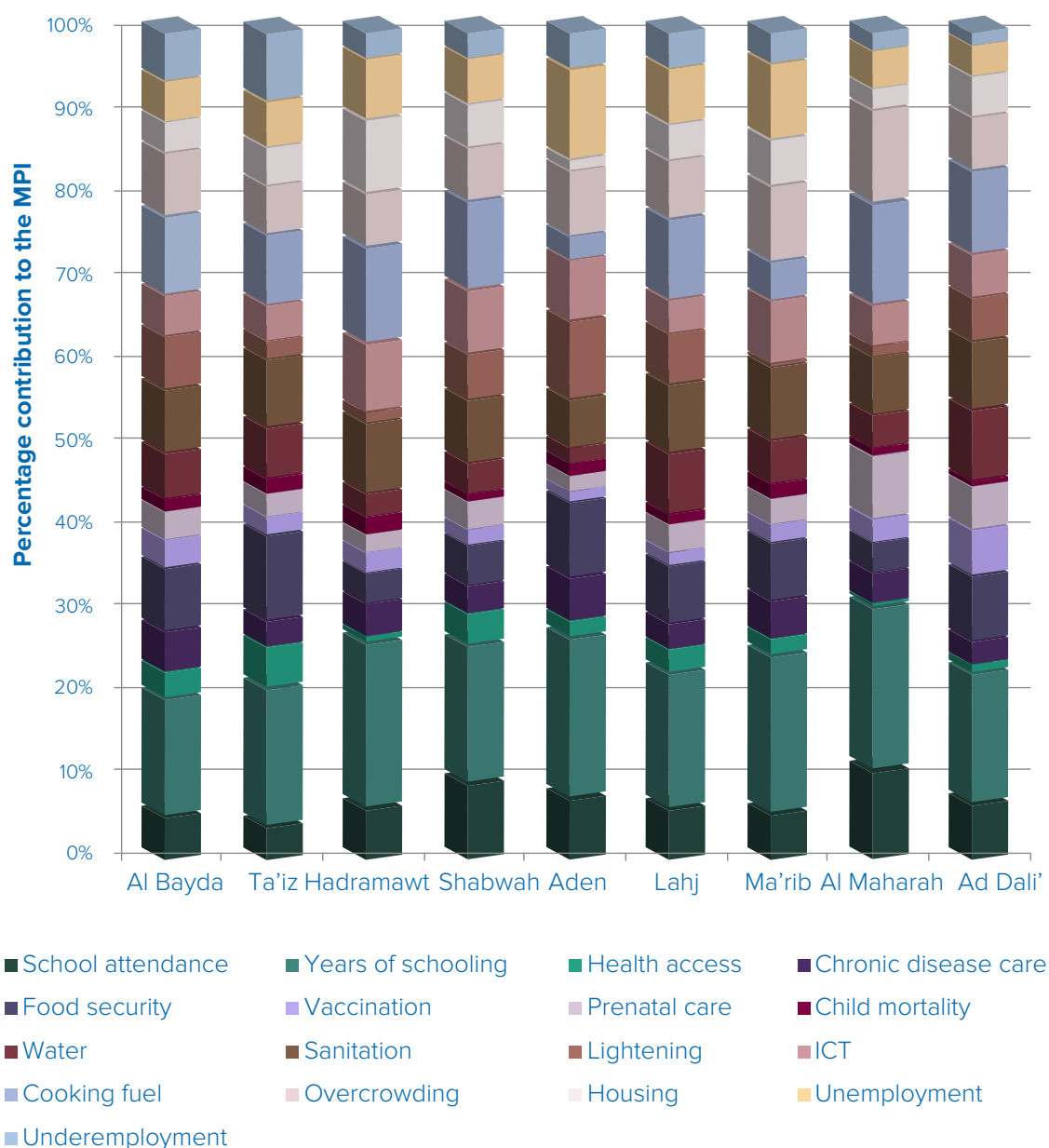


Source: Authors' calculations based on data from the YHDS 2021.

Since the Alkire-Foster method allows subgroup decomposability and dimensional breakdowns, it is possible to explore the composition of the MPI not only at the national and urban and rural levels but also at the governorate level. As Figure 10 highlights, breakdowns by region are particularly important because multidimensional poverty varies across

governorates. There are some notable patterns. For instance, the school attendance indicator contributes more in Shabwah and Al Maharah. Among the indicators in the living standards dimension, cooking fuel makes one of the largest contributions overall yet is less than 5 percent in Ad Dali' and Ma'rib.

Figure 10. Percentage contributions of each indicator to governorate MPI, 2021



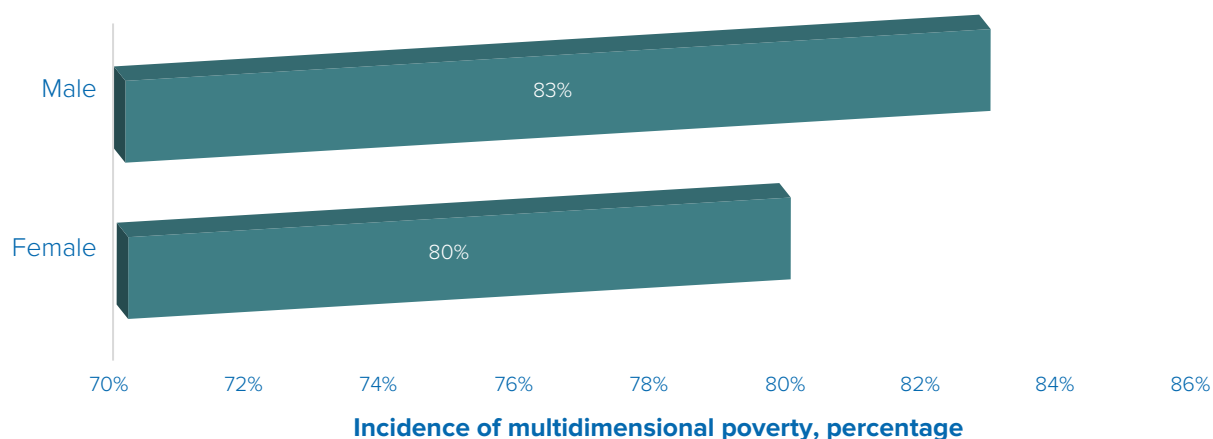
Source: Authors' calculations based on data from the YHDS 2021.

### 3.4 PERFORMANCE ACROSS THE CHARACTERISTICS OF OTHER HOUSEHOLD MEMBERS

This section presents the main results from exploring multidimensional poverty based on the characteristics of household members: namely, the sex of the household head, marital status of the household head and household size.

Figure 11 compares the national MPI for female-headed households and male-headed households. As can be seen, female-headed households have a lower incidence of multidimensional poverty than male-headed ones. The differences are not significant, however.

Figure 11. National MPI by sex of the head of household, 2021



Source: Authors' calculations based on data from the YHDS 2021.

As shown in Table 5, no significant differences exist between the censored headcount ratios by sex of the head of the household. The largest differences are found in the indicators of overcrowding and health-care access, where female-headed households<sup>6</sup>

present deprivations that are more than 15 percentage points lower than for male-headed households. By contrast, female-headed households have higher deprivations on the food security indicator.

Table 5. Censored headcount ratios by sex of household head, 2021

Indicators	Censored headcount ratio (percentage)		Difference (percentage points)	Significant (5%)
	Female household head	Male household head		
School attendance	23.1	26.9	3.84	
Years of schooling	75.3	79.9	4.60	
Health access	10.4	26.0	15.54	***
Chronic disease care	15.2	26.9	11.75	***
Food security	62.5	56.3	-6.20	
Vaccination	6.3	17.7	11.38	***
Prenatal care	12.3	23.2	10.84	***
Child mortality	10.3	10.9	0.58	
Water	42.8	51.2	8.38	
Sanitation	70.8	75.6	4.75	
Electricity	37.6	37.8	0.19	
ICT	41.0	50.5	9.48	***
Cooking fuel	57.3	64.8	7.52	***
Overcrowding	31.4	48.8	17.44	***
Housing	25.7	35.6	9.95	***
Unemployment	22.6	29.5	6.91	***
Underemployment	24.9	25.2	0.31	

Source: Authors' calculations based on data from the YHDS 2021.

Note: Significance level \*\*\*0.001.

<sup>6</sup> In 2021, 15.5 percent of people in Yemen lived in a household with a female head.

Table 6 presents the incidence and intensity of multidimensional poverty and the MPI by the marital status of the household head. Households where the head is divorced have a lower incidence of multidimensional poverty than other households. By contrast, households where the head is married

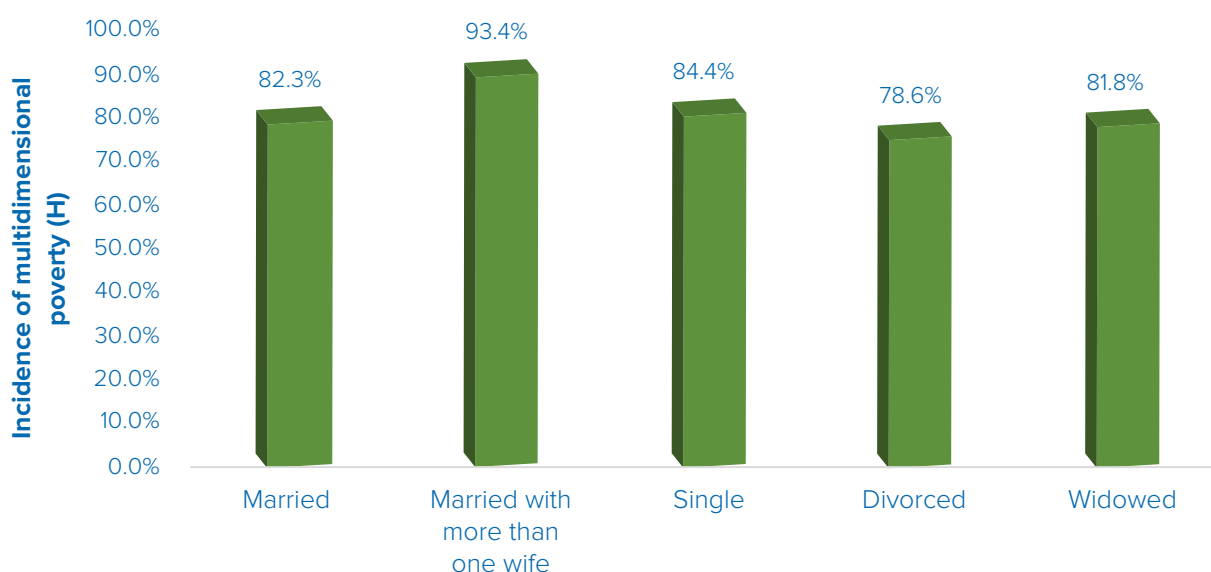
to more than one wife have higher levels of people living in multidimensional poverty, and the intensity of their poverty is greater. More than 82 percent of people in households with a married head live in multidimensional poverty (Figure 12).

**Table 6. Multidimensional poverty by marital status of household head, 2021**

Index	Marital status of household head				
	Married	Married with more than one wife	Single	Divorced	Widowed
MPI	0.386	0.557	0.362	0.293	0.332
Headcount ratio (H)	82.3%	93.4%	84.4%	78.6%	81.8%
Intensity (A)	46.9%	59.7%	42.9%	37.2%	40.5%

Source: Authors' calculations based on data from the YHDS 2021.

**Figure 12. Incidence of multidimensional poverty by marital status of household head, 2021**



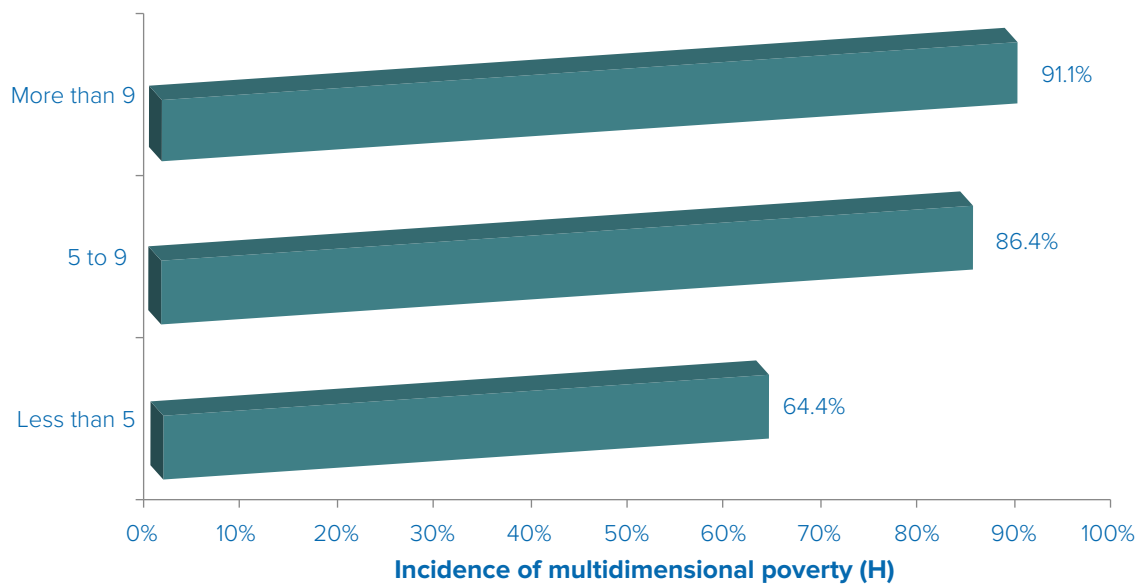
Source: Authors' calculations based on data from YHDS 2021.

Household size is another interesting characteristic in the analysis of multidimensional poverty. Significant differences exist in the incidence of multidimensional poverty between people living in households with fewer than five members and those in larger

households. The incidence of poverty among people in smaller households is 64.4 percent compared to 86.4 and 91.1 percent for people in households with five to nine members or more than nine members, respectively (Figure 13).<sup>7</sup>

<sup>7</sup> Of the total population in Yemen, 20.6 percent of people live in households with up to four members, 62.6 percent in households with five to nine members, and 16.8 percent in households with more than nine members.

Figure 13. Incidence of multidimensional poverty by size of household, 2021

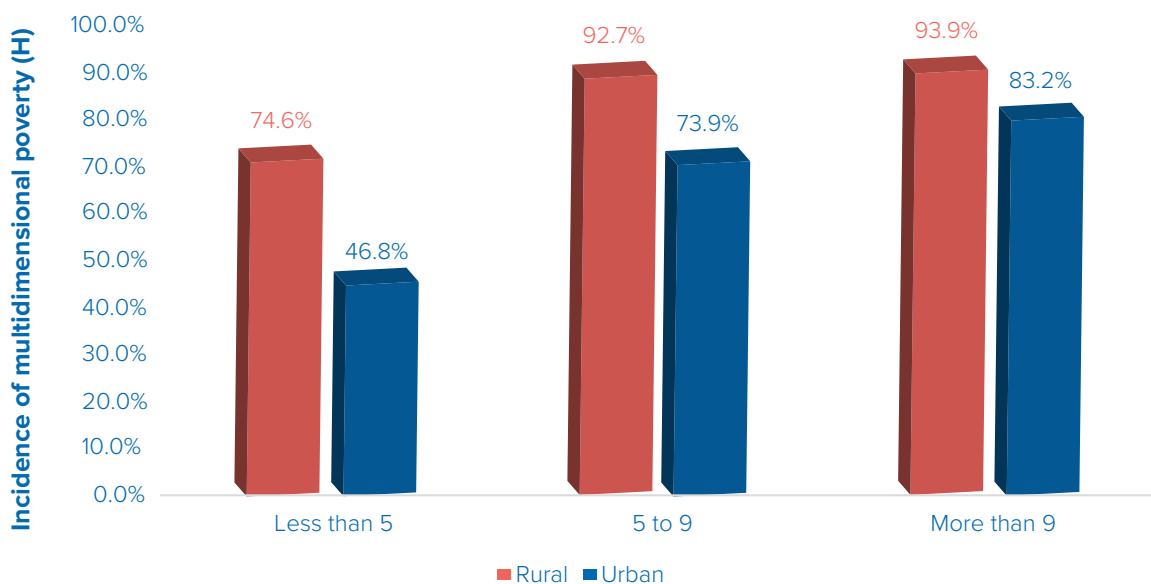


Source: Authors' calculations based on data from the YHDS 2021.

We also analysed the incidence of multidimensional poverty by household size in rural and urban areas. As expected, households in rural areas, no matter their size, are poorer than households in urban areas. There are no significant differences in the incidence of

multidimensional poverty between households in rural areas with more than nine members and those with five to nine members. In urban areas, the incidence of multidimensional poverty increases in larger households (Figure 14).

Figure 14. Incidence of multidimensional poverty by household size in rural and urban areas, 2021



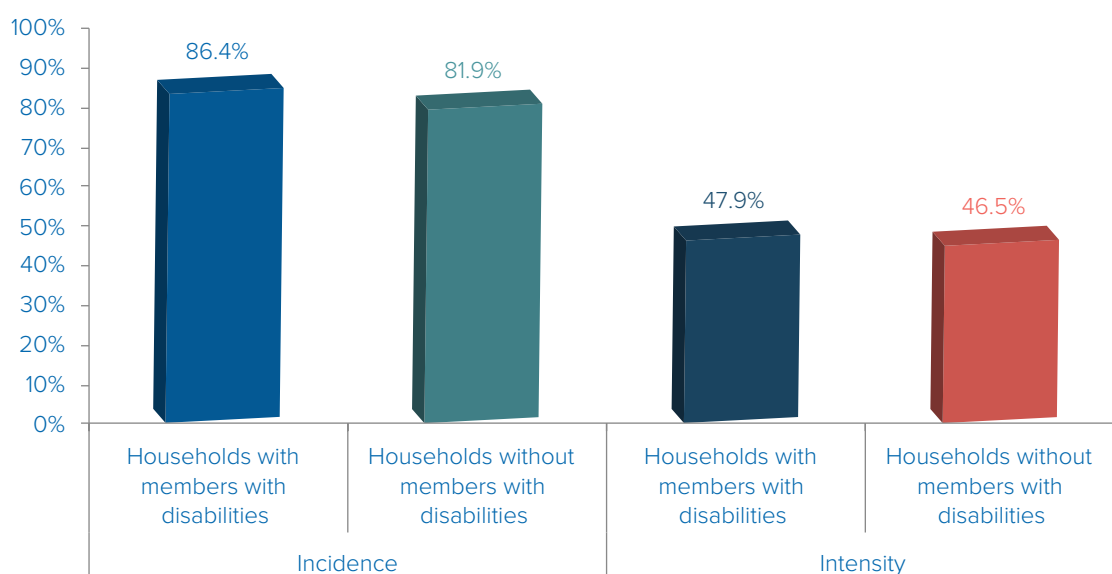
Source: Authors' calculations based on data from the YHDS 2021.

### 3.4.1 Households with members with disabilities

In 2021, 17.2 percent of people in Yemen lived in a household with at least one member with a disability. Analysis of levels of multidimensional poverty in these households finds that they have higher levels of multidimensional poverty than households

without members with disabilities (86.4 compared to 81.2 percent). Levels of intensity are also higher in households with members with disabilities, but differences were not significant (Figure 15).

Figure 15. Incidence and intensity of multidimensional poverty for households with and without members with disabilities, 2021



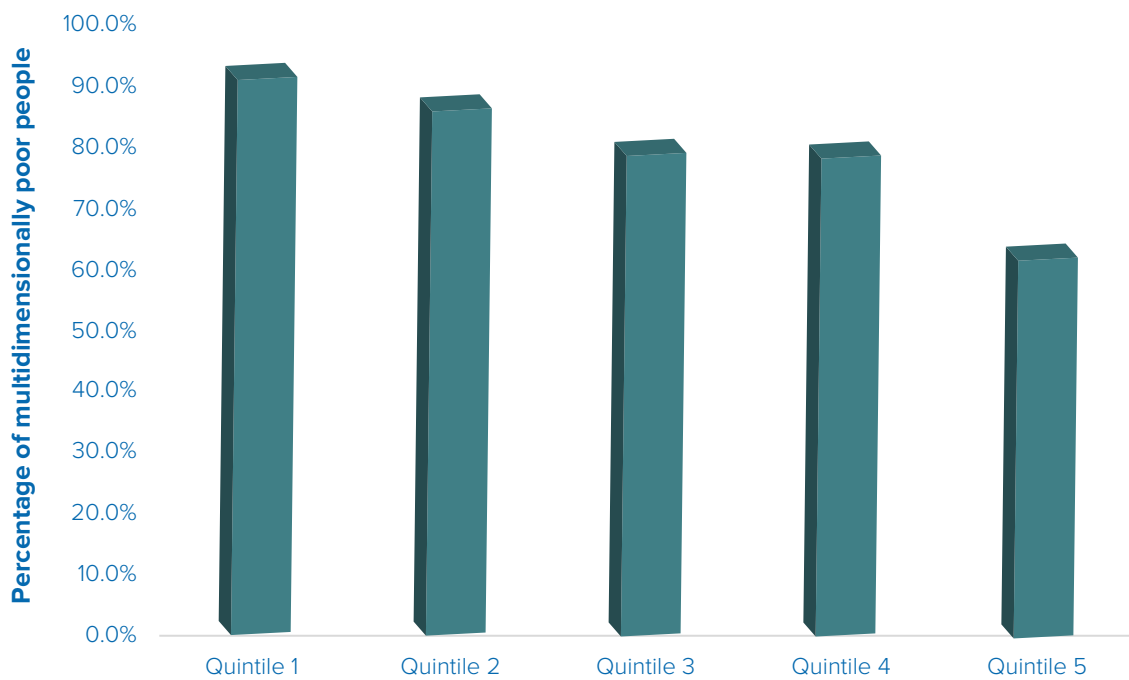
Source: Authors' calculations based on data from the YHDS 2021.

Finally, we analysed the incidence of multidimensional poverty by quintile of the wealth index (Figure 16). The results show that, as expected, those in the poorest quintile experience the highest rates of multidimensional poverty.<sup>8</sup> Even in the richest quintile, however, 64 percent of people are multidimensionally

poor. This finding suggests that although multidimensionally poor people are overrepresented in the poorest groups according to some measures, an important percentage of people live in households that are not considered poor under other measures.

<sup>8</sup> The wealth index is calculated using principal component analysis. It combines information on housing materials, access to services (water, sanitation, electricity) and asset ownership.

Figure 16. Incidence of multidimensional poverty by quintile of the wealth index, 2021



Source: Authors' calculations based on data from the YHDS 2021.

### 3.5 ROBUSTNESS ANALYSIS

To evaluate the robustness of results to changes in different parameters, pairwise comparisons and rank robustness tests were conducted. These are presented in Appendix 3 and show that the results of

the national MPI are robust to changes in poverty cut-offs and weights.



## Chapter 4

# Conclusions and Recommendations



*Photo: UNDP Yemen. Local farmers supported through cash for work activities.*

This report reveals high levels of multidimensional poverty and deprivation in Yemen, and differences among governorates, between rural and urban areas and based on household characteristics. These results inform several policy recommendations to reduce multidimensional poverty and deprivation and leave no one behind.

The key proposal is to design and implement a poverty reduction strategy. This is required to address decentralized service provision through the rehabilitation of essential infrastructure and improved institutional capabilities, and to expand economic opportunities. The strategy should focus on several areas:

#### Improving access to quality education

- Increase the number of education centres across the country to guarantee that school-aged children attend school and complete their secondary education. Education centres must provide school meals to reduce undernutrition and food insecurity in school-aged children.
- Increase the number of years of education for adults. Establishing vocational training centres would provide more flexible education for individuals above school age so they can finish learning and improve competencies and employment skills.
- Guarantee access to microfinance services for poor households, aiming to promote enterprises and alternative income-generation activities.

#### Improving access to health

- Increase the number of health-care services across the country. This will bolster access to

health care and have a direct impact on the health of adults and children. International organizations could help to articulate a strategy informed by international best practices and with links to community and national service providers.

- Ensure access to vaccinations for all children, especially those under 5 years old. A vaccination programme should be implemented locally and work with international organizations to guarantee the provision of vaccines to all 22 governorates. It is vital to establish an information system for monitoring children receiving vaccines.<sup>9</sup>
- Guarantee access to basic services such as water, sanitation, clean energy and the Internet. In the case of water, it is important to ensure that people in all governorates can drink clean water; given the current situation, each governorate should evaluate available resources and implement strategies to provide access to all. Similar strategies are recommended for other services.

#### Expanding economic opportunities

- Revitalize local economic activities that will contribute to increasing employment and household incomes. Value chains in agriculture and fishery have much potential for most Yemenis.
- Disparities in living standards among regions, towns, and urban and rural areas are large. Local development strategies or action plans are highly recommended to investigate and tackle issues related to housing space, essential housing materials and clean cooking fuel, basic social services and local economic development.

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<sup>9</sup> If this is not possible, using vaccination cards is an option, as is working with local communities to identify children who have not received vaccines.

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# APPENDIX 1: THE MULTIDIMENSIONAL POVERTY INDEX—METHODOLOGY AND PROPERTIES

## The MPI methodology

Suppose at a particular point in time, there are  $n$  people in the country and their well-being is evaluated by  $d$  indicators.<sup>10</sup> We denote the achievement of person  $i$  in indicator  $j$  by  $x_{ij} \in \mathbb{R}$  for all  $i=1, \dots, n$  and  $j=1, \dots, d$ . The achievements of  $n$  persons in  $d$  indicators are summarized by an  $n \times d$  dimensional matrix  $X$ , where rows denote persons and columns denote indicators. Each indicator is assigned a weight based on the value of a deprivation relative to other deprivations. The relative weight attached to each indicator  $j$  is the same across all persons and is denoted by  $w_j$ , such that  $w_j > 0$  and  $\sum_{j=1}^d w_j = 1$ .

In a single-dimension analysis, people are identified as poor as long as they fail to meet a threshold called the ‘poverty line’, and are non-poor if otherwise. In a multidimensional analysis based on a counting approach—as with the adjusted headcount ratio—a person is identified as poor or non-poor in two steps. In the first step, a person is identified as deprived or not on each indicator subject to a *deprivation cut-off*. We denote the deprivation cut-off for indicator  $j$  by  $z_j$ , and the deprivation cut-offs are summarized by vector  $z$ . Any person  $i$  is deprived on any indicator  $j$  if  $x_{ij} < z_j$  and non-deprived, otherwise. We assign a *deprivation status score*  $g_{ij}$  to each person based on the deprivation status on each indicator. If person  $i$  is deprived on indicator  $j$ , then  $g_{ij}=1$ ; and  $g_{ij}=0$ ,

## Properties of the MPI

We now outline some features of  $M_0$  that are useful for policy analysis. The first is that  $M_0$  can be expressed as a product of two components: the share of the population that is multidimensionally poor, or the multidimensional headcount ratio ( $H$ ), and the average of the deprivation scores among poor people only, or intensity ( $A$ ). Technically,

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

otherwise. The second step uses the weighted deprivation status scores of each person on all  $d$  indicators to identify the person as poor or not. An overall *deprivation score*  $c_i \in [0, 1]$  is computed for each person by summing the deprivation status scores on all  $d$  indicators, each multiplied by their corresponding weights, such that  $c_i = \sum_{j=1}^d w_j g_{ij}$ . A person is identified as poor if  $c_i \geq k$ , where  $k \in (0, 1]$ , and non-poor, otherwise.<sup>11</sup> The  $k$  value is the *poverty cut-off*, and represents the minimum proportion of weighted indicators on which a person must be deprived to be considered multidimensionally poor. The deprivation scores of all  $n$  persons are summarized by vector.

After identifying the set of poor people and their deprivation scores, we obtain the adjusted headcount ratio ( $M_0$ ). Many countries refer to this as the MPI. The *focus* axiom requires that while measuring poverty, the focus should remain only on those people identified as poor.<sup>12</sup> This entitles us to obtain the censored deprivation score vector  $c(k)$  from  $c$ , such that  $c_i(k) = c_i$  if  $c_i \geq k$  and  $c_i(k) = 0$ , otherwise. The  $M_0$  is equal to the average of the censored deprivation scores:

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

where  $q$  is the number of poor people.<sup>13</sup> This feature has an interesting policy implication for intertemporal analysis. A certain reduction in  $M_0$  may occur either by reducing  $H$  or by reducing  $A$ . This difference cannot be understood by merely looking at  $M_0$ . If a reduction in  $M_0$  occurs merely as the result of a reduction in the number of people who are marginally poor, then  $H$  decreases but  $A$  may not. On the other hand, if a reduction in  $M_0$  is the result of a reduction in

<sup>10</sup> The meanings of the terms ‘dimension’ and ‘indicator’ are slightly different in Alkire and Foster (2014) and Alkire and Santos (2010). The former makes no distinction between these two terms. The latter, however, uses the term ‘dimension’ to refer to a pillar of well-being. A dimension may consist of several indicators.

<sup>11</sup> For  $k=100\%$ , the identification approach is referred to as the intersection approach; for  $0 < k \leq \min\{w_1, \dots, w_d\}$ , it is referred to as the union approach (Atkinson 2003). Alkire and Foster’s dual cut-off approach requires  $\min_j\{w_j\} \leq k \leq 1$ , thus it includes union, intersection and also intermediate cut-offs.

<sup>12</sup> In the multidimensional context, there are two types of focus axioms. One is a deprivation focus, which requires that any increase in already non-deprived achievements should not affect a poverty measure. The other is a poverty focus, which requires that any increase in the achievements of non-poor persons should not affect a poverty measure. See Bourguignon and Chakravarty (2003) and Alkire and Foster (2014).

<sup>13</sup> This feature is analogous to that of the poverty gap ratio, which is similarly expressed as a product of the headcount ratio and the average income gap ratio among poor people.

the deprivation of the poorest of poor people, then  $A$  decreases but  $H$  may not.<sup>14</sup>

The second feature of  $M_0$  is that if the entire population is divided into  $m$  or mutually exclusive and collectively exhaustive groups, then the overall  $M_0$  can be expressed as a weighted average of the  $M_0$  values of  $m$  subgroups, where the weights are the respective population shares. We denote the achievement matrix, the population and the adjusted headcount ratio of subgroup  $l$  by  $X^l$ ,  $n^l$  and  $M_0(X^l)$ , respectively. Then the overall  $M_0$  can be expressed as

$$M_0 = MPI = \sum_{\ell=1}^m \frac{n^\ell}{n} M_0(X^\ell).$$

This feature is also known as *subgroup decomposability* and is useful for understanding the contribution of different subgroups to overall poverty levels.<sup>15</sup> Note that the contribution of a subgroup to overall poverty depends both on the poverty level of that subgroup and its population share.

The third feature of  $M_0$  is that it can be expressed as an average of the censored headcount ratios of indicators weighted by their relative weight. The censored headcount ratio of an indicator is the proportion of the population that is multidimensionally

poor and simultaneously deprived on that indicator. Let us denote the censored headcount ratio of indicator  $j$  by  $h_j$ . Then  $M_0$  can be expressed as

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

where  $g_{ij}(k) = g_{ij}$  if  $c_i \geq k$  and  $g_{ij}(k) = 0$ , otherwise. Similar relationships can be established between  $A$  and deprivations among poor people. Let us denote the proportion of poor people deprived on indicator  $j$  by  $h_j^p$ . Then, dividing both sides of the above relationship by  $H$ , we find

$$A = \frac{MPI}{H} = \sum_{j=1}^d w_j \frac{h_j}{H} = \sum_{j=1}^d w_j h_j^p.$$

Breaking down poverty in this way allows an analysis of multidimensional poverty that depicts clearly how different indicators contribute to poverty and how their contributions change over time. Let us denote the contribution of indicator  $j$  to  $M_0$  by  $\phi_j$ . Then, the contribution of indicator  $j$  to  $M_0$  is

$$\phi_j = w_j \frac{h_j}{MPI} = w_j \frac{h_j^p}{A}.$$

<sup>14</sup> Apablaza and Yalonetzky (2014) have shown that the change in  $M_0$  can be expressed as  $\Delta M_0 = \Delta H + \Delta A + \Delta H \times \Delta A$ , where  $\Delta x$  is referred to as a change in  $x$ .

<sup>15</sup> See Foster, Greer and Thorbecke (1984) for a discussion of this property.

## APPENDIX 2: REDUNDANCY TEST

Table A2.1 Redundancy test of uncensored headcount ratios, 2021

	School attendance	Years of schooling	Health access	Chronic disease care	Food security	Vaccination	Prenatal care	Child mortality	Water	Sanitation	Lightening	ICT	Cooking fuel	Overcrowding	Housing	Unemployment
Years of schooling	0.92	.														
Health access	0.28	0.95	.													
Chronic disease care	0.26	0.97	0.42	.												
Food security	0.63	0.93	0.87	0.66	.											
Vaccination	0.44	0.96	0.28	0.31	0.67	.										
Antenatal care	0.40	0.95	0.30	0.32	0.66	0.41	.									
Child mortality	0.56	0.94	0.36	0.29	0.69	0.39	0.33	.								
Water	0.54	0.93	0.68	0.59	0.71	0.66	0.60	0.44	.							
Sanitation	0.85	0.93	0.96	0.87	0.91	0.92	0.89	0.93	0.93	.						
Lightening	0.50	0.94	0.41	0.45	0.64	0.42	0.49	0.44	0.60	0.81	.					
ICT	0.61	0.94	0.48	0.56	0.54	0.59	0.59	0.51	0.59	0.81	0.60	.				
Cooking fuel	0.74	0.93	0.82	0.75	0.75	0.79	0.77	0.78	0.75	0.93	0.66	0.62	.			
Overcrowding	0.67	0.95	0.63	0.55	0.70	0.74	0.64	0.75	0.55	0.86	0.55	0.54	0.74	.		
Housing	0.37	0.93	0.41	0.49	0.67	0.49	0.42	0.42	0.64	0.94	0.36	0.48	0.89	0.56	.	
Unemployment	0.34	0.93	0.29	0.27	0.60	0.31	0.26	0.35	0.48	0.88	0.46	0.57	0.67	0.52	0.28	.
Underemployment	0.27	0.96	0.46	0.30	0.81	0.32	0.31	0.40	0.63	0.93	0.46	0.57	0.75	0.61	0.43	0.30

Source: Authors' calculations based on data from the YHDS 2021.

## APPENDIX 3: ROBUSTNESS OF THE MPI TO ALTERNATIVE WEIGHTS AND POVERTY CUT-OFFS

Robustness checks were conducted to test the sensitivity of the level and composition of the measure to small changes in weights and poverty cut-offs, and to validate the measure as robust and legitimate for policy purposes.

Table A3.1 presents the Spearman and Kendall rank correlation coefficients between the governorate rankings using the selected poverty cut-off for the

national MPI, 30 percent, and the rankings for alternative poverty cut-offs, from 25 to 50 percent. The Spearman coefficient is equal to 1.00 for poverty cut-offs from 25 to 35 percent. The Kendall coefficient is also equal to 1.00 for these same cut-offs, implying that all pairs of comparisons are concordant. At higher values of the poverty cut-off, the coefficients fall to 0.96 and 0.88 for Kendall and Spearman, respectively.

*Table A3.1 Correlation among governorate rankings for different poverty cut-offs, 2021*

Poverty cut-off	Coefficient	Poverty cut-off = 30%
25%	Spearman	1.000
	Kendall	1.000
35%	Spearman	1.000
	Kendall	1.000
50%	Spearman	0.967
	Kendall	0.889

Source: Authors' calculations based on data from the YHDS 2021.

When the Spearman and Kendall rank correlation coefficients were calculated for different combinations of weights (one dimension taking the weight of 33 percent and the other three each of 13.3 percent), analysis revealed that for the three structures, the

Spearman coefficient was higher than 0.9 and the Kendall Tau-b coefficient was higher than 0.7. Thus, more than 70 percent of the comparisons are concordant in each case (Table A3.2).

*Table A3.2 Correlation among regional rankings based on different weight structures, 2021*

			MPI weights 1
			Equal weights
MPI weights 2	33% health	Spearman	0.90
	13.3% other dimensions	Kendall	0.70
MPI weights 3	33% maternal and child health	Spearman	0.98
	13.3% other dimensions	Kendall	0.82
MPI weights 4	33% education	Spearman	0.99
	13.3% other dimensions	Kendall	0.85
MPI weights 5	33% living standards	Spearman	0.93
	13.3% other dimensions	Kendall	0.72
MPI weights 6	33% services	Spearman	1.0
	13.3% other dimensions	Kendall	0.87
MPI weights 6	33% employment	Spearman	0.91
	13.3% other dimensions	Kendall	0.71

Source: Authors' calculations based on data from the YHDS 2021.

Rank correlations are not ideal for situations with a low number of regions, as is the case here. A better way to evaluate the robustness of the measure is to assess pairwise comparisons using standard errors. The percentage of robust pairwise combinations by region shows that 100 percent are robust to changes in the dimensions' weights from 20 to 40 percent

per dimension compared with the original structure, and 64 percent are significantly different among all seven weight options. In the case of variations in the poverty cut-off, 97 percent of the pairwise regional comparisons are robust to changes in poverty cut-offs from 25 to 50 percent.



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