

Supplementary material

We present here some additional descriptive material and definitions to the main manuscript.

Supplement 1: Additional descriptive materials and robustness checks

Figure 1.1 IRAQ - Ninewa Governorate - Mosul City

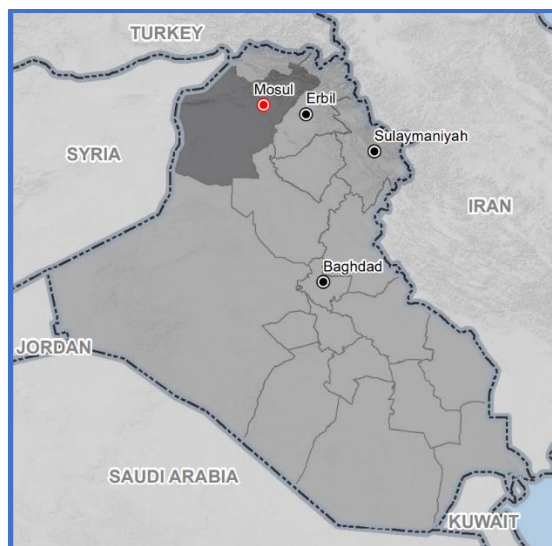
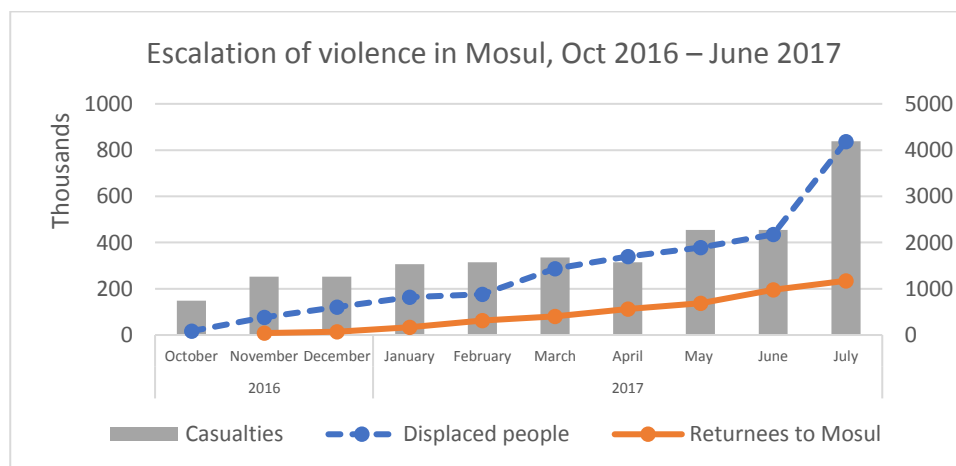


Figure 1.2 The incidence of casualties in and around Mosul



Source: Authors' elaboration from UNAMI and UNHR 2017 and UNICEF 2018b.

Table 1.1: Demographic characteristics of east Mosul population by displacement status (in percent of respective group)

	Total	IDP	IDP Returnee	Host	Stayee
Child under 5	12.5	13.8	11.9	12.9	12.0
Child 5 to 14	29.3	30.9	33.9	28.7	28.6
Child 15 to 17	6.2	6.5	6.4	5.7	6.2
Child under 18	48.0	51.2	52.2	47.3	46.8
Youth 18 to 24	12.1	12.5	14.0	11.5	12.1
Adult 25 to 34	14.7	14.6	12.2	15.5	14.7
Adult 35 to 50	15.5	14.3	15.1	15.9	15.9
Adult 51 to 64	7.0	5.4	5.5	7.0	7.7
Adult aged 65+	2.4	1.9	0.8	2.6	2.6
<i>Observations</i>	<i>63,922</i>	<i>16,569</i>	<i>629</i>	<i>6,878</i>	<i>39,846</i>
<i>Share of population</i>	<i>100</i>	<i>25.92</i>	<i>0.98</i>	<i>10.76</i>	<i>62.34</i>

Source: authors' estimates from UNICEF-UN-OHCHR 2017

Table 1.2: Correlations among dimensions deprivations

Dimensions Deprivation	Housing	Water	Sanitation	Education	Health	Legal Status	Protection	Safety	Food Security
Housing	1.000	-0.014	0.460	0.049	0.037	0.045	0.059	-0.012	0.056
Water	-0.014*	1.000	-0.084	0.024	0.065	0.024	0.008	0.047	0.147
Sanitation	0.460*	-0.084*	1.000	0.022	0.040	0.026	0.036	-0.101	-0.086
Education	0.049*	0.024*	0.022*	1.000	-0.083	-0.061	0.108	0.015	0.093
Health	0.037*	0.065*	0.040*	-0.083*	1.000	0.866	0.005	-0.031	-0.004
Legal Status	0.045*	0.024*	0.026*	-0.061*	0.866*	1.000	0.007	-0.036	-0.023
Protection	0.059*	0.008	0.036*	0.108*	0.005	0.007	1.000	0.005	0.162
Safety	-0.012*	0.047*	-0.101*	0.015*	-0.031*	-0.036*	0.005	1.000	0.075
Food Security	0.056*	0.147*	-0.086*	0.093*	-0.004	-0.023*	0.162*	0.075*	1.000

Note: * significant at <0.05

Table 1.2 Priority needs reported by households according to displacement status

	Total	IDP	IDP Returnee	Host	Stayees
Priority: Shelter	59.2	79.3	63.3	59.6	50.6
Priority: Food	79.6	81.5	43.9	87.0	78.1
Priority: Health	52.5	50.9	40.9	49.9	53.8
Priority: Education	3.5	2.7	1.1	1.9	4.2
Priority: Water	45.7	35.0	26.4	63.3	47.4
Priority: Sanitation	0.5	0.1	1.0	0.2	0.7
Priority: HH items	11.7	10.5	42.4	5.5	12.8
Priority: Clothing	2.7	2.6	11.0	2.6	2.6
Priority: Household repairs	7.8	5.6	30.8	4.5	8.9
Priority: Documents	1.3	1.1	1.1	0.7	1.4
Priority: Productive Assets	5.2	4.4	19.6	1.1	6.1
Priority: Employment	27.9	25.6	18.6	20.0	30.3

Source: authors' estimates from UNICEF-UNCHR 2017

Table 1.3: Assistance received by household type

	Total	IDP	IDP Returnee	Host	Stayee
Received assistance	53.2	42.5	70.4	54.8	57.1
Received cash assistance	0.1	0.1	1.0	0.1	0.1
Received food assistance	52.8	42.2	68.8	54.3	56.8
Other type of assistance	4.5	2.8	31.5	3.4	5.0

Source: authors' estimates from UNICEF-UN-OHCHR 2017

Table 1.4: Probability of being deprived in at least 1 dimension

	Coefficients		Marginal Effects	
	Reduced model	Full model	Reduced model	Reduced model
Base category: Stayee				
IDP	0.48*** (0.04)	0.47*** (0.04)	0.10*** (0.01)	0.10*** (0.01)
IDP returnee	0.61*** (0.19)	0.19 (0.21)	0.12*** (0.02)	0.05 (0.05)
Host community	0.51*** (0.06)	0.54*** (0.06)	0.10*** (0.01)	0.11*** (0.01)
Indicator of economic vulnerability	0.30*** (0.04)	0.23*** (0.04)	0.07*** (0.01)	0.05*** (0.01)
Received food assistance	-0.16*** (0.03)	-0.15*** (0.03)	-0.04*** (0.01)	-0.03*** (0.01)
Received cash assistance	-0.19 (0.43)	-0.39 (0.41)	-0.04 (0.10)	-0.08 (0.09)
Age		-0.00 (0.00)		-0.00 (0.00)
Child is male		-0.01 (0.02)		-0.00 (0.00)
Head of HH is female		0.20*** (0.07)		0.04*** (0.02)
Age of head of HH		-0.01*** (0.00)		-0.00*** (0.00)
Base category: no education				
Education of the head of HH = 1, Primary school		-0.26*** (0.05)		-0.05*** (0.01)
Education of the head of HH = 2, Secondary school		-0.29*** (0.06)		-0.06*** (0.01)
Education of the head of HH = 3, High education institute		-0.30*** (0.10)		-0.06*** (0.02)
Education of the head of HH = 4, Vocational training		-0.26 (0.19)		-0.05 (0.04)
Education of the head of HH = 5, University		-0.32*** (0.08)		-0.07*** (0.02)
Head of HH is disabled/has chronic condition		-0.05 (0.06)		-0.01 (0.01)
Number of disabled members		0.10*** (0.03)		0.02*** (0.01)
HH is labor constrained		0.21* (0.12)		0.05* (0.03)
Observations	30,164	28,465	30,164	28,465
Overall average			85.34	85.34

Probit estimate, Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' elaboration

Table 1.5: Reduced Ordered Probit model.

	Number of deprivations - Ordered Probit Coefficients	Ordered Probit M.E. - 1 deprivation	Ordered Probit M.E. - 2 deprivations	Ordered Probit M.E. - 3 deprivations	Ordered Probit M.E. - 4 deprivations	Ordered Probit M.E. - 5 deprivations	Ordered Probit M.E. - 6 deprivations
Base category: stayee							
IDP	0.57*** (0.03)	0.00 (0.00)	0.09*** (0.00)	0.08*** (0.00)	0.03*** (0.00)	0.01*** (0.00)	0.00* (0.00)
IDP returnee	0.69*** (0.10)	-0.01 (0.01)	0.11*** (0.01)	0.10*** (0.02)	0.04*** (0.01)	0.01*** (0.00)	0.00 (0.00)
Host community	0.56*** (0.04)	0.00 (0.00)	0.09*** (0.01)	0.07*** (0.01)	0.03*** (0.00)	0.01*** (0.00)	0.00* (0.00)
Indicator of economic vulnerability	0.35*** (0.03)	0.01*** (0.00)	0.06*** (0.00)	0.04*** (0.00)	0.02*** (0.00)	0.00*** (0.00)	0.00* (0.00)
Received food assistance	-0.18*** (0.02)	-0.00*** (0.00)	-0.03*** (0.00)	-0.02*** (0.00)	-0.01*** (0.00)	-0.00*** (0.00)	-0.00* (0.00)
Received cash assistance	0.58 (0.37)	0.01 (0.01)	0.09 (0.06)	0.07 (0.05)	0.03 (0.02)	0.01 (0.00)	0.00 (0.00)
<i>Observations</i>	<i>30,164</i>	<i>30,164</i>	<i>30,164</i>	<i>30,164</i>	<i>30,164</i>	<i>30,164</i>	<i>30,164</i>

Probit estimate, Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Notes: Controls for demographic composition of the household.

Source: authors' estimates from UNICEF-UN-OHCHR 2017

Supplement 2: Methodological note.

The measure we use in our analysis is ultimately a human-rights-based count measure, where dimensions of deprivation are counted and their sum calculated, attributing equal weights to each. Dimensions are constructed by aggregating indicators using the union approach: a child is deprived in a dimension if she/he is deprived in any of the indicators included in that dimension. This approach minimizes the probability of exclusion error. It implies that indicators can never be substituted, thus providing a more demanding or ‘higher’ bar for multidimensional poverty definition—commonplace in measures based on non-substitutable human rights. Compared with a classical application of Alkire-Foster, the MPI, MODA typically provides a higher deprivation count, while it is less sensitive to sudden changes in deprivation (see Hjelm et al., 2016).

The deprivation headcount ratio for each indicator and dimension is the number of children deprived in each specific indicator and dimension as a share of the child reference population:

$$h_{j,r} = \frac{q_{j,r}}{n_r}$$
$$q_{j,r} = \sum_{i=1}^{n_r} y_{ij}$$

Where:

$h_{j,r}$ is headcount ratio of children deprived in dimension j of the reference population r

q_j is the number of deprived children in dimension j of the reference population r

n_r is total number of children in the reference population r

y_{ij} is the deprivation status of child i in dimension j ,

The deprivation status in each dimension j , y_{ij} is defined with the union approach as follows:

$$y_{ij} = \begin{cases} 1 & \text{if } x_{nj} > Z_{nj} \quad \forall x_j \in N_j \\ 0 & \text{otherwise} \end{cases}$$

Where x_{nj} is indicator n of dimension j , Z is the threshold for indicator x , and N_j is the set of indicators for dimension j .

The total amount of deprivations is calculated as follows:

$$D_i = \sum_{j=1}^d y_{ij}$$

Where D_i is the total number of dimensions each child i is deprived in, and y_j is the deprivation status of child i in each dimension j , as defined above.

A child is considered deprived (D) if the number of dimensions in which the child is deprived (d) is equal to or larger than the cut-off point, k . This can be defined as:

$$\begin{aligned} D_{ik} &= 1 \text{ if } d \geq k \\ D_{ik} &= 0 \text{ if } d < k \end{aligned}$$

Where k is an integer number between 0 and J , J being the maximum number of dimensions defined for that reference population.

The headcount ratio of deprived individuals (H_k) at any cutoff k is therefore defined as follows:

$$H_k = \frac{\sum_n^{N_k} D_{ik}}{N}$$

Where N is the total of individuals in a given population or group; D_{ik} are the individuals who are deprived, as defined above; and N_k is the total of individuals who are deprived according to the cutoff k .

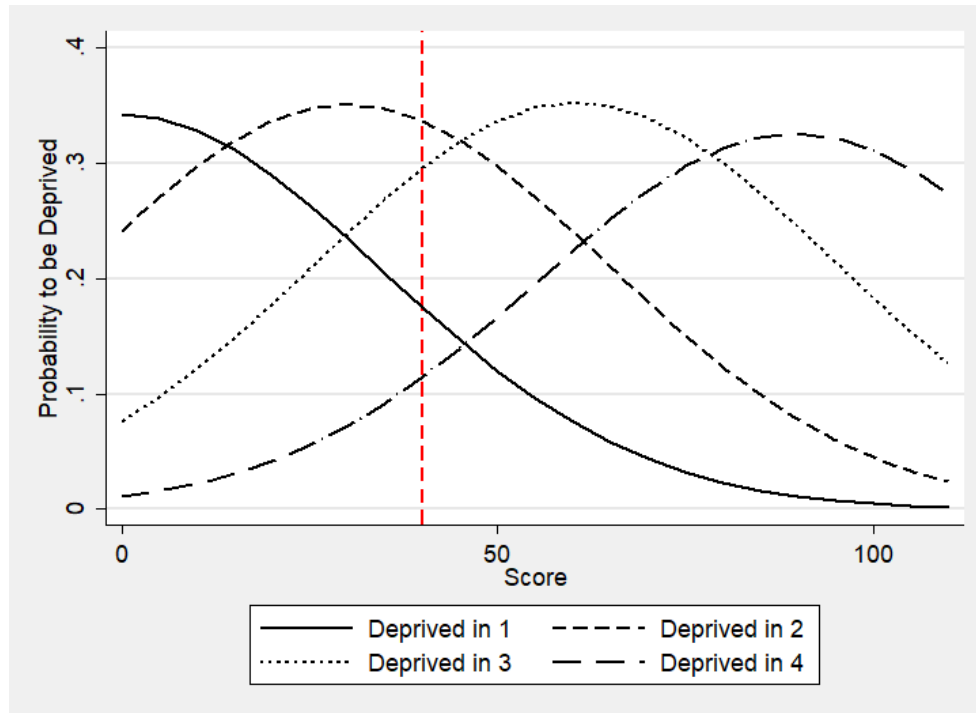
Supplement 3: The allocation of humanitarian assistance in East Mosul

We look at the relationship between child deprivation and the vulnerability score assigned by UNHCR and other agencies used to target the beneficiaries of assistance. Notably, this score was developed on the basis of the data collected by the assessment we use to construct child deprivation, and it has been subsequently employed to deliver assistance after data collection. We have therefore no means to assess the impact of assistance that has been delivered according to this score. We find it however interesting to assess how the tool to provide relief compares with our assessment of child deprivation. We did not use the score as a measure of household vulnerability for two reasons: first, the score contains some of the same indicators used as deprivation, which would make it impossible to do complementary analysis. Second, we were interested in a measure of monetary means of the household.

The vulnerability score used in east Mosul is based on a series of characteristics of the household, such as the gender of the household head; whether the household is in a rented dwelling; the number of household members working; household size; the presence of pregnant women and/or lactating mothers; education status of father and mother; and coping strategies of the household. Each of these features is associated with a score from 0 (not vulnerable) to 10 (most vulnerable). The final score is the sum of all the sub-scores, from 0 to a theoretical maximum of over 100 (depending on the number of children and the number of conditions reported): the higher the score, the higher the vulnerability of the household. Benefits are granted above the score threshold, contrary to common practice with a PMT score.

Figure 3.1 plots the probability to be deprived in 1, 2, 3, and 4 dimensions, by vulnerability score. The graph shows that setting a low threshold for assigning humanitarian assistance leads to capturing a larger share of deprived children. By contrast, setting a high threshold for assistance will still capture those more deprived, but in a lower proportion. The analysis also shows that a low threshold will not only capture children with four deprivations but also a considerable proportion of children with three and two deprivations. In other words, in order to capture a large amount of multi-deprived children, the threshold needs to be set at a relatively low score. An intermediate threshold of 50 translates into assisting a large number of children with three and four deprivations but a lower share of children with two and one deprivations. In east Mosul, receiving assistance was set at a score of 40 (red dashed line).

Figure 3.1: Distribution of the probability of deprivation by the vulnerability score



Source: authors' estimates from UNICEF-UNCHR 2017

Figure 3.2 plots the marginal effects of having received food assistance—the main type of assistance received—across each of the dimensions of deprivation. Marginal effects from a probit estimation are reported as point estimates within their confidence intervals. Assistance is negatively and significantly associated with the probability of being deprived in safety, legal status, sanitation, water, and housing. However, it is positively associated (although we suspect this is related to low statistical power) with the probability of being deprived in food insecurity. We can think likely that food assistance helps families free up resources for other purposes, therefore leading to a decrease in deprivation in other dimensions, however more assistance is needed to improve access to food.

Figure 3.2: Correlation of food assistance with each dimension

