COVID-19 Vulnerability Monitoring Framework

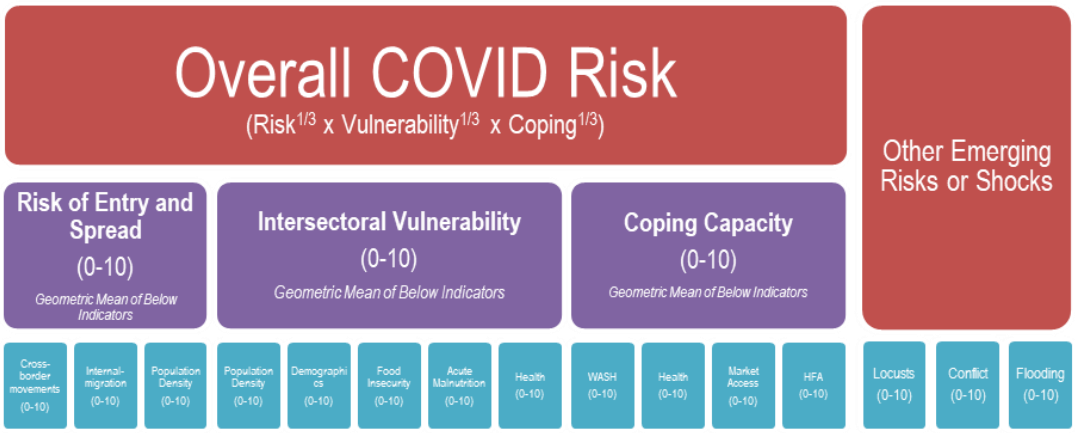
COVID-19 is an international public health emergency on a previously unforeseen scale, and confirmed cases have rapidly been increasing since the first case was identified in March. In order to assist in "*containing the spread of COVID-19 pandemic, decrease morbidity and mortality*"[1], there is a need for prioritization of areas where populations may have the greatest risk of exposure to COVID-19, and which areas have populations at greater risk for severe COVID-19 outcomes, and where populations have the least ability to cope with the impact of the pandemic.

A COVID-19 Vulnerability baseline framework was developed and approved by the Needs Assessment Working Group (NAWG) to identify priority areas based on factors that would likely increase the risk of spread/entry of the virus as well as the risk of severe outcomes due to the intersectoral vulnerability of the population. This document details a revised version of the framework in order to provide an update to the risk situation and incorporate additional best practices in creating composite frameworks. Key revisions from the baseline framework include:

List of Key Changes from Baseline

1) **Addition of two new indexes: "Coping Capacity" and "Other Emerging Risks or Shocks"** – Coping capacity is added to account for the populations ability to cope with the impact of COVID-19 at the county level. Other emerging risks or shocks are added to view the overlap between risk of COVID-19 and other major contextual shocks affecting populations.
2) **Incorporated several additional best practices for risk composite indicators** – Several practices identified in other risk frameworks have been incorporated into this version of the monitoring framework. Changes include:
    a. *Normalization of indicators* – Each category of indicators was normalized to a scale of 0-10 to allow for more justifiable comparability between indicators.
    b. *Definition of Risk* – Overall risk score was included and was defined as Exposure x Vulnerability x Ability to Cope.
    c. Aggregation – Indicators are aggregated to an index scale of 0-10 for either Risk of Entry, Intersectoral Vulnerability, or Coping Capacity using geometric means[2].
    d. *Relative weighting of indicators* – Some indicator scores may have changed from the baseline during the revision process, however these indicators are weighted when aggregated to ensure they have the same relative contribution to the index score as they did in the baseline.
3) **Other revisions to baseline indicators**
    a. *Internal migration and COVID-19 cases in South Sudan* – Flow monitoring for internal movements, and current county level COVID-19 caseloads, are incorporated into the Risk of Spread/Entry Index.
    b. *Revised weights and thresholds for Acute Malnutrition* – Weights based on IPC Acute Malnutrition classification were modified to allow for a P5 classification.

Figure 1: Overview of COVID-19 Vulnerability Monitoring Framework



[1] Global Humanitarian Response Plan COVID-19. United Nations Coordinated Appeal. April – December 2020.
[2] Geometric means take the product of the nth root of each element that is being averaged. This is often used in composite indicators when aggregating elements that are not conceptually alike.

Table 1: Risk of Entry and Spread Index

Category	Indicator	Rationale/Comments	Proposed weights and thresholds		Data sources
COVID-10 Caseload **If weight from COVID cases is greater than the overall Risk for Entry and Spread index, then this score takes precedence.**	# of confirmed COVID-19 cases in county	The greater the number of confirmed cases, the greater the risk of exposure for the county population	0	0 cases	Ministry of Health, WHO
			3.33	1-5 cases	
			6.67	6-49 cases	
			10	50+ cases	
High levels of population movement (0-10) *Indicators aggregated with geometric means* **Anecdotal reports of population movements not captured in flow monitoring data, or known information gaps can trigger a decision tree, which may alter weights**	# of individuals reported arriving from neighboring countries/camps within the last month # of individuals reported arriving from COVID affected district in neighboring countries/camps within the last month	Migration from neighboring countries with confirmed COVID-19 cases may increase the risk for cross-country transmission	2.5	>= 50 and <150 individuals[3] arriving from neighbouring countr(ies) per month	IOM Flow Monitoring REACH PRM UNHCR Flow Monitoring
			5	>= 150 individuals arriving from neighbouring countr(ies) per month	
			7.5	>= 15 and <150 individuals[4] arriving from COVID-affected areas in neighbouring countr(ies) per month	
			10	>=150 individuals arriving from COVID-affected areas in neighbouring countr(ies) per month	
	# of individuals reported arriving from other counties in South Sudan within the last month # of individuals reported arriving from COVID affected counties in South Sudan in the last month	Migration from affected areas in South Sudan with confirmed COVID-19 cases may increase the risk for county to county transmission	2.5	>=50 and <200 recorded arrivals from an internal movement	IOM Flow Monitoring REACH PRM UNHCR Flow Monitoring
			5	>= 200 recorded arrivals from internal movement	
			7.5	>=35 and <150 recorded arrivals from an affected SSD county	
			10	>= 150 recorded arrivals from an affected SSD county	
Population density (0-10) *Indicators aggregated by summing weights*	Presence of IDP/Refugee sites (not in host community)	Informal camps, IDPs/Refugees not integrated in the host community. IDPs/Refugees living in camp-like or informal settings are considered more vulnerable due to the poor and concentrated living conditions, which may increase the rate of COVID transmission in those populations.	0.83	>=2,000 and 5,000	CCCM Cluster – Camp-like settings in SSD; UNHCR
			1.67	>=5,000 and <=20,000	
			2.5	>20,000 and <=55,000	
			3.33	>55,000	
	Presence of large urban centres	Large urban centres may lead to increased transmission given they are often key transit hubs, markets, and have high population density.	0	<100,000	European Commission Global Human Settlement Layer
			1.67	>=100,000 and <=250,000	
			3.33	>250,000	
	Avg. # people / km^2	Increased population density may lead to increased transmission; consider urban centres and POC sites	0.42	>50th to 75th percentile	OCHA COD-PS
			0.83	>75 to 90th percentile	
			1.25	>90 to 95th percentile	
			1.67	>=95th percentile	
	Household size	Counties with larger household size may have higher likelihood for increased transmission due to closer proximity of household members	0	Avg. HH size is below the 50th percentile of national average	FSNMS Round 25 data[5]
			0.83	Avg. HH size is in the 50-75th percentile of national average	
			1.67	Avg. HH size is in the 75-100th percentile of national average	

[3] Median number of individual arrivals into counties in South Sudan from neighbouring countries per county was 91.5 in March 2020.
[4] Median number of individual arrivals into counties in South Sudan from confirmed COVID-affected areas in neighbouring countries per county was 14 in March 2020. It is noted that this number will likely increase as COVID spreads, so this threshold may fluctuate.
[5] FNSMS is representative of rural areas only

Table 2: Intersectoral Vulnerability Index

Category	Indicator	Rationale/Comments	Weights	Thresholds	Data sources
Population density (0-10) *Indicators aggregated by summing weights*	Presence of IDP/Refugee sites (not in host community)	Informal camps, IDPs/Refugees not integrated in the host community. IDPs/Refugees living in camp-like or informal settings are considered more vulnerable due to the poor and concentrated living conditions, which may increase the rate of COVID transmission in those populations.	0.83	>=2,000 and 5,000	OCHA – Camp-like settings in SSD; UNHCR
			1.67	>=5,000 and <=20,000	
			2.5	>20,000 and <=55,000	
			3.33	>55,000	
	Presence of large urban centres	Large urban centres may lead to increased transmission given they are often key transit hubs, markets, and have high population density.	0	<100,000	European Commission Global Human Settlement Layer
			1.67	>=100,000 and <=250,000	
			3.33	>250,000	
	Avg. # people / km^2	Increased population density may lead to increased transmission; consider urban centres and POC sites	0.42	>50th to 75th percentile	OCHA COD-PS
			0.83	>75 to 90th percentile	
			1.25	>90 to 95th percentile	
			1.67	>=95th percentile	
	Household size	Counties with larger household size may have higher likelihood for increased transmission due to closer proximity of household members	0	Avg. HH size is below the 50th percentile of national average	FSNMS Round 25 data[6]
			0.833	Avg. HH size is in the 50-75th percentile of national average	
			1.67	Avg. HH size is in the 75-100th percentile of national average	
Demographics (0-10)	Avg. # of elderly (60+) in the HH	Due to elderly vulnerability to COVID	0	<0.69	FNSMS Round 25 data[5]
			5	>=0.7 and <0.89	WFP Urban Demographics Data (only Wau, Juba, and Bor, 2017)
			10	>= 0.9	
High food insecurity (0-10) *Indicators aggregated by sum of weights*	% of HHs by IPC Phase classification from Projection 1 (Feb – April 2020)	Greater food insecurity means a greater likelihood of reduced quantity or quality of the household diet, which could lead to a weakened immune system.	0	P3 < 20%	IPC South Sudan Jan 2020
			1.67	P3+ >=20% AND P3+ <50%	
			3.33	P3+ >= 50%	
			5	P3+ >= 75% OR P4+>= 20%	
			6.67	P5>0 OR P4+>= 30%	
	% of HH reportedly main source of food is markets in lean season	Food insecurity may increase for market dependent households due to 1) spikes in food prices, and 2) reduced accessibility to markets due to movement restrictions. This increased risk of food insecurity may lead to a greater reduction in immune response, and therefore more severe COVID-19 outcomes.	3.33	if >30% in lean season	FSNMS Rd 24
High malnutrition (0-10)	IPC AMN Phase classification Projection (May-August 2020)	Acute malnutrition reduces immunity	2.5	IPC AMN P2	IPC South Sudan Jan 2020
			5	IPC AMN P3	
			7.5	IPC AMN P4	
			10	IPC AMN P5	
Disease (0-10) *Indicators aggregated by sum of weights*	Presence of malaria 'epidemic', malaria 'alert' or other confirmed disease outbreak	The dual burden of malaria or other infectious diseases and COVID-19 will likely increase morbidity and mortality as other illnesses become more difficult to treat due to competing health system resources. Especially some concerns of co-morbidity of malaria and COVID-19[7]. Malaria is treated here is a proxy for infectious diseases.	0	No disease outbreak	IDSR/EWARS
			3.33	'Alert' level of total morbidities or malaria specific	
			6.67	'Epidemic' levels of total morbidities or malaria specific OR confirmed disease outbreak	
	% of HHs self-reporting a household member	General, self-reported question for populations that may have people with chronic health issues, however some chronic health issues may not necessarily link to immune suppression or increased risk of severe/critical COVID-19 cases.	3.33	> 10% HH report family members with chronic illness in last month	FNSMS Round 25

[6] FNSMS is representative of rural areas only

[7] Preparedness is essential for malaria-endemic regions during the COVID-19 pandemic. The Lancet. March 16th, 2020

has a chronic illness in the last 3 months

Table 3: Lack of Coping Capacity Index

Category	Indicator	Rationale/Comments	Proposed weights and thresholds		Data sources
WASH (0-10)	% of population travelling 30 minutes or less to a water source AND have access to soap for handwashing	Access to clean water and soap are requisite for hand-washing practices, which is an essential preventive behavior to fight COVID-19.	0 10	>20% <=20%	FNSMS Round 25 data[5]
Health (0-10) *Indicators aggregated with geometric mean*	% of population walking more than ½ day to a to a functional health facility	Individuals may be asked to stay at home with suspected symptoms of COVID-19, but if case is critical, access to functional facility will impact mortality rate and containment.	0 5 10	<=10% >10% and <=30% >30%	FNSMS Round 25 data[5]
	# of COVID-19 health pillar activities reportedly active	The more comprehensive a COVID response in a given county, the greater the coping ability of the population for the outbreak. There are 9 pillars: Coordination, Case Management, IPC, Laboratory, Logistics & Operations, Risk Communications, Screening Point of Entry, Surveillance, and Isolation Wards. Should be comprehensive of Health Cluster, Health Pooled Fund, and World Bank partners commitments.	0 - 8 10	+1 for each COVID pillar not reportedly covered If none of the 9 pillars are reported	Health Cluster
Market Access (0-10) *Indicators aggregated by sum of weights*	% change in main cereal prices compared to median of previous 3 months	Lack of financial or physical access to markets can impact food security, which increases the risk of severe COVID outcomes.	0 0.75 1.5 2.25 3 3.75	<0% 0-20% 20-<40% 40-<60% 60-<80% >100%	JMMI / CLIMIS
	Percentile of main cereal price in last month above the national median	Locations that have had chronically high cereal prices greater than the last 3 months may not show a price spike, however are still vulnerable due to high prices. Comparing main cereal prices to the national median will highlight areas with high prices, which reduces access to food, deteriorates household food security, and increases the risk of severe COVID outcomes.	0 1.25 2.5 3.75	<50th percentile or median >50 - <75th percentile 75-<90th percentile >90th percentile	JMMI / CLIMIS
	% of assessed settlements reporting 3+ hour walk to reach nearest market	Physical distance to a market reduces the household's ability to access food, which deteriorates food security and increases the risk of severe COVID outcomes.	0 .5 1 1.5 2 2.5	0% 0-<20% 20-<40% 40-<60% 60-<80% 80-100	REACH AoK
Humanitarian Food Assistance (0-10)	Status of GFD program cycles	Populations that are dependent on the humanitarian food assistance are vulnerable to delays in their program cycle. Counties highly dependent on HFA	**May GFD Status**	**Missed Distribution in Last 3 Months**: **No** / **Yes**	WFP
			Non-HFA Dependent Counties: Completed Distribution or None Planned	0 / 1	
			Non-HFA Dependent Counties: Ongoing Distribution	1.67 / 2	
			Non-HFA Dependent Counties: Missed or Late Distribution	2.5 / 3	
			HFA Dependent Counties: Completed Distribution	4.17 / 5	
			HFA Dependent Counties: Ongoing Distribution	6.25 / 7.5	
			HFA Dependent Counties: Missed or Late Distribution	8.33 / 10	

Table 4: Other Emerging Risks or Shocks (Conflict Risk)

Category	Composite Indicator	Sub-Indicator	Rationale/Comments	Proposed weights and thresholds		Data sources
Conflict Risk (0-10) *Composite indicators aggregated by geometric mean*	**Exposure to Conflict (composite) (0-10)** *Indicators aggregated by sum of weights*	# Incidents of conflict in the last 3 months (battles, violence against civilians, riots/protests) # of fatalities	Conflict and inter-communal violence can increase vulnerability and can have negative implications on access to resources, services and livelihoods.	**See weights table in Annex 2**		ACLED;
		# of assessed settlements reporting the likelihood of increased conflict in the next month	Community reports from key informants can inform on the risk of continued conflict.	0 .5 1 1.5 2 2.5	0% 0-<20% 20-<40% 40-<60% 60-<80% 80-100	Area of Knowledge (AoK)
	Impact of Conflict (composite) (0-10) *Indicators aggregated by sum of weights*	% of assessed settlements reported conflict as a barrier to accessing health services, in the last month % of assessed settlements reported conflict as a barrier to accessing markets in the last month % of assessed settlements reported conflict as a barrier to accessing food or livelihood activities in the last month % of assessed settlements reported conflict as a cause for displacement in the last month	Conflict-affected populations need access to livelihoods or humanitarian services to cope with the impact of conflict. Without these, the population will likely suffer more severe results from the incidents.	1.25 **2.5** 1.25 **2.5** 1.25 **2.5** 1.25 **2.5**	>=25% and <50% affect market access >=50% affect market access >=25% and <50% affect health access >=50% affect health access >=25% and <50% affect food/livelihoods access >=50% affect food/livelihoods access >=25% and <50% cause displacement >=50% cause displacement	Area of Knowledge (AoK)

Table 5: Other Emerging Risks or Shocks (Locusts)

Category	Indicator	Rationale/Comments	Proposed weights and thresholds		Data sources
Desert Locusts (0-10)	Any reported presence of desert locusts	Desert locusts will have a large impact on seasonal agriculture and likely cause food security to deteriorate in affected areas.	10	If any reported presence	FAO

Table 6: Other Emerging Risks or Shocks (Flooding)

Category	Composite Indicator	Sub-Indicator	Rationale/Comments	Proposed weights and thresholds	Data sources
Flooding (0-10) *Composite indicators aggregated by geometric mean*	Flooding Vulnerability (0-10) *Indicators aggregated by sum of weights*	# of "heavy" flooding events since 2015 for the June – August period (>2 z-score in a dekad) # of "heavy" flooding events since 2015 for the Sept – Dec period (>2 z-score in a dekad) # of "moderate" flooding events since 2015 for the June - August period (1.5 z-score in a dekad) # of "moderate" flooding events since 2015 for the Sept -Dec period (1.5 z-score in a dekad)	Flood affected counties in 2019 are already vulnerable. Additional shocks such as locusts, COVID, conflict or future flooding will much more severely impact these populations.	+1.43 for each moderate flooding event + 2.86 for each heavy flooding event, summed separately	Monthly CLIMIS rainfall data, 2015-2020

Flooding Exposure (0-10) *Indicators aggregated by sum of weights*	"Heavy" or "moderate" flooding event in past 3 months *Heavy is >2 SD in a dekad* *Moderate is >1.5 SD in a dekad*	High rainfall events in the recent months increases the chances that the population has lost or depleted resources due to flooding	"Moderate" flooding event, with rainfall in a dekad > 1.5 SD from the long term mean	5	CHIRPS
			"Heavy" flooding event, with rainfall in a dekad > 2 SD from the long term mean	7.5	
	Mean z-score of 10 and 15-day forecasted rainfall data	High levels of projected rainfall will increase the chance of flooding.	0	<0 z-score	CHIRPS-GEFS
			0.5	0 to <0.5 z-score	
			1	0.5 to <1 z-score	
			1.5	1 to <1.5 z-score	
			2	1.5 to <2 z-score	
			2.5	>2 z-score	
Flooding Coping (0-10) *Indicators aggregated by sum of weights*	% of assessed settlements reported flooding as a barrier to accessing health services, in the last month	Flooding-affected populations need access to livelihoods or humanitarian services to cope with the impact of conflict. Without these, the population will likely suffer more severe results from the incidents.	1.25	>=25% and <50% affect market access	Area of Knowledge (AoK)
			2.5	>=50% affect market access	
	% of assessed settlements reported flooding as a barrier to accessing markets in the last month		1.25	>=25% and <50% affect health access	
			2.5	>=50% affect health access	
	% of assessed settlements reported flooding as a barrier to accessing food or livelihood activities in the last month		1.25	>=25% and <50% affect food/livelihoods access	
			2.5	>=50% affect food/livelihoods access	
	% of assessed settlements reported flooding as a cause for displacement in the last month		1.25	>=25% and <50% cause displacement	
			2.5	>=50% cause displacement	

Annex 1: Decision Tree for Flow Monitoring Data (Internal Movements)

Figure 1: Decision Tree for Adjusting Weights for Cross-Border Flows

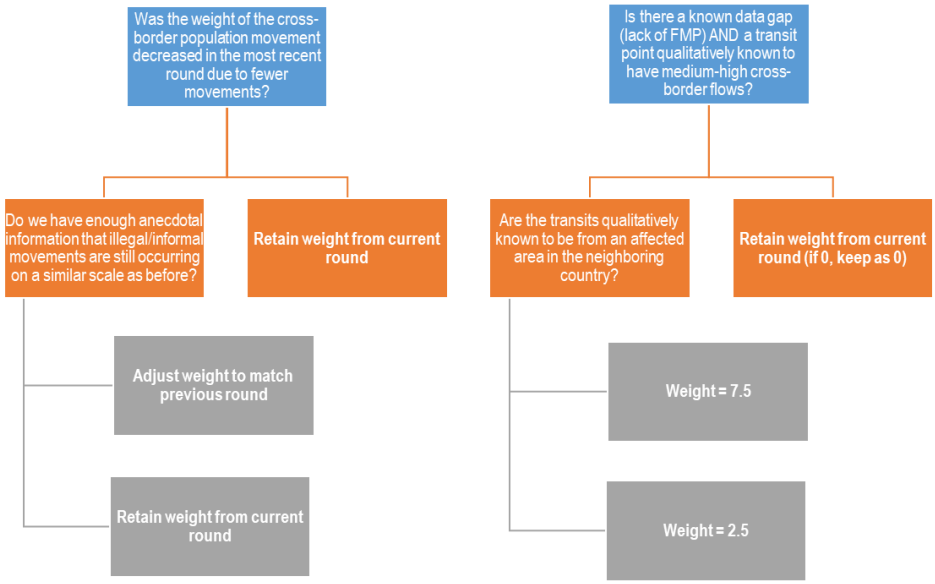
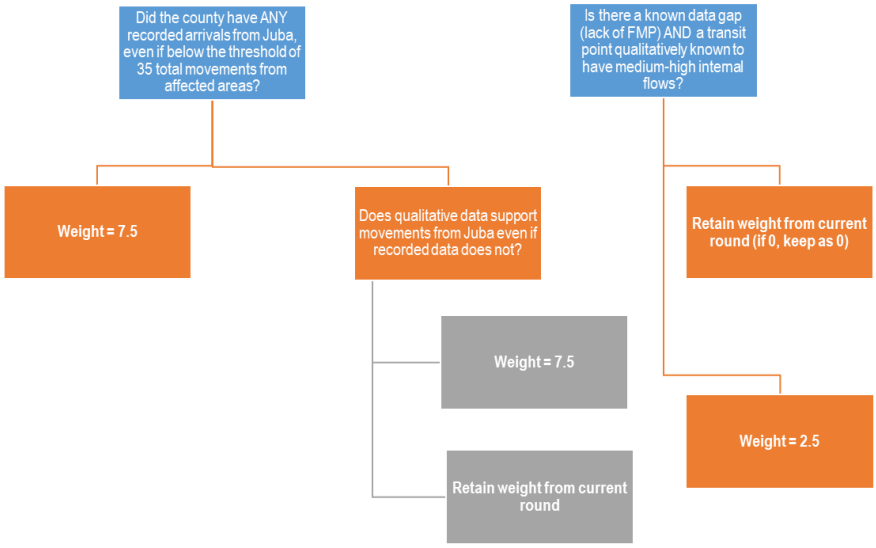


Figure 2: Decision Tree for Adjusting Weights for Internal Movement Flows



Annex 2: Conflict Risk Exposure

Table: Conflict Exposure Weight Table

		# of incidents (including similar/related in nearby counties)				
		1	**2**	**3**	**4**	**>5**
# of fatalities	**0**	1	2	3	4	5
	1-9	2	3	4	5	6
	10-49	4	5	6	7	8
	50-99	6	7	8	9	10
	=>100	8	9	10	10	10