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TRANSFORMATION TOWARDS SUSTAINABLE  
AND RESILIENT WASH SERVICES

## Containment of the acute watery diarrhea outbreak in Sudan: the WASH side of the story

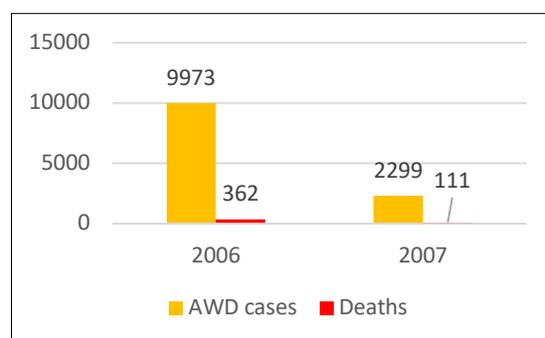
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*Sudan is prone to WASH related epidemics including repeated Acute Watery Diarrhoea (AWD) outbreaks. In 2016-2017, Sudan witnessed an unprecedented resurgence of AWD outbreak, reaching 36,460 cases and 818 deaths encompassing all states. The total cases exceeded by 60% the “worst case” scenario envisaged in the National AWD Preparedness and Response Plan, necessitating its reformulation. The rapidity and severity of the outbreak required the relevant Ministries to collaborate in an extraordinary manner with key support from UNICEF and WHO. Coordination forums led at the highest-level including the Vice President, Ministers and Governors ensured rapid assessment and response to the outbreak. The initial ad-hoc response eventually metamorphosed into a systematic, coordinated and integrated Health and WASH planning and response. Timely WASH interventions on a massive scale aided by innovative ladder approach of moving from emergency temporary to long-term durable solutions effectively contributed to containing AWD.*

### Evolution of the AWD outbreak In Sudan

In Sudan, occasional outbreaks of AWD continued over the years - 1966, 1970, 1972, 1980, 1981, 1985 until 1988. The disease reappeared in 1999, 2006 and 2007 as a part of the 7th pandemic spread. The last AWD outbreak during 2006-2007 affected all states in Sudan with a total case load of 12,272, 473 deaths, and a Case Fatality Rate (CFR) of 4% (Figure 1).



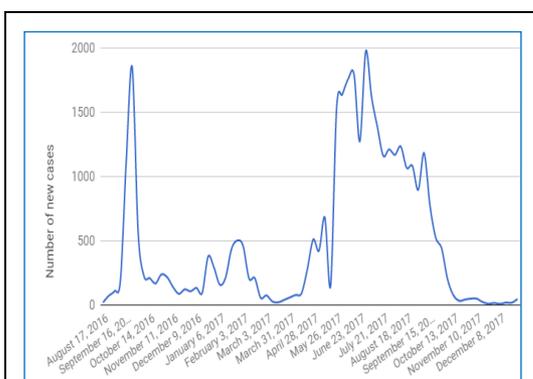
**Figure 1. AWD Outbreak in Sudan, 2006-2007**

Source: Federal Ministry of Health, Sudan

### 2016-2017 AWD outbreak

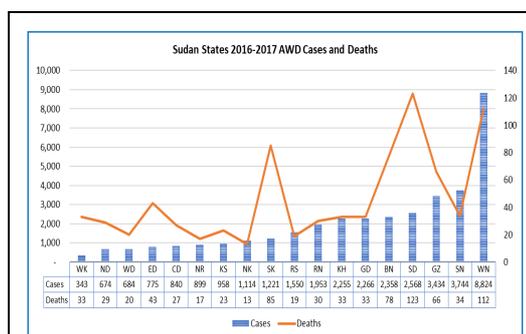
The 2016-2017 AWD outbreak had two major waves – one in August 2016 in Kassala state, spreading across eight states (Kassala, Blue Nile, River Nile, Gezira, Sennar, Khartoum, Gedarif and Red Sea) with the peak weekly caseload (1,852 cases) reported in second week of September 2016. The second major wave erupted in White Nile state in April 2017 and spread across all the 18 states of Sudan caused by contaminated water and food and population movement, with the peak weekly caseload (1,976 cases) reported in last week of June 2017. Since June 2017, the case load decreased due to the extensive integrated intersectoral planning and response until its containment at the end of 2017 (Figure 2).

The cumulative caseload reached 36,460 with 818 deaths from all over Sudan 18 states as of end of December 2017 with a Case Fatality Rate (CFR) of 2.2% (Federal Ministry of Health and WHO 2016-2017). The first case was reported from Kassala State on 21 August 2016 while the highest number of cases were reported from White Nile State (8,824) and the highest number of deaths were reported from South Darfur sates (123). Refer to Figure 3 for more details.



**Figure 2. AWD Progression, 2016-17**

Source: Federal Ministry of Health & WHO Sudan



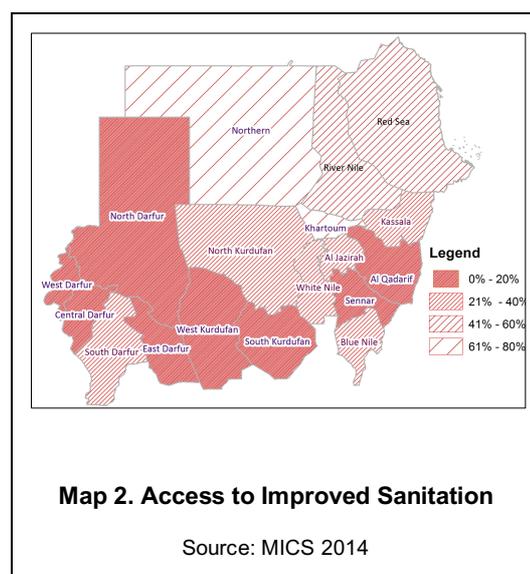
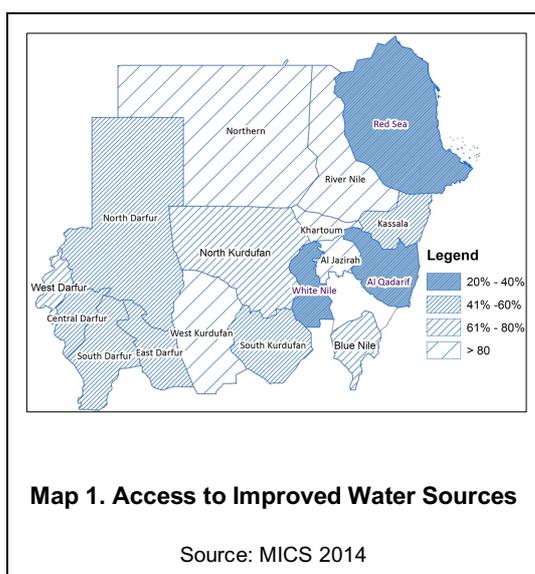
**Figure 3. AWD Spread across states, 2016-17**

Source: Federal Ministry of Health & WHO Sudan

### Key Issues underlying the resurgence of AWD outbreak

The resurgence of this widespread AWD outbreak in 2016-2017 is linked primarily to the following:

- **Low access to and use of safe drinking water and poor access to sanitation.** 68% of the population have access to basic water, while only 33% use improved sanitation facilities (MICS 2014). 29% of Sudanese people have no sanitation facilities and continue to defecate in the open. Wide disparities in access between states further compound the risks. Maps- 1 & 2 depicts variations in access to improved water sources and improved sanitation across states respectively.
- **Reliance of rural population on unprotected surface and groundwater sources and unsafe water handling & storage practices.** Routine testing of water sources during the outbreak revealed high bacteriological contamination. In White Nile state, 220 (80%) out of the 276 water samples tested from different water sources and the households were bacteriologically contaminated.
- **Poor hygiene practices** (lack of handwashing, safe food handling and solid waste management). Less than half of households have a specific place for hand washing, while only a quarter of households have a specific place for hand washing with water and soap.
- **High rates of malnutrition** among children with 16% global acute malnutrition and 38% stunting rates. Eleven out of 18 States are above the WHO nutrition emergency thresholds.
- **Inadequate Health services** in relation to AWD identification, isolation and containment.
- **Considerable population movement** - internal and cross border movements, displacements and refuge.
- **Inadequate and unfunded preparedness and response plans** coupled with lack of prepositioned supplies and inter-sectoral planning & coordination.



### Renewed strategies for the AWD response

The AWD response in the immediate aftermath of the outbreak was more sporadic, with efforts more at controlling the out-break, which was initially successful for a while when the AWD cases were more localized. As the AWD cases erupted from multiple locations, the current approach of localized intensified effort could not contain the spread in several AWD hit localities. As the outbreak exploded, the existing National AWD Preparedness and Response Plan (Government of Sudan 2017) in its current form proved largely inadequate.

Under the leadership of the Federal Ministry of Health (MoH) and the Federal Ministry of Water Resources, Irrigation and Electricity (MoWRIE), and with full involvement of UNICEF & WHO, the existing AWD Preparedness and Response Plan was reviewed and reframed. An upgraded comprehensive inter-sectoral AWD response plan was the outcome of this exercise, with following key considerations:

- Inter-sectoral AWD risk analysis and reframing of scenarios to forecast AWD cases;
- Activating integrated intersectoral coordination, approaches and joint interventions;
- Development of an operational guidance in terms of specific interventions in the “Control Phase” and “Prevention Phase”;
- Indicative budget requirements for activities in the control and prevention phases;
- Enhance the level of preparedness to respond to potential AWD cases in the coming six months by having contingency supplies pre-positioned, ready to be deployed to states as required;
- Activate and strengthen real time monitoring, mapping and information management systems;
- Reinforce national as well as equip state-level capacities; and
- Expand Partnerships to involve NGOs and private sector and mobilize governmental and non-governmental resources.

### Innovative AWD risk analysis and determination of expected caseload

All the 18 States were categorized into high, medium and low risk based on current Attack Rate (AR) and the following risk factors, that were weighted based on the degree of risk:

- Water & Sanitation coverage (weight: 45%; possible status- low, medium and high)
- Status of Health systems (weight: 30%; possible status- low, medium and high)
- Extent of IDPs/Refugees’ presence (weight: 10%; possible status- low, medium and high)
- Accessibility due to security (weight: 5%; possible status- low, medium and high)
- Rainy season intensity and duration (weight: 10%; possible status- low, medium and high)

Table-1 shows the risk analysis that was carried out for two possible scenarios (optimistic and pessimistic). The probable ARs were calculated by multiplying the current AR with the overall weighted risk factor, that included all above risk factors. For the pessimistic scenario, the probable AR was multiplied by 1.5.

**Table 1. AWD Risk Analysis Matrix**

Current Situation				Weighted Risk Factors							Expected Scenarios for Attack rates and cases				
States	2017 Population (2013 census CBS projection)	Total cumulative cases wk 33/2016-wk 26/2017	Current Attack rate	45%		30%		10%		5%		10%		100%	
				Water & sanitation coverage (MICS 2014)		Health systems status		Extent of Refugees/ IDPs		Accessibility		Rainy season		Total risk factors	
				coverage %	Risk level	Risk level	Risk level	Risk level	Risk level	Expected Attack rate	Expected cases	Expected Attack rate	Expected cases		
Kassala	2,438,808	429	0.02%	24.84%	3	2	1	1	1	2	2.3	0.05%	1,219	0.08%	1,829
Blue Nile	1,080,743	1530	0.14%	36.49%	2	2	3	3	3	2.25	0.32%	3,443	0.48%	5,164	
River Nile	1,472,257	791	0.05%	44.72%	2	1	1	1	1	1.45	0.08%	1,147	0.12%	1,720	
Gezira	4,926,555	2291	0.05%	37.72%	2	2	1	1	3	1.95	0.09%	4,467	0.14%	6,701	
Sennar	1,847,458	2818	0.15%	17.46%	3	3	1	2	3	2.75	0.42%	7,750	0.63%	11,624	
Khartoum	7,687,547	1954	0.03%	62.66%	1	1	1	1	1	1	0.05%	3,844	0.08%	5,766	
Gedaref	2,108,468	1415	0.07%	3.97%	3	3	1	2	3	2.75	0.18%	3,891	0.28%	5,837	
Red Sea	1,447,787	1137	0.08%	11.37%	3	3	1	1	1	2.5	0.20%	2,843	0.29%	4,264	
Northern	913,533	367	0.04%	76.30%	1	1	1	1	1	1	0.05%	457	0.08%	685	
White Nile	2,410,260	7493	0.31%	20.06%	3	3	3	2	3	2.95	0.92%	22,104	1.38%	33,157	
North Kordofan	2,460,663	486	0.02%	22.52%	3	2	1	1	1	2.2	0.05%	1,230	0.08%	1,845	
South Kordofan	1,647,294	386	0.02%	9.64%	3	2	2	3	3	2.6	0.06%	1,004	0.09%	1,505	
West Kordofan	1,100,000	239	0.02%	9.71%	3	3	2	2	3	2.85	0.06%	681	0.09%	1,022	
North Darfur	2,296,068	204	0.01%	7.80%	3	2	3	2	1	2.45	0.05%	1,148	0.08%	1,722	
South Darfur	4,025,210	0	0.00%	18.87%	3	2	3	2	2	2.55	0.05%	2,013	0.08%	3,019	
East Darfur	1,194,981	241	0.02%	6.27%	3	3	3	2	3	2.95	0.06%	711	0.09%	1,066	
West Darfur	947,952	0	0.00%	14.19%	3	2	3	2	2	2.55	0.05%	474	0.08%	711	
Central Darfur	777,158	0	0.00%	8.93%	3	3	3	2	3	2.95	0.05%	389	0.08%	583	
<b>Total</b>	<b>40,782,742</b>	<b>21,781</b>	<b>0.05%</b>	<b>28.23%</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>0.14%</b>	<b>58,814</b>	<b>0.22%</b>	<b>88,221</b>	

Based on above exercise, there were three High Risk States (with expected AR>=0.25%) with 33,296 expected cases; two medium risk states (with expected AR>= 0.1% and <0.25%) with 6,734 expected cases and Thirteen Low Risk States (with expected AR < 0.1%) with 18,784 expected cases, under the optimistic scenario. The optimistic scenario was considered more reasonable for the next six-month period, with an option to revisit the exercise, should the outbreak swell. **In summary, an estimated 40 million people in Sudan were at various degree of risk from AWD.**

**GIS Mapping and improved analytics**

GIS mapping was used to overlay water sources on most AWD affected communities to identify the source of the outbreak. Initial mapping of AWD affected communities and the water sources being used in these communities in the most affected - White Nile state clearly revealed that bulk of the AWD cases were related to the consumption of unsafe water from the river Nile.

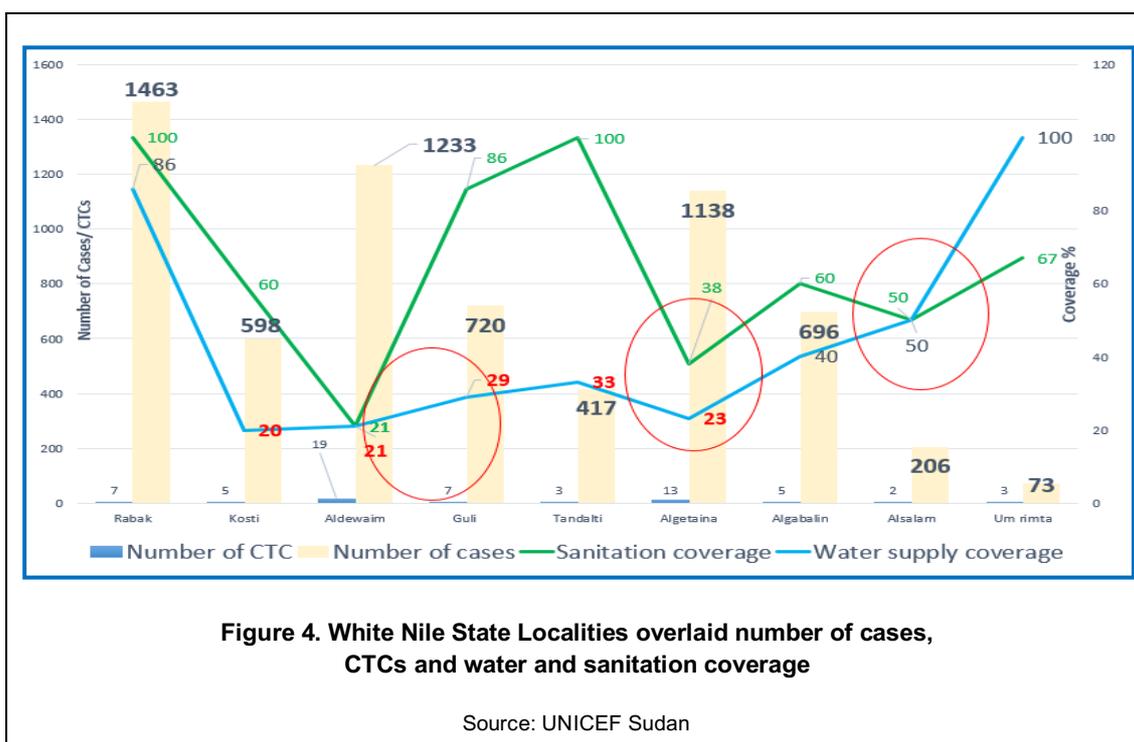
Similar assessment of the situation of WASH in Cholera Treatment Centres (CTCs) in 9 localities in White Nile state revealed a grim picture. Figure-4 clearly showed the linkage between the high levels of the cases and the poor water and sanitation situation in the CTCs, while also pointing out that there were other causes at play (e.g. contacts between patients and caregivers). Maps and analysis like this helped provide insight into prioritizing appropriate interventions for quicker containment of AWD cases. The map also guided location of Oral Rehydration Centres and CTCs so that more cases could be accessed in a short time.

**Prioritization of WASH interventions**

Package of WASH Interventions were prioritized to complement other sectoral interventions based on the level of risk identified above, the evolving situation and available resources. It was recognized that there would be difference in interventions based on “control phase” or “prevention phase”.

- **Control Phase:** To contain the current AWD outbreak in affected communities and prevent its spread into other “at risk” communities;
- **Prevention Phase:** Prevention of and preparedness for the current and future outbreaks through system strengthening and sustainable preventive interventions.

Within the aforementioned phases, following interventions were prioritized. The combined WASH interventions including Government and UNICEF’s contributions (UNICEF Sudan 2017) to that plan is provided in table 2.



### Outcome of the integrated interventions

The outcome of the extensive integrated intersectoral planning and response was the continuous decrease in the number of new AWD cases starting from July 2017 until being contained by the end of Dec. 2017.

### Results from the UNICEF WASH supported interventions

- On an average, 2 million AWD affected/at risk population were reached on monthly bases with chlorinated water (through chlorination of water sources, water transporting carts and household water disinfection);
- 237,415 gained access to safe water through construction/rehabilitation of water facilities;
- 61.0 million liters of life saving improved chlorinated water was trucked to the critically affected/at risk population while preparing for sustainable solutions;
- On an average, 2 million AWD affected/at risk population were reached on monthly bases with intensive hygiene promotion interventions.

### Key learnings (what was different?)

- **High-level engagement and leadership:** Several committees were established to closely monitor and contain the AWD situation. These include the High-Level Committee led by the Vice President and co-chaired by the Minister of Health & included Governors and relevant Federal Ministers; Technical Committee led by the Minister of Health including under-secretaries from the relevant ministries, WHO and UNICEF; and the Daily Task Force committee comprising senior officials from the related Ministries, WHO and UNICEF.
- **Prognosis of AWD cases based on a more comprehensive and collaborative effort** that took into consideration weighted scores for the current fatality rates, Water & Sanitation coverage, Status of Health systems, Extent of IDPs/Refugees presence, Accessibility and Rainy season intensity.
- **Prioritization of Government resources for AWD:** In addition to significant support for WASH supplies from UNICEF, the Government secured supplies worth nearly US\$ 3.6 million that included procurement of Oxfam tanks, chlorine powder and household chlorination tablets, Poly Aluminum Chloride and dosing pumps.
- **Integrated multi-sectoral interventions at community level and at the Treatment Centres:** At the community level, the multi-sectoral nature of interventions included WASH interventions, promotion of key household practices (covering health seeking behaviours; awareness on proper feeding and hand-

washing practices), establishment of ORS corners and screening of SAM cases (in areas with high malnutrition burden). At the CTCs this included ensuring safe access to water, improved sanitation, provision of medical supplies for CTCs and training of Health workers.

- **Ladder approach to service provision with an eye on durable solution:** In the initial stages of the AWD outbreak, the focus was on ensuring people had access to chlorinated water through chlorination of all improved water sources. For those households without access to improved water sources – temporary measures such as the innovative use of OXFAM tanks (twin – one for settling and the other for disinfection) close to surface water sources (such as Nile) was put in place; chlorination was ensured for donkey carts carrying surface water for distribution to households; while household chlorination tablets were distributed to others. Soon after water sources were rehabilitated and new ones constructed as a means to proffer long-term durable solution as well as reduce the enormous cost of monthly household disinfection supplies. Capacity building/training activities were embedded in the interventions – be it for proper chlorination or water quality testing or for proper management of facilities.
- **Private sector engagement:** Successful tri-partite arrangement between the White Nile State Government, private sector (Kenana Sugar Company) and UNICEF to increase access to sustainable improved water sources for 32,000 AWD affected/at risk population. UNICEF is contributing 72.5% of the total cost while Kenana is covering the rest as a part of its social responsibility programme, while Government will provide the necessary human resources and operational budget. In addition, mobile phone companies such as MTN aired free SMS on proper hygiene practices reaching a large number of mobile phone connected Sudanese population.

### **Conclusions and moving forward**

- The 2016-2017 AWD outbreak brought together stakeholders at the highest level demonstrating strong leadership and commitment thereby ensuring sound collaboration between the various line ministries at all levels.
- Managing the emergency response in all future interventions using the ladder approach that starts with temporary WASH solutions but gradually progressing towards a long term sustainable solution.
- The outbreak engaged government staff massively across the country, which will stand them in good stead, should another outbreak happen. Systems have been put in place and government staff trained on a number of issues.
- The outbreak also sensitized a wide variety of stakeholders including local citizens who are now aware of the risks and more amenable to future promotional messages. The widespread outbreak underscored the importance of WASH and has been given due priority since then at the national and state.
- As part of preparedness measures, WASH supplies have been already pre-positioned by the Government in readiness for any potential outbreak.
- The ambitious Zero Thirst program that is being implemented by the MoWRIE is expected to alleviate some of the challenges with water availability. A similar effort being undertaken by MoH is the development of a Roadmap to eliminate open defecation in Sudan. These two programs together when fully implemented are expected to alleviate the burden of WASH related diseases include AWD outbreak.

<b>Table 2. Priority WASH Interventions based on degree of risk</b>				
<b>Priority interventions</b>		<b>High risk States</b>	<b>Medium risk States</b>	<b>Low risk States</b>
<b>Improved Water Supply (Planned National Interventions and UNICEF contribution)</b>				
Chlorination of improved water sources and water transportation means including in all CTCs and ORTCs (facility %)	Combined	100%	100%	100%
	Unicef	30%	20%	10%
Water disinfection at Household level for households without access to improved water sources (households%)	Combined	60%	40%	20%
	Unicef	12%	8%	4%
Construction of new improved water sources for population without access to improved water including in all CTCs and ORTCs (population%)	Combined	15%	10%	5%
	Unicef	1.5%	1.0%	0.5%
Rehabilitation of improved water sources for population without access to improved water sources including in all CTCs and ORTCs (population%)	Combined	30%	20%	10%
	Unicef	3%	2%	1%
Water quality testing at source, transportation means and household levels and water safety planning and implantation.	Combined	√	√	√
	Unicef	√	√	√
<b>Sanitation and hygiene (National target and UNICEF contribution)</b>				
Construction of emergency latrines including in all CTCs and ORTCs for population with no access to improved sanitation (population%)	Combined	3%	2%	1%
	Unicef	1.5%	1.0%	0.5%
Conduct weekly mass media hygiene promotion programmes and C4D events on Radio, TV, newspapers and social media	Combined	√	√	√
	Unicef	√	√	√
Conduct monthly health/hygiene promotion awareness, cleaning and vector control campaigns (population %)	Combined	15%	10%	5%
	Unicef	3%	2%	1%
<b>Coordination, monitoring and capacity building (National target and UNICEF contribution)</b>				
Activate WASH sector coordination at state level a part of the overall AWD integrated coordination forum (meetings)	Combined	Daily	Weekly	Biweekly
	Unicef	Daily	Weekly	Biweekly
Build the capacity of WASH response team and community members at state, Locality and community levels with focus on women participation.	Combined	√	√	√
	Unicef	√	√	√
Strengthen/activate WASH monitoring/MIS and GIS mapping and activate real time monitoring systems.	Combined	√	√	√
	Unicef	√	√	√

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