

Massive outbreak of poliomyelitis caused by type-3 wild poliovirus in Angola in 1999

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The largest outbreak of poliomyelitis ever recorded in Africa (1093 cases) occurred from 1 March to 28 May 1999 in Luanda, Angola, and in surrounding areas. The outbreak was caused primarily by a type-3 wild poliovirus, although type-1 wild poliovirus was circulating in the outbreak area at the same time. Infected individuals ranged in age from 2 months to 22 years; 788 individuals (72%) were younger than 3 years. Of the 590 individuals whose vaccination status was known, 23% had received no vaccine and 54% had received fewer than three doses of oral poliovirus vaccine (OPV). The major factors that contributed to this outbreak were as follows: massive displacement of unvaccinated persons to urban settings; low routine OPV coverage; inaccessible populations during the previous three national immunization days (NIDs); and inadequate sanitation. This outbreak indicates the urgent need to improve accessibility to all children during NIDs and the dramatic impact that war can have by displacing persons and impeding access to routine immunizations. The period immediately after an outbreak provides an enhanced opportunity to eradicate poliomyelitis. If continuous access in all districts for acute flaccid paralysis surveillance and supplemental immunizations cannot be assured, the current war in Angola may threaten global poliomyelitis eradication.

Keywords: Angola; epidemiological studies; health services accessibility; immunization programmes; paralysis, epidemiology; poliomyelitis, etiology; polioviruses, human 1–3, isolation and purification.

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Introduction

Widespread administration of oral poliovirus vaccine (OPV) has led to the virtual elimination of paralytic poliomyelitis in much of the world (1). In 1999, in the final stage of global eradication, many areas in Africa with continuing wild poliovirus transmission were still affected by war — Angola, the Democratic Republic of the Congo, Liberia, and Sierra Leone. It is likely that some of these countries will be among the last places in Africa with wild poliovirus transmission. This article assesses the largest poliomyelitis outbreak ever reported in the African Region in one of these war-affected areas, Angola.

Background

Angola borders the Democratic Republic of the Congo, Namibia and Zambia. Cabinda Province is

separated from the main area of Angola by a part of Bas-Congo Province, the Democratic Republic of the Congo, and borders southern Congo (Brazzaville). The country covers 1 246 700 km² and in 1999 its estimated population was 13.6 million, 6.4 million (48%) of whom were younger than 15 years. Owing to the political instability in the country since its independence in 1975, more than 1.2 million people have been internally displaced and another 200 000 Angolans are refugees outside the country (2). Health delivery systems have been disrupted — 30% of the national population has access to primary health care, 41% to safe water, and 19% to sanitation facilities (3). The capital Luanda normally accounts for 16% of the total population (ca. 2.3 million inhabitants), but an additional 800 000 displaced persons came to the city in December 1998 at the time of renewed conflict. The Ministry of Health noticed an increase of the number of cases of acute flaccid paralysis (AFP) being reported in late March 1999. In response to the main part of the outbreak in Luanda, an emergency poliomyelitis vaccination campaign was organized in Luanda Province on 17–18 April 1999 for children aged 0–4 years, with 526 036 children targeted and 634 368 vaccinated. On 1–2 May 1999, an emergency poliomyelitis vaccination campaign was organized in Benguela Province, with 255 503 children under 5 years targeted and 298 902 vaccinated. In addition, three rounds of national immunization days (NIDs) were conducted on 12–13 June, 17–18 July and

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21–22 August 1999. However, 32% of districts in the country could not be reached during these three rounds (Fig. 1). On 30 August 1999, the United Nations Security Council discussed ways of gaining access to Angola's child population and of implementing supplemental immunization rounds from October to December 1999 in districts not yet covered.

Data

Trends in reported poliomyelitis cases, by year, are shown in Table 1. From 1992 to 1996, the disease was diagnosed clinically. Starting in 1997, a system based on reporting of cases of AFP with stool specimens collected for all cases was introduced by the Angolan Ministry of Health.

Surveillance

Data for the outbreak came from the acute flaccid paralysis (AFP) surveillance system, under which all cases of AFP in children aged <15 years are reported. All cases with symptoms clinically compatible with poliomyelitis in persons aged ≥ 15 years are also

reported. A reported AFP case of any age was defined as a confirmed poliomyelitis case if the onset of paralysis occurred between 1 March and 30 May 1999 in a province with at least one confirmed isolation of wild poliovirus during that same period.

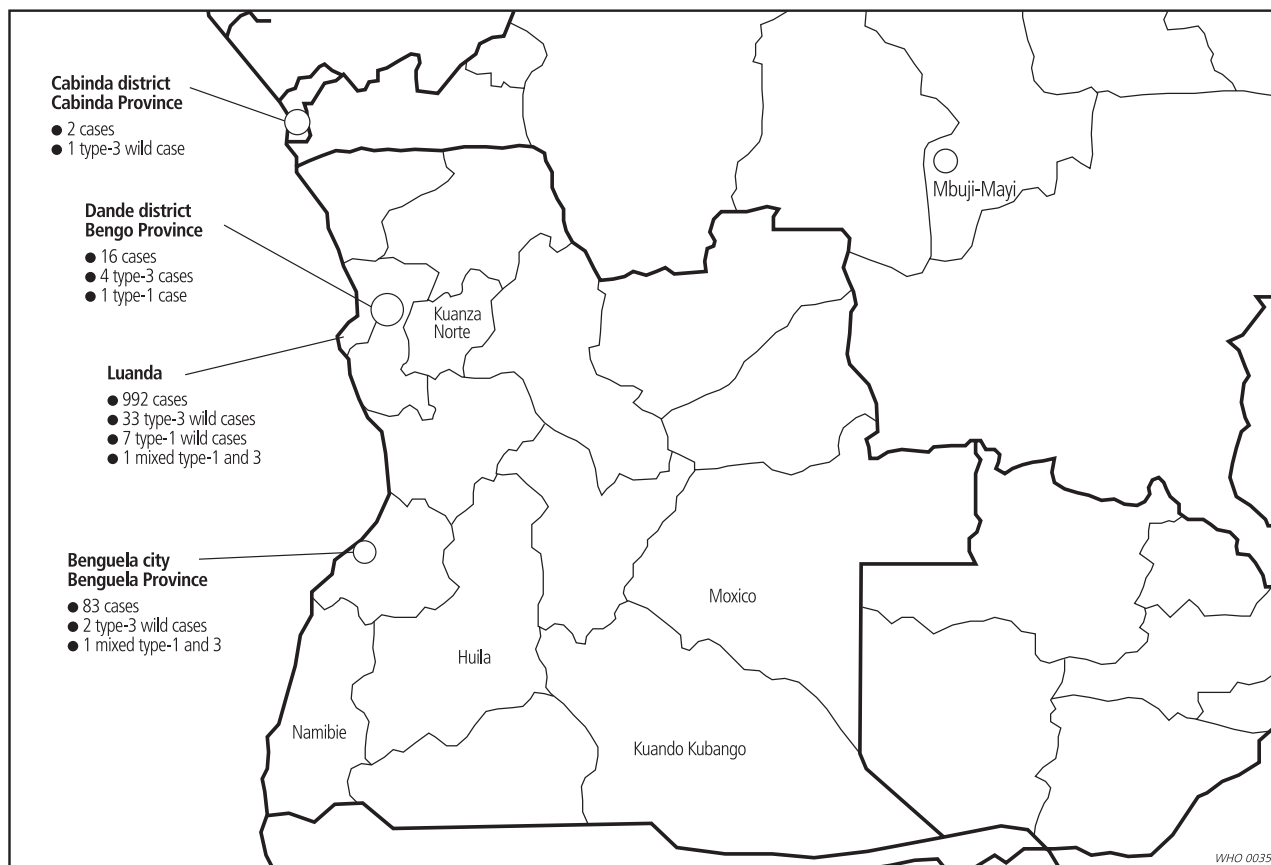
Laboratory data

Stool specimens were transported to the National Institute of Virology, Johannesburg, South Africa, which is part of the WHO Africa Poliovirus Laboratory Network. Virus isolation on tissue culture, intratypic differentiation, and partial genomic sequencing were done using standard methods (4). During partial genomic sequencing, 150 viral nucleotides in the VP1-2A region were compared between viruses.

The poliomyelitis outbreak

From 1992 to 1998, between 15 and 149 cases of poliomyelitis were reported in Angola each year. However, in 1999 a total of 1093 poliomyelitis cases were reported in the 3 months from 1 March 1999 through 30 May 1999 (Fig. 2). The distribution of cases reported from each province together with the

Fig. 1. Map showing location of poliomyelitis cases that occurred during the outbreak in Angola, 1 March–30 May 1999



types of wild polioviruses isolated are shown in Fig. 3. Of the national total, 992 cases (91%) were in Luanda Province, 83 in Benguela, 16 in Bengo and two in Cabinda. Type-3 and type-1 wild polioviruses were isolated in Luanda, Benguela and Bengo provinces. In Cabinda province, only type-3 wild poliovirus was isolated.

Cases by date of onset of paralysis for Luanda and Benguela Provinces are shown in Fig. 2. In Bengo Province, 14 of the 16 poliomyelitis cases occurred between 1 April and 12 May 1999. Type-3 wild poliovirus was first isolated from stools of a Luandan AFP patient whose onset of paralysis was on 3 March 1999. From 1 March to 17 April 1999, stool specimens were collected from 81 AFP patients; wild poliovirus was detected in 50 cases. Type-3 poliovirus alone was detected in 39 patients, type-1 wild poliovirus alone in nine, and both types in two. Collection of stool specimens was stopped on 17 April 1999 when the cause of the outbreak had been identified.

In Luanda Province, 992 AFP cases were notified, with the majority from the municipalities of Maianga (333 cases; incidence: 2.3 poliomyelitis cases per 100 000 total population), Sambizanga (105 cases; incidence: 0.9 per 100 000), Cazenga (242 cases; incidence: 0.9 per 100 000) and Viana (88 cases; incidence: 0.9 per 100 000). These municipalities are characterized by overcrowding in urban slum areas, large numbers of displaced persons and very poor water and sanitation conditions.

The age of the reported cases ranged from 2 months to 22 years; 17% were under 1 year of age; 74% were aged 1–4 years; and 9% were aged 5–15 years.

For 46% of the cases, the vaccination status was unknown. For patients whose vaccination status was known, 23% received no doses; 11% one dose; 20% two doses; 27% three doses; and 19% more than three doses of OPV.

Wild polioviruses type 3 and type 1

Wild poliovirus type 3 had not been isolated previously in Angola, although it had been isolated during the 1990s in West Africa, Chad, Central African Republic, Sudan and Madagascar. It has not been isolated in the neighbouring Democratic Republic of the Congo or in East Africa or continental southern Africa for the past 10 years. Partial genomic sequencing indicated that the strain responsible for the 1999 Angola outbreak appeared to be unrelated to any other type-3 wild polioviruses previously isolated in Africa.

Prior to the 1999 outbreak, type-1 wild polioviruses of the same genotype had previously been isolated at several times in Angola during 1994–98. During 1998, type-1 poliovirus was isolated from the stools of 14 AFP patients in Luanda. Partial genomic sequencing indicated that these type-1 polioviruses were 97% similar to each other. Wild poliovirus type 1 was isolated from a single AFP case with onset on 7 September 1998 from Luena district,

Table 1. Number of cases of poliomyelitis or acute flaccid paralysis (AFP) by year, Angola 1992 to August 1999^a

Condition	No. of cases							
	1992	1993	1994	1995	1996	1997	1998	1999 Jan–Aug
Clinical poliomyelitis	67	149	54	10	81	–	–	–
AFP	–	–	–	–	–	15	15	1109
AFP with stool specimens	–	–	–	–	–	–	9	81
Wild poliovirus (laboratory-confirmed)	–	–	–	–	2	–	3	50

^a From 1992 to 1996 poliomyelitis cases were diagnosed clinically. In 1997, an AFP surveillance system was instituted.

Fig. 2. Distribution of cases of acute flaccid paralysis (AFP), by date of onset of paralysis, Luanda and Benguela Provinces, Angola, January–June 1999

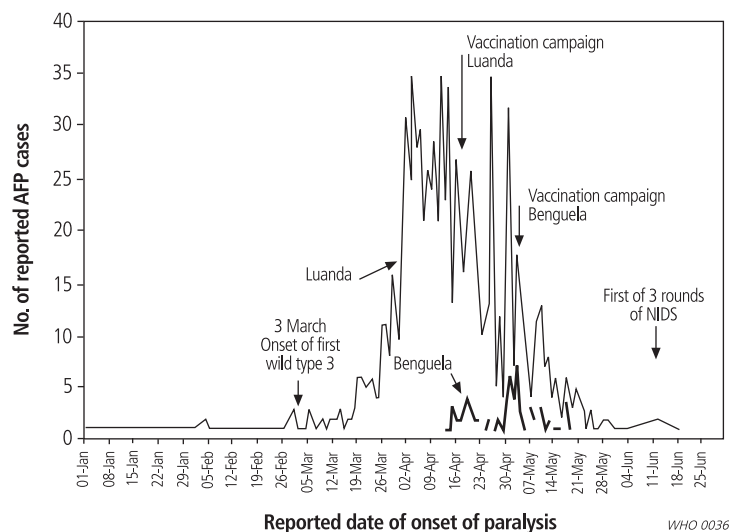
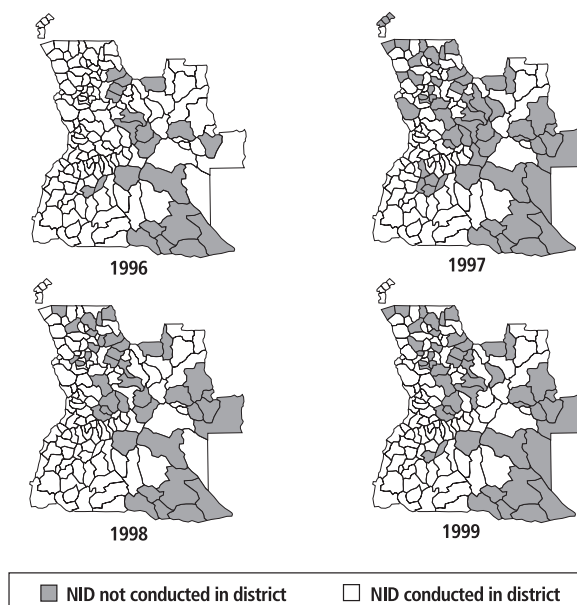


Fig. 3. Maps showing location of districts not reached during national immunization days, Angola, 1996–1999



On the sidelines of the Angolan conflict



Photo © Lord Snowdon

Kelson Castelo, now 16 years old, contracted polio as a baby. He cannot walk and is mentally disabled.



Photo © Lord Snowdon

Melita and her son Johnny live on the streets. She contracted polio as a baby. Her husband is fighting in the war and she is bringing Johnny up alone.



Photo © Lord Snowdon

A child being immunized against polio at a clinic in the Sambizanga district of the Angolan capital, Luanda. The district is one of the city's poorest.

De Beers helped fund National Immunization Days in Angola in 1999 and 2000 through a major financial donation to WHO's Polio Eradication Initiative.



Photo © Lord Snowden

Cipriano Justino, aged 19, with his withered right leg, a legacy of polio, is a regular feature of Luanda's street scene.



Photo © Lord Snowden

Zelia Miguel, 21, carrying her one-year-old son, who has been unable to walk since contracting polio a few weeks before this picture was taken.



Photo © Lord Snowden

Mothers line up in a Luanda clinic to have their infants immunized against polio.

Moxico Province (850 km east of Luanda; Fig. 3). This virus was 97% similar to the 1998 Luanda viruses and 97% similar to a virus isolated in 1996 from the same district. All type-1 wild polioviruses isolated during the 1999 outbreak in Luanda were 99–100% similar to each other, and were 98% similar to the Luanda type-1 wild polioviruses isolated in 1998. The type-1 viruses isolated in Luanda, Bengo, and Benguela Provinces in 1999 were also 99–100% similar.

During January–June 1999, no wild polioviruses were isolated from stools collected from AFP patients in the neighbouring countries of Namibia (4 cases) and Zambia (27 cases). During 1999, no AFP patients were reported from those districts of the Democratic Republic of the Congo that border Angola; 10 AFP cases with stool specimens were reported from Kinshasa, the capital, but no wild polioviruses were isolated.

Routine and supplemental immunization

Nationwide routine immunization coverage with three or more doses of OPV was 29% in 1996, 35% in 1997 and 45% in 1998.

NIDs were held in 1996, 1997, 1998, and 1999 but did not reach all districts (municipalities) of Angola. The percentage of the districts reached during the NIDs was 84% in 1996, 71% and 93% for the first and second rounds in 1997 and 73% in 1998 (Table 2, Fig. 1). The three 1999 NID rounds were conducted in 68% of the districts that were accessible in June, July and August (Fig. 1).

Discussion

The 1999 Angola poliomyelitis outbreak is the largest ever recorded in Africa. The other recent massive outbreak in Africa (approximately 1000 cases) in nearby Mbuji-Mayi, the Democratic Republic of the Congo (1150 km from Luanda; Fig. 3) in 1995 occurred under conditions of conflict and mass migration, similar to those during the Luanda outbreak. These outbreaks dramatically highlight the important relationship between civil conflict, poliomyelitis outbreaks, and eradication of the disease. Civil conflict has limited access to immunizations and health care in Angola for many years. The war has placed increased burdens on health workers

and facilities (5). Owing to the political instability, the presence of landmines and the collapsed infrastructure, the proportion of children who were immunized during routine immunization has remained less than 30% in many districts of the country. In addition, civil conflict resulted in much of the country not being reached during NIDs for three years prior to the outbreak (Fig. 1). Renewed conflict in December 1998 led to the displacement of many unvaccinated children into safer urban areas. Renewed fighting in 1999 led to 25% fewer districts being reached in the 1999 NIDs than in 1996 (Table 2).

The vast majority of cases during the outbreak occurred in Luanda, spreading to the adjacent Bengo Province and also to the city and Province of Benguela at a distance of 420 km within 6 weeks. Fortunately, the outbreak virus has not yet been detected in the neighbouring poliomyelitis-free countries of Botswana, Namibia, and Zambia. Limited poliomyelitis surveillance in Kinshasa, the Democratic Republic of the Congo, in 1999 did not reveal any type-3 wild poliovirus (WHO Africa Regional Office AFP surveillance data, July 1999).

Type-3 and type-1 wild polioviruses both caused cases during the outbreak, but the former predominated; type 3 was detected in 42 (52%) of 81 cases; and type 1 in 10 (12%). The 1999 Angola type-3 wild poliovirus genotype had not been previously identified in Africa. We suspect that this virus was circulating for many years undetected in Angola and the Democratic Republic of the Congo prior to the outbreak, reflecting the poor poliovirus surveillance in those two countries.

The type-1 wild polioviruses found during the outbreak were very similar to the other type-1 viruses found in Angola during 1994–98. The similarity between type-1 wild virus isolated in Luanda in 1994, viruses isolated in Moxico Province in 1996 and 1998, the presumed Angolan viruses that caused the poliomyelitis outbreaks in Namibia in 1993 and 1994–95 (6) and the type-1 viruses isolated in Luanda, Bengo, and Benguela Provinces in 1999 shows that this type-1 virus has a wide range and has continued to survive for many years in Angola despite several NIDs.

During the 1999 NIDs, one-third of districts could not be reached with supplemental immunization rounds. Clearly, the low coverage could jeopardize the drive to eradicate poliomyelitis in Angola. The discussions held in the United Nations Security Council in August 1999 about Angola and gaining access to the missed districts are an excellent first step. Because of the low routine coverage, multiple rounds of mass campaigns reaching every district will be necessary to eradicate poliomyelitis in Angola and permit global poliomyelitis eradication by the end of the year 2000. To keep the number of supplemental OPV rounds necessary to achieve eradication in Angola to a minimum, supplemental round coverage in every district must reach at least 80%. House-to-house immunization is likely to be the best method to assure high coverage.

Table 2. Oral poliovirus vaccine coverage of children aged 0–59 months during national immunization days, Angola 1996–98

	1996	1997	1998
Target population (0–59 months)	2 817 929	2 627 416	2 754 953
Coverage, first round (%)	71	83 ^a	91
Coverage, second round (%)	80	98 ^b	104
Districts covered, first round (%)	84	71	74
Districts covered, second round (%)	84	93	72

^a Range by district, 26–157.

^b Range by district, 36–164.

Surveillance may be the most difficult poliomyelitis eradication activity to conduct successfully since, unlike the time-limited mass campaign rounds, surveillance requires constant access to all districts in the whole country for up to 5 years. It is unlikely that the Global Poliomyelitis Eradication Certification Commission would certify eradication globally unless it could be certain that all districts had been reached with immunization and surveillance and that no wild poliovirus still exists in Angola.

To achieve poliomyelitis eradication in Angola, high-quality AFP surveillance and supplementary immunization rounds will also be needed in the neighbouring Democratic Republic of the Congo. During this outbreak, type-3 wild poliovirus was isolated on both sides of that country's Bas Congo Province in the Angolan Provinces of Cabinda and Bengo. It is therefore likely that type-3 wild virus is continuing to circulate undetected in Bas Congo Province.

The post-outbreak period provides an opportunity to eliminate poliomyelitis while population

immunity is high and people are sensitized to the risk of paralytic poliomyelitis. For example, China eradicated poliomyelitis with two years of nationwide supplemental immunization in the aftermath of a major poliomyelitis outbreak with 10 000 paralytic cases (7).

Conclusion

The largest poliomyelitis outbreak ever recorded in Africa was associated with high numbers of poorly vaccinated, displaced persons fleeing civil conflict who had congregated in a big city where routine immunization coverage was low. Health officials managing such emergencies must consider steps to avoid extensive poliomyelitis outbreaks in these situations. Angola, with its civil conflict, and countries in a similar situation, like the Democratic Republic of the Congo, threaten global poliomyelitis eradication unless access to all districts continuously for AFP surveillance and intermittently for supplemental OPV immunization rounds can be swiftly guaranteed. ■

Résumé

Flambée massive de poliomyélite due au poliovirus sauvage de type 3 survenue en Angola en 1999

La plus vaste flambée de poliomyélite jamais enregistrée en Afrique (1093 cas) est survenue du 1^{er} mars au 28 mai 1999 à Luanda (Angola) et dans ses environs. Cette flambée était principalement due à un poliovirus sauvage de type 3, bien que le type 1 ait également circulé dans cette région à la même époque. Les malades étaient âgés de 2 mois à 22 ans ; 788 d'entre eux (72 %) avaient moins de 3 ans. Sur les 590 sujets dont l'état vaccinal était connu, 23 % n'avaient pas été vaccinés et 54 % avaient reçu moins de trois doses de vaccin antipoliomyélique buccal (VPO). Les principaux facteurs ayant contribué à cette flambée étaient un déplacement massif de personnes non vaccinées vers les zones urbaines, une faible couverture systématique par le VPO,

l'inaccessibilité de certaines populations lors des trois précédentes journées nationales de vaccination, et l'insuffisance des installations sanitaires. Cette flambée montre la nécessité urgente d'améliorer l'accès à tous les enfants lors des journées nationales de vaccination et souligne l'impact catastrophique des guerres qui empêchent les populations déplacées d'accéder aux vaccinations de routine. La période qui suit immédiatement une flambée offre une possibilité accrue d'éradiquer la poliomyélite. Si l'accès permanent à la surveillance de la paralysie flasque aiguë et aux vaccinations supplémentaires ne peut être assuré dans tous les districts, la guerre qui sévit actuellement en Angola risque de menacer l'éradication mondiale de la poliomyélite.

Resumen

Brote masivo de poliomiélitis causado por el poliovirus salvaje de tipo 3 en Angola en 1999

El mayor brote de poliomiélitis jamás registrado en África (1093 casos) tuvo lugar entre el 1 de marzo y el 28 de mayo de 1999 en Luanda (Angola) y sus alrededores. El principal responsable del brote fue un poliovirus salvaje de tipo 3, si bien el poliovirus salvaje de tipo 1 también circulaba en la zona del brote en esas fechas. Los individuos infectados tenían entre dos meses y 22 años; de ellos, 788 (72%) tenían menos de tres años. De los 590 individuos cuyo estado de vacunación se conocía, el 23% no había sido vacunado, y el 54% había recibido menos de tres dosis de la vacuna oral contra el poliovirus (OPV). Los factores que más contribuyeron a este brote fueron los siguientes: el desplazamiento masivo de personas no vacunadas a entornos urbanos; una baja cobertura sistemática con OPV; la existencia de

poblaciones inaccesibles durante los tres días nacionales de inmunización anteriores, y un saneamiento inadecuado. Este brote demuestra la necesidad urgente de mejorar el acceso a todos los niños durante los días nacionales de inmunización, así como el espectacular efecto que puede tener la guerra al forzar a las personas a desplazarse y dificultar el acceso a la inmunización sistemática. El periodo inmediatamente posterior a un brote brinda una preciosa oportunidad para erradicar la poliomiélitis. Si no es posible asegurar el acceso permanente en todos los distritos a la vigilancia de la parálisis flácida aguda y a las operaciones de inmunización suplementaria, el conflicto bélico por el que atraviesa Angola puede hacer peligrar la erradicación mundial de la poliomiélitis.

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