Scale-up of a programme for malaria vector control using long-lasting insecticide-treated nets: lessons from South Sudan

Emmanuel Chanda, a Constantino D Remijo, b Harriet Pasquale, b Samson P Baba b & Richard L Lako b

Introduction

Malaria remains an important cause of morbidity and mortality. Approximately 219 million malaria cases and 660 000 malaria-related deaths were reported globally in 2010.1 The greatest toll is exacted in sub-Saharan Africa, where over 80% of all malaria episodes and 90% of all malaria-related deaths occur.2 The huge malaria burden in sub-Saharan Africa has been partly attributed to the presence of efficient vectors that maintain high levels of transmission.3 Recent increases in international funding for malaria control have enabled many countries with endemic malaria to scale up their vector control efforts at both individual and community levels.4 In some countries in sub-Saharan Africa, for example, millions of long-lasting insecticide-treated nets (LLINs) have been distributed.5 By 2012, an estimated 53% of the households considered to be at risk of malaria in this region had at least one LLIN each.6

In South Sudan – formerly Southern Sudan, an autonomous region that in 2011 gained its independence from the country then known as Sudan – malaria control is currently based on the early definitive diagnosis of febrile cases by microscopy or the use of a rapid diagnostic test, the treatment of malaria cases with artemisinin-based combination therapy, and the use of LLINs and intermittent preventive treatment.7 The national Ministry of Health supports a well-established health information system that uses surveillance at sentinel sites to estimate the incidence of malaria and determine the outcomes of malaria-control interventions.8

Although South Sudan received considerable financial support to scale up LLIN coverage – both from the Global Fund to Fight AIDS, Tuberculosis and Malaria’s rounds 2, 7 and 10 for malaria control, and other funding agencies – malaria remained endemic in all 10 of South Sudan’s administrative states in 2012.9 This paper describes the approaches that first Southern Sudan and then South Sudan followed to scale up LLIN coverage, the challenges encountered, the lessons learnt from this experience, and how these lessons have informed LLIN distribution.

Local setting

Human malaria occurs throughout South Sudan and the country’s entire population is considered to be at risk of the disease.10 Transmission of the causative parasites occurs for 7 to 8 months of the year in the south of the country and for 5 to 6 months of the year in the north. The main vectors are Anopheles gambiae sensu stricto, A. arabiensis and A. funestus.11 Attempts to control the vectors have been limited and intermittent and have had little apparent impact on the huge malaria burden.

Five decades ago, “indoor residual spraying” and larviciding were used to limit malaria transmission in what was then southern Sudan.12 However, these interventions ceased when the First and Second Sudanese Civil Wars – in 1955–1972 and 1983–2005, respectively – led to a general collapse of infrastructure and public health services. After several decades without any vector control, programmatic control of the malaria vectors was relaunched in Sudan – along with malaria case management – in 2004. Insecticide-treated bednets were distributed to individuals who were considered particularly vulnerable to malaria: children younger than 5 years, pregnant women, internally displaced persons and nomadic pastoralists. These nets were initially distributed on a small scale – via a public–private partnership – using a social marketing

Problem

Long-lasting insecticidal nets (LLINs) are important tools in malaria control. South Sudan, like many other endemic countries, has struggled to improve LLIN coverage and utilization.

Approach

In 2006, Southern Sudan – known as South Sudan after independence in 2011 – initiated a strategic plan to increase LLIN coverage so that at least 60% of households had at least one LLIN each. By 2008, the target coverage was 80% of households and the Global Fund had financed a phased scale-up of LLIN distribution in the region.

Local setting

South Sudan’s entire population is considered to be at risk of malaria. Poor control of the vectors and the large-scale movements of returnees, internally displaced people and refugees have exacerbated the problem.

Relevant changes

By 2012, approximately 8.0 million LLINs had been distributed in South Sudan. Between 2006 and 2009, the percentage of households possessing at least one LLIN increased from about 12% to 53% and LLIN utilization rates increased from 5 to 25% among children younger than 5 years and from 5 to 36% among pregnant women. The number of recorded malaria cases increased from 71 948 in 2008 to 1 198 357 in 2012.

Lessons learnt

In post-conflict settings, a phased programme for the national scale-up of LLIN coverage may not have a substantial impact. A nationwide campaign that is centrally coordinated and based on sound guidelines may offer greater benefits. A strong partnership base and effective channels for the timely and supplementary deployment of LLINs may be essential for universal coverage.

Abstract in العربية, Français, Русский и Español at the end of each article.
approach. The large-scale deployment of LLINs was only attempted after the signing of a comprehensive peace agreement in 2005. Even then, the scale-up of LLIN coverage was hampered by strong social and geographical barriers. "Post-conflict” southern Sudan was characterized by poor infrastructural development, transport and health services, the presence of large numbers of vulnerable individuals other than those previously targeted – such as orphans, the elderly, the chronically ill, returnees and refugees – and a general preference for a locally made and untreated cotton bednet – called dumuria – over conventional insecticide-treated bednets. There was no coordinated or standardized system for the distribution or quality control of LLINs and no relevant national operational guidelines, training manuals or communication strategy. Although there were systems in place for the monitoring and supervision of the net distributions, these had no set targets or reporting protocols.

Relevant changes
Policy and guidance

Southern Sudan’s Ministry of Health issued a health policy document in 2006 that emphasized the need for malaria control and the same Ministry developed a strategic plan to cover malaria control between 2007 and 2013. The plan prioritized the distribution of LLINs. The initial target of the distribution – 60% household coverage – was soon raised to 80% household coverage in the relevant guidelines. In 2007 the Global Fund to Fight AIDS, Tuberculosis and Malaria financed the scale-up of LLIN distribution in Southern Sudan, with the stated aim of reducing malaria incidence in the region by at least 50% by 2010.

Delivery mechanisms

In an attempt to ensure universal LLIN coverage – that is, to ensure that every sleeping space in every household is covered by an LLIN – guidelines were developed to streamline LLIN deployment and improve the uptake and utilization of the nets throughout Southern Sudan. Distribution of most (80%) of the nets followed a phased approach in which, in any single year, community-based mass distribution campaigns were run in just one to four states. The ultimate aim of the distributions was to provide at least one net for every 1.8 people – as recommended by the World Health Organization (WHO). The mass distribution campaigns followed a prescribed methodology and targeted 100% of the population in both rural and urban areas. They aimed to increase the level of supervision, accuracy and quality of the work conducted by community volunteers and to improve each beneficiary’s knowledge of LLIN use and maintenance. For each mass distribution, a coordinator, a supervisor to cover each subcounty or payam, a site manager, a community registrar and one or two community “communicators” were recruited to conduct and supervise all of the logistical, financial, training and communication activities. All of these personnel were given activity-based training that was tailored to the needs of the target communities. The implementation process involved bottom-up “micro-planning”, with community participation. This planning phase was followed by 5 days of household registration by community volunteers and 2 days of identifying suitable sites for the distribution of the LLINs. One net was given for every two people in each household. Supervision of the distributions was the responsibility of the supervisors, managers and implementing partners. After each mass distribution, a “hang it, use it” campaign was conducted to help householders hang the distributed nets before the distribution sites were cleaned and tidied.

The 20% of nets not distributed in the mass campaigns were given out during the provision of routine health services, particularly to children and pregnant women who were attending clinics associated with the Expanded Programme on Immunization or antenatal care. In one small area of South Sudan, a method for the “continuous” distribution of LLINs was piloted in an attempt to see if universal LLIN coverage could be maintained through a community-based replacement mechanism.

For each mass distribution, the target number of nets – that is, the number needed to satisfy the goal of at least one net in 80% of households – was estimated. The numbers of nets distributed were subsequently expressed as percentages of the corresponding target numbers – to give an “administrative coverage” for each distribution.

Challenges and obstacles encountered

Although LLIN distribution has been the main vector-control intervention in South Sudan, with enough nets distributed to reach – in theory – the current target of 80% household coverage, several challenges were encountered during the scale-up (Table 1) and the malaria burden remains high (Fig. 1). The intervention has not been nearly as effective as anticipated, probably because of suboptimal LLIN coverage, retention and utilization. Many members of targeted households were seen sleeping outdoors, without a bednet. Some used the distributed nets for fishing or fencing. Although the national guidelines for the LLIN distributions recommended that only net types that had been prequalified by the WHO be distributed, not all of the distributed nets met this criterion. “Leakage” of the distributed nets into local markets and their illegal sale were reported. Despite the supplementary, clinic-based distribution of LLINs, the LLIN utilization rates among pregnant women and children younger than 5 years remained disappointing. The insecticidal activity and physical durability of the nets may be compromised by the harsh environmental conditions that are common in South Sudan. Attempts to improve LLIN use – via information and education or behaviour-change communications – have been weak (see below). Effective LLIN distribution in South Sudan is made difficult by the population movements and overcrowding that result from natural disasters, armed conflicts and intercommunal violence.

Community sensitization and mobilization

The mass media and interpersonal communication channels have been used to disseminate behavioural-change and information and education communications. These communications have emphasized the main benefit of LLIN retention and use – that is, malaria prevention – as well as the need to use the nets every night, irrespective of the season, the correct way to hang and use the nets, and who should be given priority for sleeping under the nets. Unfortunately, such communications have been rarer and more sporadic than intended and largely confined to the days when mass distributions were occurring. Leakage...
Successful delivery of LLINs requires meticulous operational considerations and preparedness. Adequate planning – including detailed logistical assessments to obtain relevant local data – is crucial for both the quantification of needs and the distributions. This process should include stakeholders and community involvement.

Spatial scale, performance and policy change

By 2012, LLINs had been distributed in every state of South Sudan. In every state-wide mass distribution except two, the administrative coverage was 83.8 to 100%. The exceptions were the distribution in Western Equatoria in 2008 (32.3%) and that in Central Equatoria in 2010 (69.0%). The number of nets distributed each year gradually increased, from 45,000 in 2003 to 1,529,509 in 2012 (Fig. 1). By 2012, approximately 8 million LLINs had been distributed. The percentage of households having at least one LLIN reportedly increased from about 12% in 2006 to 53% in 2009. Other investigations indicated that this proportion increased from 34.2% in 2010 to 66.3% in 2012. Between 2006 and 2012, LLIN utilization rates increased from 5 to 42.7% among children younger than 5 years old and from 5 to 38.2% among pregnant women. Despite these apparent improvements in malaria prevention – and the downward trend seen in reported cases of malaria between 2003 and 2007 – the annual numbers of reported malaria cases gradually increased from 71,948 in 2008 to 1,198,357 in 2012 (Fig. 1). These disappointing observations – and the fact that the observed utilization rates fall well below the values that might be expected from the numbers of nets distributed – have led to the effectiveness of a phased distribution being questioned and a proposed policy change to the implementation of a single, nationwide distribution every 2 years.

Lessons learnt and discussion

The main lessons learnt are summarized in Box 1. While widespread access to insecticide-treated bednets has been advocated by the Roll Back Malaria Partnership, universal deployment of such nets still requires major financial, technical and operational inputs, particularly in post-conflict environments.

Table 1. Challenges encountered in scaling up net distribution and remedial measures implemented, Southern Sudan, 2003–2010, and South Sudan, 2011–2012

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Remedial measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance by the population to use the nets and misuse of the nets for fishing, fencing, etc.</td>
<td>Strengthened educational and behaviour-change communications frequently disseminated via print and mass media channels in addition to “malaria commemorative” days</td>
</tr>
<tr>
<td>Leakage of distributed LLINs into the market</td>
<td>Qualitative research to determine why leakage is occurring. Hampering leakage by removing nets from packaging and labelling them “not for sale”</td>
</tr>
<tr>
<td>Influx of untreated nets and other unrecognised types into the country</td>
<td>Only WHO-approved LLINs of at least 100 denier were procured centrally</td>
</tr>
<tr>
<td>Low ownership of LLINs by vulnerable groups</td>
<td>“Continuous” community-based distribution investigated</td>
</tr>
<tr>
<td>Weak monitoring and evaluation</td>
<td>A documentation system at national, state and county levels was established and regular supervisory visits to health facilities were supported</td>
</tr>
<tr>
<td>Lack of operational research to guide informed decision-making</td>
<td>Consumer preference studies on net shape, size, colour, coverage, retention, use and durability and on effective replacement mechanisms are planned. Vector bionomics and insecticide susceptibilities and epidemiological impact of LLIN distribution are to be arranged</td>
</tr>
<tr>
<td>Weak collaboration among the partners involved in planning, implementation, monitoring and evaluation, including limited capacity for supportive supervision at state and county level</td>
<td>Partnerships strengthened via a Malaria Technical Working Group, overall technical oversight of implementation at national level, coordination of the implementation at state and county levels and primary microplanning for a coordinated delivery of mass distributions at county level</td>
</tr>
<tr>
<td>Lack of defined roles and responsibilities for implementing partners</td>
<td>Roles for different partners were defined</td>
</tr>
<tr>
<td>Variation in size of eligible population because of movements of refugees, returnees and internally displaced persons</td>
<td>Size of the eligible population confirmed – before the distribution – during a logistical assessment in collaboration with IOM, UNHCR and other partners “on the ground”</td>
</tr>
<tr>
<td>Inaccessibility because of natural disasters and violence</td>
<td>Humanitarian organizations and international NGOs deployed in the affected areas</td>
</tr>
<tr>
<td>Conditions of households predispose the LLINs to heavy wear and tear</td>
<td>Increased health education and emphasis on the need to maintain the physical integrity of the nets</td>
</tr>
<tr>
<td>Inconsistencies in distribution campaigns</td>
<td>A nationwide mass campaign should be conducted every 2 years and supplemented by the routine distribution of LLINs via antenatal clinics and EPI</td>
</tr>
<tr>
<td>Inadequate information and education or behaviour-change communications and educational materials on LLINs</td>
<td>The choice of media, messages and target audiences to be based on the results of formative research</td>
</tr>
</tbody>
</table>

EPI, Expanded Programme on Immunization; IOM, International Organization for Migration; LLINs, long-lasting insecticide-treated nets; NGOs, nongovernmental organizations; UNHCR, Office of the United Nations High Commissioner for Refugees; WHO, World Health Organization.

* The partners in the public sector were to mobilize resources and partnerships, ensure equitable distributions and access, and monitor and regulate the quality of the distributions. Those in the private commercial sector were to create awareness and demand, update strategies and maintain transportation and storage. Civil society and NGOs were to encourage community involvement and participation and equitable distribution to people at risk and support the development and dissemination of educational communications and materials. Multilateral agencies and donors were to provide LLINs and other resources, build capacity and provide advocacy for the prioritization of the LLIN-based programmes.
community participation – in a bottom-up micro-planning approach – as critical elements. Community volunteers need to be trained well if they are to supervise logistical activities, communicate and conduct registration and distribution activities effectively. Immediately after the distribution, a campaign to support the hanging and correct use of the nets should be conducted.

It seems clear that in South Sudan the distribution of sufficient nets to exceed the set target – of at least one LLIN in 80% of households – has failed to halt a recent upward trend in malaria incidence. LLIN usage remains relatively low. All sectors of South Sudanese society need to be educated and mobilized to promote the retention and appropriate use of LLINs. Research is needed to identify the most effective media, messages and target audiences, and to determine the causes of net misuse and the net shapes, colours and sizes preferred by the end-users. Although the government of South Sudan had declared insecticide-treated nets to be exempt from import tariffs and taxes, it has not legislated to ensure that the LLINs being distributed are of adequate quality. The leakage or theft of LLINs for resale – although irritating to the distribution teams – may not be particularly detrimental to South Sudan’s malaria-control efforts, since the people who buy nets are probably more likely to use nets than those who receive nets free of charge.

Malaria monitoring, evaluation and surveillance are essential for establishing the effectiveness of interventions and for the early detection of – and prompt response to – malaria outbreaks and epidemics. In South Sudan, the reporting system for malaria is fully integrated into the country’s routine health management information system. The development and improvement of this system could in part explain the observed upsurge in the annual numbers of malaria cases reported between 2008 and 2012. The varying quality of the system for recording malaria cases in Southern Sudan and South Sudan since 2003 makes it difficult to assess the true impact of the distributed LLINs.

If universal LLIN coverage is to be achieved and sustained among at-risk populations, refugees and other displaced individuals have to be considered in our strategic planning. Effective methods for the supplementary distribution of LLINs – beyond the mass distributions – also need to be developed and deployed. These methods may include community-based “continuous” distributions, commercial distribution, channels to target orphans, the aged and the chronically ill, access to LLIN during routine visits to health facilities, and school-health-based and employer-based schemes for the distributions of LLINs. There is also a need to establish the true impact of LLINs on the principle entomological indicators associated with the transmission of malarial parasites.

In South Sudan, flooding, armed conflicts and intercommunal violence – which lead to population displacement and overcrowding – could be playing a major role in compromising the efficacy of the LLIN distributions. In 2012, for example, the states of Jonglei, Northern Bahr el Ghazal, Upper Nile and Warrap suffered both heavy flooding and active conflict. The poor quality of housing – particularly in rural areas and the camps for displaced populations – may also have reduced the effectiveness of the LLINs that were distributed. Improvement in housing has been shown to enhance the efficacy of LLINs and could be useful in post-conflict settings.

The observations made in Southern Sudan and South Sudan over the last decade demonstrate that a phased and fragmented scale-up of LLIN distribution may be both arduous and a poor approach to universal coverage, at least in a post-conflict setting. The scale-up of LLIN distributions in similar settings will need to be carefully considered and adapted to the local context.
Lessons from the field

Malaria vector control: lessons from South Sudan

Emmanuel Chanda et al.

Aim: To summarize the experience of South Sudan in scale-up of long-lasting insecticidal nets (LLINs) for malaria control.

Methods: In 2006, South Sudan launched a strategic plan to increase LLIN coverage to at least 60% of households by 2008, targeting 80% by 2011. The Global Fund provided funds for phased increases in LLIN distribution.

Results: By 2012, South Sudan had distributed approximately 8 million LLINs. The coverage of LLINs among households increased from 12% in 2006 to 53% in 2009. The percentage of children under 5 using LLINs increased from 5% to 25%, and among pregnant women from 5% to 36%. The number of recorded malaria cases increased from 71,948 in 2008 to 1,198,357 in 2012.

Lessons: A national strategy for phased LLIN scale-up may not have significant impact in conflict contexts. A centrally coordinated, evidence-based national campaign might be more effective. Creating a strong network of partners and effective channels for timely and complementary LLIN distribution may be crucial for universal coverage.

Acknowledgements

We thank the members of all of the communities where nets were distributed, the implementing partners and the state-level malaria-programme officers, for their cooperation and support. We also thank Robert Azairwe, Edward Bepo, Margaret Betty Eyobo and Othwonh Thabo for their invaluable contributions to the National Malaria Control Programme in South Sudan.

Funding: This research was funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria – via Population Service International.

Competing interests: None declared.

Résumé

Elargissement d'un programme de lutte contre les vecteurs du paludisme à l'aide de moustiquaires imprégnées d'insecticide longue durée: les leçons du Soudan du Sud

Problème: Les moustiquaires imprégnées d'insecticide longue durée (MILD) sont des outils importants dans la lutte contre le paludisme. Le Soudan du Sud, comme beaucoup d'autres pays endémiques, s'efforce d'améliorer la couverture et l'utilisation des MILD.

Approche: En 2006, le sud du Soudan - appelé Soudan du Sud après son indépendance en 2011 - a lancé un plan stratégique visant à augmenter la couverture des MILD, de sorte qu'au moins 60% des ménages disposent d'une moustiquaire au moins. En 2008, l'objectif
of coverage was 80% of households and the World Bank had financed an expansion plan ofLLIN distribution in the region.

Environment

Local setting. The population of the South Sudan is considered as exposed to malaria. A control measure to vectors and the formidable movements of returnees, of displaced and of refugees exacerbated the problem.

Significant changes. In 2012, 8 million of LLIN was distributed in South Sudan. Between 2006 and 2009, the percentage of households possessing a LLIN was passed of 12% to 53%, and the rate of utilisation of LLIN was passed of 5% to 25% among the households.

Objective. The objective was that 80% of households and the World Bank had financed the phased expansion of LLIN distribution in the region. In 2006, South Sudan, known as South Sudan, began to be recognized as independent. In 2009, the number of cases of malaria increased from 71,948 in 2008 to 1,198,357 in 2012.

Lessons learned

In post-conflict situations, a phased program, complemented by other measures of LLIN may be essential for universal coverage. A strong partnership and effective channels for timely deployment may offer greater benefits. A national campaign that is coordinated from the center and based on achievable principles, can deliver greater benefits.

Lessons from the field

Malaria vector control: lessons from South Sudan

Emmanuel Chanda et al.


Resumen

Ampliación de un programa de control de vectores de la malaria mediante mosquiteros tratados con insecticida de larga duración: lecciones de Sudán del Sur

Situación. Los mosquiteros insecticidas de larga duración (LLIN, por sus siglas en inglés) son herramientas importantes para el control de la malaria. Sudán del Sur, como muchos otros países endémicos, ha luchado por mejorar el uso y la cobertura de los LLIN.

Enfoque. En 2006, Sudán meridional, conocido como Sudán del Sur desde su independencia en 2005, inició un plan estratégico para aumentar la cobertura de los LLIN a fin de que el mínimo de 60% de los hogares dispusieran de al menos un LLIN. En 2008, la cobertura objetivo era un 80% de los hogares y el Fondo Mundial había financiado un plan de ampliación por fases de distribución de LLIN en la región.

Marco regional. Se considera que toda la población de Sudán del Sur está en riesgo de contraer la malaria. Además, el control deficiente de los vectores y los movimientos a gran escala de los repatriados, los desplazados internos y los refugiados han exacerbado el problema.

Lessons from the field
Malaria vector control: lessons from South Sudan
Emmanuel Chanda et al.

References


14. Lengeler C. Insecticide-treated bed nets and curtains for preventing malaria. Cochrane Database Syst Rev 2004;2:CD000363. PMID:15106149


