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Tuberculosis among nomads in Adamawa, Nigeria: outcomes from two years of active case finding

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SUMMARY

BACKGROUND: Nomadic populations are often isolated and have difficulty accessing health care, leading to increased morbidity and mortality. Although Nigeria has one of the highest tuberculosis (TB) burdens in Africa, case detection rates remain relatively low.

METHODS: Active case finding for TB among nomadic populations was implemented over a 2-year period in Adamawa State. A total of 378 community screening days were organised with local leaders; community volunteers provided treatment support. Xpert® MTB/RIF was available for nomads with negative smear results.

RESULTS: Through active case finding, 96 376 nomads were verbally screened, yielding 1310 bacteriologically positive patients. The number of patients submitting sputum for smear microscopy statewide increased by 112% compared with the 2 years before the intervention. New smear-positive notifications increased by 49.5%, while notifications of all forms of TB increased by 24.5% compared with expected notifications based on historical trends. Nomads accounted for respectively 31.4% and 26.0% of all smear-positive and all forms TB notifications. Pre-treatment loss to follow-up and treatment outcomes were similar among nomads and non-nomads.

DISCUSSION: Nomads in Nigeria have high TB rates, and active case-finding approaches may be useful in identifying and successfully treating them. Large-scale interventions in vulnerable populations can improve TB case detection.

KEY WORDS: active case finding; nomads; Nigeria; TB; Xpert® MTB/RIF; Adamawa

NOMADS ARE COMMUNITIES of people who constantly migrate in search of pasture for their livestock, subsisting on hunting and gathering or often driven by climatic conditions.[1] Such communities usually roam over hundreds of kilometres, and often pass through resting points where temporary tents are erected for the purpose of resting the herds and seeking medical attention for both people and animals.[1] Although population estimates of nomads and semi-nomads are difficult to calculate, their number in the developing world is estimated at 50–100 million, with approximately 60% found in Africa, including Nigeria.[2,3] In Nigeria, there are an estimated 9.4 million nomads migrating through 31 of its 36 states.[4] The Fulani tribe, which represents 6.6% of the overall population of Nigeria,[5] comprises a large proportion of its nomadic population.

Nigeria, which has one of the highest burdens of TB globally, is plagued by low TB case detection rates; only 16% of estimated incident TB cases are currently notified.[6] Adamawa State has an estimated population of 3.7 million, which includes approximately 450 000 nomadic pastoralists (12% of the population), and ranks among the eight states with the highest total TB notifications, despite being only the twenty-seventh most populous state in 2010.[7]

Nomads often have poor access to health care, including TB services and immunisation.[1,8] The TB burden among nomadic pastoralists is exacerbated by low vaccination coverage (including bacille Calmette-Guérin vaccine), high rates of bovine TB, frequent consumption of unpasteurised milk, high levels of malnutrition and living in poorly ventilated and overcrowded dwellings/tents.[1,9–12] Compounding the TB burden is the tendency of nomadic populations to consult traditional healers, presenting at health facilities only after long delays.[2,13] Despite these findings, there have been some efforts to improve TB services among nomadic communities in Nigeria. Such services have focused on passive case detection, whereby symptomatic individuals access health facilities on their own initiative. The lifestyle of highly mobile populations can complicate the provision of routine, 'passive' TB care, as many people

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with TB are missed and a community-based approach may help.[14,15]

Given the paucity of information on the TB burden among the nomadic people of Nigeria and the suboptimal case detection rates in the country, we implemented and evaluated an intervention of programmatic active case finding (ACF) and strengthened treatment support among nomads in Adamawa State. Our aims were to describe TB epidemiology among both nomadic and non-nomadic populations in Adamawa State, and to evaluate the outcomes of targeted ACF among nomads on state-wide TB case notifications.

METHODS

From January 2012 to December 2013, we implemented an ACF intervention consisting primarily of a series of community screening camps targeting the state's nomadic population; identified TB patients were notified to the National TB and Leprosy Control Programme (NTLCP). To improve awareness about TB-related symptoms and the availability of free diagnosis, a series of messages was disseminated through local radio and television stations in several languages. Training on TB detection and treatment support was provided to both facility-based health care workers and community volunteers from nomadic communities. Using maps developed for livestock management in Adamawa State as a guide, nomadic communities, settlements and cattle routes were charted and health facilities were identified, including existing DOTS and microscopy centres proximal to migration routes. The dates and locations of screening days, usually community market days, were agreed upon after consultation with nomadic community leaders. Screening days began with a health education session on TB, followed by systematic verbal screening of all individuals in attendance, to identify people with presumed TB.

All individuals self-reporting a cough for $\geqslant 2$ weeks were eligible to submit sputum for smear microscopy. Three sputum specimens were collected and transported by community volunteers to the nearest of 44 accredited microscopy laboratories in the state. As part of sustained ACF activities following the screening days, community volunteers continued to identify people with TB symptoms and refer them to microscopy laboratories for testing. Microscopy results were returned to the communities by the local TB supervisors.

Anyone with at least two smear-positive results was eligible for treatment initiation at one of the 142 DOTS (treatment) facilities throughout the state. Individuals with at least two smear-negative results were asked to provide an additional early-morning sputum specimen for testing with the Xpert® MTB/RIF assay (Cepheid, Sunnyvale, CA, USA). Counselling and testing (HCT) for human immunodeficiency virus (HIV) infection was offered to all diagnosed TB patients upon initiation of anti-tuberculosis treatment. People diagnosed with TB were registered at health facilities and received treatment support and monitoring from community volunteers and local leaders.

Data analysis

Nomadic TB patients were disaggregated from state case notification data during quarterly NTLCP cohort review meetings using their unique names and the location of their communities/settlements. All TB patients diagnosed and notified among nomads during the intervention period were included in this analysis. Information on age, sex, laboratory results, TB classification, TB-HIV co-infection and treatment outcome was extracted using definitions standardised by the World Health Organization (WHO) and the International Union Against Tuberculosis and Lung Disease. Case notification data were also retrospectively collected from 2004 to 2011, while laboratory testing data were collected from 2010 onwards. We were unable to disaggregate retrospective data into nomad and non-nomad categories. Patients with positive Xpert test results were notified as smear-negative cases according to NTLCP policy at the time, as the WHO 2013 reporting guidelines had not been incorporated.[16]

We tested associations for significance between nomads and non-nomads and pre- and post-intervention using Pearson's χ^2 two-tailed test. The number of expected TB cases in Adamawa State during the intervention was estimated using simple linear regression to fit a trend line through the historical notifications and compared to observed notifications. All data were abstracted from the registers in a de-identified manner and analysed using Stata version 13 (StataCorp, College Station, TX, USA).

Approval to conduct the intervention was obtained from the Adamawa State Ministry of Health (Yola, Nigeria), which waived the need for informed consent.

RESULTS

During the intervention period, 680 community volunteers, 435 health workers, 85 laboratory staff and 21 TB supervisors received training on TB screening, diagnosis and treatment in the intervention area. Promotional radio ($n = 815$) and television ($n = 217$) spots in various local languages were aired and 14 radio and television programmes and documentaries were broadcast on local channels to increase awareness about TB symptoms and diagnosis.

A total of 378 nomadic communities and settlements were visited once throughout the implementation of this intervention. During the screening days,

Table 1 Results from active case finding to detect TB among nomadic communities in Adamawa State, 2012 and 2013

	2012 *n* (%)	2013 *n* (%)	Both years *n* (%)
Community screening days	170	208	378
People verbally screened	20 907	75 469	96 376
People tested with smear microscopy	4 433 (21.2)	5 457 (7.2)	9 890 (10.3)
Smear+ patients detected	646 (14.6)	504 (9.2)	1 150 (11.6)
Xpert® MTB/RIF tests performed	654	1 031	1 685
MTB+, RMP-susceptible patients detected*	45 (6.9)	115 (11.2)	160 (9.5)
MTB+, RMP-resistant patients detected*	10 (1.5)	19 (1.8)	29 (1.7)
Bacteriologically positive patients notified†	653	601	1 254
All forms TB patients notified	884	893	1 777
MTB+, RMP-resistant patients notified*	9	18	27

* MTB+ and/or RIF+ = positive Xpert® MTB/RIF test result.
† Bacteriologically positive (smear or Xpert).
TB = tuberculosis; MTB = *Mycobacterium tuberculosis*; RIF/RMP = rifampicin.

96 376 nomadic pastoralists were screened verbally, averaging 255 individuals per screening day (Table 1), with large differences between the first and second year. Sputum from 9890 (10.3%) of those screened was collected and examined, resulting in the detection of 1150 (11.6%) smear-positive TB cases. Of 8740 nomads with two or more smear-negative microscopy results, 1685 (19.3%) were tested using Xpert, yielding an additional 160 *Mycobacterium tuberculosis* positive, rifampicin (RMP) susceptible or indeterminate patients and 29 *M. tuberculosis*-positive, RMP-resistant patients. Of the 1310 nomads with bacteriologically positive results with no RMP resistance, 1254 (95.7%) were initiated on first-line treatment, while 27 of the 29 RMP-resistant patients were started on second-line treatment. Nomads were less likely than non-nomads to accept HIV testing (65.7% vs. 76.6%, $P < 0.001$) and, among those tested, were less likely to be HIV-positive (13.0% vs. 19.4%, $P < 0.001$). Women had higher rates of TB-HIV co-infection than men (22.8% vs. 15.3%, $P < 0.001$) (Table 2).

During the 2 years before the intervention, sputum samples from 12 690 individuals were tested by the network of state laboratories, with 20.7% of those tested being diagnosed with smear-positive TB. The number of people tested during the intervention period increased dramatically to 26 917, representing an increase of 112%, while the positivity rate decreased from 20.7% to 14.0%. Pre-treatment loss to follow-up, i.e., the number of smear-positive individuals who did not start treatment, was similar in the 2-year pre-intervention period to that during the intervention (7.4% vs. 7.8%, $P = 0.089$) (Table 3).

In the 8 years preceding the intervention (2004–2011), an average of 1189 smear-positive TB cases and 2828 cases of all forms of TB were notified annually in Adamawa State (Figure). For the 2-year pre-intervention period, a total of 2436 smear-positive and 5544 cases of all forms of TB were notified. Based on historical trends, there should have been 2327 (95% confidence interval [CI] 2095–2558) smear-positive and 5505 (95%CI 5219–5791) all forms of TB cases in the state during the intervention. ACF activities resulted in the notification of 3479 smear-positive and 6842 all forms of TB cases, an increase of 49.5% for smear-positive notifications and 24.3% all forms of TB over the expected number of notifications. Nomads comprised 34.6% of all

Table 2 TB-HIV counselling, testing and co-infection among nomads and non-nomads in Adamawa State, 2012–2013

	Nomads *n* (%)	Non-nomads *n* (%)	Total *n* (%)	*P* value (sex)
Counselled, *n*				
Male	765	3086	3851	
Female	524	1889	2413	
Total	1289	4975	6264	
Tested				
Male	504 (65.9)	2323 (75.3)	2827 (73.4)	0.029
Female	343 (65.5)	1488 (78.8)	1831 (75.9)	
Total	847 (65.7)	3811 (76.6)	4658 (74.4)	
P value (nomad/non-nomad)	<0.001			
HIV-positive				
Male	58 (11.5)	374 (16.1)	432 (15.3)	<0.001
Female	52 (15.2)	365 (24.5)	417 (22.8)	
Total	110 (13.0)	739 (19.4)	849 (18.2)	
P value (nomad/non-nomad)	<0.001			

TB = tuberculosis; HIV = human immunodeficiency virus.

Table 3 Microscopy results from the pre-intervention (2010–2011) and intervention (2012–2013) periods, Adamawa State

	2010 *n*	2011 *n*	2012 *n*	2013 *n*	*P* value
Total tested	6 704	5 986	12 281	14 636	
Nomads tested	—	—	4 433	5 457	
Sputum smear-positive results	1 402	1 229	1 977	1 798	
Smear positivity rate, %	20.9	20.5	16.1	12.3	
2-year smear positivity rate	20.7		14.0		<0.001
Sputum smear-positive cases notified	1 314	1 122	1 812	1 667	
Pre-treatment loss to follow-up, %	6.3	8.7	8.3	7.3	
2-year pre-treatment loss to follow-up	7.4		7.8		0.089

bacteriologically positive and 26.0% of all forms of TB notifications in the State during the intervention. A slightly lower male:female ratio of TB cases was notified among nomads (1.4:1) and non-nomads (1.5:1) (data not shown).

Treatment success rates among new smear-positive cases were high (89.3%), and similar in both nomads (90.5%) and non-nomads (88.7%), although cure rates were higher among non-nomads (88.5%) than nomads (84.5%). There were no statistically significant differences in treatment outcomes between the intervention and 2-year pre-intervention periods (Table 4).

DISCUSSION

This evaluation addresses the dearth of published literature on the TB burden in nomadic populations in Africa.[17] While other studies have documented high rates of undetected TB through ACF efforts in Africa,[18,19] the scale of this intervention is much greater and is linked to a substantial increase in TB notifications at the state level. Our findings suggest that targeted outreach efforts can identify large numbers of people with undetected TB among high-risk nomadic groups, which can be used to close the case detection gap.

Modelling suggests that focusing efforts on stopping TB transmission in 'hot spots' may have a considerable impact on incidence.[20] We found that more people needed to be screened and tested to find a case during the second year of the intervention, as the numbers of people screened rose with greater acceptance of intervention activities by staff and the nomads. A reduction in the number of smear-positive/bacteriologically positive cases, as well as increases in the proportion of smear-negative and extra-pulmonary TB cases, were recorded in the second year; ACF may produce temporary increases in notifications as prevalent cases are detected, treated and reported. Nevertheless, many more cases were still being notified in the second year of the intervention than the number estimated on the basis of historical trends. Based on the recent prevalence survey, the WHO has revised the prevalence estimate to 326 per 100 000 population in Nigeria; the North East region of the country was found to have higher rates than the national average.[6,21] Sustained ACF interventions and long-term monitoring of resultant trends is required to document impact.

Concerns have been raised about the possible negative effects that ACF interventions may have on treatment outcomes.[22] Our results demonstrate that high rates of treatment success can be maintained despite increased caseloads and mobile populations. The results also support the findings of a systematic review that found no differences in treatment outcomes between actively and passively found cases.[23]

A recent randomised controlled trial in Southern Africa and a programmatic evaluation in Nepal have shown that the use of the Xpert assay will improve the proportion of bacteriologically positive cases placed on treatment, but may not impact the overall numbers of people treated for TB.[24,25] Our efforts at the community level, combined with new technologies, identified a large number of previously undetected TB cases among nomads measured at the state level for all forms of TB. This supports other findings that have demonstrated that large increases in case detection are possible when efforts are made to reach those with limited access.[26–28]

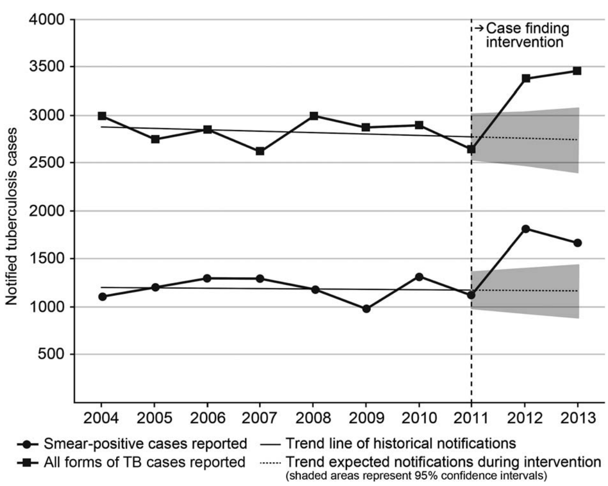

Figure Historical and intervention tuberculosis case notifications in Adamawa State 2004–2013.

Table 4 Anti-tuberculosis treatment outcomes: new smear-positive cases in Adamawa State, 2009–2012

Year	New smear-positive notified *n*	Cured *n* (%)	Treatment complete *n* (%)	Treatment success *n* (%)	Died *n* (%)	Treatment failure *n* (%)	Loss to follow-up *n* (%)	Transfer out *n* (%)
2009	984	835 (84.9)	72 (7.3)	907 (92.2)	46 (4.7)	6 (0.6)	16 (1.6)	9 (0.9)
2010	1314	1017 (77.4)	179 (13.6)	1196 (91.0)	64 (4.9)	14 (1.1)	19 (1.4)	21 (1.6)
2011	1122	922 (82.2)	66 (5.9)	988 (88.1)	95 (8.5)	6 (0.5)	19 (1.7)	14 (1.2)
2012	1812	1579 (87)	36 (2.2)	1615 (89.3)	121 (6.7)	11 (0.6)	36 (2.0)	29 (1.6)
Nomads	608	514 (84.5)	34 (5.6)	548 (90.1)	27 (4.4)	7 (1.2)	19 (3.1)	7 (1.2)
Non-nomads	1204	1065 (88.5)	2 (0.2)	1067 (88.7)	94 (7.8)	4 (0.3)	17 (1.4)	22 (1.8)

We encountered difficulties in testing individuals eligible for Xpert; only one in five people with smear-negative results received the test. This was due to a number of factors, including difficult terrain, security threats and the need for repeated visits to carry out sputum collection, which could be mitigated by direct Xpert testing. The use of Xpert among smear-negative patients demonstrated the usefulness of more sensitive testing, as the yield of a single follow-on Xpert test was almost identical to the yield of the three initial smear microscopy investigations. We were unable to assess loss to follow-up associated with the need to submit three sputum specimens. However, given the high additional yield of a one-off Xpert test and the speed with which results are returned (compared to a series of smears), this assay can be a useful tool for rapidly linking patients to appropriate treatment in highly mobile populations using ACF. Xpert testing helped identify a number of smear-negative patients infected with RMP-resistant strains. To date, Nigeria has mainly limited Xpert testing to retreatment cases, and has detected a relatively small number of drug-resistant cases.[28] However, there is great potential for case finding for drug-resistant TB if Xpert testing is used for new cases.[29]

Our evaluation has a number of limitations, including the fact that it was not a controlled research study. Furthermore, more smear-negative cases were registered during the intervention despite a focus on increased smear testing, likely due to better awareness among health facility staff and the increase in individuals identified with symptoms. While we strongly believe that the large number of TB cases detected through ACF among nomads and initiated on treatment is the cause of the steep rise in notifications in Adamawa State, we are unable to develop a causal relationship. However, we used a mix of project and routinely collected NTLCP data to measure the impact of the intervention under routine conditions; this can help guide local policy decisions,[30] and resulted in nomadic populations being prioritised as a key affected population in Nigeria's national strategic plan, which focuses on improving case detection. As the primary diagnostic tool, we used smear microscopy to detect TB. Previous studies and prevalence surveys have shown that large proportions of smear-positive TB may be culture-negative in ACF interventions,[21,31] likely due to the specificity of the test in low-prevalence settings. However, even when doubling the number of patients tested, the yield from microscopy was still high and comparable to that from routine practice in other settings.[32,33] This is in line with general expectations of yield from microscopy in passive case detection,[34] suggesting that many more TB cases may be found through further improvements in case detection, although Xpert may be useful for one-off testing with higher sensitivity and specificity.

CONCLUSIONS

With new and ambitious global TB strategies being introduced,[35] work must focus on groups that have been missed by routine TB care services. In many settings, those most difficult to reach are precisely the groups that TB programmes have failed to help, demonstrating that greater efforts and resources will be required to fulfil the goal of TB elimination. A case in point, traditionally neglected nomadic communities in Nigeria, with a large burden of undiagnosed TB, should be given strong consideration when tailoring approaches for improved TB care, as doing so can significantly improve the numbers of people treated for the disease.

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Conflicts of interest: JC and AJC are members of the TB REACH Secretariat, but were not involved in the grant proposal or the decision to fund the project. All other authors declare no conflicts of interest.

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RESUME

CONTEXTE : Les populations nomades sont souvent isolées et ont du mal à accéder aux soins de santé, ce qui entraine une augmentation de la morbidité et de la mortalité. Le Nigéria a l'un des taux les plus élevés de tuberculose (TB) en Afrique, mais le taux de détection des cas reste assez faible.

MÉTHODES : La recherche active de cas de TB dans les populations nomades a été mise en œuvre sur une période de 2 ans dans l'état d'Adamawa. Un total de 378 jours de dépistage communautaire a été organisé avec les leaders locaux ; les volontaires communautaires ont offert leur soutien au traitement. Le Xpert® MTB/RIF a été disponible pour les nomades dont les résultats de frottis étaient négatifs.

RÉSULTATS : Une recherche active de cas auprès de 96 376 nomades par interrogatoire a abouti à 1310 patients confirmés par bactériologie. Dans l'ensemble de l'état, le nombre de patients soumettant des crachats pour un examen microscopique de frottis a augmenté de 112% par comparaison aux 2 années précédant l'intervention. Les nouvelles notifications de frottis positifs ont augmenté de 49,5% tandis que les notifications de toutes les formes de TB ont augmenté de 24,5% par rapport aux notifications attendues en fonction des tendances historiques. Les nomades représentaient 31,4% et 26,0% de toutes les notifications de frottis positifs et de toutes les formes de TB, respectivement. La proportion de perdus de vue avant le traitement et les résultats du traitement ont été similaires chez les nomades et les populations sédentaires.

CONCLUSION : Les nomades du Nigeria ont un taux élevé de TB et des approches de recherche active de cas seraient utiles pour les identifier et les traiter avec succès. Des interventions à grande échelle au sein de populations vulnérables peuvent améliorer le dépistage des cas.

RESUMEN

MARCO DE REFERENCIA: Las poblaciones nómadas suelen estar aisladas y su acceso a la atención sanitaria es difícil, lo cual tiene como resultado una mayor morbilidad y mortalidad. En Nigeria se observa una de las cargas de morbilidad por tuberculosis (TB) más altas de África y sin embargo, las tasas de detección siguen siendo muy bajas.

METODOS: En el estado de Adamawa, se introdujo una estrategia de búsqueda activa de casos de TB en las poblaciones nómadas durante un período de 2 años. Se coordinaron con los líderes locales 378 días de detección comunitaria y voluntarios de la comunidad aportaron el respaldo al tratamiento. Se contaba con la prueba Xpert® MTB/RIF para las personas nómadas con resultados negativos de la baciloscopia.

RESULTADOS: Mediante la estrategia de búsqueda activa de casos se examinaron verbalmente 96 376 personas y se detectaron 1310 pacientes con resultados bacteriológicos positivos. A escala del estado, el número de pacientes que aportó muestras de esputo para baciloscopia aumentó un 112%, en comparación con los 2 años anteriores a la intervención. La notificación de casos nuevos con baciloscopia positiva aumentó un 49,5% y la notificación de todas las formas de TB aumentó un 24,5%, en comparación con las notificaciones previstas con base en las tendencias históricas. A la población nómada correspondió la notificación de 31,4% de los casos de TB con baciloscopia positiva y el 26,0% de todas las formas de TB. Las pérdidas durante el seguimiento antes del tratamiento y los desenlaces terapéuticos fueron equivalentes en las poblaciones nómadas y sedentarias.

CONCLUSIÓN: La población nómada en Nigeria presenta altas tasas de TB y las estrategias de búsqueda activa de casos de TB pueden ser eficaces en la detección y el tratamiento de los pacientes. Las intervenciones de amplia escala en las poblaciones vulnerables pueden mejorar la detección de los casos de TB.