

## Cardiovascular Topics

# Positive impact of training rural health workers in identification and prevention of acute rheumatic fever in eastern Uganda

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### Abstract

**Background:** Diagnosis of acute rheumatic fever (ARF) is mainly clinical. Delayed or missed diagnosis and failure to administer appropriate and timely treatment of ARF leads to rheumatic heart disease (RHD), which could necessitate expensive treatments such as open-heart surgery. Implementation of preventative guidelines depends on availability of trained healthcare workers. As part of the routine support supervision, the Uganda Heart Institute sent out a team to rural eastern Uganda to evaluate health workers' knowledge level regarding management of ARF.

**Methods:** Health workers from selected health facilities in Tororo district, eastern Uganda, were assessed for their knowledge on the clinical features and role of benzathine penicillin G (BPG) in the treatment and prevention of ARF recurrence. Using the RHD Action Needs assessment tool, we generated and administered a pre-test, then conducted training and re-administered a post-test. Eight months later, health workers were again assessed for knowledge retention and change in practices. Statistical analysis was done using Stata version 15.

**Results:** During the initial phase, 34 of the 109 (31%) health workers passed the pre-test, indicating familiarity with clinical features of ARF. The level of knowledge of BPG use in ARF was very poor in all the health units [25/109 (22.6%)] but improved after training to 80%, as shown by the chi-squared test ( $\chi^2 = 0.000$ ). However, retention of this knowledge waned after eight months and was not significantly different compared to pre-training ( $\chi^2 \geq 0.2$ ).

**Conclusion:** A critical knowledge gap is evident among health workers, both in awareness and treatment of ARF, and calls for repetitive training as a priority strategy in prevention.

**Keywords:** acute rheumatic fever/RHD, prevention, health-worker training, Uganda

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Rheumatic heart disease (RHD) is the most serious complication of acute rheumatic fever (ARF). Although preventable, RHD is still a significant public health problem in limited-resource settings, with the majority of patients presenting with complications at first diagnosis.<sup>1,2</sup>

The unabated progression of RHD results from recurrences of ARF, triggered by frequent attacks of group A streptococcal pharyngitis.<sup>3</sup> Those diagnosed with advanced valvar heart disease present with overt symptoms and the mortality rate is high at 17.8% in the first year of detection.<sup>1</sup> Diagnosis of ARF remains clinical, based on the modified Jones criteria,<sup>4</sup> and relies on the health worker having a high index of suspicion.<sup>5</sup>

Frontline healthcare providers need to have the knowledge and skills required to recognise and treat ARF,<sup>6,7</sup> which includes prompt administration of benzathine penicillin G (BPG). Early recognition of ARF is essential in preventing progression of ARF to RHD.

Our group has previously performed school screening for latent RHD in various regions of northern and western Uganda, to improve early detection of RHD.<sup>8</sup> However, eastern Uganda has not had any of these programmes and it is unknown whether healthcare providers in this region have adequate knowledge on prevention, diagnosis and treatment of RHD. Training health

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workers in high-risk settings to detect ARF/RHD is a key strategy in preventing ARF.<sup>9</sup>

As a pilot study, we conducted an assessment on the knowledge level of ARF/RHD prevention among healthcare providers in Tororo district, eastern Uganda. This report will provide a scalable approach for training healthcare workers and effectively improving ARF detection in regional centres in Uganda.

## Methods

The Uganda Heart Institute is a lone cardiovascular centre serving a population of 45 million.<sup>10</sup> With a limited number of cardiovascular specialists, training of healthcare workers in the rural areas is critical in the prevention of ARF and RHD.

In 2008, we conducted an assessment of healthcare workers' knowledge of ARF clinical features and the use of BPG in the treatment of ARF/RHD in the Tororo district, eastern Uganda. This district was chosen because many children from the region presented to our centre with advanced RHD, and there was strong political support from the district leaders.

Tororo district is located 200 km from Uganda's capital, Kampala. It covers an area of 1 192 km<sup>2</sup> and has a population of 597 500. More than 80% of the population reside in the rural area.<sup>11,12</sup> Health services are decentralised within the district and are headed by a district health officer.

The district has one general hospital (Tororo Hospital) that provides the highest level of healthcare, and three health centre IVs (Nagongera, Mukuju and Mulanda), 12 health centre IIIs and 33 health centre IIs.<sup>13</sup> All the participating health units are owned by the government of Uganda under the supervision of the Ministry of Health.

The district's healthcare work force consists of six medical doctors, 27 medical clinical officers, 30 nursing officers, 22 laboratory technicians, one technologist and support staff (nursing aides, volunteers) at both Tororo Hospital and health centre IVs.<sup>11</sup> Only 54.9% of the required health posts in the Tororo district public sector are filled and the district has no specialists.<sup>11</sup> All healthcare workers at the Tororo Hospital and the three health centre IVs were offered assessment and training as they are most likely to manage patients with ARF and RHD.

Healthcare-provider training was conducted in two phases. Phase 1 (May 2018) included a pre-test, followed by intensive training and administration of a post-training test at the end of the lectures. The intensive training involved lectures by a paediatric cardiologist (JN) and a paediatric cardiology fellow (EN) at each respective facility.

Phase 2 of the training was held eight months later (January 2019) at the same health facilities, with the aim of assessing for knowledge retention. The same pre-test was given, followed by refresher lectures. We did not administer a post-test. Healthcare providers who had not participated in phase 1 training were permitted to attend the second training session.

Questions were adapted from the RHD Action Needs assessment tool.<sup>9</sup> The test included 10 multiple-choice questions with topics ranging from the causative organism for ARF, the age most affected, ARF clinical features, and treatment and prevention of RHD. Diagnostic clinical features included fever, joint pains, joint swelling (mono/polyarthrititis) or abnormal movements based on the 2015 modified Jones' criteria.<sup>4</sup> However, our major focus was on assessing knowledge of clinical features

of ARF, and the role of BPG in the treatment and prevention of ARF recurrence.

To substantiate findings from the pre-training knowledge assessment, medical records were reviewed at the general hospital to assess whether health workers had made a diagnosis of ARF or RHD within the two years prior to the training. The general hospital pharmacy was inspected for the availability of BPG. A radio talk show was also held to raise community awareness of the disease and more specifically, to reach out to healthcare providers who had not received training.

The study was conducted within the auspices of the Uganda national rheumatic heart disease registry by the institutional research and ethics committee of Makerere University School of Medicine, reference number: 2013-072, and the Uganda National Council for Science and Technology. Additional administrative clearance and consent were obtained from the Tororo district local government leadership. The training was conducted as routine support supervision by the Uganda Heart Institute as mandated through the Ministry of Health.

## Statistical analysis

The data were entered into an excel sheet (Microsoft Excel 2010) and then analysed using Stata Statistical Software: Release 15 (College Station, TX: Stata Corp LLC). Descriptive statistics are presented using simple percentages. We then compared participants' knowledge of clinical features of ARF and treatment of ARF immediately pre and post training using the chi-squared test. We also compared the pre-test results at initial training with knowledge at six months using the chi-squared test.

## Results

A total of 109 healthcare providers participated in the pre-test phase 1 training. Of these, 34/109 (31%) were familiar with the clinical features of ARF, whereas 25/109 (23%) had knowledge of the role of BPG. Most of the participants were nurses [51 (47%)], six (5.5%) were doctors, 19 (17%) were clinical officers, and other health cadres. One hundred and twelve participated in the post-test, and of those, 85 (75.8%) passed the post-test in relation to clinical features of ARF (Table 1).

There was a significant improvement in the knowledge of clinical features of ARF in phase 1 across all four health centres where training was conducted, as shown by the chi-squared test in Table 1. Level of awareness was lowest among healthcare providers in the most remote health facility (Mulanda health center IV) (Table 1).

The level of knowledge of BPG use in ARF was very poor in all health units [25/109 (23%)] but improved after training, with

**Table 1. Assessment of knowledge of the clinical features of ARF in phase 1**

Health unit	Number passed pre-test (total)	Number passed post-test (total)	$\chi^2$ test
Nagongera	7 (20)	16 (20)	0.004
Mulanda	5 (23)	13 (21)	0.070
Mukuju	8 (26)	30 (36)	0.000
Tororo	14 (40)		0.0007
Total	34 (109)	85 (112)	

Table 2. Assessment of knowledge of BPG use in ARF in phase 1

Health unit	Number passed pre-test (total)	Number passed post-test (total)	$\chi^2$ test
Nagongera	4 (20)	19 (20)	0.000
Mulanda	4 (23)	18 (21)	0.000
Mukuju	6 (26)	22 (36)	0.000
Tororo	11 (40)	31 (35)	0.000
Total	25 (109)	90 (112)	

90/112 (80%) passing the post-test, as shown by the chi-squared test ( $\chi^2 = 0.000$ ) in Table 2.

One hundred and fifteen healthcare providers were pre-tested during the second phase and only 34/115 (30%) had knowledge of ARF clinical features prior to training. The level of knowledge was not significantly different compared to pre-training ( $\chi^2 \geq 0.2$ ). Twenty-six of the 115 health workers (22.6%) had knowledge of the use of BPG in the treatment of ARF (Table 3). There was no difference in knowledge about BPG use at baseline and at eight months, as shown in Table 3.

## Discussion

Early diagnosis of disease depends on the knowledge base of the first/primary contact health-worker and referral to the specialist. Healthcare worker training helps raise community awareness of the symptoms and treatment of ARF and RHD. The primary healthcare worker plays a pivotal role in ensuring medication administration is safe and timely. Limited studies in sub-Saharan Africa have evaluated health-worker practices regarding RHD prevention, such as raising awareness of effective prevention of ARF.

As a pilot study, an assessment was conducted on the knowledge level of ARF/RHD prevention among healthcare providers in the Tororo district, eastern Uganda. Only 31% of the rural health workers in our study had knowledge of the diagnosis of ARF prior to the initial training, and 75% passed the post-test, which was statistically significant, implying they had learned the clinical features of ARF. Our findings are comparable with a study conducted at the University Teaching Hospital in the heart of Zambia.<sup>14</sup> Participants primarily comprised nurses (65%), and at baseline, only 15% had knowledge of RHD.<sup>14</sup> This group, contrary to our study, conducted bi-monthly training during the follow-up period.

Diagnosis of ARF appears to be an overall challenge across the healthcare sector. In Khartoum, northern Sudan, Osman and colleagues evaluated physicians' knowledge on the prevention of ARF. Fifty-five per cent of these doctors were familiar with the treatment of ARF recurrence prior to training, and 60% after the training.<sup>15</sup> In Cameroon, 87% of medical students had a knowledge of BPG use in preventing ARF.<sup>16</sup>

In our study during the baseline evaluation, 31% of the participating health workers had familiarity with the clinical features of ARF, whereas only 23% had knowledge of the role of BPG in the treatment and prevention. There was no difference in knowledge across the health units. In the pre-test, a great number of health workers confused BPG for benzyl penicillin.

Interestingly, following the initial training, there was marked improvement in knowledge pertaining to the clinical features of ARF and the use of BPG. However, the attained information waned over the eight-month period as we did not offer refresher

Table 3. Level of knowledge of ARF clinical features from pre training to eight months post training

Health unit	Number passed phase 1 (total)	Number passed at 8 months (total)	$\chi^2$ test
Nagongera	7 (20)	6 (31)	0.21
Mulanda	5 (23)	7 (22)	0.45
Mukuju	8 (26)	8 (26)	1.00
Tororo	14 (40)	13 (36)	0.94
Total	109	115	

courses during that time. This was statistically significant.

There was a trend towards a decrease in knowledge retention steadily as one moved away from the general district hospital in Tororo town to the peripheral health centres in the rural areas. Additionally, training at eight months demonstrated minimal increment in the knowledge base. The health workers seemed familiar with prevention of ARF recurrence, but not with the clinical features of ARF. This emphasises the need for ongoing support supervision at the district hospital and health centres, coupled with regular training, as was done in the Zambian study, where bi-monthly health-worker training sessions were conducted. This in the long run, improved retention of information.<sup>14</sup> The knowledge of ARF clinical features is critical in early diagnosis, treatment and prevention of irreversible RHD.<sup>17</sup>

Primordial and primary prevention of ARF involves modifying the housing environment, reducing poverty levels for high-risk communities and eradicating group A streptococcal infection and carriage with the use of antibiotics to treat streptococcal throat infections.<sup>5</sup> On the other hand, secondary prophylaxis involves preventing recurrence and disease progression for individuals who have suffered from ARF. In this case, intramuscular BPG prophylaxis is paramount in preventing recurrence of ARF.

In our study, we were not able to directly correlate the health-worker knowledge base with the prevalence of RHD in the Tororo district. Our findings indicated that eight months after initial training, the health workers still had challenges in identifying the clinical features, never mind the use of BPG in the treatment of ARF. This would directly impact negatively on early diagnosis of ARF/RHD.

Even though we noted a low knowledge level on the clinical features and BPG use in ARF and RHD, the challenging health referral system in Uganda, together with widespread poverty, hinder patient access to early diagnosis and treatment of ARF.<sup>18</sup> Late patient referrals with advanced RHD depict a multi-stage knowledge gap in ARF diagnosis. Of the participants in this study, approximately half were nurses and only 5.5% were medical doctors, serving 600 000 people in the Tororo district.<sup>13</sup>

Learning from the human immunodeficiency virus (HIV) model, raising awareness is a major preventative strategy that worked effectively for Uganda at the peak of the HIV epidemic.<sup>19</sup> During the early years of the HIV epidemic, care was initially confined to the city and a few regional referral hospitals.<sup>20</sup> However, with intense campaigns and educative programmes, anti-retroviral therapy can now be prescribed by health workers at lower health centres. Given the limited number of cardiac specialists in Uganda,<sup>21</sup> if we extrapolate the HIV preventative model, the lowest qualified nurse would be comfortable making the diagnosis of ARF and RHD, prescribe basic treatment such

as BPG and make appropriate referrals to a centre where a detailed cardiac evaluation can be done.

The strength of our model or approach is the fact that health workers were trained at their respective health centres, which reduced their distraction from work. Secondly, the support team (JN, EN) was able to review patients with the health workers and demonstrate ARF clinical signs, emphasising the importance of early diagnosis by having a high index of suspicion.

Our strongest support was the active involvement of both the legislative and administrative arms of the Tororo district local government. With political involvement in health-related campaigns, the local community and religious leaders tend to engage in health preventative projects, which impacts positively on attitudes for new strategies.<sup>22</sup>

Our weakness was the absence of more frequent refresher courses with health workers, which was well demonstrated in HIV-based studies as the key in sustaining new programmes.<sup>23</sup>

## Conclusion

From this study, we observed sub-optimal knowledge of ARF diagnosis and the use of BPG among health workers in rural eastern Uganda. Political support from the district enabled access to and acceptability of the training programme at different levels, and improved health-worker knowledge on RHD and BPG use. This report will provide a scalable approach for training healthcare workers and effectively improve ARF detection in regional centres in Uganda.

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