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## HIV management by nurse prescribers compared with doctors at a paediatric centre in Gaborone, Botswana

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### Abstract

**Objectives**—To compare compliance with national paediatric HIV treatment guidelines between nurse prescribers and doctors at a paediatric referral centre in Gaborone, Botswana.

**Methods**—A cross-sectional study was conducted in 2009 at the Botswana-Baylor Children's Clinical Centre of Excellence (COE), Gaborone, Botswana, comparing the performance of nurse prescribers and physicians caring for HIV-infected paediatric patients. Selected by stratified random sampling, 100 physician and 97 nurse prescriber encounters were retrospectively reviewed for successful documentation of eight separate clinically relevant variables: pill count charted; chief complaint listed; social history updated; disclosure reviewed; physical exam; laboratory testing; World Health Organization (WHO) staging documented; paediatric dosing.

**Results**—Nurse prescribers and physicians correctly documented 96.0% and 94.9% of the time, respectively. There was a trend towards a higher proportion of social history documentation by the nurses, but no significant difference in any other documentation items.

**Conclusions**—Our findings support the continued investment in programmes employing properly trained nurses in southern Africa to provide quality care and ART services to HIV-infected children who are stable on therapy. Task shifting remains a promising strategy to scale up and sustain adult and paediatric ART more effectively, particularly where provider shortages threaten ART rollout. Policies guiding ART services in southern Africa should avoid restricting the delivery of crucial services to doctors, especially where their numbers are limited.

In areas where HIV prevalence is high and resources are limited, models of care that rely exclusively on doctors to provide patient management are not always feasible. Doctor shortages are expected to continue worsening in high-prevalence settings in coming years, further exacerbating these difficulties.<sup>1,2</sup> This is particularly true where the availability of paediatric HIV care is concerned, as global shortages of doctors with paediatric experience are well documented,<sup>3-5</sup> and nearly 7 of every 10 children who need antiretroviral therapy (ART) do not currently receive it.<sup>6</sup> A distinct challenge to the global goal of universal access to ART is therefore the under-representation of children, as opposed to adults, in ART programmes.<sup>6,7</sup>

Programmes are therefore increasingly turning to task-shifting strategies to address human resource limitations and to facilitate both decentralisation and scale-up of health care services.<sup>8</sup> The African experience with task-shifting of HIV care and treatment by non-doctor clinicians has so far increased the number of patients on ART and improved the decentralisation of services.<sup>9-14</sup> While there are legitimate concerns about the quality of task-shifted care,<sup>13,15</sup> good outcomes have been documented in the context of appropriate training and support for task-shifted personnel.<sup>16,17</sup> Many developing countries have few options other than task-shifting for the rapid scale-up of HIV care and treatment programmes.<sup>3,6,9,13</sup>

Even in the context of conflicting data regarding the reliability of task-shifting, nurses are an attractive target for task-shifting of ART management, given their ubiquitous role in health systems and their availability in most high HIV prevalence settings. In Botswana there is approximately 1 doctor per 3 500 people,<sup>18</sup> but they tend to work in large urban facilities, beyond the reach of Botswana's largely rural population. Indeed, many rural clinics are currently staffed entirely by nurses. Compared with other countries in southern Africa, Botswana's nurse-to-patient ratio is relatively high,<sup>18</sup> and this robust cadre is well positioned to catalyse ART rollout in the country.<sup>10,18</sup>

In response to Botswana's limited supply of doctors able to provide HIV management, the Botswana Ministry of Health's nurse-prescriber training programme commenced in 2008, extending access to an estimated 20 000 clients in rural Botswana.<sup>19</sup> Nurses are trained to become nurse prescribers to provide routine ART management for stable patients, including children, as defined by standardised criteria.

We investigated the performance of this new cadre of providers of paediatric ART, using charting documentation to compare the rate of compliance with national HIV guidelines by doctors and certified nurse prescribers in a single government-affiliated clinic in Botswana. The nature of the pre-service training received by the nurse prescribers reviewed is as follows:

**Training components.** Four weeks of training on management of ART for stable paediatric patients, including didactics and practicum; an additional month of clinical mentorship attached to a licensed physician with paediatric HIV experience.

**Training objectives.** Correctly prescribing ART; monitoring therapeutic outcomes; identifying and managing appropriately adverse reactions related to ART; addressing

adherence issues; understanding when referral to an HIV-experienced physician is required (including ART failure and severe ART toxicity); providing other aspects of HIV care; monitoring laboratory results; isoniazid preventive therapy; and co-trimoxazole prophylaxis.

We are not aware of any studies that compare this metric in resource-limited settings, and this is the first published study from Botswana that compares compliance with national HIV guidelines of doctors and nurses in the management of HIV-infected children. We hypothesised that there would be no difference in guideline compliance between physicians and nurse prescribers.

## Methods

### Study design

We compared the performance of nurse prescribers and doctors caring for HIV-infected paediatric patients using chart documentation as the metric of performance. The medical records of paediatric patients aged 1 – 16 years who had been seen at the Botswana-Baylor Children's Clinical Centre of Excellence (COE), a large and busy government-affiliated clinic in Gaborone, Botswana, between 5 January 2009 and 31 March 2009 were retrospectively reviewed.

### Sampling

Patient visits ('encounters') were selected by stratified random sampling conducted via review of patient records for January - March 2009. From the patient visits to the COE during this period, we identified encounters which met our inclusion/exclusion criteria below – a total of 800 doctor-patient encounters and 776 nurse-prescriber-patient encounters. Based on the randomly ordered patient identification numbers, we then numbered the encounters. Using a random number table and by spinning a pencil, we randomly picked a starting point between 1 and 800 for the doctor encounters and between 1 and 776 for the nurse prescriber encounters. With this random starting point, our selection of encounters for review was every 7th encounter down the list until 100 doctor encounters and 97 nurse prescriber encounters had been selected for the study. These patient encounters were then audited by one of the study authors (GM) for successful documentation of eight separate clinically relevant variables: (i) adherence – pill count performed and charted; (ii) chief complaint – patient complaints documented and attended to in the plan; if no chief complaint was given by the patient, this was stated in the chart; (iii) social history – social history with any changes documented; (iv) disclosure – if full or partial disclosure was reviewed with the patient and/or caregiver; (v) physical examination – adequate physical examination of at least six body systems; (vi) laboratory tests ordering (LTO) – monitoring laboratory tests ordered correctly according to national ART guidelines; (vii) staging – WHO staging performed; and (viii) dosing – paediatric dosing performed according to national ART guidelines.

### Inclusion/exclusion criteria

All encounters met the criteria for standard, routine paediatric ART management, defined by the Botswana Ministry of Health as an otherwise well-appearing child, aged 1 – 16 years, on first-line ART for at least 1 year with the following characteristics: (i) viral load undetectable (<400 copies/ml) for at least 6 months after full suppression (<400 copies/ml); (ii) CD4 cell count ( >25% for children aged <13 years; >150 cells/ $\mu$ l for children aged 13 years); (iii) weight and height for age within two Z-scores of 50th percentile; (iv) developmental milestones within normal limits; and (v) on first-line ART regimen as defined by the Botswana National HIV/AIDS Treatment Guidelines: (stavudine or zidovudine) + lamivudine + (nevirapine or efavirenz).

On the basis of these criteria, encounters with any non-stable patients or patients on second-line or salvage ART were excluded. Also excluded were acute visits for ill children, ART initiation visits, and visits dedicated to counselling support.

### Data collection methods

Encounters for review were selected based on stratified random sampling as described above. The COE's electronic medical record (EMR) was used to generate reports for each encounter that detailed the successful documentation of completion of each of eight clinical variables.

We estimated that doctors would accurately document 90% of the charted items, which is consistent with approximate upper limits in the literature.<sup>20</sup> We predetermined that a documentation difference of more than 5% between doctors and nurses would be considered clinically significant. A two-group chi-square test with 80% power to detect a difference between an overall doctor documentation rate of 90% and an overall nursing documentation rate of 85% would require a sample size in each group of at least 686 documentation items for our primary outcome. Sample size was calculated with nQuery Advisor® 6.02 (Statistical Solutions, Saugus, Massachusetts, USA).

### Data analysis

Data were entered into an Excel database (Microsoft 2003, Seattle, Washington, USA) and analysed using Minitab-® 15 (State College, Pennsylvania, USA). Quantitative data were analysed for the eight clinical variables individually and for combined values. Mean compliance scores were calculated for both nurse and doctor encounters. The two-sample test for binomial proportions was used to calculate *p*-values; a *p*-value of less than 0.05 was considered statistically significant for our primary outcome. For our secondary outcomes (the eight individual documentation items), a *p*-value of less than 0.00625 using Fisher's exact test was considered statistically significant. This reduction from a *p*-value of 0.05 was due to the number of categories under evaluation, in an effort to minimise the chance of a type I error by applying the Bonferroni principle.

### Ethical approval

This study was approved by the Health Research and Development Committee (HRDC), Ministry of Health, Botswana, and the Institutional Review Board, Baylor College of Medicine, USA.

## Results

### Participants

During the study period, there were 3 eligible nurse prescribers and 10 eligible doctors. One hundred doctor-patient encounters and 97 nurse prescriber-patient encounters were reviewed, with 800 doctor and 776 nurse prescriber documentation items collected for analysis.

### Descriptive data

Two of the 3 nurse prescribers and 1 of the 10 doctors were female. The average number of years of working with the most recent Botswana National Guidelines at this time for the doctors and nurse prescribers was 17 months (95% confidence interval (CI) 10 – 24 months) and 3.7 months (95% CI 3.0 – 4.3 months), respectively.

## Outcome data

Table I describes the percentage of appropriate documentation for nurse prescribers and doctors. Overall, nurses and doctors correctly documented 96.0% and 94.9% of the time, respectively. There was a trend towards a higher proportion of social history documentation by the nurse; however, using a  $p$ -value cut-off of 0.00625 according to the Bonferroni multiple comparison methods, this value of 0.024 was not a statistically significant difference between the two groups. There was no significant difference in any other documentation items included in the study.

## Discussion

This study, comparing certified nurse prescribers and doctors, successfully demonstrates comparable performance. All documented  $p$ -values above reflect the non-inferiority of nurse-provided services compared with doctors. The observed trend towards better attention towards children's social situations by nurses could be important in determining ART outcomes, given the association between complicated social situations and unsuccessful HIV care.<sup>21</sup>

Although published commentaries have discussed issues relating to task-shifting in Botswana,<sup>10,19,22</sup> we know of no studies that have compared the quality of services of nurse and doctor providers in Botswana. Additionally, the literature review uncovered no data from any country or region establishing the non-inferiority of nurses compared with doctors specifically in relation to paediatric ART management.

Nonetheless, our findings are broadly in agreement with those of the CIPRA-SA trial.<sup>16</sup> The CIPRA-SA randomised non-inferiority trial compared nurse versus doctor management of ART care, finding nurse-monitored ART non-inferior to doctor-monitored ART for a composite endpoint of treatment-limiting events, including mortality, treatment failure, ART toxicity and adherence with follow-up care.

A strength of our study is its reflection of routine clinical practice in a busy paediatric ART centre. However, it has some limitations, in addition to its retrospective design. The relationship between the metric we evaluated – compliance with national HIV management guidelines – and good paediatric patient outcomes is not currently reported in the literature and cannot be determined by our study. The need for further studies in this area is clear, including prospective non-inferiority studies of routine paediatric ART practice by nurse prescribers powered to explore differences in patient outcomes, as well as cost-effectiveness of nurse-directed models of paediatric ART care for specific clinical outcomes.

Care should be taken in broadly generalising our study results. Our setting in a paediatric-specialised centre in a large urban area is not necessarily typical of most settings in southern Africa or other resource-limited settings where paediatric ART care is delivered. The training received by nurse prescribers in our setting may also not be typical of other paediatric ART settings. The latter is important, as southern African studies of task-shifted care suggest that the nature of pre-service training substantially influences provider practice and treatment outcomes in patient cohorts managed by non-doctors.<sup>16,17,23</sup>

The nurse prescribers in CIPRA-SA were experienced and well trained, all having undergone an additional year of clinical training in primary health care and specialised didactic and clinical training in HIV management, including ART.<sup>16</sup> However, where pre-service training is less comprehensive, results have been concerning.<sup>13,15,17</sup> In Mozambique, a nationwide evaluation of non-doctor clinicians managing patients on ART noted a high rate of ART management errors; correct management of all main aspects of patient care

included in the evaluation (staging, co-trimoxazole, ART, opportunistic infections and adverse drug reactions) was observed in only 10.6% of reviewed encounters.<sup>17</sup> These clinicians (known as *tecnicos de medicina*) had all received 30 months of general pre-service training not including HIV/AIDS content, but only 2 weeks of HIV-specific didactic training, mostly emphasising ART, before beginning to manage ART. Subsequent to this evaluation, Mozambique's scope of practice and training for non-doctor cadres in HIV management was revised.<sup>17</sup>

## Conclusions

In southern Africa, there is an urgent need to broaden current doctor-directed models of HIV/AIDS care, particularly where children are concerned. Our findings further support the continued investment in programmes employing properly trained nurses in southern Africa to provide quality care and ART services to HIV-infected children who are stable on therapy. Task shifting is a promising strategy to scale up and sustain adult and paediatric ART more effectively, particularly where provider shortages threaten ART rollout. Policies guiding ART services in southern Africa should avoid restricting the delivery of crucial services to doctors, especially where their numbers are limited, while ensuring that cadres of health care workers to whom essential services are shifted are both well trained and properly supported longitudinally.

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## References

1. Scheffler RM, Liu JX, Kinfu Y, Poz MR. Forecasting the global shortage of physicians: an economic-and needs-based approach. *Bull World Health Organ.* 2008; 86:516–523. [PubMed: 18670663]
2. Price J, Binagwaho A. From medical rationing to rationalizing the use of human resources for AIDS care and treatment in Africa: a case for task-shifting. *Dev World Bioeth.* 2010; 10:99–103. [PubMed: 20456474]
3. Kline MW. Perspectives on the pediatric HIV/AIDS pandemic: catalyzing access of children to care and treatment. *Pediatrics.* 2006; 117:1388–1393. [PubMed: 16585337]
4. Kline MW, Ferris MG, Jones DC, et al. The Pediatric AIDS Corps: responding to the African HIV/AIDS health professional resource crisis. *Pediatrics.* 2009; 123:134–136. [PubMed: 19117871]
5. World Health Organization. *World Health Statistics, 2011.* Geneva: WHO; 2011.
6. World Health Organization. *Progress Report, 2010.* Geneva: WHO; 2010. *Towards Universal Access: Scaling-up Priority HIV/AIDS Interventions in the Health Sector.*
7. Prendergast A, Tudor-Williams G, Jeena P, et al. International perspectives, progress, and future challenges of pediatric HIV infection. *Lancet.* 2007; 370:68–80. [PubMed: 17617274]
8. McPake B, Mensah K. Task shifting in health care in resource-poor countries. *Lancet.* 2008; 372:870–871. [PubMed: 18790295]
9. Fredlund VG, Nash J. How far should they walk? Increasing antiretroviral therapy access in a rural community in northern KwaZulu-Natal, South Africa. *J Infect Dis.* 2007; 196:S469–S473. [PubMed: 18181696]
10. Miles K, Clutterbuck DJ, Seitio O, et al. Antiretroviral treatment roll-out in a resource-constrained setting: capitalizing on nursing resources in Botswana. *Bull World Health Organ.* 2007; 85:555–560. [PubMed: 17768505]

11. Morris MB, Chapula BT, Chi BH, et al. Use of task-shifting to rapidly scale-up HIV treatment services: experiences from Lusaka, Zambia. *BMC Health Serv Res.* 2009; 9:5. [PubMed: 19134202]
12. Cohen R, Lynch S, Bygrave H, et al. Antiretroviral treatment outcomes from a nurse-driven, community-supported HIV/AIDS treatment programme in rural Lesotho: observational cohort assessment at two years. *J Int AIDS Soc.* 2009; 12:23. [PubMed: 19814814]
13. Callaghan M, Ford N, Schneider H. A systematic review of task-shifting for HIV treatment and care in Africa. *Human Resources for Health.* 2010; 8:8. [PubMed: 20356363]
14. Collins FS, Glass RI, Whitescarver J, Wakefield M, Goosby EP. Developing health workforce capacity in Africa. *Science.* 2010; 330:1324–1325. [PubMed: 21127233]
15. Philips M, Zachariah R, Venis S. Task-shifting for antiretroviral treatment delivery in sub-Saharan Africa: not a panacea. *Lancet.* 2008; 371:682–684. [PubMed: 18295026]
16. Sanne I, Orrell C, Fox MP, et al. Nurse versus doctor management of HIV-infected patients receiving antiretroviral therapy (CIPRA-SA): a randomised non-inferiority trial. *Lancet.* 2010; 376:33–40. [PubMed: 20557927]
17. Brentlinger PE, Assan A, Mudender F, et al. Task shifting in Mozambique: cross-sectional evaluation of non-physician clinicians' performance in HIV/AIDS care. *Human Resources for Health.* 2010; 8:23. [PubMed: 20939909]
18. Samb B, Celletti F, Holloway J, et al. Rapid expansion of the health workforce in response to the HIV epidemic. *N Engl J Med.* 2007; 357:2510–2514. [PubMed: 18077816]
19. Hulela, E.; Puvimanasinghe, J.; Ndwapi, N., et al. Task shifting in Botswana: empowerment of nurses in ART roll-out. Presented at the XVII International AIDS Conference; 3–8 August 2008; Mexico City. Abstract no.WEPE0108.
20. So L, Beck CA, Brien S, et al. Chart documentation quality and its relationship to the validity of administrative data discharge records. *Health Informatics J.* 2010; 16:101–113. [PubMed: 20573643]
21. Otieno PA, Kohler PK, Bosire RK, et al. Determinants of failure to access care in mothers referred to HIV treatment programs in Nairobi, Kenya. *AIDS Care.* 2010; 22:729–736. [PubMed: 20467938]
22. Bussmann C, Rotz P, Ndwapi N, et al. Strengthening healthcare capacity through a responsive, country-specific, training standard: The KITSO AIDS Training Program's support of Botswana's national antiretroviral therapy rollout. *Open AIDS Journal.* 2008; 2:10–16. [PubMed: 18923699]
23. Philips M, Lynch S, Massaquoi M, et al. Task shifting for HIV/AIDS: Opportunities, challenges and proposed actions for sub-Saharan Africa. *Trans R Soc Trop Med Hyg.* 2009; 103:549–558. [PubMed: 18992905]

**Table I**

Percentage of appropriate documentation in the charts by nurse prescribers and doctors

<b>Documentation item</b>	<b>Appropriate nurse documentation (% (N)) of documentations)</b>	<b>Appropriate doctor documentation (% (N)) of documentations)</b>	<b><i>p</i>-value</b>
Pill count charted	100 (97)	97 (100)	0.246
Chief complaint listed	100 (97)	99 (100)	1.000
Social history updated	95.9 (97)	86 (100)	0.024
Disclosure reviewed	95.9 (97)	92 (100)	0.373
Physical exam	94.8 (97)	96 (100)	0.745
Laboratory testing	93.8 (97)	94 (100)	1.000
WHO staging documented	90.7 (97)	96 (100)	0.160
Paediatric dosing	96.9 (97)	99 (100)	0.362
Cumulative of 8 items	96.0 (776)	94.9 (800)	0.335