Underutilisation of routinely collected data in the HIV programme in Zambia: a review of quantitatively analysed peer-reviewed articles

Tendai Munthali 1,2*, Patrick Musonda 1, Paul Mee 5, Sehlulekile Gumede 1,3, Ab Schaap 3,4, Alwyn Mwinga 4, Caroline Phiri 2, Nathan Kapata 2, Charles Michelo 1 and Jim Todd 3

Abstract

Background: The extent to which routinely collected HIV data from Zambia has been used in peer-reviewed published articles remains unexplored. This paper is an analysis of peer-reviewed articles that utilised routinely collected HIV data from Zambia within six programme areas from 2004 to 2014.

Methods: Articles on HIV, published in English, listed in the Directory of open access journals, African Journals Online, Google scholar, and PubMed were reviewed. Only articles from peer-reviewed journals, that utilised routinely collected data and included quantitative data analysis methods were included. Multi-country studies involving Zambia and another country, where the specific results for Zambia were not reported, as well as clinical trials and intervention studies that did not take place under routine care conditions were excluded, although community trials which referred patients to the routine clinics were included. Independent extraction was conducted using a predesigned data collection form. Pooled analysis was not possible due to diversity in topics reviewed.

Results: A total of 69 articles were extracted for review. Of these, 7 were excluded. From the 62 articles reviewed, 39 focused on HIV treatment and retention in care, 15 addressed prevention of mother-to-child transmission, 4 assessed social behavioural change, and 4 reported on voluntary counselling and testing. In our search, no articles were found on condom programming or voluntary male medical circumcision. The most common outcome measures reported were CD4+ count, clinical failure or mortality. The population analysed was children in 13 articles, women in 16 articles, and both adult men and women in 33 articles.

Conclusion: During the 10 year period of review, only 62 articles were published analysing routinely collected HIV data in Zambia. Serious consideration needs to be made to maximise the utility of routinely collected data, and to benefit from the funds and efforts to collect these data. This could be achieved with government support of operational research and publication of findings based on routinely collected Zambian HIV data.

Keywords: Routinely collected data, HIV, Zambia
**Background**

Worldwide, many countries routinely collect data on HIV care and services, which is then used to provide national and international indicators about the HIV epidemic. These indicators provide information and insight to aid policymakers and planners when making important decisions about HIV services, to request for further research, and in advocacy for new initiatives and funding [1, 2].

Sub-Saharan Africa is home to approximately 71% of the people living with HIV [3]. Zambia is a high HIV burden country within sub-Saharan Africa, having a national HIV prevalence of 11.6% and almost 980,000 people living with HIV in 2016 [4–6]. The HIV epidemic in Zambia is generalised and is mainly attributed to unprotected heterosexual activity [7]. This creates a need to monitor the HIV epidemic by focusing on indicators of effective prevention and on the quality of the HIV services in Zambia [8]. Six key service areas are prioritised in the country for prevention and treatment of HIV. These are (1) voluntary medical male circumcision (VMMC); (2) condom programming; (3) behavioural change; (4) HIV testing and counselling (HTC); (5) prevention of mother-to-child transmission (PMTCT); and (6) treatment and retention in care [7]. At national level, these programmes are monitored using routinely collected data and periodic country representative surveys.

Routinely collected data can also be used to understand the effectiveness of services and to improve decision-making in the healthcare system. The benefits in using routinely collected data include wider coverage of recorded items from across the whole country and the longitudinal nature of the data allowing estimation of trends and changes in the use of services [9]. The use of these data in this way is cost effective, as it is already collected and readily available for analysis. Therefore, research can be conducted in a timely and cost-efficient manner [10]. It can be the basis of sampling for clinical trials, cohort studies and case-control studies, as matched case-control analyses can be performed repeatedly over long time periods [11]. Routinely collected data are usually clinic based, but results from analysis of such data can be generalisable to the whole population if the services are widely used and serve all sections of society [10]. One of the main data collection systems for the routine collection of data from the HIV programme is SmartCare, which is one of the largest electronic patient monitoring systems (PMS) in Africa and is used in South Africa and Ethiopia [12]. In Zambia, the SmartCare database is used as a PMS for HIV services, and the data are used to monitor and plan improvements in the country’s HIV programme. SmartCare has been used as a pilot since 2004, and was officially rolled out in 2006 [13], with 528 clinics using SmartCare in 2012, and implemented in more than 700 clinics that provide antiretroviral therapy services by 2013 [14, 15]. SmartCare data, in facilities where it is available, is used to provide aggregate reports for DHIS2, and other health management information systems at the district level. In some health facilities, the SmartCare data can inform the drug ordering and the laboratory information systems, but this is not possible in most health facilities in Zambia.

Research has revealed that countries like Zambia, with one of the highest HIV/AIDS prevalence rates in Africa, are not the largest contributors to research on HIV/AIDS. This was evident in a review of three journals focusing on HIV/AIDS [16], which showed that the United States of America and Western Europe accounted for 85% of all published articles between 1986 and 2003. In sub-Saharan Africa, 50% of all publications on Africa indexed in PubMed between 1981 and 2009 were from South Africa, Uganda and Kenya. Zambia was ranked seventh, with 922 publications within that period, translating to approximately 32 publications per year [17]. This paper is a review of published studies using routinely collected HIV data from Zambia from 2004 to 2015, within the six areas of focus (VMMC, condom programming, behavioural change, HTC, PMTCT, and treatment and retention in care). We sought to examine the extent to which routinely collected HIV data has been analysed quantitatively for publication and identify gaps that exist across the six prioritised areas. It is hoped that findings from this review will potentially inform guidelines and strategies as well as stimulate policy dialogue in the use of routinely collected data.

**Methods**

**Literature search strategy**

We conducted a literature review of studies that reported results from routinely collected HIV data in Zambia. We utilised a detailed search protocol and standard systematic review procedures (Additional file 1) for papers which utilised routinely collected HIV data from primary to tertiary healthcare settings, using SmartCare or other electronic or paper-based PMS data in Zambia. We included studies published between 2004 (when SmartCare started) and November 2015. The search was conducted between July and November 2015. We selected only original articles from peer-reviewed journals on HIV studies conducted in Zambia utilising routinely collected data and quantitative methods of data analysis. All reported studies relevant to our search topic were reviewed, regardless of sample size. Articles were excluded if they were not written in English or where the specific results for Zambia were not reported from regional or multi-country studies. Clinical trials and intervention studies that did not take place under routine care conditions were also excluded, although
community trials that referred patients to the routine clinics were included.

We searched the PubMed, Google Scholar, Directory of Open Access Journals, and African Journals Online databases for articles on HIV in Zambia that utilised routinely collected data (Table 1). We used a combination of search words that included “HIV”, “SmartCare” and “routinely collected data”, among others (Table 1). One of the authors (TM) searched for articles and extracted the data from included studies, while another author (SG) reviewed the extracted data for discrepancies. All discrepancies were discussed and resolved. A standard data extraction form was used to review and extract data such as sample size, study design, number of study sites, dates of data collection, year of publication and main outcomes.

Data analysis
The selected papers could only be categorised by the six programme areas as the range of topics covered prevented aggregated statistical analysis of findings. All eligible articles were further grouped by the populations used in the papers, namely adult (males and females above 15 years of age), women and children (under the age of 15 years) to assess how effectively the priority areas cover the different age categories. The eligible articles were also analysed based on institutions that collaborated to publish the articles.

Results
A total of 1846 titles were reviewed and 1048 were excluded because they were not published in journals (n = 482), were published before 2004 (n = 335), or the topics were not relevant (n = 231). A total of 791 abstracts were then reviewed. Of these, some were excluded because they were clinical trials (n = 39), qualitative studies (n = 110), or did not use routinely collected data (n = 470), or were multi-country studies that did not include specific data on Zambia (n = 103) (Fig. 1). From these, 69 full length articles were selected, of which seven were found to be multi-country studies that did not use routinely collected data, and the remaining 62 were considered for categorisation. The articles were then classified into the six HIV service areas.

Overall, 15 articles addressed PMTCT, four focussed on HTC, four covered social and behavioural change (Table 2), and 39 covered treatment and retention in care. Our search did not reveal any articles that used routinely collected HIV data in Zambia reporting outcomes in the areas of condom programming or VMMC utilising quantitative methods.

The majority of the papers were mostly large samples, with thousands of subjects, covering many different health facilities. The articles on HIV treatment and retention in care covered topics such as enrolment and retention into antiretroviral therapy, effectiveness of different drug regimens, coinfections with laboratory confirmed pathogens, comorbidities using clinical signs and symptoms, and food supplementation (Table 3). The 15 PMTCT articles found addressed elimination of pediatric HIV infections, transmission of HIV to the babies, and improvement of survival in infected mothers and their exposed children.

We found four articles on HTC covering couple counselling and provider-initiated testing and counselling. Articles on social and behaviour change looked at creating demand for adherence, prevention interventions, improved biomarkers and treatment uptake. Treatment and care had the largest number of articles with 39 articles covering the topic (Table 3). Of the 62 articles, 33 full length papers utilised adult only routinely collected data and addressed retention in care, access to HIV treatment, mortality and clinical outcomes. A total of 16 full-length articles used data from only women, covering contraception, PMTCT and antenatal HIV prevalence rates. The articles using data on women only were published between 2010 and 2011, and had sample sizes ranging from 1435 to 138,884. There were 13 peer-reviewed articles that addressed paediatric HIV care and treatment. These were published between 2007 and 2013, with sample sizes ranging from 1120 to 4975. Our search did not reveal any articles utilising routinely collected HIV data specifically on adolescents aged 10–24 years old.

The 62 papers analysed were published in collaboration with partner institutions (Fig. 2). The Centre for Infectious Disease Research in Zambia and the University of Alabama had the highest contribution, with collaboration on 42 and 29 papers, respectively. The staff from national and district levels of the Ministry of Health participated in 40 of the published articles, while the lower collaboration was from institutions based in the United Kingdom, with collaboration on

| Database                                      | Search terms                                                                 |
|-----------------------------------------------|------------------------------------------------------------------------------|
| Google Scholar (July 3, 2015)                 | HIV + SmartCare + Zambia HIV + routine + data HIV/AIDS                        |
|                                               | + "routinely collected data" + Zambia Condom + HIV + Zambia                  |
| PubMed (July 15, 2015)                        | HIV/AIDS + "routinely collected data" + Zambia + routine data                 |
|                                               | Condom + HIV                                                                  |
| African Journals Online (November 6, 2015)    | HIV + routine + data + Zambia + condom + "routinely collected data" + SmartCare |
| Directory of Open Access Journals (November 11, 2015) | HIV + Zambia + condom + "routinely collected data" + SmartCare |

Page 3 of 10
only 8 articles, four from LSHTM and four from other universities.

**Discussion**

The review of published articles showed that considerable strides are being made in utilisation of routinely collected HIV data in Zambia. A total of 62 articles were found and considered in this review. Treatment and retention in care and PMTCT had the highest contribution, with counselling and social and behavioural change having four articles each. However, we could not find published papers that utilised quantitative data analysis methods in our search on VMMC and condom programming despite the importance of these programmes and the inclusion of data from these programmes in SmartCare. The broad focus of the literature search on HIV in Zambia should have identified many papers on condom programming or VMMC, but the only papers found were qualitative studies on these topics. It was also observable during the search process that quantitatively analysed studies on HIV in adolescents in the country were limited and information for this age group has to be extracted from paediatric and adult studies.

This study was a collection of articles covering a diverse range of topics, which meant that no meta-analysis of the studies was possible. One of the goals of this paper was to highlight the range and diversity of the topics available for analysis using routinely collected data, and to explore the gaps in the published literature so far. The main topics were grouped into treatment and retention in care, PMTCT, HTC, condom programming and VMMC. Our search on VMMC and condom programming revealed no quantitatively analysed papers and few qualitatively analysed papers.

We did not include a large number of qualitatively analysed, clinical trial and survey-based articles, which have made important contributions to policy change in HIV care and treatment in Zambia. Further, risk of bias in individual study papers selected was not prioritised during the selection process since the rationale of the review was to assess the extent of utilisation of routinely collected data in the country. Only peer-reviewed articles where included because the assumption was that the peer-review process implies some form of quality control for biases in selected papers. In addition, only one of the authors reviewed the titles and abstracts,
which could be a source of bias. However, as far as we are aware, this is the first study to provide such a baseline of studies for future referral.

The total number of published articles found in our literature search on the six HIV programmatic areas using routinely collected data meeting our criteria was quite low (an average of six articles per year) considering that these have been published in the past 10 years. This finding is lower than the 32 articles per year reported by Uthman [17], but in line with findings by the Ministry of Health [18], where the use and analysis of routinely collected data were found to be inadequate in Zambia, with analysed data displayed in graphs and information from the districts rarely used for decision-making at district levels. The reasons for these low numbers could be the limited data analysis skills, unavailability of data analysis software, disapproval or lack of support from supervisors, and lack of time and opportunity [9–11, 18–20]. It could be further argued that the limited use of routinely collected data was due to lack of knowledge on the benefits of analyzing such data at facility and district levels and poor data management, which could be alleviated by deliberate policy from government to support existing staff capacity building, operational research and publication of findings [18, 21].

| First author, year of publication | Data collection period | Sample size | Sampled population | Outcomes assessed |
|----------------------------------|-----------------------|-------------|--------------------|-------------------|
| **HIV testing and counselling**  |                       |             |                    |                   |
| Topp et al. [31]                 | 2008–2011             | 2239        | Adults only        | CD4 count, haemoglobin level, BMI, education level, partner’s HIV status |
| Topp et al. [32]                 | 2008–2010             | 44,420      | Adults only        | HIV testing, enrolment into care |
| Czaicki et al. [33]              | 2011–2012             | 10,806      | Adult couples      | Cohabitation length, prior HIV testing, current antiretroviral use |
| Kankasa et al. [34]              | 2006–2007             | 15,670      | Children           | HIV testing, testing coverage, HIV counselling, |
| **PMTCT**                       |                       |             |                    |                   |
| Killam et al. [35]               | 2007–2008             | 13,917      | Women initiating ART | Women eligible for ART, women initiating ART |
| Stringer et al. [36]             | 2001                  | 17,263      | Women only         | Women tested, mothers and babies receiving NVP |
| Stringer et al. [37]             | 2003                  | 8787        | Mother baby pairs  | Gravidity, offered testing, tested, infant given NVP |
| Chibwesha et al. [38]            | 2007–2010             | 1813        | Mother baby pairs  | CD4 count, date of highly active ART initiation, infant HIV status |
| Liu et al. [39]                  | 2007–2009             | 13,888      | Women initiating ART | CD4 count, haemoglobin level, syphilis, tuberculosis, HIV status |
| Chintu et al. [40]               | 2004–2006             | 6740        | Women on ART       | Mortality, NVP exposure, CD4 count, haemoglobin level |
| Mandala et al. [41]              | 2007–2008             | 14,815      | Women on ART       | CD4 count, initiated on ART |
| Torpey et al. [20]               | 2005–2008             | 9723        | Women on ART       | HIV testing, enrolment to care, received ART |
| Chibwesha et al. [42]            | 2009–2010             | 18,407      | Women initiating ART | CD4 count, haemoglobin level, use of contraceptives |
| Stringer et al. [43]             | 2002–2006             | 243,302     | Women and baby pairs | HIV status, number testing positive, attended antenatal care |
| Mulindwa [44]                    | Not stated            | 146         | Women initiating ART | NVP toxicity, hepatic toxicity, WHO grading of toxicity |
| Ngoma et al. [45]                | 2008–2009             | 279         | Women only         | HIV-free at 12 months, mortality rates, HIV transmission |
| Torpey et al. [46]               | 2007–2010             | 28,320      | Children only      | HIV testing, type of PMTCT regimen |
| Torpey et al. [47]               | 2007–2009             | 8237        | Children           | HIV testing, type of PMTCT regimen |
| Albrecht et al. [48]             | 2001–2003             | 760         | Women only         | PMTCT drug adherence, partner disclosure |
| **Social and behavioural change** |                       |             |                    |                   |
| Kankasa et al. [34]              | 2004–2007             | 27,115      | Adults on ART      | Adherence, mortality, loss to follow-up, CD4 count |
| Goldman et al. [49]              | 2006–2007             | 913         | Adults on ART      | Adherence, viral load |
| Carlucci et al. [50]             | 2006                  | 542         | Adults on ART      | Drug adherence |
| Birbeck et al. [51]              | 2005–2006             | 255         | Adults on ART      | Drug adherence |

**ART** antiretroviral therapy, **BMI** body mass index, **NVP** nevirapine
| First author            | Data collection period | Sample size | Sampled population | Outcomes assessed                                                                 |
|------------------------|------------------------|-------------|--------------------|----------------------------------------------------------------------------------|
| Cantrell et al. [52]   | 2004–2005              | 636         | Adults on ART      | Adherence to medication, CD4, weight gain                                         |
| Koethe et al. [53]     | 2004–2008              | 27,915      | Adults initiating ART | Weight gain, death, treatment failure, BMI                                         |
| Tirivayi et al. [54]   | 2009                   | 291         | Adults on ART      | Adherence to medication, CD4, BMI                                                 |
| Koethe et al. [55]     | 2004–2009              | 56,612      | Adults on ART      | CD4, mortality, BMI                                                               |
| Stringer et al. [56]   | 2004–2007              | 14,736      | Adults on ART      | Single dose substitution, CD4 count, haemoglobin level, BMI, mortality             |
| Chi et al. [57]        | 2007–2010              | 18,866      | Adults initiating ART | CD4, clinical disease staging, BMI, serum creatinine adherence, mortality         |
| Chi et al. [58]        | 2007–2009              | 10,485      | Adults on ART      | Drug substitution, mortality, loss to follow-up, withdrawal and death              |
| Chi et al. [59]        | 2004–2008              | 24,366      | Adults on ART      | CD4 counts, age clinical staging, haemoglobin, tuberculosis co-infection, adherence |
| Chi et al. [60]        | 2007                   | 33,704      | Adults on ART      | Cut-off points defining loss to follow-up, sensitivity, specificity, misclassification rate |
| Giganti et al. [61]    | 2004–2010              | 40,410      | Adults on ART      | Haemoglobin level, CD4, ART regimen                                               |
| Vinikoor et al. [62]   | 2015                   | 20,308      | Adults on ART      | HBsAg, CD4, BMI, WHO staging                                                      |
| Mulenga et al. [63]    | 2004–2007              | 25,779      | Adults on ART      | Mortality, creatinine clearance                                                    |
| Stringer et al. [64]   | 2004–2005              | 21,755      | Adults initiating ART | Clinical staging, CD4, mortality, BMI, haemoglobin level, adherence               |
| Seu et al. [65]        | 2009–2012              | 68          | Adults failing treatment | CD4 count, adherence, HIV drug resistance mutations                               |
| Krebs et al. [66]      | 2005                   | 1343        | Adults lost to follow-up | CD4 count, BMI, mortality, home visit categories (traced, untraceable, died)      |
| Vinikoor et al. [67]   | 2004–2010              | 53,015      | Adults missing pharmacy refills | CD4 count, clinical staging, pharmacy refills, adherence, ART regimen             |
| Vinikoor et al. [68]   | 2004–2011              | 92,130      | Adults on ART      | Adherence, CD4 count, mortality, long-term follow-up                              |
| Harris et al. [69]     | 2005–2007              | 20,153      | Tuberculosis/HIV co-infected adults | Enrolment on ART, CD4 count, WHO staging                                          |
| Mweemba et al. [70]    | 2011–2013              | 91,130      | Adults initiating ART | Hepatitis B co-infection, WHO staging, CD4 count                                   |
| Dee et al. [71]        | 2007                   | 13          | Laboratories       | CD4 count, haemoglobin, liver function test                                      |
| Chi et al. [72]        | 2004–2006              | 6740        | Women exposed to nevirapine | WHO stage, CD4 cell count, status, BMI                                          |
| Bolton-Moore et al. [73]| 2004–2007             | 4975        | Children on ART    | CD4 percentage, weight-for-age Z scores, clinical staging, haemoglobin level, mortality |
| Mubiana-Mbewe et al. [74]| 2004–2006           | 1705        | Children enrolled into care | CD4 percentage, clinical staging, haemoglobin level                              |
| Scott et al. [75]      | 2006–2011              | 1334        | Children on ART    | CD4 percentage, fixed and variable unit costs                                    |
| Kiage et al. [76]      | 2009–2011              | 822         | Mother-infant pairs | WHO staging, CD4/CD8 percentage, HIV, haemoglobin panel, maternal-CD4 count       |
| Sutcliffe et al. [77]  | 2004–2008              | 1278        | Children on ART    | Enrolment in ART, loss to follow-up, mortality, clinical staging, CD4 percentage |
| Iyer et al. [78]       | 2006–2011              | 1102        | Children initiating ART | Age, CD4 percentage, ART initiation, full blood count, blood chemistry           |
| Sutcliffe et al. [79]  | 2004–2008              | 863         | Children on ART    | Mortality, CD4, HIV, haemoglobin level                                             |
| Sutcliffe [80]         | 2000–2002              | 492         | Children on ART    | CD4 count, haemoglobin level, mortality                                           |
| Van Dijk et al. [81]   | 2007–2012              | 77          | Children on ART    | Weight-for-age Z scores, CD4 percentage                                            |
| Van Dijk et al. [82]   | 2007–2010              | 198         | Children on ART    | Treatment outcomes, viral load, CD4 percentage, retention in care, mortality      |
| Sutcliffe et al. [83]  | 2007–2009              | 193         | Children initiating ART | Weight-for-age and height-for-age Z scores                                      |
| Nkamba [84]            | Not stated             | 59          | Children on ART    | T cell subsets CD4 and CD8 memory                                                |
Treatment and retention in care had the largest number of studies. This is in line with global trends in HIV prevention strategies where treatment and retention in care have been identified as the most effective HIV prevention tool among the biomedical prevention tools analysed to date [22, 23]; more research is encouraged in these areas. However, considering the period under review, the number of studies found on retention and care were rather low. Similar trends of low levels of publication in this area have been attributed to long follow-up periods required to monitor retention in care as well as to inconsistent information systems that make it difficult to track patients that seek care from multiple facilities [24].

There was also a limited number of studies that looked at children born with HIV infection identified in our search. This is in line with findings from a systematic review of care and retention in HIV-infected children in low- and middle-income countries, where limited data were also found in Asia, Eastern Europe and Latin America [25], attributed to emphasis on studies on adult data. It was also apparent that no quantitative peer-reviewed studies on treatment and retention among adolescents already in HIV care in Zambia were found in our search. Data on this age group has to be extracted from paediatric and adult studies. Similar findings have been reported in studies conducted in southern Africa in 2009 [26] and 2010 [27], where few data were reported on perinatally infected adolescents with most of the available data on adherence and outcomes emerging from the developed world. It is further argued that data for adolescents in southern Africa are disaggregated into 0–14, 15–19 and 15–24 year age groups, which makes it difficult to ascertain adolescent-specific data since, in most cases, the data includes very young children or adults [28].

The search on condom programming revealed mostly intervention studies in settings where prospective users could access them. Reasons for this could be the mode of distribution, which is restricted to public health facilities and to private health facilities only on request [29]. Similarly, Kane et al. [30] argued that use of aggregate data on condom sales does not provide information on utilisation of condoms after they are obtained, resulting in the need for in-depth analysis on factors associated with condom use. The same could be concluded on usefulness of aggregate condom distribution data. Moreover, condom distribution data are difficult to document in routinely collected data and thus there is heavy reliance...

**Table 3** Studies utilising routinely collected data on HIV treatment and retention in care in Zambia (Continued)

| Study               | Time Period  | Sample Size | Data Collection                                                                 |
|---------------------|--------------|-------------|---------------------------------------------------------------------------------|
| Van Dijk et al.     | 2007–2008    | 192         | Children on ART Years of receiving ART, distance from clinic, CD4 percentage, weight-for-age Z score |
| Sinkala et al.      | 2005–2006    | 5609        | Adults only Colonskopy, laparoscopy, culture results                             |
| Sheyo [87]          | 2009–2010    | 452         | Adults and children HIV status, burn history, burn outcome and management        |
| Brugha et al. [88]  | 2004–2007    | 39          | Health facilities VCT, ART, PMTCT, childhood immunisation service and coverage trends |
| Kancheeya et al.    | 2003–2006    | 203         | Adults HIV status, VCT                                                          |
| Kaile et al. [90]   | 2004         | 18          | Adults on ART Blood pressure serum potassium, creatinine and sodium, Karnofsky score, WHO staging |

**Fig. 2** Graph showing number of articles published by each collaborating institution

**ART** antiretroviral therapy, **BMI** body mass index, **PMTCT** prevention of mother-to-child transmission, **VCT** voluntary counselling and testing
on survey data [7]. There is an urgent need to understand the demographics of condom distribution in the country. Similar trends were revealed in the VMMC programme, which also yielded low numbers of peer-reviewed articles that utilised routinely collected quantitative data, despite the country not meeting its circumcision targets [7].

Conclusion
There are positive advances being made in the HIV programme in the use of routinely collected data in Zambia. This progress must be nurtured and enhanced if Zambia is to reach elimination stages in HIV control. However, more efforts must be put into research and publishing results in critical areas, such as paediatric and adolescent care, VMMC and condom distribution, in order to build the skills and knowledge-base to deliver HIV services. Research on adolescent and childhood HIV morbidity and mortality outcomes as well as social behavioural change needs is important because HIV-infected adolescents and children are the key population in reducing HIV spread in their generation.

To improve the use of routinely collected data for use in publications the government could deliberately put in place policies to prioritise training of civil servants working in various programmes in operational research and consequently fund publishing of findings. These published articles would aid in international resource mobilisation for most programmes in the country as programme level data can be easily accessed in peer-reviewed articles.

Abbreviations
HTC: HIV testing and counselling; PMS: patient monitoring system; PMTCT: prevention of mother to child transmission; VMMC: voluntary male circumcision

Acknowledgements
We acknowledge the SEARCH Project team in London for the additional training in HIV data analysis and support while in London.

Funding
This writing or this paper was supported by the Sustainable Evaluation training in HIV data analysis and support while in London.

Availability of data and materials
The dataset supporting the conclusions of this article is included with the manuscript drafts for scientific merit and depth. All authors read and whole team participated in the critical review and editing of all the analysed articles. CM, PM, JT, NK and CP reviewed all the drafts for intellectual content, participated in the interpretation of the findings. The whole team participated in the critical review and editing of all the manuscript drafts for scientific merit and depth. All authors read and approved the final manuscript.

Competing interests
The authors declare that they have no competing interests.

Consent for publication
Not applicable.

Ethics approval and consent to participate
Not applicable.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Author details
1School of Public Health, University of Zambia, Lusaka, Zambia. 2Ministry of Health, Lusaka, Zambia. 3Department of Population Health, London School of Hygiene and Tropical Medicine, London, United Kingdom. 4Zambia AIDS Related Tuberculosis (ZAMBART) Project, Lusaka, Zambia. 5MeSH Consortium, Department of Social Economic and Health Research, Faculty of Public Health and Policy, London School of Hygiene and Tropical Medicine, London, United Kingdom.

Received: 9 June 2016 Accepted: 30 May 2017
Published online: 13 June 2017

References
1. World Health Organization. Consolidated Strategic Information Guidelines for HIV in the Health Sector. Geneva: WHO; 2015.
2. World Health Organization. National AIDS Programmes: A Guide to Indicators for Monitoring and Evaluating National Antiretroviral Programmes. Geneva: WHO; 2005.
3. UNAIDS. The Gap Report. Geneva: UNAIDS, 2014.
4. National HIV/AIDS Council Zambia; Zambia Country Report: Monitoring the Declaration of Commitment on HIV and AIDS and the Universal Access, The United Nations General Assembly Special Session on HIV and AIDS. Lusaka: Republic of Zambia; 2014.
5. UNAIDS. Global Report: UNAIDS Report on the Global AIDS Epidemic 2013. Geneva: UNAIDS, 2013.
6. Ministry of Health. Zambia Population-Based HIV Impact Assessment (ZAMPHIA) 2015–2016, Summary Sheet. Preliminary Findings. Lusaka: Ministry of Health; 2016.
7. Ministry of Health. National AIDS Strategic Framework 2014-2016: A Nation Free from the Threat of HIV and AIDS. Lusaka: Ministry of Health; 2014.
8. Central Statistical Office, Ministry of Health, and ICF International, Zambia Demographic and Health Survey 2013–14. Rockville: CSO, MoH, and ICF Int; 2014.
9. Deeny SR, Steventon A. Making sense of the shadows: priorities for creating a learning healthcare system based on routinely collected data. BMJ Qual Saf. 2015;24(8):505–15.
10. Grzeskowiak LE, Gilbert AL, Morrison JL. Methodological challenges in using routinely collected health data to investigate long-term effects of medication use during pregnancy. Ther Adv Drug Saf. 2013;4(1):27–37.
11. Bain MR, Chalmers IW, Brewster DH. Routinely collected data in national and regional databases-an under-used resource. J Public Health. 1997;19(4):413–8.
12. Tasse J-M, Malatasi K, Pujades-Rodriguez M, Poulet E, Bennett D, Hames A, Mahy M, Schechter M, Souteyrand Y, Dabis F. Evaluation of three sampling methods to monitor outcomes of antiretroviral treatment programmes in low-and middle-income countries. PloS One. 2010;5(11):e13899.
13. Ministry of Health. National Health Report, Directorate of Public Health and Research. Lusaka: MoH; 2012.
14. Ministry of Health. List of Health Facilities in Zambia. Preliminary Report. Lusaka: MoH; 2013.
15. PEPFAR. Zambia Operational Plan Report FY 2013. Washington, DC: PEPFAR; 2013. https://www.pepfar.gov/documents/organization/222188.pdf . Accessed July 2015.
16. UusikulA A, Toompeare K, et al. HIV research productivity and structural factors associated with HIV research output in European Union countries: a bibliometric analysis. BMJ Open. 2015;5(2):e006591.
17. Uthman OA. Pattern and determinants of HIV research productivity in sub-Saharan Africa: bibliometric analysis of 1981 to 2009 PubMed papers. BMC Infect Dis. 2010;10:47.
18. Ministry of Health. Assessment of the Health Information System in Zambia. Lusaka: Ministry of Health, Department of Planning and Development, Monitoring and Evaluation Unit; 2007.
19. Zachariah R, Ford N, Maher D, Bissell K, Van den Bergh R, van den Boogaard W, Reid T, Castro KG, Draguez B, von Schreeb J. Is operational research delivering the goods? The journey to success in low-income countries. Lancet Infect Dis. 2012;12(5):415–21.
