RESEARCH ARTICLE

Can we find the missing men in clinics? Clinic attendance by sex and HIV status in rural South Africa [version 1; peer review: 1 approved, 1 approved with reservations]

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v1 **First published:** 02 Jul 2021, **6**:169
https://doi.org/10.12688/wellcomeopenres.16702.1
Latest published: 02 Jul 2021, **6**:169
https://doi.org/10.12688/wellcomeopenres.16702.1

Abstract

Background: HIV-negative men are over-represented in tuberculosis (TB) prevalence surveys including the first South African national TB prevalence survey in 2018. Traditionally, TB screening is focused in clinics. We aimed to determine the frequency of primary healthcare clinic (PHC) attendance among HIV-negative men in a TB-prevalent setting.

Methods: Since January 2017, PHC attendees in a rural South African demographic surveillance area (DSA) were asked their reason for attendance. HIV status was defined as positive if tested positive in a DSA sero-survey or attended clinic for HIV care; negative if tested negative between January 2014—December 2017 and no HIV-related visits; and HIV-unknown otherwise.

Results: Among 67124 DSA residents (≥15 years), 27038 (40.3%) were men; 14196 (21.2%) were classified HIV-positive, 18892 (28.1%) HIV-negative and 34036 (50.7%) HIV-unknown. Between April 2017 and March 2018, 24382/67124 (36.3%, 95% confidence interval [CI] 36.0–36.7) adults made ≥1 PHC visit, comprising 9805/40086 (24.5%, 95%CI 23.6–25.3) of HIV-negative or unknown women and 3440/27038 (12.7%, 95%CI 11.6–13.8) of HIV-negative or unknown men. Overall, HIV care accounted for 37556/88109 (42.6%) of adult PHC visits.

Conclusion: In this rural population, HIV-negative and -unknown men rarely attend PHCs. Improving TB screening in clinics may not reach a key population with respect to undiagnosed TB. Additional strategies are needed to diagnose and treat TB earlier.

Open Peer Review

Approval Status ✓ ?

	1	2
version 1 02 Jul 2021	✓ view	? view

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Any reports and responses or comments on the article can be found at the end of the article.

Keywords
Tuberculosis, Africa, Active Case Finding, Primary Health Care

This article is included in the Africa Health Research Institute (AHRI) gateway.

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Author roles: Randera-Rees S: Visualization, Writing – Original Draft Preparation, Writing – Review & Editing; **Clarence Safari W**: Data Curation, Formal Analysis, Visualization; **Gareta D**: Conceptualization, Project Administration, Resources, Writing – Review & Editing; **Herbst K**: Conceptualization, Funding Acquisition, Investigation, Methodology, Project Administration, Supervision, Writing – Review & Editing; **Baisley K**: Conceptualization, Data Curation, Formal Analysis, Methodology, Supervision, Writing – Review & Editing; **Grant AD**: Conceptualization, Funding Acquisition, Investigation, Methodology, Supervision, Writing – Original Draft Preparation, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

Grant information: We acknowledge the financial support provided by the HIV Research Trust, UK, in a form of a visiting scholarship to WS to the Africa Health Research Institute. This work was supported by the Wellcome Trust through the Strategic Award to the Africa Health Research Institute [201433].
The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

How to cite this article: Randera-Rees S, Clarence Safari W, Gareta D *et al.* **Can we find the missing men in clinics? Clinic attendance by sex and HIV status in rural South Africa [version 1; peer review: 1 approved, 1 approved with reservations]** Wellcome Open Research 2021, **6**:169 https://doi.org/10.12688/wellcomeopenres.16702.1

First published: 02 Jul 2021, **6**:169 https://doi.org/10.12688/wellcomeopenres.16702.1

Introduction

Based on data from 2013, South Africa was estimated to have 160000 "missing" people with tuberculosis (TB), that is individuals with active TB disease who were not on treatment[1], who may contribute to continuing transmission. South Africa is committed to finding the missing 160000[1]; however, how best to do this is uncertain.

The World Health Organization (WHO) has traditionally recommended active case finding for TB among individuals attending health facilities[2]. However, this approach will only reduce transmission if people with undiagnosed, infectious TB are identified at health facilities and start appropriate treatment early, and therefore reduce their duration of infectiousness. This is particularly a concern for men, who are generally perceived to attend health care facilities less often than women[3,4].

National surveys in Tanzania, Rwanda, Zambia and Kenya have found that TB prevalence was significantly higher in men than women[5–7]. In addition, in Zambia and Kenya (where the prevalence surveys offered HIV testing as well as TB screening) over 80% people with undiagnosed active TB were HIV-negative or HIV-unknown. In South Africa the first national TB prevalence survey took place in 2018. Among the survey participants who reported at least one TB symptom, more men (71.3%) than women (63.4%) did not seek care[8]. TB prevalence was higher in men, with a prevalence almost 1.6 times that of women[8]. 77% of participants who screened positive for TB were HIV negative or unknown[8]. It is therefore likely that a priority group among the "missing 160000" are men with negative or unknown HIV status[8].

The aim of this study was to describe the frequency of primary healthcare clinic (PHC) attendance by sex and HIV status in 11 clinics in rural KwaZulu-Natal, South Africa.

Methods

Study area and population

The study was conducted in the Africa Health Research Institute (AHRI) demographic surveillance area (DSA), in uMkhanyakude district, KwaZulu-Natal, South Africa. The AHRI DSA covers 845km^2, with approximately 25000 homesteads and over 60000 residents aged 15 years or above. AHRI has undertaken population-based demographic surveillance since 2000 with annual HIV sero-surveys since 2003. This district had an annual notification rate of all TB cases of 394 per 100,000 population in 2018 and 64.4% of those notified for TB were HIV positive[9]. In addition, in 2017-8, 9.9% of Xpert MTB/RIF results from uMkhanyakude showed rifampicin resistance, among the highest prevalence in the country[9].

The population of interest in our analysis were all individuals over the age of 15 years who were a resident member (defined as intending to spend the majority of nights at a household within the study area) of a household in the AHRI DSA on 1st July 2017.

Data collection

Since January 2017, individuals who sought health care at any one of the 11 PHC's serving the AHRI DSA on weekdays between 7am and 7pm have been registered by a member of AHRI staff, and their self-reported reason for attending clinic recorded, using an electronic system known as ClinicLink[10]. For this analysis, we used ClinicLink data to determine the number of PHC visits made by AHRI DSA residents between 1 April 2017 and 31 March 2018. Visit data from AHRI DSA residents were retrospectively linked to their demographic surveillance data and HIV sero-survey data.

Case definitions

Participants were considered to be HIV negative if they tested negative in a sero-survey between 1st January 2014 and 31st December 2017 and had no HIV-related PHC visits recorded in ClinicLink; HIV-positive if they tested HIV-positive in a DSA sero-survey or had an HIV-related visit recorded in ClinicLink; or HIV-unknown otherwise.

Statistical analysis

The main outcome for this analysis was the proportion of DSA residents visiting PHCs between April 2017 and March 2018, stratified by sex and HIV status.

We categorized PHC visits into three subgroups: 1. HIV visits, including antiretroviral therapy (ART) start or follow-up; 2. acute visits, including family planning, minor ailments, maternity, reproductive health, circumcision, or emergency care; and 3. other chronic (non-HIV), including care for TB, diabetes or hypertension.

All data was analysed using Stata (StataCorp. 2017. *Stata Statistical Software: Release 14.1*. College Station, TX: StataCorp LLC).

Ethical approval

The AHRI demographic surveillance system, ClinicLink study and linkage to Department of Health ART records are approved by the Biomedical Research Ethics Committee of the University of KwaZulu-Natal, South Africa (Ref: BE290/16). DSA residents give written informed consent for household demographic surveys, individual health and behaviour questionnaires, and HIV sero-surveys. Individuals attending clinics provide written informed consent to record visits.

Results

Table 1 shows the demographic characteristics of 67124 resident adults (40086 [59.7%] women) over the age of 15 years in the AHRI DSA on 1st July 2017. Of all residents included, 14196/67124 (21.2%) were classified as HIV-positive, 18892/67124 (28.1%) HIV-negative and 34036/67124 (50.7%) HIV-unknown. Among women, 10692/40086 (26.7%) were HIV-positive[11]. Furthermore, among 27038 men, 3504/27038 (13.0%) were classified as HIV-positive and 16630 (61.5%) HIV-unknown.

Table 1. HIV status of 67124 adults resident in the Africa Health Research Institute demographic surveillance area[1], stratified by sex.

Characteristics	Total	Females	Males
Total, N (row %)	67124	40086 (59.7%)	27038 (40.3)
HIV-positive[2], N (column %)	14196 (21.2)	10692 (26.7%)	3504 (13.0)
HIV-negative[3], N (column %)	18892 (28.1)	11988 (29.9%)	6904 (25.5)
HIV-unknown[4], N (column %)	34036 (50.7)	17406 (43.4%)	16630 (61.5)

[1] Africa Health Research Institute (AHRI) undertakes population-based demographic surveillance in a rural district of Kwazulu Natal, South Africa with annual HIV sero-surveys. Individuals were included if they were resident in the AHRI demographic surveillance area on 1st July 2017.

[2] Participants were considered to be HIV-positive if they tested HIV-positive in a demographic surveillance area sero-survey or had an HIV-related visit recorded.

[3] Participants were considered to be HIV negative if they tested negative in a sero-survey between 1st January 2014 and 31st December 2017 and had no HIV-related PHC visits recorded.

[4] Participants were considered to be HIV unknown if neither 2 nor 3 was true.

Table 2 shows the proportion of adults making one or more PHC visits (for any reason) during the study year, by sex and HIV status. Among all 67124 residents, 36.3% (95% confidence interval [CI] 36.0–36.7) visited one of the eleven PHCs serving the AHRI DSA during the study period. The median number of PHC visits (among the 24382 residents who visited a PHC) was two (range: 1–26) per person among men and three (range: 1–22) visits per person among women. Of the 67124 adult DSA residents, among HIV-positive individuals, 8554/10692 (80%, 95%CI 79.3–80.8) of HIV-positive women and 2593/3504 (73.7%, 95%CI 72.2–75.1) of HIV positive men visited a PHC for any reason at least once during the one-year period. In contrast, among the HIV-negative or HIV-unknown adult residents, 9805/29394 (33.4%, 95%CI 32.8–33.9) of women and 3340/23534 (14.6%, 95%CI 14.2–15.1) of men visited a PHC at least once during the one-year period of the study.

AHRI adult residents made a total of 88109 visits to the 11 PHCs during the study period (Table 3). Of the total number of PHC visits, HIV care accounted for 37556/88109 (42.6%), acute conditions for 31147/88109 (35.4%) while other chronic care accounted for 19406/88109 (22.0%). Excluding visits for antenatal and paediatric care, there were more PHC visits by women compared to men regardless of HIV status among all visit categories.

Discussion

By nesting this study within a demographic surveillance area, we have been able, for the first time, to quantify PHC visits based on a population denominator and stratified by HIV status. As anticipated, we found that men who are HIV-negative or with unknown HIV status rarely visit PHCs for any reason. Reducing TB transmission requires that people with active TB are identified and start effective treatment early, in order to reduce their duration of infectiousness. The traditional approach of "passive case finding" depends on people who are symptomatic with active TB seeking care in clinics and being successfully diagnosed and treated[12]. The rationale for "intensified case finding" among clinic attendees is that it is far more efficient for health workers to screen for TB among people attending clinics than in the general population[2]. However, if people with TB have relatively mild or intermittent symptoms[13], particularly if they are HIV-negative or unaware of their status, they may not prioritise seeking care. Our data show that HIV-negative or -unknown men rarely visit PHCs, and therefore attempts to reduce the duration of infectiousness of HIV-negative men with active TB will need to reach outside health facilities. These data illustrate that HIV care has become a dominant reason for PHC attendance among adults in this setting of very high HIV prevalence, accounting for nearly half of all daytime visits by adults. This finding is unlikely to be generalisable to settings where HIV prevalence is less high. However, as we move towards 90:90:90 and then 95:95:95 HIV care cascade targets, and HIV prevalence increases as ART prolongs survival, PHCs in many settings will need to provide care for increasing numbers of people on ART. Our data underline the importance of efforts to simplify HIV care by reducing visit frequency, and strengthening systems to support further decentralisation of ART delivery to community level[14].

Several studies both in South Africa and the wider African region have quantified reasons for visits to health facilities, but we are not aware of similar studies based in demographic surveillance areas or other settings with a population denominator and comprehensive data on HIV status[15].

A study in the Western Cape in 2016 used home-based surveys to determine if respondents had attended a PHC facility

Table 2. Proportion of adults resident in the Africa Health Research Institute demographic surveillance area[1] who attended a primary healthcare clinic between April 2017 and March 2018, stratified by sex and HIV status.

Sex	HIV-positive			HIV-negative/HIV-unknown			All		
	n[2]	N[3]	% (CI)	n[2]	N[3]	% (CI)	n[2]	N[3]	% (CI)
Females	8555	10692	80.0 (79.3,80.8)	9805	29394	33.4 (32.8,33.9)	18360	40086	45.8 (45.3,46.3)
Males	2582	3504	73.7 (72.2,75.1)	3440	23534	14.6 (14.2,15.1)	6022	27038	22.2 (21.8,22.8)
Total	11137	14196	78.5 (77.8,79.1)	13145	52928	24.8 (24.5,25.2)	24382	67124	36.3 (36.0,36.7)

[1] Africa Health Research Institute (AHRI) undertakes population-based demographic surveillance in a rural district of Kwazulu Natal, South Africa with annual HIV sero-surveys. Individuals were included if they were resident in the AHRI demographic surveillance area on 1st July 2017.

[2] n represents the number of resident adults making ≥1 primary healthcare clinic visit (for any reason) in the study year.

[3] N represents number of resident adults in the Africa Health Research Institute Demographic Surveillance Area's population for each category.

Table 3. Number and type of primary healthcare visits made by adults resident in the Africa Health Research Institute demographic surveillance area[1] during the study year by sex (N=88109).

Sex	HIV care visits		Acute care visits		Other chronic care visits		Total	
	n[2]	%[3]	n[2]	%[3]	n	%[3]	n[2]	%[3]
Females	29384	33.3	25303	28.7	15000	17.0	69687	79.1
Males	8172	9.3	5844	6.6	4406	5.0	18422	20.9
Total	37556	42.6	31147	35.4	19406	22.0	88109	100

[1] Africa Health Research Institute (AHRI) undertakes population-based demographic surveillance in a rural district of KwaZulu Natal, South Africa with annual HIV sero-surveys. Individuals were included if they were resident in the AHRI demographic surveillance area on 1st July 2017.

[2] n represents the number of visits.

[3] The percentages represent n/N, where N is the total visits made by all adults during study period.

in the past six months. Similar to our finding, they found that men were less likely to attend clinic that women[16]. Furthermore fewer than 20% of all men aged 18–25 years, or men aged 26–45 who attended bars, attended a clinic[16].

A study in rural Tanzania in 2019 examined the quality of outpatient care of 2002 women seen in PHCs by asking women about their most recent outpatient experience in a household survey in 2002[17]. The study found that the most common reasons for seeking care were fever or malaria (33.9%), vaccination of infants (33.6%) and non-emergency check-ups (13.4%)[17]. This difference is expected given that malaria is rare in South Africa[17] with 9478 malaria cases and 76 malaria deaths in 2017[18], whereas Tanzania had 4241364 malaria cases and 6313 deaths in 2015[19].

In South Africa, a study in 2010 looked specifically at chronic non-communicable diseases in PHC facilities in the Western Cape, North West, Northern Cape and Limpopo provinces in South Africa. Health care workers recorded the age and gender of each patient and the reasons for each encounter. They found that hypertension was the commonest non-communicable disease (NCD) diagnosis encountered (13.1%), followed by type 2 diabetes (3.9%)[20]. Only 1.1% of respondents with an NCD also had HIV by self-report[20]. Women accounted for 12526 (66.6%) of consultations and men for 6288 (33.4%)[20].

However, this study was focused on multimorbidity and did not include HIV care as an independent reason for clinic attendance. Furthermore, it did not consider acute care as a primary reason for consultation.

In the past 30 years, the number of individuals receiving care for HIV in clinics has grown significantly with improved and comprehensive ART treatment services[21]. Given our finding that HIV-negative men rarely visit PHCs, improved coverage of TB screening in PHCs is likely to be inadequate to achieve earlier TB diagnosis and treatment among this important group. Additional research is needed to determine how to promote early diagnosis of TB among men. Facilitators to improve men's access and utilisation of PHC clinics including improved models of male-centred care, and novel approaches need to be explored[22]. Barriers that prevent men testing and accessing health services, including stigma, need to be better understood[16,22]. Novel approaches are necessary to access and provide TB screening services to men[22]. Innovative strategies are needed to access this notoriously hard to reach key population, interrupt TB transmission and find the "missing 160000".

Limitations of this analysis include that clinic attendance was only captured in the eleven PHCs serving the AHRI DSA, therefore any visits by residents in our study population to more distant clinics, hospitals and private institutions would have been missed. The number of PHC visits we recorded should therefore be regarded as a minimum estimate. In addition, no data capture occurred at night and over weekends, which means that some acutely ill people, and those seeking care for trauma will have been missed, particularly at the one PHC which is open 24 hours a day. However, it might be difficult to implement TB screening in people who are attending for acute or trauma care and so this is unlikely to substantially change our conclusions.

Some misclassification of HIV status is likely. Participants were considered to be HIV negative if they tested negative between the 1st of January 2014 and the 31st December 2017 and had no evidence of HIV-positive status. This may have resulted in misclassification of HIV-negative people as HIV-unknown. We grouped HIV positive and unknown together so this does not affect our conclusions. A participant was considered to be HIV-positive if the last HIV test recorded by AHRI's DSA was positive or if they have had any HIV-related PHC visit in the DSA. Therefore, anyone who tested HIV positive outside the DSA and did not attend for HIV care in the eleven DSA clinics or became HIV-positive after testing negative will have been misclassified as HIV-negative or -unknown[23].

Conclusion

In rural South Africa, only 15% HIV-negative or unknown men attended a PHC for any reason during the year this research was conducted. Therefore, improving TB screening in clinics as an isolated strategy will not reach a key population with respect to undiagnosed TB. Additional strategies are likely to be needed to diagnose and treat TB earlier, particularly in men.

Data availability

Underlying data

AHRI Data Repository: Clinic attendance by sex and HIV status in rural South Africa. https://doi.org/10.23664/AHRI.CLINIC.VISITS.CODE.2021[11].

Acknowledgements

We acknowledge and appreciate the hard work of Africa Health Research Institute staff who contributed to collecting and managing the Clinic Link data.

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Open Peer Review

Current Peer Review Status: ✔ ?

Version 1

Reviewer Report 12 August 2022

https://doi.org/10.21956/wellcomeopenres.18417.r51640

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Thank you for this manuscript that casts a needed spotlight on a population group that requires attention in efforts to address the TB burden. The manuscript is well written.

Did the authors analyze the data by age group? Stratification by age will also be helpful since it likely affects the decision and ability to attend PHC facilities:- for example the SA TB prevalence survey found the largest prevalence to notification ratio in younger people (15-24 years) and older people 65 years+. This may also be true by sex and could direct targeting and differentiation of interventions for different segments of the male population.

Did the authors consider separating the HIV-ve and HIV status-unknown groups? Those whose status is unknown group could be different from those LWH and those HIV-ve since they have never accessed testing and could require further and different attention and interventions - did they even attend PHCs at all even for chronic conditions?

Please add more literature including some of the more recent literature that explores men's views on TB and healthcare facility attendance. Chikovore J *et al* have published extensively on this subject (see reference list for example)[1]. Issues around male attendance at health facilities are also documented in the SA CRG report: *South African Community Rights and Gender Assessment: Exploring the impact of gender, key population membership, and the legal environment on TB vulnerability, treatment access, and quality of care*[2].

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Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Public health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 08 June 2022

https://doi.org/10.21956/wellcomeopenres.18417.r50585

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It is conventional wisdom to assert that men do not seek health care at the same frequency as women but the evidence behind the claim has always been weak which is why this is an important and cleverly designed study that will be widely cited. Researchers working on gender and TB have been searching for just this parameter for their models, so this study fills an unmet need. Taking place in a HDSS, the investigators obtained hard-to-find denominators for their estimates and

stratified by HIV status, a key predictor of health seeking in many settings. It is great to have an estimate of the magnitude of the difference in clinic attendance both for the modellers but also for the funders of different kinds of active case finding efforts.

This methodology should be emulated in other settings and WHO should recommend this approach to estimation of health seeking as the starting point for all national TB care cascade and patient pathway studies instead of the flawed proxy currently recommended (i.e. use of the entirely hypothetical child fever health seeking question from demographic and health surveys. The use of health seeking for child fever is invalid for TB symptom health seeking behavior and obscures the important gender differences shown by the authors. The authors are giving us a great new way to work in a gender disaggregated way and it would be handy if they provided an SOP to help other DHSS with the linking aspect.

To be thorough, I offer some critiques:

1. The authors assert that because HIV-negative men are less likely to seek formal public health care during day time hours, that non-passive case finding may be needed to reach this population with TB screening services. However, they do not mention exactly what that would look like. I infer that they are well aware that actually, men are also less likely to participate in generic community TB screening activities (and the South African TB prevalence survey is an example). Therefore the authors were strategically vague as to possible solutions to this challenge.

2. In the abstract the proportion of HIV-negative men seeking any care was (12.7%, 95%CI 11.6–13.8), but in the conclusion, it is given as 15%, which is the correct proportion?

3. The authors refer to HIV-negative men as a “Notoriously Hard To Reach Key Population”, which connotes that repeated efforts have been made to reach men and therefore they obtained notoriety due to multiple failures be reached. I am not aware of many failed scientifically-driven efforts to reach men with TB in the community. On the contrary, the TB scientific community has simply been negligent in serving the needs of its largest risk group, a group that has been consistently under-served and over-represented for decades if not centuries. It is important to situate the blame for the current situation on public health actors and not the people with TB.

4. The authors identify the absence of night and weekend data as a limitation that would have no impact on the robustness of the estimates because TB screening would not be feasible, but I was not convinced. Men are disproportionately impacted by trauma and they make up the bulk of the admissions for trauma. The statistics probably included labor and delivery even though that service is not particularly conducive to TB screening either. It would not have detracted greatly from the paper to have just conceded that it was a limitation, that the missing data was non-random, and tried to do a bit of sensitivity analysis around it.

5. There is now a rich and informative literature on what South African men with TB want in health care and why they do not seek care in public health spaces. Unfortunately, this important body of work was not as well cited in this manuscript as it could have been. It would have been useful for hypothesis generation and for the discussion. The list of lovely papers and books about TB, health seeking and men is long, and many of the best are focused on South African men:

- 1. *Chikovore J, Pai M, Horton KC, Daftary A, Kumwenda MK, Hart G, et al. Missing men with tuberculosis: the need to address structural influences and implement targeted and multidimensional interventions. BMJ Glob Heal. 2020;5(5):e002255.*
- *2. Daniels J, Medina-Marino A, Glockner K, Grew E, Ngcelwane N, Kipp A. Masculinity, resources, and retention in care: South African men's behaviors and experiences while engaged in TB care and treatment. Soc Sci Med. 2021;270:1–15.*
- *3. Gibbs A, Sikweyiya Y, Jewkes R. "Men value their dignity": Securing respect and identity construction in urban informal settlements in South Africa. Glob Health Action. 2015;8(1).*
- *4. Van Heerden A, Msweli S, Van Rooyen H. "Men don't want things to be seen or known about them": A mixed-methods study to locate men in a home based counselling and testing programme in KwaZulu-Natal, South Africa. African J AIDS Res. 2015;14(4):353–9.*
- *5. Reihling H. Affective Health and Masculinities in South Africa [Internet]. London: Routledge; 2020. Available from: https://www.taylorfrancis.com/books/9781000050462*

The authors conclude with a call for further research to understand men's behavior better, which is fine. Yet this belies the fact there is quite some research on-going on men and TB and/or men and health seeking. One might argue that what is really needed at this juncture is rigorously controlled and well-resourced trials to drive pro-men policy changes to remake the TB service delivery paradigm so that does not devalue or turn off one of its most important client groups.

[*I still think the field (not these authors particularly) would do well to try to study how we got here. How did we arrive at a situation where our largest and most consequential risk group has been so under-served? It is kind of flabbergasting how we have collectively dropped the ball and it would be worthwhile to unpack that so we don't do it again*.]

In conclusion, this is a methodologically important paper and I hope it is widely replicated.

References

1. Chikovore J, Pai M, Horton KC, Daftary A, et al.: Missing men with tuberculosis: the need to address structural influences and implement targeted and multidimensional interventions.*BMJ Glob Health*. **5** (5). PubMed Abstract | Publisher Full Text
2. Daniels J, Medina-Marino A, Glockner K, Grew E, et al.: Masculinity, resources, and retention in care: South African men's behaviors and experiences while engaged in TB care and treatment.*Soc Sci Med*. **270**: 113639 PubMed Abstract | Publisher Full Text
3. Gibbs A, Sikweyiya Y, Jewkes R: 'Men value their dignity': securing respect and identity construction in urban informal settlements in South Africa.*Glob Health Action*. 2014; **7**: 23676 PubMed Abstract | Publisher Full Text
4. Van Heerden A, Msweli S, Van Rooyen H: "Men don't want things to be seen or known about them": A mixed-methods study to locate men in a home based counselling and testing programme in KwaZulu-Natal, South Africa. *African Journal of AIDS Research*. 2015; **14** (4): 353-359 Publisher Full Text
5. Reihling H: Affective Health and Masculinities in South Africa. *Routledge*. 2020. Reference Source

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: TB epidemiology, stigma and gender

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.