**Tobacco use among people living with HIV: analysis of data from**

**Demographic and Health Surveys from 28 low- and middle-income countries**

Noreen D. Mdege PhD,1\* Sarwat Shah MScPH,1 Olalekan A. Ayo-Yusuf PhD,2 James Hakim FRCP,3 Kamran Siddiqi PhD1

1Department of Health Sciences, Faculty of Science, University of York, Heslington, York YO10 5DD, UK

2School of Oral Health Sciences, Sefako Makgatho Health Sciences University, PO Box D12, Medunsa 0240, Pretoria, South Africa.

3Department of Medicine, College of Health Sciences, University of Zimbabwe, Harare, Zimbabwe

\*Corresponding author:

Department of Health Sciences

Faculty of Science

University of York

Heslington, York YO10 5DD

UK

Tel: +44(0)1904321836

Email: noreen.mdege@york.ac.uk

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**Abstract**

**Background** Tobacco use among people living with HIV (PLWH) results in excess morbidity and mortality. Yet, very little is known about the extent of tobacco use among PLWH in low- and middle-income countries (LMICs). We assessed the prevalence of tobacco use among PLWH in LMICs.

**Methods** We estimated the country-specific, regional and overall prevalence of current tobacco use (smoked, smokeless and any tobacco use) among 6,729 HIV-positive men and 11,495 HIV-positive women (aged 15–49 years), and compared them to those in 193,763 HIV-negative men and 222,808 HIV-negative women, respectively. We used Demographic and Health Surveys data collected between 2003 and 2014 from 28 LMICs.

**Findings** The overall prevalence among HIV-positive men was 24·4% (95% CI 21·1–27·8) for current smoking, 3·4% (95% CI 1·8–5·6) for smokeless tobacco use and 27·1% (95% CI 22·8–31·7) for any tobacco use. The prevalence of any tobacco use and current smoking were higher in HIV-positive than HIV-negative men (Risk Ratios (RR) 1·41(95% CI 1·26-1·57) and 1·46 (95% CI 1·30-1·65) respectively). The difference in smokeless tobacco use prevalence between HIV-positive and HIV-negative men was not statistically significant (RR 1.26 (95% CI 1.00-1.58). The overall prevalence among HIV-positive women was 1·3% (95% CI 0·8–1·9) for current smoking, 2·1% (95% CI 1·1–3·4) for smokeless tobacco use and 3·6% (95% CI 2·3–5·2) for any tobacco use. Any tobacco use, current smoking and smokeless tobacco use were more prevalent in HIV-positive than in HIV-negative women (Risk Ratios 1·36 (95% CI 1·10-1·69); 1·90 (95% CI 1·38-2·62) and 1.32 (85% CI 1.03-1.69), respectively).

**Interpretation** The high prevalence of tobacco use in PLWH mandates targeted policy, practice and research action to promote tobacco cessation and to improve the health outcomes in this population.

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| **Research in context****Evidence before this study**We searched Medline (OVID platform) for articles published until 31 December 2015 thatinclude the search terms “smoking” or “tobacco use” or “smokeless” or “cigarette” AND “HIV” or “human immunodeficiency virus” or “AIDS” or “Acquired Immune Deficiency Syndrome” in the title and were from low-income and middle-income countries (LMIC). This search was updated on 30 September 2016. We identified six primary research articles on the prevalence of tobacco smoking among people living with HIV (PLWH) covering eight countries, of which only one was based on national-level DHS data from one country. No multi-LMIC comparisons on the topic were identified.**Added value of this study**Our study is the largest to report country-level and overall prevalence estimates for tobacco smoking, smokeless tobacco use and any tobacco use among PLWH from 28 LMICs using nationally representative data that is comparable across countries. It is also the first to compare the country-level prevalence estimates for tobacco use for PLWH with those for HIV-negative individuals in the respective countries where such data is available.**Implications of all the available evidence**Findings from our study and all the other studies confirm that for LMICs, the prevalence of tobacco use is higher among PLWH than those without HIV, for both men and women. There is an urgent need for policy, practice and research action on tobacco cessation among PLWH to prevent the excess morbidity and mortality due to tobacco-related diseases and improve the health outcomes in this population. This action could include exploring effective and cost-effective tobacco-cessation interventions for PLWH that are appropriate and scalable in low-resource settings; the integration of tobacco use services within HIV programmes in LMICs including proactive identification and recording of tobacco use, as well as the provision of tobacco use cessation interventions; increasing healthcare providers awareness and competencies on providing tobacco use cessation services among PLWH; increasing awareness of the harms due to tobacco use and the benefits of quitting among PLWH; and implementing smoke free policies within HIV services. |

**Introduction**

The advent of and increased access to antiretroviral therapy (ART) has transformed HIV from a deadly disease to a chronic condition for many people living with HIV (PLWH).1 With ART, PLWH can now have a near-normal life expectancy.1 However, unhealthy behaviours such as tobacco use threaten to undermine some of the gains that have been made.2 Smoking increases the risk of death among PLWH.3,4 A study among 924 HIV-positive women on ART in the USA reported an increased risk of death due to smoking with a hazard ratio (HR) of 1·53 (95% CI=1·08-2·19).3 A prospective cohort of 17,995 HIV-positive individuals from Europe and North America receiving ART found a mortality rate ratio of 1·94 (95% CI = 1·56–2·41) for smokers when compared to non-smokers.4 The average years of life lost by HIV-infected smokers compared with HIV-infected non-smokers have been estimated as 12·3 years, which represents more than a twofold increase in the number of years lost by HIV infection alone.5

PLWH are more susceptible to tobacco-related illnesses such as cardiovascular disease, cancer and pulmonary disease when compared to those who are HIV-negative or the general population.6-8 Furthermore, smoking among PLWH increases susceptibility to infections such as bacterial pneumonia, oral candidiasis and tuberculosis.9-11 A recent case-control study among 279 ART naïve HIV-positive men in South Africa found that current smoking tripled the risk of pulmonary tuberculosis (adjusted OR 3·2; 95%CI: 1·3–7·9, p = 0·01).12 Smoking also increases the risk of developing AIDS (HR 1·36; 95% CI: 1·07-1·72) among PLWH.3 This increased susceptibility has been mainly attributed to biochemical mechanisms including immunosuppressive effects of smoking; and its negative impact on immune and virological response even when on ART.13 Behavioural mechanisms have also been suggested; for example, association between smoking and non-adherence to antiretroviral therapy.14,15

There is lack of population-level prevalence estimates of tobacco use among PLWH from LMICs where the burden of HIV and tobacco-related illnesses are greatest.16-18 The current study aimed to address this evidence gap for all forms of tobacco use among PLWH, using data from 28 nationally representative household surveys. The study also compared tobacco use prevalence among PLWH to that among HIV-negative individuals.

**Methods**

**Data sources and procedures**

We performed a secondary analysis of the most recent (as at December 2015) Demographic and Health Survey (DHS) data from 28 LMICs where both tobacco use and HIV test data were made publicly available. Access and use of this data was authorized by the DHS program.

The DHS is designed to collect cross-sectional data that are nationally representative, on the health and welfare of women of reproductive age (15-49), their children and households, at about 5-year intervals across many LMICs. The DHS procedure including the two staged sampling approach for the selection of census enumeration areas and households, questionnaire validation, data collection for household, men and women, and data validation are comprehensively described elsewhere.19 In all selected households, women aged 15-49 are eligible to participate and those who give consent are interviewed using the women’s questionnaire. In many surveys men aged 15-54 (or up to 59 years in some instances) from a sub-sample of the main survey households are also eligible to participate and those who give consent are interviewed using a men's questionnaire. The surveys are comparable across countries through the use of standard model questionnaires and sampling methods.

In this study, we analysed country-level DHS data to compute prevalence estimates in PLWH. We also computed relative prevalence ratios (as risk ratios) comparing prevalence between HIV-positive and HIV-negative individuals.

**Variables of interest**

In the DHS, tobacco use is ascertained by three questions to be answered “yes” or “no”. Two are about whether, at current, the respondent smokes cigarettes, or use any other type of tobacco. The third asks the respondent what type(s) of tobacco they currently smoke or use, for which all tobacco types are recorded including country-specific products.20 HIV status data are obtained from an HIV testing protocol that undergoes a host country ethical review and provides status from informed, anonymous, and voluntary HIV testing for both women and men. Blood spots are collected on filter paper from a finger prick and transported to a laboratory for testing. The testing involves an initial ELISA test, and then retesting of all positive tests and 5-10 percent of the negative tests with a second ELISA. For those with discordant results on the two ELISA tests, a new ELISA or a Western Blot is performed.

**Statistical analysis**

For each country, where HIV status data could be linked to individual records in the general survey, data on HIV-positive and HIV-negative individuals (as confirmed by blood test results) were included in the analysis. Respondents were classified as a “tobacco smoker” if they responded “yes” to smoking cigarettes, pipes, or other country-specific smoking products such as water pipe/ hookah. They were classified as “smokeless tobacco users” if their response was “yes” to the use of chew, snuff, or other country-specific smokeless tobacco products. Respondents who indicated that they smoked tobacco and/or used smokeless tobacco were also classified as “any tobacco users”.

*National level prevalence estimate*

For each country, the crude prevalence of tobacco smoking, smokeless tobacco use and any tobacco use were estimated separately for males and females. Analysis was performed using STATA version 14. The analysis included sampling weights to account for differential probabilities of selection and participation, and also accounted for clustering and stratification in the sampling design.21 Within STATA version 14, we declared the DHS datasets as survey type from two-stage cluster sampling: 1) the selection of census enumeration areas based on a probability (proportional to area size), and 2) random selection of households from a complete listing of households within the selected enumeration areas.19 The reported estimates include the associated 95% confidence intervals. We also computed age-standardised prevalence rates for men and women separately, using the World Health Organization (WHO) World Standard Population Distribution based on world average population between 2000-2025.22

*Pooled regional level prevalence*

Countries were classified geographically into the following six WHO regions: Africa, Americas, Eastern Mediterranean, Europe, South-East Asia and Western Pacific. Pooled regional estimates were only computed for the African region where there was sufficient number of countries with available data to conduct a meta-analysis. These were computed in MetaXL version 5·3 by first stabilisation of the variances of the raw proportions with a double arc-sine transformation and then application of a random-effects model.23 We assumed that the country level estimates were different, yet related. By conducting a random-effects meta-analysis, the standard errors of the country-specific estimates are adjusted to incorporate a measure of the extent of variation among them.24 The amount of variation, and hence the adjustment, can be computed from the estimates and standard errors from the country level data included in the meta-analysis.24

*Overall pooled prevalence estimates for all 28 countries*

The overall pooled prevalence estimates were computed for all countries combined together; using the same methodology as for the regional level estimates.

*Relative prevalence ratios*

To study differences between prevalence rates between HIV-positive and HIV-negative individuals, we estimated country, regional and overall relative prevalence ratios for tobacco smoking, smokeless tobacco use and any tobacco use separately for males and females. This analysis was conducted in RevMan version 5.1 using the random effects model, as described above.

*Heterogeneity assessment*

We used the I² statistic to assess heterogeneity between country-specific estimates: values of 25% or less indicated low heterogeneity, whilst values of >25% but < 75% indicated moderate heterogeneity, and values of 75% or greater indicated high heterogeneity. Potential sources of heterogeneity for prevalence estimates were explored through meta-regression analysis. This tested the association between the country level covariates in table 1, as well as year of survey (as a binary outcome: in or before 2009 which is approximately the mid-point, or after 2009), with estimated prevalence of any tobacco use. Meta-regression was performed using STATA version 14.

**Role of the funding source**

The funders did not have any role in study design; the collection, analysis, and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication. NDM had full access to all the data in the study and had final responsibility for the decision to submit for publication.

**Results**

We were able to link HIV status data with the individual data in the general DHS survey for 28 LMICs. For these, our analysis provided data for 6,729 HIV-positive men (aged 15-59 years) and 11,495 HIV-positive women (aged 15–49 years), as well as 193,763 HIV-negative men and 222,808 HIV-negative women for the same age groups. Out of all LMICs, we were able to include 24 (~52%) of 46 in Africa, two (~8%) of 26 in the Americas, one (9%) of 11 in Southeast Asia, and one (~6%) of 18 in the Western Pacific regions. Data was not available for any of the LMICs in Europe and the Eastern Mediterranean.

**Country level characteristics of participants**

Table 1 shows the country-level characteristics of HIV-positive and HIV-negative men and women whose data was included in the analysis.

**Tobacco use among HIV-positive men**

Of HIV-positive men from the 27 LMICs, 27·1% (95% CI 22·8–31·7) reported any tobacco use (Table 2). The crude prevalence ranged from 9·7% (Ethiopia) to 68·2% (India). The regional pooled prevalence of any tobacco use was 26·0% (95% CI 22·7–29·4) for Africa.

Of the HIV-positive men 24·4% (95% CI 21·1–27·8) reported smoking tobacco (Table 2). There was a substantial variation in crude prevalence of current tobacco smoking across countries, from 9·7% (Ethiopia) to 54·8% (in The Gambia). The regional pooled prevalence of current tobacco smoking in HIV-positive men was 24·2% (95% CI 20·9–27·6) for the African region.

Overall, 3·4% (95% CI 1·8–5·6) of HIV-positive men reported use of smokeless tobacco (Table 2). The country level crude prevalence varied considerably and was as high as 41·4% in India. The regional pooled prevalence of current smokeless tobacco use was 2·6% (1·7–3·6) for Africa.

When compared to HIV-negative men, the pooled prevalence among HIV-positive men was significantly higher for any tobacco use (Risk Ratio (RR) 1·41, 95% CI 1·26-1·57) and for smoking (RR 1·46, 95% CI 1·30-1·65) (Figures 1a and 1b respectively). The difference between the two groups on smokeless tobacco use prevalence (RR 1·26, 95% CI 1·00-1·58) (Figure 1c) did not reach statistical significance. The pooled prevalence for the African region were significantly higher for the HIV-positive men than HIV-negative men for any tobacco use (RR 1·42, 95% CI 1·26-1·60), smoking (RR 1·47, 95% CI 1·29-1·66) as well as smokeless tobacco use (RR 1·35, 95% CI 1·05-1·73).

**Tobacco use among HIV-positive women**

Overall, 3·6% (95% CI 2·3–5·2) of the HIV-positive women from the 28 included LMICs reported any tobacco use (Table 3). Lesotho had the highest crude prevalence at 16.4%. The regional pooled prevalence of any tobacco use was 2·8% (95% CI 1·6–4·3) for Africa.

1·3% (95% CI 0·8–1·9) of HIV-positive women reported smoking tobacco (Table 3). Dominican Republic had the highest crude prevalence at 10·1%. The regional pooled prevalence of current tobacco smoking in HIV-positive women was 1·0% (95% CI 0·6–1·4) for the African region.

Of HIV-positive women, 2·1% (95% CI 1·1–3·4) reported smokeless tobacco use (Table 3). Lesotho had the highest crude prevalence at 15·7%. The regional pooled prevalence of current smokeless tobacco use was 1·9% (0·9–3·2) for Africa.

When compared to HIV-negative women, the pooled prevalence among HIV-positive women were significantly higher for any tobacco use (RR 1·36, 95% CI 1·10-1·69), current smoking (RR 1·90, 95% CI 1·38-2·62), and smokeless tobacco use (RR 1·32, 95% CI 1·03-1·69) (Figure 2a, 2b and 2c respectively). The pooled prevalence for the African region were significantly higher for the HIV-positive women than HIV-negative women for any tobacco use (RR 1·34, 95% CI 1·04-1·72), smoking (RR 1·87, 95% CI 1·29-2·72) as well as smokeless tobacco use (RR 1·42, 95% CI 1·09-1·85).

**Heterogeneity**

Tables 2 and 3 shows substantial heterogeneity in prevalence estimates between countries within and across regions. However meta-regression did not reveal any significant predictor variable for both men and women.

**Discussion**

To our knowledge, this is the largest study to provide up-to-date country-specific, regional (specifically the African region) and overall prevalence estimates for tobacco smoking, smokeless tobacco use and any tobacco use among PLWH using nationally representative samples from 28 LMIC. The study demonstrates that, in LMICs, tobacco use prevalence is generally higher for PLWH than HIV-negative individuals for both men and women.

Other studies have reported a higher prevalence of smoking in PLWH than HIV-negative individuals or the general population. For example, in the USA the reported prevalence of smoking among PLWH is 50-70% compared to ~20% in general population or HIV-negative individuals.3,9,25-31 These differences are much higher than the differences that were observed for tobacco use in the current study, and are observed for both men and women. A possible explanation is that most of the developed country studies were conducted in non-random samples of population subgroups, such as those in a particular treatment program or low-income groups. In addition, this could be attributed to differences in the profile of HIV-positive populations in developed countries compared to LMICs (e.g. mostly male vs. mostly female respectively). Very few studies have examined tobacco use prevalence among PLWH in LMICs, most of which are also of small non-random sub-samples, and only present data on tobacco smoking. 32-35 In addition, a few make comparisons with the general population prevalence or that among HIV-negative individuals. Those that have used larger or population level data have reported prevalence estimates that are closer to our findings. A cross-sectional survey among 6,111 factory workers - 88% who were men - in Zimbabwe found a smoking prevalence of 27% among PLWH versus 17% among HIV-negative individuals (p < 0·001).36 More recently Lall and colleagues reported tobacco use prevalence of 68% among HIV-positive men versus 58% among HIV-negative men in India from a secondary data analysis of 50,079 observations from the 2006 general population National Family Health Survey data.37

We found substantial variation in smoking, smokeless tobacco use and any tobacco use prevalence between countries. Tobacco smoking was much more prevalent among men than women, an observation which is consistent with findings from elsewhere.38 For women, smokeless tobacco was the primary form of tobacco use in 11 out of the 28 countries. This has also been noted elsewhere,21 and the potential reasons include that, in some countries, smokeless tobacco use is more socially acceptable than tobacco smoking among women.39 There is also a potential for misclassification, particularly due to under-reporting in contexts where this behaviour is not socially or culturally acceptable, particularly for women.35,40 This suggests the need to take into account gender differences in product preferences when designing policies and interventions for tobacco use cessation in this population. In addition, although the prevalence of smoking is very low overall among women in this population, it is possible that they are exposed to second-hand smoke, particularly if their partners smoke, and the prevalence of this exposure and associated harms needs investigation. A recent analysis of DHS data from 19 Sub-Saharan Africa countries also identified other factors that increase the risk of being a smoker among PLWH in addition to gender, including being from poorer households and living in urban areas.38

It has been suggested that the high tobacco use among PLWH is due to a number of reasons including tobacco being used to cope with HIV-related symptoms such as neuropathic pain, as well as with anxiety, stress and depression, all of which are higher in this population.30,41 Studies have found that PLWH express an inaccurate perception of their life expectancy which affects their perceived susceptibility to the risks of tobacco use.42 In addition, a study among 301 HIV-positive individuals in Mali found that whilst knowing their HIV-infection did not lead to taking up smoking, it negatively influenced those already smoking by increasing their consumption.43 These taken together, suggest that it might not be enough to provide this population with information on the harms of tobacco use. Instead, there is need to also emphasis the benefits of quitting either through use of targeted graphic health labels or use of culturally-appropriate mass communication media as provided for in the guidelines for the implementation of these World Health Organization Framework Convention on Tobacco Control-compliant tobacco control policies.

PLWH who use tobacco find it hard to quit and often recommence use after they have stopped.25,28,31  Recently, Pool and colleagues published a systematic review including 14 studies (13 of which were conducted in the USA) on effectiveness of smoking cessation interventions among PLWH, most which combined pharmacotherapy with nicotine replacement therapy and/or varenicline and psychotherapy.44 They found some poor quality evidence of effectiveness in the short term but no clear evidence of effectiveness in the long-term.44 Many interventions included in these studies were not tailored to the unique needs of PLWH; this was suggested as a potential reason for their poor success rates.16 HIV-positive individuals face social stigma, mental and physical comorbidities, alcohol misuse, and co-dependencies on other substances; all of which influence their tobacco use behaviour, quit attempts and successful cessation rates. Future interventions should take account of these complex social, psychological and other health challenges faced by most PLWH.

In DHS data, current tobacco use status (including smoking status and smokeless tobacco use) are ascertained by self-report which raises possibilities of under-reporting, as mentioned previously. 35,40 Smokeless tobacco was treated as a homogeneous group in this study when in fact it is a surrogate term for a diverse range of tobacco products including snuff and chewing tobacco. In addition, there were differences between countries in the way data on smokeless tobacco use was collected and recorded which meant making clear distinctions between different smokeless tobacco products proved even more difficult. The study comprised observations from individuals who had agreed to have an HIV test as part of the DHS, and had their test results data available that could be linked to their tobacco use data in the general DHS dataset. This meant that our sample was restricted to a self-selected population and may not represent the general population – a limitation of the DHS data on HIV and not just of our analysis. Furthermore, the samples analysed for some countries were relatively small, particularly for PLWH. Although unlikely, there is still a potential for selection bias where those included in the sample were significantly different from those who were not, with respect to their smoking status. There is evidence to suggest that the prevalence of tobacco use could be growing in some LMICs, especially in females.21 Our study included data from 2003 to 2014; and therefore our prevalence estimates could be lower than the current status. Our analysis was limited to a few WHO regions; and even within these regions, with the exception of Africa, only a few countries were included due to unavailability of DHS data. Other countries had tobacco use data but did not have linked HIV data or did not make it publicly available. This restricted our ability to compute wider regional and global prevalence estimates.

Tobacco use leads to significant morbidity and mortality among HIV-positive individuals.45 Countries with a high prevalence of tobacco use among HIV-infected populations, as highlighted by our study, should prioritise introducing tobacco cessation in their HIV treatment plans. However, most HIV care providers are less likely to correctly identify current smokers, and feel confident in their ability to influence smoking cessation, than general health workers.46 Given the overwhelming task of managing HIV-infection and its complications, tobacco cessation may also be less of a priority from both provider’s and patient’s perspective.25,42,47 Future research action to improve the health of this population could therefore include exploring effective and cost-effective tobacco cessation interventions for PLWH that are sustainable and scalable in low-resource settings. For policy and practice, action could include the integration of tobacco cessation within HIV programmes in LMICs including proactive identification and recording of tobacco use, as well as the provision of tobacco cessation interventions; increasing healthcare providers awareness and skills in providing cessation advice to PLWH; increasing awareness of the harms due to tobacco use and the benefits of quitting among PLWH; and implementing smoke free policies within HIV-treatment facilities.

**Contributors**

NDM conceptualised the study, developed the analytical strategy, performed the statistical analysis, interpreted the results, and wrote the first draft of the report. SS contributed to obtaining data, statistical analysis, interpretation of the results and revision of the report. OAAY and JH contributed to the analysis, interpretation of results and revision of the report. KS contributed to the conceptualization of the study, analytical strategy, interpretation of results, and performed critical revisions of the report.

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**Declaration of interests**

We declare no competing interests.

**References**

1. Mills EJ, Bakanda C, Birungi J, et al. Life expectancy of persons receiving combination antiretroviral therapy in low-income countries: a cohort analysis from Uganda. *Annals of Internal Medicine* 2011; **155**(4): 209-16.

2. Siddiqi K, Mdege N. Smoking: A major roadblock in the fight against AIDS. *Nicotine & Tobacco Research* 2016; doi:10.1093/ntr/ntw130.

3. Feldman JG, Minkoff H, Schneider MF, et al. Association of cigarette smoking with HIV prognosis among women in the HAART era: a report from the women’s interagency HIV study. *American Journal of Public Health* 2006; **96**(6): 1060–5.

4. Helleberg M, May MT, Ingle SM, et al. Smoking and life expectancy among HIV-infected individuals on antiretroviral therapy in Europe and North America *AIDS* 2015; **29**(2): 221–9.

5. Helleberg M, Afzal S, Kronborg G, et al. Mortality attributable to smoking among HIV-1-infected individuals: A nationwide, population-based cohort study. *Clinical Infectious Diseases* 2013; **56**(5): 727–34.

6. Petoumenos K, Worm S, Reiss P, et al. Rates of cardiovascular disease following smoking cessation in patients with HIV infection: results from the D:A:D study. *HIV Medicine* 2011; **12**(7): 412–21

7. Soliman EZ, Sharma S, Arastéh K, et al. Baseline cardiovascular risk in the INSIGHT Strategic Timing of AntiRetroviral Treatment (START) trial. *HIV Medicine* 2015; **16**(S1): 46-54.

8. Wistuba II, Behrens C, Milchgrub S, et al. Comparison of molecular changes in lung cancers in HIV-positive and HIV-indeterminate subjects. *Journal of the American Medical Association* 1998; **279**(19): 1554-9.

9. Burns DN, Hillman D, Neaton JD, et al. Cigarette smoking, bacterial pneumonia, and other clinical outcomes in HIV-1 infection. Terry Beirn Community Programs for Clinical Research on AIDS. *Journal of Acquired Immune Deficiency Syndromes & Human Retrovirology* 1996; **13**: 374–83.

10. Carpio E, López V, Fardales V, Benítez I. Oral manifestations of HIV infection in adult patients from the province of Sancti Spiritus, Cuba. *Journal of Oral Pathology and Medicine* 2009; **38**(1): 126-31.

11. Ramin B, Kam D, Feleke B, Jacob B, Jha P. Smoking, HIV and non-fatal tuberculosis in an urban African population [Short Communication]. *International Journal of Tuberculosis and Lung Disease* 2008; **12**(6): 695-7.

12. Bronner Murrison L, Martinson N, Moloney RM, et al. Tobacco smoking and tuberculosis among men living with HIV in Johannesburg, South Africa: A Case-Control Study. *PLOS ONE* 2016; **11**(11): e0167133.

13. Miguez-Burbano MJ, Burbano X, Ashkin D, et al. Impact of tobacco use on the development of opportunistic respiratory infections in HIV seropositive patients on antiretroviral therapy. *Addiction Biology* 2003; **8**(1): 39–43.

14. Moreno JL, Catley D, Lee HS, Goggin K. The relationship between ART adherence and smoking status among HIV+ individuals. *AIDS and behavior* 2015; **19**(4): 619-25.

15. Nguyen NTP, Tran BX, Hwang LY, et al. Effects of cigarette smoking and nicotine dependence on adherence to antiretroviral therapy among HIV-positive patients in Vietnam. *AIDS Care* 2016; **28**(3): 359-64.

16. Moscou-Jackson G, Commodore-Mensah Y, Farley J, DiGiacomo M. Smoking-cessation interventions in people living with HIV infection: a systematic review. *The Journal of the Association of Nurses in AIDS Care* 2014; **25**(1): 32–45.

17. Ortblad KF, Lozano R, Murray CJL. The burden of HIV: insights from the Global Burden of Disease Study 2010. *AIDS* 2013; **27**(13): 2003–17.

18. World Health Organization. Tobacco, Fact Sheet 2014. [online]. World Health Organization; 2014.

19. Rutstein SO, Rojas G. Guide to DHS statistics: Demographic health surveys methodology. Maryland: USAID, 2006.

20. MEASURE DHS, ICF International. Questionnaires: household, woman's, and man's; demographic health survey methodology. Maryland: USAID, 2011.

21. Caleyachetty R, Tait CA, Kengne AP, Corvalan C, Uauy R, Echouffo-Tcheugui JB. Tobacco use in pregnant women: analysis of data from Demographic and Health Surveys from 54 low-income and middle-income countries. *The Lancet Global health* 2014; **2**.

22. Ahmad OB, Boschi-Pinto C, Lopez AD, Maurray CJL, Lozano R, Inoue M. Age standardization of rates: A new WHO standard. Geneva: World Health Organization, 2001.

23. Barendregt JJ, Doi SA, Lee YY, Norman RE, Vos T. Meta-analysis of prevalence. *Journal of Epidemiology and Community Health*, 2013; http://jech.bmj.com/content/67/11/974.full.pdf [accessed 04 January 2016].

24. DerSimonian R, Laird N. Meta-analysis in clinical trials. *Controlled Clinical Trials* 1986; **7**(7): 177-88.

25. Burkhalter JE, Springer CM, Chhabra R, Ostroff JS, Rapkin BD. Tobacco use and readiness to quit smoking in low-income HIV-infected persons. *Nicotine and Tobacco Research* 2005; **7**(4): 511-22.

26. Crothers K, Griffith TA, McGinnis KA, et al. The impact of cigarette smoking on mortality, quality of life, and comorbid illness among HIV-positive veterans. *Journal of General Internal Medicine* 2005; **20**(12): 1142-5.

27. Dube SR, McClave A, James C, Caraballo R, Kaufmann R, Pechacek T. Vital signs: current cigarette smoking among adults aged ≥18 years—United States, 2009 *Morbidity & Mortality Weekly Report* 2010; **59**(35): 1135–40.

28. Gritz ER, Vidrine DJ, Lazev AB, Amick BCr, Arduino RC. Smoking behavior in a low-income multiethnic HIV/AIDS population. *Nicotine and Tobacco Research* 2004; **6**(1): 71-7.

29. Mamary EM, Bahrs D, Martinez S. Cigarette smoking and the desire to quit among individuals living with HIV. *AIDS Patient Care STDS* 2002; **16**: 39–42.

30. Tesoriero JM, Gieryic SM, Carrascal A, Lavigne HE. Smoking among HIV positive New Yorkers: prevalence, frequency, and opportunities for cessation. *AIDS and Behavior* 2010; **14**: 824–35.

31. Webb MS, Vanable PA, Carey MP, Blair DC. Cigarette smoking among HIV+ men and women: examining health, substance use, and psychosocial correlates across the smoking spectrum. *Journal of Behavioral Medicine* 2007; **30**(5): 371-83.

32. Waweru P, Anderson R, Steel H, Venter WDF, Murdoch D, Feldman C. The prevalence of smoking and the knowledge of smoking hazards and smoking cessation strategies among HIV positive patients in Johannesburg, South Africa. *South African medical journal = Suid-Afrikaanse tydskrif vir geneeskunde* 2013; **103**(11): 858-60.

33. Iliyasu Z, Gajida AU, Abubakar IS, Shittu O, Babashani M, Aliyu MH. Patterns and predictors of cigarette smoking among HIV-infected patients in northern Nigeria. *International Journal of STD & AIDS* 2012; **23**(12): 849-52.

34. Jaquet A, Ekouevi DK, Aboubakrine M, et al. Tobacco use and its determinants in HIV-infected patients on antiretroviral therapy in West African countries. *The International Journal of Tuberculosis and Lung Disease* 2009; **13**(11): 1433-9.

35. Mwiru RS, Nagu TJ, Kaduri P, Mugusi F, Fawzi W. Prevalence and patterns of cigarette smoking among patients co-infected with human immunodeficiency virus and tuberculosis in Tanzania. *Drug and Alcohol Dependence* 2017; **170**: 128-32.

36. Munyati SS, Redzo N, Dauya E, et al. Human immunodeficiency virus, smoking and self-rated health in Harare, Zimbabwe. *International Journal of Tuberculosis and Lung Disease* 2006; **10**(11): 1279-85.

37. Lall P, Saifi R, Kamarulzaman A. Tobacco consumption among HIV-positive respondents: findings from the third round of the National Family Health Survey. *Nicotine & Tobacco Research*, 2016; doi: 10.1093/ntr/ntw111 [accessed April 18, 2016].

38. Uthman OA, Ekström AM, Moradi TT. Influence of socioeconomic position and gender on current cigarette smoking among people living with HIV in sub-Saharan Africa: disentangling context from composition. *BMC Public Health* 2016; **16**(1): 998.

39. Rogers JM. Tobacco and pregnancy. *Reproductive Toxicology* 2009; **28**: 152-60.

40. Dietz PM, Homa D, England LJ, et al. Estimates of nondisclosure of cigarette smoking among pregnant and nonpregnant women of reproductive age in the United States. *American Journal of Epidemiology* 2011; **173**(3): 355-9.

41. Humfleet GL, Delucchi K, K. K, Hall SM, Dilley J, Harrison G. Characteristics of HIV-positive cigarette smokers: a sample of smokers facing multiple challenges.(2009). . *AIDS Educ Prev* 2009; **21**((3 Suppl)): 54-64.

42. Reynolds NR, Neidig JL, Wewers ME. Illness representation and smoking behavior: a focus group study of HIV-positive men. *JANAC: Journal of the Association of Nurses in AIDS Care* 2004; **15**(4): 37-47.

43. Baya B, Maiga CAK, Sarro Yd, et al. Relationship between HIV positive status announcement and smoking among infected-individuals in Bamako, Mali. *Journal of AIDS & Clinical Research*, 2016; 7:617. doi:10.4172/2155- 6113.1000617 [accessed 23 February 2017].

44. Pool ER, Dogar O, Lindsay RP, Weatherburn P, Siddiqi K. Interventions for tobacco use cessation in people living with HIV and AIDS. *The Cochrane database of systematic reviews* 2016; (6): CD011120.

45. Lifson AR, Neuhaus J, Arribas JR, et al. Smoking-related health risks among persons with HIV in the strategies for management of antiretroviral therapy clinical trial. *American Journal of Public Health* 2010; **100**: 1896-903.

46. Crothers K, Goulet JL, Rodriguez-Barradas MC, et al. Decreased awareness of current smoking among health care providers of HIV-positive compared to HIV-negative veterans. *Journal of General Internal Medicine* 2007; **22**(6): 749-54.

47. Nicholas PK, Voss JG, Corless IB, et al. Unhealthy behaviours for self-management of HIV-related peripheral neuropathy. *AIDS Care* 2007; **19**(10): 1266-73.

**Table 1: General characteristics of men and women included in the analysis**

|  |  |
| --- | --- |
| **HIV-positive men and women** | **HIV-negative men and women** |
| **Country** | **Number analysed (Male/Female)** | **Mean age in years****(Male/ Female)** | **Percentage urban****Dwellers****(Male/ Female)** | **Percentage within lowest household****wealth quintile****(Male/ Female)** | **Percentage not working****(Male/ Female)** | **Percentage with no education****(Male/ Female)** | **Number analysed (Male/Female)** | **Mean age in years****(Male/ Female)** | **Percentage urban****Dwellers****(Male/ Female)** | **Percentage within lowest household****wealth quintile****(Male/ Female)** | **Percentage not working****(Male/ Female)** | **Percentage with no education****(Male/ Female)** |
| Burkina Faso 2010 | 60 / 100 | 36·1 / 33·7 | 52·5 / 58·7 | 13·8 / 10·9 | 1·6 / 22·5 | 49·0 / 61·0 | 6974 / 8246 | 31·9 / 28·6 | 28·7 / 26·4 | 17·4 / 18·3 | 7·0 / 25·2 | 61·6 / 74·1 |
| Burundi 2010 | 56 / 108 | 40·3 / 33·1 | 34·0 / 37·3 | 14·2 / 16·0 | 2·5 / 24·6 | 25·7 / 34·5 | 4022 / 4401 | 31·2 / 27·7 | 14·5 / 10·1 | 16·1 / 20·0 | 12·7 / 26·3 | 31·7 / 45·6 |
| Cambodia 2005 | -/ 49 | -/ 32·7 | -/ 38·6 | -/ 13·6 | -/ 44·9 | -/ 26·1 | -/ 8139 | -/ 29·9 | -/ 17·6 | -/ 17·6 | -/ 34·6 | -/ 19·8 |
| Cameroon 2011 | 215 / 434 | 37·0 / 31·6 | 55·9 / 61·5 | 6·2 / 7·5 | 9·4 / 28·8 | 4·4 /10·5 | 6730 / 6819 | 30·3 / 27·8 | 54·9 / 53·2 | 18·8 / 16·9 | 22·2 / 38·7 | 9·5 /21·4 |
| Côte d'Ivoire 2011 | 127 / 209 | 42·4 / 32·4 | 56·6 / 61·3 | 17·1 / 12·0 | 7·2 / 20·2 | 41·0 / 58·2 | 4222 / 4446 | 31·1 / 27·9 | 50·9 / 50·8 | 19·1 / 17·6 | 17·5 / 34·2 | 35·1 / 53·8 |
| Dominican Republic 2013 | 113 / 80 | 37·9 / 33·6 | 71·9 / 68·5 | 47·8 / 33·3 | -/ 50·2 | 14·2 / 17·8 | 9604 / 8817 | 32·4 / 29·8 | 72·2 / 75·9 | 22·6 / 16·0 | -/ 52·1 | 3·8 / 1·9 |
| Ethiopia 2011 | 182 / 358 | 37·2 / 31·7 | 65·7 / 67·3 | 3·2 / 4·5 | 7·8 / 43·9 | 22·5 / 35·4 | 12816 / 15147 | 30·4 / 27·6 | 21·5 / 23·1 | 16·8 / 18·4 | 19·8 / 62·4 | 32·6 / 51·1 |
| Gabon 2012 | 168 / 315 | 41·0 / 32·6 | 85·8 / 89·4 | 18·6 / 14·8 | 23·1 / 38·4 | 5·2 / 1·3 | 5331 / 5174 | 31·7 / 28·4 | 87·0 / 88·3 | 14·8 / 14·8 | 30·9 / 56·6 | 6·4 / 5·4 |
| Gambia 2013 | 48 / 93 | 37·8 / 34·0 | 51·2 / 63·1 | 27·3 / 21·9 | 17·1 / 44·1 | 59·0 / 57·2 | 3239 / 4394 | 28·8 / 27·2 | 62·0 / 55·9 | 14·9 / 16·6 | 33·6 / 55·9 | 31·9 / 46·4 |
| Ghana 2003 | 68 / 120 | 39·3 / 31·7 | 43·5 / 53·2 | 13·6 / 8·0 | 8·1 / 16·5 | 13·4 / 22·4 | 4197 / 5151 | 30·8 / 29·0 | 44·9 / 48·3 | 17·5 / 17·3 | 25·8 / 25·1 | 17·4 / 28·4 |
| Haiti 2012 | 170 / 249 | 38·9 / 31·7 | 52·0 / 51·1 | 12·7 / 9·5 | 20·0 / 52·9 | 22·4 / 15·6 | 9029 / 9077 | 30·6 / 28·0 | 44·1 / 47·2 | 18·0 / 15·6 | 30·4 / 59·1 | 12·8 / 14·8 |
| India 2005-6 | 279 / 191 | 35·1 / 30·7 | 40·6 / 43·4 | 17·3 / 13·8 | 4·7 / 41·5 | 26·6 / 48·8 | 49814 / 52662 | 31·1 / 29·0 | 35·4 / 32·7 | 16·1 / 17·0 | 14·4 / 62·9 | 18·2 / 39·7 |
| Kenya 2008-9 | 154 / 318 | 35·2 / 31·4 | 22·1 / 30·9 | 7·5 / 13·7 | 5·4 / 24·0 | 3·6 / 6·4 | 2941 / 3493 | 29·2 / 28·4 | 25·5 / 23·0 | 14·6 / 18·5 | 13·9 / 45·9 | 3·8 / 9·0 |
| Lesotho 2009 | 543 / 997 | 36·2 / 32·0 | 31·7 / 38·0 | 12·5 / 11·1 | 24·4 / 51·3 | 17·8 / 0·9 | 2532 / 2852 | 27·8 / 26·8 | 27·1 / 30·8 | 15·4 / 16·0 | 39·6 / 65·2 | 11·9 / 1·3 |
| Liberia 2013 | 45 / 83 | 33·4 / 31·9 | 84·2 / 80·6 | 8·9 / 7·5 | 28·1 / 61·1 | 15·9 / 44·7 | 3756 / 4294 | 29·0 / 28·3 | 58·1 / 59·8 | 18·7 / 18·0 | 28·4 / 44·7 | 12·8 / 32·9 |
| Malawi 2010 | 530 / 890 | 36.4 / 32·4 | 32·5 / 34·6 | 9·1 / 11·7 | 7·6 / 36·4 | 7·7 / 16·9 | 5979 / 6506 | 28·1 / 27·3 | 19·9 / 17·4 | 14·6 / 17·7 | 18·3 / 45·7 | 6·5 / 15·2 |
| Mali 2012 | 31 / 66 | 39·1 / 30·1 | 45·0 / 39·9 | 15·9 / 14·4 | 9·4 / 54·7 | 64·9 / 61·7 | 3720 / 5044 | 33·1 / 28·7 | 24·9 / 24·6 | 19·6 / 20·0 | 10·3 / 55·4 | 61·4 / 75·1 |
| Namibia 2013 | 419 / 814 | 38·3 / 37·4 | 56·7 / 48·8 | 15·8 / 22·4 | 30·3 / 48·6 | 13·5 / 8·8 | 3455 / 4170 | 30·2 / 31·7 | 55·6 / 54·7 | 14·7 / 15·5 | 45·2 / 60·3 | 8·7 / 6·5 |
| Niger 2012 | 17 / 27 | 40·4 / 33·5 | 33·1 / 57·4 | 15·5 / 11·7 | 13·8 / 80·1 | 47·4 / 53·2 | 3509 / 5074 | 33·5 / 28·8 | 24·5 / 18·6 | 15·0 / 17·7 | 18·5 / 77·9 | 62·1 / 80·5 |
| Republic Democratic of Congo 2013 | 44 / 133 | 34·3 / 31·7 | 47·1 / 53·1 | 13·1 / 7·3 | 18·3 / 33·2 | 3·7 / 10·8 | 8278 / 9183 | 31·4 / 29·1 | 37·0 / 37·3 | 17·0 / 18·9 | 23·7 / 33·0 | 4·2 / 15·9 |
| Rwanda 2010 | 154 / 266 | 39·3 / 33·4 | 35·0 / 35·4 | 13·5 / 16·0 | 5·0 / 29·2 | 15·5 / 17·3 | 6142 / 6686 | 29·9 / 28·0 | 15·3 / 14·4 | 14·9 / 18·2 | 9·4 / 28·4 | 11·9 / 15·2 |
| Sao Tome and Principe 2008-9 | 39 / 37 | 34·3 / 32·9 | 31·4 / 27·5 | 33·4 / 19·4 | 11·1 / 46·9 | 2·4 / 18·1 | 2121 / 2513 | 30·5 / 28·9 | 49·8 / 55·1 | 18·8 / 17·6 | 17·3 / 47·1 | 1·4 / 5·7 |
| Senegal 2010-11 | 26 / 61 | 39·0 / 35·2 | 40·1 / 54·7 | 29·3 / 17·0 | 16·3 / 56·8 | 73·7 / 67·4 | 4295 / 5529 | 30·0 / 27·9 | 55·3 / 48·9 | 15·5 / 16·3 | 21·1 / 60·8 | 38·6 / 57·4 |
| Sierra Leone 2013 | 81 / 141 | 32·8 / 29·0 | 61·9 / 53·5 | 9·2 / 10·2 | 20·3 / 36·7 | 40·2 / 45·6 | 6654 / 7724 | 31·4 / 28·6 | 36·9 / 35·3 | 18·7 / 18·4 | 20·7 / 32·4 | 42·6 / 56·4 |
| Swaziland 2006-7 | 704 / 1438 | 32·8 / 29·1 | 36·9 / 31·3 | 15·0 / 16·3 | 28·8 / 52·6 | 11·9 / 10·3 | 2898 / 3146 | 24·2 / 27·1 | 26·4 / 24·3 | 14·9 / 16·0 | 55·7 / 64·6 | 6·5 / 7·2 |
| Togo 2013-14 | 72 / 127 | 40·9 / 34·8 | 57·4 / 69·1 | 7·4 / 2·9 | 1·1 / 18·6 | 9·7 / 28·4 | 4293 / 4680 | 31·3 / 29·2 | 43·7 / 44·8 | 17·7 / 17·6 | 24·9 / 29·3 | 12·5 / 31·2 |
| Zambia 2013-14 | 1573 / 2328 | 36·0 / 32·3 | 61·2 / 64·6 | 8·3 / 10·4 | 15·6 / 43·9 | 3·3 / 7·2 | 12001 / 13105 | 29·7 / 27·6 | 44·0 / 43·0 | 15·9 / 18·5 | 27·5 / 52·4 | 3·6 / 8·3 |
| Zimbabwe 2010-11 | 811 / 1463 | 35·8 / 32·3 | 32·0 / 34·8 | 19·6 / 18·2 | 31·0 / 55·5 | 1·2 / 2·0 | 5234 / 6389 | 27·7 / 27·3 | 29·6 / 30·7 | 16·1 / 18·9 | 40·3 / 65·4 | 1·0 / 2·4 |

**Table 2: Prevalence of tobacco use in HIV positive men by WHO region**

|  |  |  |
| --- | --- | --- |
|  | **Crude prevalence (95% CI)** | **Standardized prevalence (95% CI)** |
| **Tobacco smoking**  | **Smokeless tobacco use** | **Any tobacco use**  | **Tobacco smoking** | **Smokeless tobacco use** | **Any tobacco use** |
| **Africa** |
| Burkina Faso 2010 | 25·3(16·4 – 36·9) | 6·1(1·8 – 18·9) | 28·0(18·4 – 40·2) | 23·5(15·8 – 31·1) | 8·9(4·5 – 13·2) | 29·8(21·5 – 38·1) |
| Burundi 2010 | 10·0(4·4 – 21·3) | 10·5(3·7 – 26·3) | 18·1(9·2 – 32·4) | 12·5(1·8 – 23·2) | 9·6(5·6 - 13·6) | 19·3(9·0 – 29·7) |
| Cameroon 2011 | 23·4(17·2 – 30·9) | 0·7(0·2 – 3·0) | 24·1(17·9 – 31·6) | 19·2(13·4 – 24·9) | 0·6(-0·3 – 1·5) | 19·8(14·0 – 25·6) |
| Côte d'Ivoire 2011 | 24·9(16·7 – 35·6) | 0·5(0·1 – 3·4) | 24·9(16·7 – 35·6) | 44·3(33·9 – 54·7) | 0·2(-0·3 – 0·7) | 44·3(33·9 – 54·7) |
| Ethiopia 2011 | 9·7(4·9 – 18·2) | 0·2(0·03 – 1·1) | 9·7(4·9 – 18·2) | 8·3(3·6 – 13·1) | 0·1(-0·04 – 0·2) | 8·3(3·6 – 13·1) |
| Gabon 2012 | 22·0(13·3 – 34·2) | 0·0 | 22·0(13·3 – 34·2) | 21·1(12·0 – 30·1) | 0·0 | 21·1(12·0 – 30·1) |
| Gambia 2013 | 54·8(31·3 – 76·3) | 6·0(1·3 – 23·4) | 54·8(31·3 – 76·3) | 42·1(25·9 – 58·4) | 10·8(-0·4 – 21·9) | 42·1(25·9 – 58·4) |
| Ghana 2003 | 23·4(14·5 – 35·4) | 0·9(0·1 – 6·4) | 23·4(14·5 – 35·4) | 22·0(12·3 – 31·7) | 1·0(-1·0 – 2·9) | 22·0(12·3 – 31·7) |
| Kenya 2008-9 | 26·7(17·2 – 39·0) | 2·3(0·4 – 13·6) | 26·8(17·3 – 39·1) | 22·2(14·1 – 30·3) | 3·4(-1·4 – 8·3) | 22·3(14·2 – 30·4) |
| Lesotho 2009 | 41·1(36·6 – 45·7) | 1·0(0·3 – 2·7) | 41·1(36·6 – 45·7) | 38·8(34·1 – 43·5) | 1·1(-0·2 – 2·5) | 38·8(34·1 – 43·5) |
| Liberia 2013 | 23·1(9·0– 47·6) | 0·0 | 23·1(9·0– 47·6) | 23·8(13·6 – 33·9) | 0·0 | 23·8(13·6 – 33·9) |
| Malawi 2010 | 18·8(14·9 – 23·5) | 0·6(0·2 – 1·6) | 19·2(15·2 – 23·8) | 16·1(12·2- 20·0) | 0·5(-0·02 – 1·0) | 16·4(12·5– 20·3) |
| Mali 2012 | 31·6(16·1 – 52·6) | 6·7(1·5 – 25·2) | 35·3(19·0 – 55·9) | 30·3(16·3 – 44·4) | 3·9(-1·3 – 9·1) | 33·0(18·4 – 47·7) |
| Namibia 2013 | 20·6(16·0 – 26·2) | 2·9(1·5 – 5·5) | 23·2(18·2 – 29·3) | 20·8(15·3 – 26·3) | 3·3(1·2 – 5·5) | 24·1(18·3 – 30·0) |
| Niger 2012 | 33·9(12·5 – 64·7) | 2·5(0·3 – 20·0) | 36·4(14·2 – 66·3) | 21·6(6·2 – 37·1) | 1·4(-1·9 – 4·8) | 23·1(7·5 – 38·6) |
| Republic Democratic of Congo 2013 | 24·7(12·7 – 42·5) | 3·3(0·7 – 13·5) | 28·0(15·8 – 44·6) | 17·7(7·6 – 27·8) | 1·8(-0·7 – 4·3) | 19·5(9·6 – 29·5) |
| Rwanda 2010 | 23·6(17·2 – 31·5) | 7·1(3·9 – 12·7) | 27·9(21·0 – 36·0) | 26·3(17·9 – 34·6) | 5·8(2·1 – 9·4) | 30·2(21·2 – 39·2) |
| Sao Tome and Principe 2008-9 | 13·2(3·2 – 40·7) | 2·1(0·3 – 15·1) | 15·3(4·5 – 41·0) | 4·5(-0·1 – 9·2) | 2·3(-2·1 – 6·7) | 6·8(0·6 – 13·1) |
| Senegal 2010-11 | 22·0(5·8 – 56·2) | 8·0(2·2 – 25·1) | 26·5(8·7 – 57·9) | 22·6(13·8 – 31·4) | 8·5(-0·4 – 17·5) | 28·3(17·9 – 38·7) |
| Sierra Leone 2013 | 19·9(12·3 – 30·7) | 0·2(0·03 – 1·8) | 19·9(12·3 – 30·7) | 18·3(10·6 – 26·0) | 0·3(-0·3 – 0·9) | 18·3(10·6 – 26·0) |
| Swaziland 2006-7 | 26·0(22·5 – 29·9) | 5·3(3·8 – 7·3) | 30·1(26·3 – 34·2) | 21·9(18·7 – 25·0) | 4·7(3·2 – 6·3) | 25·5(22·1 – 28·9) |
| Togo 2010-14 | 13·5(7·2 – 23·8) | 5·4(1·7 – 16·3) | 18·9(11·2 – 30·0) | 6·7(2·9 – 10·5) | 10·0(6·2 – 13·8) | 16·7(11·9 – 21·5) |
| Zambia 2013-14 | 24·5(22·0 – 27·1) | 1·4(0·8 – 2·5) | 25·1(22·6 – 27·8) | 22·3(19·8 – 24·7) | 1·3(0·6 – 2·1) | 22·9(20·4 – 25·3) |
| Zimbabwe 2010-11 | 33·1(29·5 – 37·0) | 2·9(1·9 – 4·6) | 34·8(31·0 – 38·8) | 31·5(27·9 – 35·1) | 2·8(1·3 – 4·3) | 33·0(29·3 – 36·7) |
| *Pooled regional estimate* | 24·2(20·9-27·6) | 2·6(1·7-3·6) | 26·0(22·7-29·4) |  |  |  |
| Statistical heterogeneity I2 Chi2, p | 86·7(81·5-90·5)0·000 | 75·6(63·7-83·5)0·000 | 86·1(80·5-90·1)0·000 |  |  |  |
| **Americas** |
| Dominican Republic 2013 | 25·8(16·9 – 37·4) | 0·6(0·1 – 4·3) | 26·4(17·3 – 38·1) | 25·3(16·1 – 34·5) | 0·6(-0·6 – 1·8) | 25·8 (16·5– 35·2) |
| Haiti 2012 | 12·3(7·4 – 19·8) | 1·8(0·7 – 4·6) | 13·2(8·1 – 20·7) | 9·3(5·2 – 13·3) | 1·4(0·1 – 2·6) | 9·9(5·7 – 14·1) |
| **South-East Asia** |
| India 2005-6 | 40·3(31·2 – 50·1) | 41·4(32·0 – 51·5) | 68·3(59·1 – 76·2) | 37·8(32·1 – 43·5) | 37·3(31·3 – 43·3) | 60·3(54·6 – 65·9) |
| **POOLED GLOBAL OVERALL ESTIMATE FOR THE 27 INCLUDED LMICs** | 24·4(21·1 – 27·8) | 3·4 (1·8 – 5·6) | 27·1(22·8 – 31·7) |  |  |  |
| Statistical heterogeneity I2 Chi2, p | 88·2(84·1 – 91·3)0·000 | 93·8 (92·0 – 95·1)0·000 | 93·1 (91·1 – 94·7)0·000 |  |  |  |

**Table 3: Prevalence of tobacco use in HIV positive women by WHO region**

|  |  |  |
| --- | --- | --- |
|  | **Crude prevalence (95% CI)** | **Age standardised prevalence (95%CI)** |
| **Tobacco smoking**  | **Smokeless tobacco use** | **Any tobacco use**  | **Tobacco smoking**  | **Smokeless tobacco use** | **Any tobacco use**  |
| **Africa** |
| Burkina Faso 2010 | 0·0 | 3·6(1·3 – 10·2) | 3·6(1·2 – 10·2) | 0·0 | 3·6(0·0 – 7·2) | 3·6(0·0 – 7·2) |
| Burundi 2010 | 0·0 | 8·8(4·1 – 18·0) | 8·8(4·1 – 18·0) | 0·0 | 6·6(1·8 – 11·3) | 6·6(1·8 – 11·3) |
| Cameroon 2011 | 1·0(0·4 – 2·3) | 1·7(0·6 – 4·7) | 2·7(1·3 – 5·5) | 1·0(0·1 – 1·9) | 1·7(0·0 – 3·4) | 2·7(0·8 – 4·5) |
| Côte d'Ivoire 2011 | 0·0 | 1·7(0·5 – 6·0) | 1·7(0·5 – 6·0) | 0·0 | 1·8(-0·4 – 3·9) | 1·8(-0·4 – 3·9) |
| Ethiopia 2011 | 0·3(0·1 – 0·5) | 0·02(0·00 – 0·11) | 0·3(0·1 – 0·5) | 0·2(0·1 – 0·4) | 0·03(-0·03 – 0·08) | 0·2(0·1– 0·4) |
| Gabon 2012 | 4·4(1·6 – 11·3) | 0·6(0·2 – 1·4) | 4·8(1·9 – 11·4) | 8·7(4·4 – 17·0) | 0·6(0·0 – 1·2) | 9·1(0·9 – 17·3) |
| Gambia 2013 | 0·0 | 0·4(0·06 – 3·3) | 0·4(0·06 – 3·3) | 0·0 | 0·3(-0·4 – 1·0) | 0·3(-0·4 – 1·0) |
| Ghana 2003 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| Kenya 2008-9 | 1·0(0·3 – 4·1) | 0·5(0·1 – 2·1) | 1·5(0·6 – 4·3) | 0·8(-0·3 – 1·8) | 0·5(-0·2 – 1·3) | 1·3(0·0 – 2·6) |
| Lesotho 2009 | 0·7(0·3 – 1·5) | 15·7(13·2 – 18·7) | 16·4(13·8 – 19·4) | 0·6(0·1 – 1·1) | 15·2(12·9 – 17·5) | 15·9(13·6 – 18·1) |
| Liberia 2013 | 0·0 | 0·3(0·03 – 1·9) | 0·3(0·03 – 1·9) | 0·0 | 0·2(-0·2 – 0·6) | 0·2(-0·2 – 0·6) |
| Malawi 2010 | 1·0(0·4 – 2·6) | 0·3(0·2 – 0·8) | 1·4(0·7 – 2·9) | 1·0(0·1 – 1·9) | 0·3(0·0 – 0·6) | 1·4(0·4 – 2·3) |
| Mali 2012 | 0·0 | 1·4(0·2 – 9·8) | 1·4(0·2 – 9·8) | 0·0 | 1·1(-1·1 – 3·2) | 1·1(-1·1 – 3·2) |
| Namibia 2013 | 3·2(2·3 – 4·6) | 2·1(1·3 – 3·4) | 4·7(3·5 – 6·3) | 4·1(2·5 – 5·8) | 3·3(1·7 – 5·0) | 6·2(4·2 – 8·3) |
| Niger 2012 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 | 0·0 |
| Republic Democratic of Congo 2013 | 0·0 | 1·8(0·5 – 6·6) | 1·8(0·5 – 6·6) | 0·0 | 1·6(-0·3 – 3·4) | 1·6(-0·3 – 3·4) |
| Rwanda 2010 | 1·8(0·7 – 4·3) | 3·5(1·8 – 6·7) | 5·3(3·2 – 8·7) | 1·5(0·1 – 2·9) | 2·8(1·0 – 4·6) | 4·3(2·1 – 6·5) |
| Sao Tome and Principe 2008-9 | 0·7(0·08 – 5·8) | 0·0 | 0·7(0·08 – 5·8) | 0·6(-0·8 – 1·9) | 0·0 | 0·6(-0·8 – 1·9) |
| Senegal 2010-11 | 0·0 | 1·2(0·2 – 8·8) | 1·2(0·2 – 8·8) | 0·0 | 0·8(-0·8 – 2·3) | 0·8(-0·8 – 2·3) |
| Sierra Leone 2013 | 4·2(2·0 – 8·8) | 2·6(0·7 – 9·1) | 6·5(3·2 – 12·9) | 6·0(1·2 – 10·8) | 2·8(-0·9 – 6·6) | 8·6(2·5 – 14·7) |
| Swaziland 2006-7 | 2·2(1·5 – 3·4) | 1·5(1·0 – 2·3) | 3·6(2·7 – 4·9) | 2·0(1·1 – 2·8) | 2·2(1·2 – 3·3) | 4·1(2·8 – 5·5) |
| Togo 2013-14 | 0·0 | 1·5(0·3 – 6·6) | 1·5(0·3 – 6·6) | 0·0 | 1·1(-0·5 – 2·8) | 1·1(-0·5 – 2·8) |
| Zambia 2013-14 | 1·0(0·6 – 1·6) | 2·5(1·8 – 3·5) | 3·2(2·4 – 4·2)  | 1·0(0·5 – 1·5) | 2·3(1·6 – 3·1) | 3·1(2·3 – 4·0) |
| Zimbabwe 2010-11 | 0·2(0·06 – 0·5) | 0·5(0·2 – 1·1) | 0·7(0·3 – 1·2) | 0·2(0·0 – 0·3) | 0·6(0·2 – 1·0) | 0·7(0·2 – 1·1) |
| *Pooled regional estimate* | 1·0(0·6 – 1·4) | 1·9(0·9 – 3·2) | 2·8(1·6 – 4·3) |  |  |  |
| Heterogeneity I2Chi2, p | 75·3(63·3 – 83·3)0·000 | 94·1(92·3 – 95·4)0·000 | 93·5(91·5 – 95·0)0·000 |  |  |  |
| **Americas** |
| Dominican Republic 2013 | 10·1(4·0 – 23·4) |  - | 10·1(4·0 – 23·4) | 9·1(2·1 – 16·2) | - | 9·1(2·1 – 16·2) |
| Haiti 2012 | 7·6(4·3 – 13·0) | 2·4(1·1 – 5·4) | 9.3(5.7 – 14.8) | 7·1(3·2 – 11·0) | 2·2(0·4 – 4·0) | 8·6(4·4 – 12·8) |
| **South-East Asia** |
| India 2005-6 | 2·6(0·8 – 7·8) | 9·9(5·6 – 16·9) | 12·5(7·5 – 20·0) | 2·2(-0·2 – 4·5) | 9·4(4·4 – 14·4) | 11·5(6·2 – 16·8) |
| **Western Pacific** |
| Cambodia 2005 | 3·2(0·7 – 13·4) | 5·4(1·3 – 19·4) | 8·6(3·1 – 22·1) | 2·5(-1·3 – 6·3) | 3·5(-0·8 – 7·7) | 6·0(0·3 – 11·7) |
|  |  |  |  |  |  |  |
| **POOLED OVERALL ESTIMATE FOR THE 28 INCLUDED LMICs** | 1·3(0.8 – 1.9) | 2·1(1·1 – 3·4) | 3·6(2·3 – 5·2) |  |  |  |
| Statistical heterogeneity I2 Chi2, p | 81·3(73·7 – 86·6)0·000 | 93·5(91·7 – 94·9)0·000 | 93·3(91·4 – 94·8)0·000 |  |  |  |