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Is interview length associated with blood test participation? Evidence from three population-based HIV impact assessment (PHIA) surveys conducted from 2016–2017

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Abstract

Background: High response rates in surveys are critical to ensuring that findings are unbiased and representative of the target population. Questionnaire length impacts response rates, with long interviews associated with partially complete surveys, higher item nonresponse (“don’t know” and “refuse” responses), and willingness to participate in future surveys. Our aim is to determine the impact of questionnaire length on blood test participation in population-based HIV surveys.

Methods: Data are from population-based HIV impact assessments (PHIAs) conducted in Zambia, Eswatini, and Lesotho in 2016–2017. The PHIAs consist of an interview followed by a blood draw. Consent for blood draw was obtained before the interview in Eswatini, and after the interview in Zambia and Lesotho.

Interview length was measured by the survey tablet as time to complete the survey (interview duration) and number of questions answered by the participant (questionnaire length). We assessed the effects of questionnaire length and interview duration on blood test participation using logistic regression.

Results: Across all three surveys, median interview duration was 16 minutes and median number of questions was 77. In adjusted analyses, there was a negative impact of interview duration on blood draw consent for individuals with unknown status in Lesotho and a positive relationship between questionnaire length and blood draw consent in Zambia for those with HIV-negative and unknown status.

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Conclusion: Although interview length is an important consideration to reduce respondent burden, a longer questionnaire does not necessarily result in lower consent rates for blood testing.

Background

Population-based health surveys are essential tools to assess global progress and impact of national health programs.[1–3] Biomarker data such as those obtained from a blood draw, are increasingly of primary interest; thus, given the high cost of large-scale biomarker collection, obtaining high response rates is critical to ensure that findings are representative of the target population. However, these surveys tend to have low rates of participation in blood testing. For example, Demographic and Health Surveys (DHS) observe blood test response rates typically ranging from 70–85%, compared to household response rates above 95% and interview response rates between 80–95%.[4] Maximizing blood test participation remains an area of utmost importance.

Surveys with a biomarker component often involve an interview prior to testing, during which a survey questionnaire is administered. There is evidence that the length of the interview may influence willingness to participate in biomarker testing. Dillman[5] and Deutskens[6] observed associations between long questionnaires and higher rates of mid-survey drop-off (leading to partially complete surveys) and item-level nonresponse. Lopez and Walsh found in a survey of multiple persons within a household, the length of the first person's interview predicted non-response for subsequent household members.[7] Sharp and Frankel found that respondents who underwent longer interviews were less willing to participate in future surveys.[8] Reducing interview length via shorter questionnaire design has the potential to improve blood test participation, at the expense of lost opportunities to collect potentially useful questionnaire data.

An individual's choice to participate in a survey and subsequent blood testing is influenced by a number of factors, including cultural context, individual beliefs, and the perceived benefits and burden of participation. In an analysis of blood test participation in the DHS for 14 countries, individuals who were wealthier, more educated, and living in urban areas were less likely to participate in HIV testing; and although the authors hypothesized otherwise, HIV test participation was no different for chronically ill individuals.[4] Food insecurity within the household may be another reason that an individual chooses not to participate in the blood test.

In HIV biomarker surveys, a participant's knowledge of their HIV status may also influence participation in blood testing. Reniers and Eaton[9] and Larmange et al.[10] found that people with prior knowledge of their HIV-positive status were less likely to participate in surveys. Reniers and Eaton showed that this resulted in negative bias in HIV prevalence estimates.[9] Individuals who already know that they are HIV-positive have lower incentive to participate in a survey that includes HIV testing. On the other hand, if HIV testing includes additional biomarkers such as CD4 and viral load testing, these additional tests may incentivize participation among HIV-positive persons. Among those who do not know their HIV status, participating in the interview, which likely includes HIV-related questions on knowledge, attitudes, and service uptake, may instead increase their interest in HIV

testing in order to learn about their status. This could be attributed to a learning hypothesis, wherein individuals who believe they are HIV-negative or do not know their status would have increased personal interest in the survey topic and greater incentive to complete the interview and receive HIV testing, a concept described by some authors as salience.[11] We hypothesized that this would attenuate effects of long interviews on blood test participation, compared to persons previously diagnosed with HIV.

There is no evidence to our knowledge of the impact of interview length on blood test participation in the context of HIV biomarker surveys conducted in low-resource settings.[12–14] This analysis aimed to explore this relationship using data from three Population-based HIV Impact Assessments (PHIAs) conducted in Zambia[15], Eswatini[16] (formerly Swaziland) and Lesotho[17] in 2016–2017. Consent for the blood test was obtained before the interview in Eswatini and after the interview in Zambia and Lesotho. Therefore, these surveys presented a unique opportunity to test whether interview length was associated with likelihood of participating in blood testing. We hypothesized a negative association between interview length and blood test participation in Zambia and Lesotho. In Eswatini, where respondents gave blood test consent prior to the interview taking place, we hypothesized no relationship between interview length and blood test participation.

Methods

Data Source

The PHIAs are nationally representative surveys designed to assess the reach and impact of HIV programs in PEPFAR-supported countries. Each PHIA survey consisted of a household interview in which the household roster was constructed, followed by an individual interview for adults aged 15 and older in the randomly-selected household. The interview was followed by collection of venous blood from consenting participants for HIV testing. HIV rapid testing, in line with national rapid test algorithms, was conducted in the household with immediate return of test results. Individuals who tested HIV sero-positive were offered referral for HIV care and treatment services, as well as point-of-care CD4 testing. Individual interviews, counselling, testing, and return of test results were all conducted privately, within or around the home. Laboratory-based HIV viral load testing was conducted on transported specimens with results returned to a health facility of the respondent’s choice for consultation with a health care provider.

The interview consisted of a core set of questions consistent across countries, plus additional questions tailored to the country setting. The questionnaire consisted of several modules: demographics, reproductive history, children, HIV testing, care and treatment history, tuberculosis, and other HIV-related risk factors (male circumcision, sexual activity, HIV knowledge, gender norms, and violence). Select modules were administered to a subset of respondents, based upon random selection and/or demographic criteria. Interviewers trained in Good Clinical Practice[18] and survey procedures administered the survey via electronic tablet. The surveys were approved by the institutional review boards at Columbia University Irving Medical Center, the Centers for Disease Control and Prevention, and the local ethics boards in Eswatini (National Health Research and Review Board), Lesotho

(Lesotho Ministry of Health Research and Ethics Committee), and Zambia (Zambia Tropical Diseases Research Center Institutional Review Board).

Sample

The sample included participants from three PHIAs conducted in 2016–2017: Zambia PHIA (ZAMPHIA 2016), Swaziland HIV Incidence Measurement Survey 2 (SHIMS2) conducted in Eswatini, and Lesotho PHIA (LEPHIA 2016–2017). We included all adults with reported age of 15–59 years. Participants who did not complete the first question of the tuberculosis module (i.e., the last module consistently administered across all survey countries) were excluded from the analysis since biomarker data was not collected from participants with incomplete interviews (see Figure 1 for eligibility flowchart). In Eswatini and Zambia over 99% and in Lesotho around 90% of participants who started the interview reached the tuberculosis module.

Measures

We quantified interview length in two ways: (1) “questionnaire length”, the number of questions answered by the participant in the individual interview, and (2) “interview duration”, the difference in minutes between the time of initial consent to the individual interview and the time of completing the individual interview, which were captured automatically by the tablet. Questions answered in the household interview and time spent on the household interview were not included in the interview length measures. Participants whose interviews were longer than 120 minutes or who answered more than 20 questions per minute on average were determined to have invalid timestamps and were excluded for analyses on interview duration. We defined blood test participation as having consented to and provided a blood sample, regardless of whether HIV test results were determinate. In Eswatini, individuals were given the opportunity to change their consent after the interview, but few respondents changed their consent status (0.05% of those who initially consented subsequently withdrew and 0.36% of those who initially refused subsequently consented).

We considered additional variables that could influence interview length and blood test participation as potential covariates. These included demographic and other characteristics that influence survey participation such as age, gender, urban/rural residence, marital status, education, household wealth quintile, food insecurity within the household, and employment in the past 12 months. Wealth quintile is relative to other individuals in within the country. Food insecurity in the household is defined as households where the household respondent indicated in the past 4 weeks there was ever no food to eat of any kind in their household because of lack of resources to get food. A household head indicator was also included to account for the effort household respondents had expended in answering the household survey, prior to their individual interview. Survey language captures information about the survey administration and serves as a proxy for ethnicity. The analysis also included factors that determine eligibility to receive certain questionnaire modules, including self-reported HIV status, whether an individual reported ever having sex, household size, and the number of children for which the respondent provided information in the survey. Self-reported HIV status was comprised of three categories: self-reported HIV-positive, self-reported HIV-negative, and unknown HIV status (individuals who never tested or did not know their

result). Participants who refused to answer questions about their HIV testing history were excluded, as we were unable to determine their self-reported HIV status. Finally, among individuals self-reporting HIV positive and negative, we examined recent testing as whether they were tested in the 12 months prior to the survey, more than 12 months prior to the survey, or had unknown date information. For individuals with unknown self-reported HIV status, we also examined whether they were ever tested.

Analysis

We conducted descriptive analyses of all analytic variables, stratified by country. Bivariate associations between blood test participation with questionnaire length, interview duration and selected demographics were described using chi-squared tests of association. We assessed the effects of questionnaire length and interview duration on blood test participation using logistic regression to estimate odds ratios (OR) and 95% confidence intervals (CI), adjusted for all other covariates. Covariates were selected using backward elimination with a p-value cut-off of $p<0.10$. To maintain consistency between countries, covariates that were significant in any country were retained in all models. As a secondary analysis, we explored whether effect estimates varied by self-reported HIV status. An additional covariate of whether the individual had ever tested was considered for inclusion in the unknown status model, while an indicator of whether the respondent tested in the past 12 months was included in the self-reported HIV positive and HIV negative models. The analyses did not use survey weights since the current research questions were focused on survey operations and thus did not require inferring to the national population.

In Zambia and Lesotho, the blood consent was obtained after the interview, and what happened during the interview process could influence whether an individual consented to the blood draw. In Eswatini, consent for blood testing was obtained directly after interview consent, before the interview took place, so any observed effects on blood test participation could not be due to the interview process. As such, Eswatini is included to serve as a test of the assumption of no unmeasured confounding.

Results

The household response rate was 89.1% in Zambia, 84.9% in Eswatini, and 93.2% in Lesotho. The interview response rate among adults age 15–59 was 82.8% in Zambia, 90.4% in Eswatini, and 91.9% in Lesotho.[16,19,20]

The total eligible sample consisted of 44,153 adults ages 15–59 years, n=20,940 in Zambia, n=10,218 in Eswatini, and n=12,995 in Lesotho. The combined sample was 42.1% male, 37.6% urban, had a median age of 29 (range 15–59, IQR 21–40), with 49.3% of the sample married or living with a partner as if married, 85.6% having ever had sex, 25.6% in food insecure households, 35.6% having worked in the past 12 months, and 38.5% reporting for at least one child during the interview. The median household size was five (range 1–29, IQR 3–7) and 37.2% of individuals responded to the household interview as household head. Of respondents reporting on at least one child, the median number of reported children was three (range 1–18, IQR 2–4). Overall, 15.6% of respondents self-reported HIV-positive, and 98.8% of respondents who self-reported HIV positive tested as HIV-seropositive across the

three countries. The median interview duration was 16 minutes (range 2–117, IQR 11–24) and median questionnaire length was 77 questions (range 21–258, IQR 57–100). Blood test participation rates were 90.3% in Zambia, 93.8% in Eswatini, and 91.0% in Lesotho (Table 1).

In unadjusted analyses, there was no significant association between blood test participation and interview duration in Zambia ($\chi 2 = 8.7$, p-value 0.27), Lesotho ($\chi 2 = 9.9$, p-value 0.19), or Eswatini ($\chi 2 = 7.6$, p-value 0.36). Blood test participation was associated with questionnaire length in all three countries, with blood test participation increasing with the questionnaire length (Table 2).

Across all three countries, self-reported HIV-positive individuals had significantly higher blood test participation rates (97.3%) compared to those who self-reported HIV-negative or had unknown status (90.2%; t = 28.39, p-value < 0.01). Women were more likely to participate in blood testing than men (92.3% versus 90.0%, t = 8.04, p-value < 0.01). Women and individuals who reported as HIV positive had longer questionnaires and interview duration (supplemental table S1).

Results from multivariable logistic regression models are presented in Table 3. Effects for marital status, household food insecurity, and urban/rural residence were not included, as they were not significant in any of the models. After controlling for the demographic covariates, the odds of participating in biomarker testing increased by 10% for every additional 20 questions answered by participants in Zambia (adjusted OR, 95% CI: 1.10, 1.05–1.16). By contrast, longer interview duration was associated with decreased participation in biomarker testing in Lesotho (OR per additional five minutes, 95% CI: 0.94, 0.89–0.99) and Eswatini (OR, 95% CI: 0.94, 0.91–0.97). Self-reported HIV status had a strong effect on blood test participation after controlling for either questionnaire length or interview duration and other demographic factors, with self-reported HIV-negative individuals and those with unknown status being much less likely to consent, compared to those who self-reported HIV-positive.

Odds ratios for interview duration, questionnaire length, and HIV testing characteristics from the multivariable logistic regression models stratified by self-reported HIV status are presented in Table 4. Due to low variability, the models for self-reported HIV-positive individuals in all three countries could not support the inclusion of province, region, district, or sexual activity as covariates; the model for HIV-positive individuals in Zambia could not support the inclusion of wealth quintile or language. Effects for household food insecurity and marital status were not significant in any of the models stratified by self-reported HIV status.

After controlling for other demographics and whether individuals had tested recently, we observed no significant effect of interview duration on blood test participation in Lesotho, Eswatini, or Zambia for self-reported HIV-positive and HIV-negative individuals. Among those with unknown HIV status, blood test participation decreased with longer interview duration in Lesotho (OR 95% CI for each additional 5 minutes: 0.84, 0.75–0.93). Effects for

interview duration were not significant for individuals with unknown HIV status in Zambia or Eswatini.

There was a small positive effect of questionnaire length on blood test participation for those with self-reported HIV-negative status in Zambia (OR 95% CI: 1.06, 1.01–1.11) and Lesotho (OR 95% CI 1.10, 1.01–1.20) and in Zambia for individuals with unknown HIV status (OR 95% CI: 1.16, 1.02–1.31). There was no significant effect of questionnaire length on blood test participation for individuals with self-reported HIV-negative status in Eswatini and Lesotho or unknown HIV status in Eswatini. For self-reported HIV-positive individuals, the effect of questionnaire length on blood test consent was not significant in any of the three countries.

The effect of recent HIV testing varied by country and self-reported HIV status, with HIV positive individuals in Lesotho and Eswatini who tested more than 12 months prior to the survey having higher odds of blood test participation compared to those that tested recently. Self-reported HIV negative individuals in Zambia who tested more than 12 months prior to the survey had higher odds of blood test participation than those who tested more recently. Finally, among those in Lesotho with unknown status, the odds of blood test participation were higher among those who had ever tested, compared to those who had never tested or were missing a prior HIV testing status.

Discussion

This analysis aimed to assess the effect of interview duration and questionnaire length on blood test participation in three population-based HIV surveys conducted in Zambia, Eswatini and Lesotho. Blood test participation rates among those participating in the individual interview were generally over 90% in the PHIAs, similar to those observed in other biomarker surveys in these countries. For example, DHS has been conducting population-based HIV testing since 2001, consisting of collecting blood spots on filter paper from a finger prick, tested in a central laboratory. Refusal rates for HIV testing in the latest DHS were 2.0% for males and 1.5% for females in Lesotho, 6.7% for males and 5.4% for females in Zambia, and 16.6% for males and 9.5% for females in Eswatini.[21–23]

Our findings suggest that self-reported HIV status was an independent predictor of blood test participation. While previous studies found that people with prior knowledge of their HIV-positive status were less likely to participate in HIV biomarker surveys,[9,10] we found that self-reported HIV-positive persons were more likely to participate compared to self-reported HIV-negative persons and those with unknown HIV status. In PHIA, and in contrast to most prior HIV surveys, CD4 enumeration and HIV viral load test results were made available to participants who tested HIV-seropositive. These additional tests may have encouraged previously diagnosed people to participate. Although there may be some concern about misreporting of HIV status, nearly all respondents reporting in the PHIAs as previously diagnosed tested as HIV-seropositive at 98.8%.

Contrary to our hypothesis, increases in the questionnaire length was positively associated with blood test participation in Zambia, a finding that persisted after adjusting for potential

covariates. After stratifying by self-reported HIV status, this effect was found to be driven by those with self-reported HIV-negative and unknown HIV status in Zambia. After stratifying by self-reported HIV status, this result was replicated in HIV negative individuals in Lesotho. For each additional 20 questions, the odds of participation increased by 1.06 (95% CI 1.01–1.19) in Zambia and 1.10 (95% CI 1.01–1.20) in Lesotho for HIV-negative individuals; and 1.16 for those in Zambia with unknown status (95% CI 1.02–1.31). These findings support a learning hypothesis that respondents with self-reported negative and unknown HIV status may gain renewed interest in learning about their HIV status as a result of taking the survey and answering questions about health and HIV testing.

Eswatini was included to serve as a test of the assumption of no unmeasured confounding. Since consent for blood testing was obtained before the interview in Eswatini, any observed associations could not be due to effects of the interview process on blood test participation. After stratifying by self-reported HIV status and including effects for whether individuals ever tested in the unknown status model and whether they tested recently in the HIV positive and HIV negative models, there were no significant effects of questionnaire length or interview duration on blood test participation in Eswatini.

There were increased odds of blood test participation associated with testing more than 12 months prior to the survey compared to testing more recently in individuals who self-report HIV positive in both Leostho and Eswatini, and in individuals who self-reported HIV negative in Zambia. The differential impact of recent testing on blood test participation by self-reported status suggests that the country context influences the reasons for participation by different subgroups.

This analysis had several limitations. First, we conceptualized interview length to represent the degree of effort required to complete the survey, but the selected interview length variables are imperfect measures of the underlying construct. The effects of interview length on blood test participation differed by whether questionnaire length in number of questions or interview duration in minutes was used, suggesting that each measure captures different aspects of interview participation. Questionnaire length partly reflects differential eligibility to receive additional follow-up questions (e.g., participants who reported being previously tested for HIV were asked to recall the date of their last test). We controlled for sex, household size, and number of children in order to adjust for key eligibility criteria for certain modules, but there may be additional unaccounted sources of variability. Meanwhile, interview duration measures how long the interview actually took, and longer interview duration may reflect interruptions or time in which the interviewer was clarifying the questions for the respondent. We conducted sensitivity analyses with interviewer random effects to account for interviewer variability and found that results did not appreciably change (data not shown). While this analysis used the same covariates in the models across countries, there was variation between countries in the bivariate associations between blood test participation and additional demographics (Supplemental table S2).

The absence of significant results in Eswatini suggests that the models here sufficiently captured factors related to both interview duration and blood test participation. Finally, we were unable to assess the relationship between interview length and blood participation

in the 10% of respondents in Lesotho that began the interview that did not reach the tuberculosis module. Since these respondents ended the interview prior to the blood test consent questions, we are unable to remark on how they would have responded.

Most effect estimates were not statistically significant, which is partly due to limited statistical power as a result of high overall blood test participation rates. In fact, most non-participation was at the household- or individual-level, and eligibility to be included in this sample was conditional on having completed the individual interview. These findings therefore represent a self-selected sub-sample of individuals who completed the interview in each country and are therefore not generalizable to the entire target population. Furthermore, this analysis is specific to Zambia, Lesotho, and Eswatini and one should not assume these findings hold in lower-prevalence settings or in other African countries. Finally, variability in findings across stratified analyses by known HIV status across countries also suggest that the motivations underlying blood test participation may be context-specific.

Our findings provide inconclusive evidence regarding the overall effect of interview length on blood test participation, and the overall magnitude of effects were small. The conceptualization of interview length in number of questions versus interview duration is important in studies of interview length, as is the country context in studies of blood test participation. Further studies to explore factors contributing to non-participation and the potential cost-benefits of decreasing interview burden on participants are necessary.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Disclaimer

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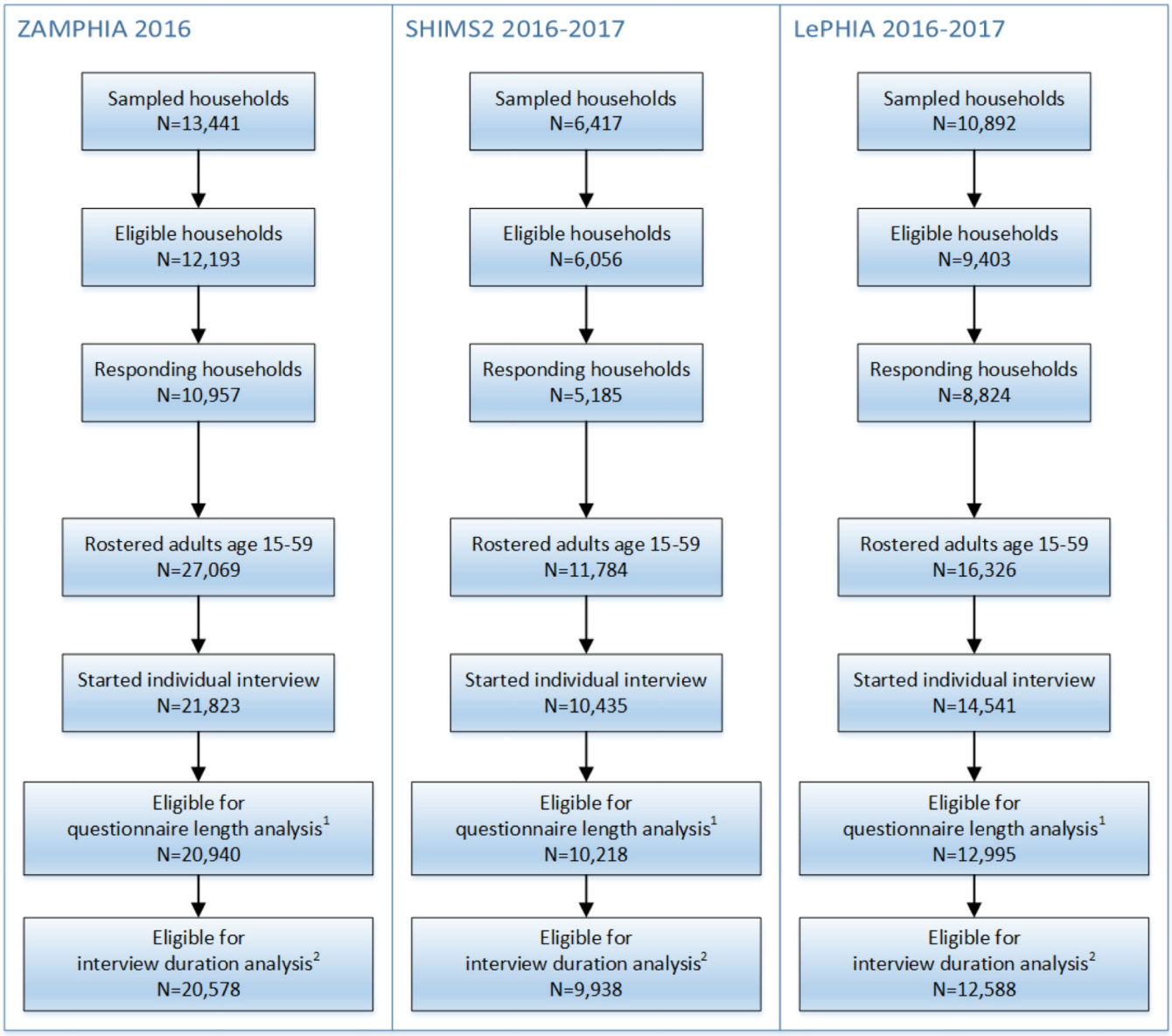

Figure 1. Eligibility criteria for inclusion in questionnaire length and interview duration analyses, ZIMPHIA 2016, SHIMS2 2016–2017, and LePHIA 2016–2017

[1]Adult respondents were eligible for questionnaire length analysis if they had complete data on blood test participation and all demographic variables and did not drop out of the survey early, as defined by having a valid response to the first question of the last required module (tuberculosis module).

[2]Eligibility for interview duration analysis excluded participants with interviews longer than 120 minutes and those who on average answered more than 20 questions per minute.

Table 1.

Sample Characteristics by Country, ZAMPHIA 2016, SHIMS2 2016–2017, and LePHIA 2016–2017

Characteristic	ZAMPHIA 2016 (n=20,940)	SHIMS2 2016–2017 (n=10,218)	LePHIA 2016–2017 (n=12,995)
Residence			
Urban, n (%)	9,142 (43.7)	2,347 (23)	5,126 (39.4)
Peri-urban, n (%)			895 (6.9)
Male, n (%)	8,815 (42.1)	4,363 (42.7)	5,405 (41.6)
Age, median (IQR)	29 (21–39)	29 (21–39)	30 (22–40)
Marital status			
Never married, n (%)	7,044 (33.6)	5,580 (54.6)	4,851 (37.3)
Married or living together, n (%)	11,728 (56.0)	3,792 (37.1)	6,234 (48.0)
Divorced, separated, or widowed, n (%)	2,168 (10.4)	846 (8.3)	1,910 (14.7)
Self-reported HIV status			
HIV-positive, n (%)	1,727 (8.2)	2,495 (24.4)	2,670 (20.5)
HIV-negative, n (%)	13,641 (65.1)	6,387 (62.5)	8,653 (66.6)
Unknown HIV status, n (%)	5,572 (26.6)	1,336 (13.1)	1,672 (12.9)
Ever had sex, n (%)	18,153 (86.7)	8,250 (80.7)	11,379 (87.6)
Household size, median (IQR)	6 (4–8)	5 (3–7)	4 (3–6)
Worked in the past 12 months, n (%)	6,749 (32.2)	4,233 (41.4)	4,754 (36.6)
Reported on at least one child during the interview, n (%)	9,329 (44.6)	3,056 (29.9)	4,608 (35.5)
Household head, n (%)	6,803 (32.5)	3,767 (36.9)	5,869 (45.2)
Food insecurity in household, n (%)	3,503 (16.7)	3,625 (35.5)	4,184 (32.2)
Wealth Quintile			
Lowest, n (%)	3,317 (15.8)	2,264 (22.2)	2,515 (19.4)
Second, n (%)	3,869 (18.5)	2,145 (21.0)	2,561 (19.7)
Middle, n (%)	4,252 (20.3)	2,376 (23.3)	2,574 (19.8)
Fourth, n (%)	4,497 (21.5)	1,689 (16.5)	2,629 (20.2)
Highest, n (%)	5,005 (23.9)	1,744 (17.1)	2,716 (20.9)
Education			
No education, n (%)	1,093 (5.2)	382 (3.7)	621 (4.8)
Primary, n (%)	9,061 (43.3)	2,812 (27.5)	5,260 (40.5)
Secondary, n (%)	9,131 (43.6)	3,104 (30.4)	5,725 (44.1)
More than secondary, n (%)	1,655 (7.9)	3,920 (38.4)	1,389 (10.7)
Language			
English, n (%)	3,433 (16.4)	312 (3.1)	345 (2.7)
Sesotho, n (%)			12,650 (97.3)
Siswati, n (%)		9,906 (96.9)	
Bemba, n (%)	8,913 (42.6)		
Nyanja, n (%)	4,188 (20.0)		

Characteristic	ZAMPHIA 2016 (n=20,940)	SHIMS2 2016–2017 (n=10,218)	LePHIA 2016–2017 (n=12,995)
Lozi, n (%)	1,008 (4.8)		
Tonga, n (%)	1,831 (8.7)		
Lunda, n (%)	582 (2.8)		
Luvale, n (%)	415 (2.0)		
Kaonde, n (%)	497 (2.4)		
Other, n (%)	73 (0.3)		
Interview length			
Questionnaire length, median (IQR)	85 (63–115)	62 (49–80)	79 (63–97)
Interview duration in minutes, median (IQR)	19 (12–27)	12 (8–18)	16 (11–23)
Participated in blood testing	18,918 (90.3)	9,580 (93.8)	11,823 (91.0)

Table 2.

Blood Test Participation Rates by Interview Length and Selected Demographics, ZAMPHIA 2016, SHIMS2 216–2017, and LePHIA 2016–2017

	ZAMPHIA 2016		SHIMS2 2016–2017		LePHIA 2016–2017	
	Blood test participation (%)	**N**	**Blood test participation (%)**	**N**	**Blood test participation (%)**	**N**
Interview duration						
Less than 10 minutes	89.9	3,349	94.3	3,322	91.8	2,541
10–20	89.9	7,728	93	4,780	91	5,832
20–30	90.6	5,703	94.7	1,515	90.5	3,100
30–40	90.5	2,444	93.8	320	90.3	968
40–50	92.3	911	95.1	82	92.6	258
50–60	91.4	360	93.5	31	90.3	72
60+	91.5	259	96.7	30	88.6	70
Missing	92.5	186	94.9	138	87	154
χ^2 (p-value)	8.7 (0.27)		9.9 (0.19)		7.6 (0.36)	
Questionnaire length						
Less than 40 questions	89.7	1,832	95.2	1,816	90.8	663
40–59	88.8	2,977	92.6	2,701	89.7	2,172
60–79	88.7	4,237	92.6	3,144	88.9	3,774
80–99	90.5	4,153	94.2	1,702	91.4	3,568
100–119	91.8	3,122	97.5	600	93.7	1,978
120–139	91.5	2,557	98.0	203	95.4	655
140–159	92.8	1,402	100.0	37	97.5	159
160+	92.3	660	100.0	15	96.2	26
χ^2 (p-value)	46.3 (<0.01)		44.5 (<0.01)		67.6 (<0.01)	
Self-reported HIV status						
HIV-positive	97.5	1,727	97.8	2,495	96.7	2,670
HIV-negative	89.4	13,641	92.6	6,387	89.8	8,653
Unknown status	90.4	5,572	91.5	1,336	87.7	1,672
χ^2 (p-value)	113.8 (<0.01)		94.3 (<0.01)		141.7 (<0.01)	
Gender						
Male	89.5	8,815	92.0	4,363	89.2	5,405
Female	90.9	12,125	95.0	5,855	92.3	7,590
χ^2 (p-value)	11.6 (<0.01)		38.0 (<0.01)		36.7 (<0.01)	

Table 3.

Adjusted Odds Ratios (95% CI) of Blood Test Participation by Interview Length, ZAMPHIA 2016, SHIMS2 2016–2017, and LePHIA 2016–2017

	Interview duration			Questionnaire length		
	ZAMPHIA 2016	**SHIMS2 2016–2017**	**LePHIA 2016–2017**	**ZAMPHIA 2016**	**SHIMS2 2016–2017**	**LePHIA 2016–2017**
Interview duration						
Per 5 additional minutes	1.00 (0.98–1.03)	**0.94 (0.89–0.99)**	**0.94 (0.91–0.97)**			
Questionnaire Length						
Per 20 additional questions				**1.10 (1.05–1.16)**	1.01 (0.88–1.16)	1.07 (0.98–1.17)
Gender						
Male vs female	**0.84 (0.75–0.94)**	**0.75 (0.62–0.90)**	**0.8 (0.70–0.91)**	**0.89 (0.79–0.99)**	**0.74 (0.61–0.89)**	**0.82 (0.72–0.94)**
Age						
25–34 vs 15–24	**0.78 (0.68–0.9)**	**0.64 (0.5–0.82)**	**0.71 (0.59–0.85)**	**0.75 (0.65–0.85)**	**0.62 (0.49–0.8)**	**0.68 (0.57–0.82)**
35–44 vs 15–24	**0.73 (0.63–0.85)**	**0.70 (0.52–0.93)**	**0.69 (0.56–0.85)**	**0.71 (0.61–0.83)**	**0.67 (0.50–0.90)**	**0.67 (0.55–0.83)**
45–59 vs 15–24	0.88 (0.75–1.04)	0.74 (0.55–1.00)	0.90 (0.72–1.13)	0.9 (0.76–1.06)	0.74 (0.55–1.00)	0.92 (0.74–1.15)
Self-Reported HIV status						
HIV-negative vs HIV-positive	**0.21 (0.15–0.29)**	**0.30 (0.22–0.41)**	**0.30 (0.24–0.38)**	**0.24 (0.18–0.33)**	**0.32 (0.23–0.43)**	**0.35 (0.27–0.44)**
Unknown vs HIV-positive	**0.26 (0.18–0.36)**	**0.20 (0.14–0.29)**	**0.21 (0.16–0.28)**	**0.31 (0.22–0.43)**	**0.21 (0.14–0.31)**	**0.25 (0.18–0.33)**
Ever had sex						
Ever vs never	**1.68 (1.42–1.99)**	0.77 (0.57–1.04)	1.20 (0.96–1.49)	**1.45 (1.21–1.74)**	**0.71 (0.51–1.00)**	1.01 (0.80–1.28)
Household size						
3–5 vs 1–2	1.02 (0.85–1.23)	1.20 (0.96–1.50)	1.09 (0.93–1.28)	1.02 (0.85–1.21)	1.17 (0.94–1.46)	1.09 (0.93–1.28)
6+ vs 1–2	**1.31 (1.09–1.57)**	**1.35 (1.07–1.70)**	**1.28 (1.06–1.55)**	**1.28 (1.06–1.53)**	**1.32 (1.05–1.66)**	**1.28 (1.06–1.54)**
Worked in the past 12 months						
Worked vs did not	1.02 (0.92–1.14)	0.84 (0.7–1.01)	**0.82 (0.71–0.94)**	1.01 (0.91–1.13)	**0.83 (0.69–0.99)**	**0.79 (0.68–0.9)**
Reported on at least one child during the interview						
Reported on 1+ vs reported on 0 children	0.97 (0.85–1.09)	1.20 (0.94–1.52)	**1.21 (1.03–1.42)**	**0.81 (0.70–0.94)**	1.13 (0.86–1.51)	1.10 (0.91–1.32)

	Interview duration			Questionnaire length		
	ZAMPHIA 2016	**SHIMS2 2016–2017**	**LePHIA 2016–2017**	**ZAMPHIA 2016**	**SHIMS2 2016–2017**	**LePHIA 2016–2017**
Wealth Quintile						
Second vs lowest	1.13 (0.97–1.32)	**0.70 (0.50–0.98)**	0.97 (0.75–1.25)	1.12 (0.96–1.31)	**0.70 (0.50–0.98)**	0.99 (0.77–1.28)
Middle vs lowest	**1.36 (1.15–1.60)**	**0.65 (0.47–0.90)**	0.80 (0.62–1.03)	**1.37 (1.16–1.61)**	**0.64 (0.46–0.88)**	0.81 (0.63–1.04)
Fourth vs lowest	**1.21 (1.01–1.45)**	**0.55 (0.39–0.76)**	**0.74 (0.57–0.95)**	**1.24 (1.03–1.48)**	**0.55 (0.4–0.77)**	**0.73 (0.57–0.93)**
Highest vs lowest	1.19 (0.97–1.46)	**0.38 (0.28–0.53)**	**0.61 (0.47–0.79)**	**1.23 (1.00–1.50)**	**0.38 (0.28–0.53)**	**0.61 (0.47–0.79)**
Education						
Primary vs no education	1.69 (1.4–2.05)	1.26 (0.66–2.44)	1.23 (0.88–1.71)	1.66 (1.37–2.01)	1.25 (0.65–2.40)	1.21 (0.87–1.67)
Secondary vs no education	1.82 (1.48–2.24)	0.80 (0.42–1.51)	0.99 (0.70–1.39)	1.79 (1.46–2.20)	0.78 (0.41–1.49)	0.97 (0.70–1.36)
More than secondary vs no education	1.20 (0.92–1.57)	**0.47 (0.25–0.89)**	**0.60 (0.42–0.86)**	1.19 (0.91–1.55)	**0.46 (0.24–0.86)**	**0.59 (0.41–0.84)**
Language						
Sesotho vs English			0.88 (0.62–1.26)			0.92 (0.65–1.30)
Siswati vs English		**1.78 (1.29–2.48)**			**1.80 (1.3–2.49)**	
Bemba vs English	1.03 (0.87–1.23)			1.05 (0.88–1.24)		
Nyanja vs English	1.16 (0.94–1.42)			1.17 (0.95–1.43)		
Lozi vs English	0.84 (0.55–1.27)			0.85 (0.56–1.29)		
Tonga vs English	1.23 (0.90–1.69)			1.25 (0.91–1.71)		
Lunda vs English	**1.56 (1.03–2.37)**			**1.64 (1.09–2.49)**		
Luvale vs English	1.08 (0.71–1.62)			1.13 (0.75–1.71)		
Kaonde vs English	1.05 (0.70–1.57)			1.09 (0.73–1.63)		
Other vs English	0.64 (0.31–1.32)			0.57 (0.28–1.16)		

*Also adjusted for province (Zambia), region (Eswatini) and district (Lesotho), not shown.

Table 4.

Adjusted Odds Ratios (95% CI) of Blood Test Participation by Interview Length and HIV Testing Characteristics, Stratified by Self-Reported HIV Status and Controlling for Additional Demographic Characteristics, ZAMPHIA 2016, SHIMS2 2016–2017, and LePHIA 2016–2017

	Interview duration			Questionnaire length		
	ZAMPHIA 2016	**SHIMS2 2016–2017**	**LePHIA 2016–2017**	**ZAMPHIA 2016**	**SHIMS2 2016–2017**	**LePHIA 2016–2017**
	Self-reported HIV positive *					
Interview duration						
Per 5 additional minutes	1.05 (0.92–1.19)	0.98 (0.84–1.14)	0.93 (0.85–1.01)			
Questionnaire Length						
Per 20 additional questions				1.14 (0.86–1.5)	1.05 (0.71–1.53)	1.12 (0.87–1.44)
Recent HIV testing						
Tested more than 12 months ago vs tested in the past 12 months	1.01 (0.5–2.04)	**2.08 (1.17–3.68)**	**1.95 (1.24–3.07)**	0.97 (0.48–1.96)	**2.16 (1.23–3.81)**	**2.03 (1.3–3.16)**
Unknown date of HIV test vs tested in the past 12 months	1.06 (0.28–4.03)	0.87 (0.20–3.88)	1.31 (0.39–4.40)	1.01 (0.26–3.88)	0.90 (0.20–4.00)	1.51 (0.45–5.08)
	Self-reported HIV negative **					
Interview duration						
Per 5 additional minutes	0.99 (0.97–1.02)	0.95 (0.89–1.01)	0.96 (0.92–1.00)			
Questionnaire Length						
Per 20 additional questions				**1.06 (1.01–1.11)**	1.06 (0.93–1.21)	**1.1 (1.01–1.20)**
Recent HIV testing						
Tested more than 12 months ago vs tested in the past 12 months	**1.5 (1.33–1.69)**	0.82 (0.66–1.02)	0.94 (0.79–1.12)	**1.52 (1.35–1.72)**	0.83 (0.67–1.04)	0.96 (0.81–1.13)
Unknown date of HIV test vs tested in the past 12 months	1.07 (0.82–1.4)	0.92 (0.55–1.53)	0.84 (0.57–1.23)	1.08 (0.83–1.4)	0.96 (0.58–1.6)	0.86 (0.59–1.26)
	Unknown self-reported HIV status ***					
Interview duration						
Per 5 additional minutes	1.02 (0.96–1.07)	0.89 (0.77–1.02)	**0.84 (0.75–0.93)**			
Questionnaire Length						
Per 20 additional questions				**1.16 (1.02–1.31)**	0.95 (0.64–1.41)	0.97 (0.75–1.24)
HIV testing						

	Interview duration			Questionnaire length		
	ZAMPHIA 2016	**SHIMS2 2016–2017**	**LePHIA 2016–2017**	**ZAMPHIA 2016**	**SHIMS2 2016–2017**	**LePHIA 2016–2017**
Ever tested for HIV vs Never testing or missing	1.1 (0.72–1.69)	1.31 (0.54–3.21)	**2.29 (1.05–4.99)**	1.04 (0.68–1.58)	1.37 (0.56–3.35)	2.06 (0.95–4.46)

*Model for self-reported positive individuals also adjusted for urban/rural residence, gender, age, number of children on which the individual reported, education, and language (Eswatini and Lesotho).

**Model for self-reported negative individuals also adjusted for gender, age, whether the individual ever had sex, household size, employment status, wealth quintile, education, language, and province (Zambia), region (Eswatini) and District (Lesotho).

***Model for individuals with unknown status also adjusted for gender, age, whether the individual ever had sex, number of children on which the individual reported, wealth quintile, education, language and province (Zambia), region (Eswatini) and District (Lesotho).