Audio computer-assisted self interviewing for sexually transmitted infection prediction

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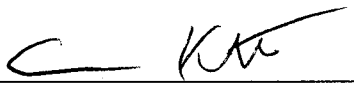
Signature 

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Abstract

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Background: Sexually transmitted infections (STI) cause considerable morbidity in the United States, but are under-assessed. We explored how to improve STI screening in STD clinics. Our aims were to: 1) identify efficient predictors of viral and non-viral STI, and 2) determine whether reporting of STI risk factors and characteristics varied by type of sexual history interview.

Design: This cross-sectional study utilized an audio computer-assisted self-interview (ACASI) followed by a clinician-administered sexual history among 295 females and 314 males (n = 609) in a public STD clinic in Seattle, Washington.

Methods: Participants were tested for herpes simplex virus type 2 (HSV-2), *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and among women, *Trichomonas vaginalis*. We assessed individual, sexual partnership, and biological risk factors to predict asymptomatic STIs using logistic regression with Akaike's information criterion (Aim 1). We assessed predictors of HSV-2 among individuals without genital lesions who had not been previously diagnosed with HSV-2; creating risk scores and examining their performance using receiver operating characteristic curves. We

assessed predictors for non-viral STI among women without vaginal discharge or abdominal pain symptoms. We assessed data completeness, item reporting, and report concordance between the two interviews (Aim 2).

Results: Asymptomatic HSV-2 seroprevalence in men (21.9%) was predicted by individual-level factors, and in women (27.3%) by both individual- and partnership-level factors. A low, medium, or high risk score was associated with HSV-2 prevalences of 8.5%, 21.3%, and 41.8% respectively in asymptomatic men and 10.0%, 43.3%, and 61.8% in asymptomatic women. There were fewer missing data in the ACASI (mean 5.4% vs. 25.5%, $p < 0.001$). Risk reporting and reporting concordance by interview largely corresponded to assumptions regarding social desirability bias, especially among women. Computerized sexual histories were acceptable to 89% of respondents.

Conclusion: Risk assessment that includes individual and partnership factors can identify asymptomatic persons with a relatively high prevalence of STI, and may help efficiently target diagnostic resources. ACASI sexual histories were more complete than recorded clinician histories, and may reduce missed opportunities to counsel about high-risk behaviors. Combining ACASI and clinician-administered histories for risk assessment in STD care settings may improve data quality and clinical management.

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Acknowledgements

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Most of all I thank my family for their unflagging encouragement, especially my husband Bart and son Aden, who literally grew up during my doctoral training; parents Sylvia and Charles, Bob and Joan; and siblings John, Mark, Brett, and Janna.

Dedication

To Bart - my rock.
And to Aden, for those nights spent rocking
in one arm while I held Rothman (1st and 2nd edition) with the other.

INTRODUCTION

Sexually transmitted infections (STIs) including human immunodeficiency virus (HIV) are a serious but "hidden epidemic" (57) in the United States. An estimated 15.3 million incident cases (21) of STI occur annually, resulting in over $17 billion in direct and indirect annual costs and lifetime costs of up to $88 billion (22). Household probability serosurveys suggest that as many as 22 percent of Americans ≥ 12 years of age have antibodies to herpes simplex virus type 2 (HSV-2) (37). By age 24 it is estimated that at least one in three individuals will have acquired an STI (6). The serious consequences of STIs include cervical, hepatic, and other cancers; infertility, ectopic pregnancy, chronic pelvic pain, reproductive and neonatal sequelae; and premature death. Because many STIs are asymptomatic, particularly in women, these infections can be missed by clinicians who do not assess for STIs in the absence of clinical indicators. Risk assessment for STIs is recommended for all adolescents and adults by national organizations (88), yet the literature shows that many clinicians do not consistently perform conduct such assessment (100). However, no standardized sexual history instruments have been provided to aid clinicians in this critical effort.

STI risk assessment conducted via a clinical sexual history (9) allows persons with high probabilities of STI to be tested, treated and counseled for STI risk reduction. Despite the importance of a thorough STI risk assessment, little work has been done to

specify which questions are needed in a sexual history (27). Nor have many studies addressed the research question of what is the best way to administer the sexual history. Audio computer-assisted self-interviewing (ACASI) has been found to have advantages over other interview modes in terms of improved exposure measurement (104), but has not been widely compared to the standard approach of a clinician-administered face-to-face interview.

In this dissertation we set out to identify predictors of STIs in a high-volume urban sexually transmitted disease (STD) clinic in Seattle, Washington, using ACASI and clinician history interviews. Our research questions were to define what might be important to include in a STI screening sexual history, and to assess whether there is an optimal way to administer these questions in terms of interview mode. We hypothesized that we could a) identify a subset of useful STI risk screening items, and b) that the ACASI would yield more complete exposure reporting.

We looked at viral (HSV-2) and non-viral STIs (gonorrhea, chlamydia, and in women, trichomoniasis) in order to capture risk behaviors that may occur over different lengths of time. We focused on persons without specific HSV-2 or bacterial symptoms, as STI screening of asymptomatic individuals allows the most effective targeting for diagnostic testing. We assessed bacterial and protozoan infections in asymptomatic women (gonorrhea, chlamydia, and trichomoniasis), though the prevalence of these infections in our study setting was low. Given the prevalences in this clinic, we had

the most statistical power to look at HSV-2. Therefore we focused our main predictor analysis on this outcome.

Advances in type-specific rapid HSV assays, synergy between HSV-2 and HIV infection acquisition, and transmission reduction that can occur when HSV-2 seropositive persons use condoms and take suppressive antiviral therapy, have led some to call for wider HSV-2 screening (14). Others remain unconvinced that HSV-2 antibody screening is yet warranted (117). Chapter 1 presents the results of our search for risk assessment items to identify asymptomatic patients at risk for HSV-2 seropositivity, and to assess a risk score based on these. By focusing on asymptomatic HSV-2 and attempting to identify a limited number of predictors that can effectively discriminate those individuals at higher versus lower risk of this highly prevalent infection, this work contributes to the debate about HSV-2 screening. If validated in other STD clinic populations, such an approach could reduce the number of HSV antibody tests needed, thus saving resources.

Chapter 2 explores ACASI and clinician sexual histories in terms of data completeness, levels of risk reporting, and potential impact of measurement error for STI estimation and clinical management. This analysis contributes to understanding the role for ACASI as a potential adjunct to the clinician-administered sexual history in STD care settings.

Elucidating effective sexual history items to identify important STIs such as HSV-2, and what combination of interviews yields the best information, will improve STI clinical management, surveillance, and epidemiologic research. After further refinement and testing, these findings have the potential to save clinician time and health system resources. This is work we plan to continue in future research.

CHAPTER 1

Individual and Sexual Partnership Predictors of Sexually Transmitted Infection in an STD Clinic Population

Background

Because many clinicians do not consistently assess risk of sexually transmitted infection (STI) (100) and the infections themselves often are asymptomatic, many STIs remain undetected for extended periods. STI risk screening allows for selective microbiological testing, particularly in asymptomatic individuals (55). Early case detection and treatment can eliminate or reduce disease progression in the index patient, and prevent sexual or perinatal transmission. Universal STI testing can be cost-prohibitive even in settings such as sexually transmitted disease (STD) clinics (20). Identifying strong predictors of STI can enable selective screening in high risk persons. Despite recommendations (38) that all sexually active adolescents and adults be assessed via a sexual history for STI risk, it remains an open question as to which among the variety of clinically and epidemiologically relevant variables should be assessed (50).

In this cross-sectional study we examined a range of exposures and characteristics as predictors of STIs in an STD clinic population. Our goal was to identify items potentially useful for targeting STI screening. We focused on predictors for

asymptomatic infections, since in STD care settings individuals with symptoms are likely to be tested or empirically treated without need for further criteria.

A number of demographic and behavioral, sexual partnership or network, biological, and ecological factors have been found to influence STI acquisition and transmission , (5, 15, 85). Clinical sexual histories have tended to focus on individual-level factors such as number of recent sexual partners (16). Disease transmission modeling (80) and some empiric data suggest the importance of also understanding sexual partnership characteristics as STI predictors. Partnership factors potentially driving STI transmission include sexual mixing across subgroups with different STI probabilities - for example, mixing across age or race/ethnicity classifications (4). Also of interest is concurrency, meaning more than one sexual partnership overlapping in the same time period (43). Sexual partner concurrency has been noted as a risk factor for chlamydia, gonorrhea, and syphilis infection acquisition (28, 34, 92) and transmission (61, 87), though others have questioned whether it is a major determinant of HIV transmission in five cities in sub-Saharan Africa (65). Individuals whose sexual partner has concurrent sex partners may have an increased risk of STI acquisition (78).

We considered three main STI risk domains representing individual demographic and behavioral factors, biological characteristics, and partnership characteristics (Table 1.1) (64). A fourth domain of societal-level or structural factors such as neighborhood

social capital (56) or incarceration rates may well influence STI acquisition and transmission, but it would represent cross-level bias to assume that these aggregate measures can be applied to predicting STI in a given individual. These variables also are not likely to be readily available to clinicians to incorporate in an STI risk screen and so were not explored in this analysis.

We collected data using audio computer-assisted self-interviewing (ACASI), which has been shown in some settings in the United States to increase respondent self-reporting of stigmatized behaviors (48, 73, 75) and to result in more internally consistent and complete data than that obtained through face-to-face or self-administered paper and pencil interviews (58). We used data collected from an ACASI sexual history instrument to assess the contribution of variables in the three domains as predictors of selected prevalent viral, bacterial, or protozoan infections including herpes simplex virus type 2 (HSV-2), *Neisseria gonorrhoeae* (GC), *Chlamydia trachomatis* (CT), and in women, *Trichomonas vaginalis* (TV) infections.

These STIs represent different periods of infectiousness corresponding to both recent and longer-term behavioral risk patterns. Recent exposure variables may be more likely to predict curable bacterial STIs most likely to produce acute symptoms, leading to short durations of infectiousness when diagnosis and curative treatment are very accessible (3). Screening criteria have tended to focus on bacterial STIs (76). Longer-duration exposures are relevant for incurable persistent viral infections such as HSV-2,

and also for curable bacterial STI or trichomoniasis in settings where case detection or treatment are less accessible. Few HSV-2 screening criteria have been published to date (25). We therefore looked particularly at HSV-2, as this infection constitutes a preponderance of overall STI burden, is often transmitted during asymptomatic or subclinical shedding (60), and can have serious and costly sequelae (36) including increased risk for HIV replication (93) and transmission (89, 111). HSV-2 serologic screening of general populations (51) or high-risk populations have not been recommended to date (31). However this may change if suppressive antiviral therapy (83, 117) is found to reduce HSV-2 and HIV transmission, and as evidence accumulates that condom use by individuals who know that they have genital herpes reduces the risk of HSV transmission to seronegative partners (17, 112). It has been suggested that HSV type-specific screening may be warranted for specific populations such as STD clinic attendees (14, 46).

Methods

Study Population

Six hundred and nine 14 to 65 year old English-speaking attendees of the Seattle, Washington public STD clinic completed an ACASI interview prior to their clinical exams.

Recruitment

Research assistants approached clinic attendees in the waiting room using quota sampling to achieve a 50:50 sex ratio for the first 100 participants. Thereafter, probability sampling was undertaken using a random selection algorithm. The waiting room was divided into numbered quadrants. Using a random number generator on a handheld calculator, first the quadrant and then a seat number within the quadrant were selected, and the person in that seat was approached. A total of 1705 individuals were approached, of whom 571 were ineligible because they were not getting a full exam (57%), had appointments (23%), were unable to understand English (12%), or another reason. Of the remaining 1134, 626 accepted, for participation uptake of 55.2%. Twenty-three participants were excluded from full analysis because of incomplete interviews or lab information (n = 14) or duplicate interviews (n = 9), leaving 603 usable subjects for the regression analysis.

After affirming interest in the study, the research assistant took potential participants to a private room and reviewed the study purpose, obtained informed consent, and assisted the participant in a brief ACASI tutorial. The confidentiality of interview data was emphasized to participants verbally, in the consent, and during the ACASI interview.

Upon completion of the ACASI, participants went on to their exam, where the clinician conducted the clinic's sexual history interview and collected blood, urine and vaginal fluid study specimens using standardized procedures. Participants were paid $25 following their exam. The study was approved by the STD Clinic Research Committee and by the University of Washington Human Subjects Division.

Instrument development

The ACASI tool contained all the variables included in the Public Health Seattle-King County (PHSKC) STD Clinic sexual history, including reason for visit, current symptoms, prior STD history, sexual behaviors with specific partners in defined time periods, obstetrical-gynecologic history, and HIV risk. Clinicians reviewed the ACASI variables to ensure that question sequence and wording approximated typical clinical usage.

Sex was defined in the ACASI as any kind of oral, vaginal, or anal sex involving two or more people, including contact between penis and vagina, penis and anus, penis and mouth, mouth and vagina, and mouth and anus but excluding mouth-to-mouth kissing or hand touching of the breasts, penis, vagina, or anus (12). Sex work was defined as exchanging "sex for money, drugs, or something you needed." Homelessness was self-identified by individuals who indicated that they had no current residential zip code.

Additional items for the ACASI tool were selected based on the model of STI risk outlined in Table 1.1. We used items that have been recommended by entities such as the CDC (Core Items Working Group) (102) and UNAIDS (109) and that were used or psychometrically validated in other large studies. The ACASI additionally asked about age at coitarche, lifetime number of partners, history of incarceration or sexual abuse (70), depressive symptoms (99), or alcohol and substance use (13) patterns. Incarceration was defined as one or more nights in jail, prison, reform school, or detention center.

Egocentric (self-reported) local network (79) questions were asked to determine detailed characteristics of the last two sexual partners (partner's age, race, education and income, STD history, HIV/STD risks) and less detailed information about the third most recent partner, and spatial and social details regarding partnership formation. The participant's own sexual partner concurrency was ascertained by asking how long ago in days, weeks, months or years were the first and last dates of sex for the last three sexual partnerships. If the time units overlapped within six weeks, participants were asked directly if they had sex with other partners during that partnership. These data allowed us to calculate gap length — i.e., the number of days between serially monogamous relationships — that if short enough may allow transmission of untreated bacterial STI (62). Participants also indicated whether they believed any of their last three sex partners had had sex with other people during the same time that the participant was with that partner (sex partner's concurrency).

Reports elicited about protective behaviors included stage of change for condom use (33) and correctness and consistency of condom use for each sexual partnership. We developed a condom correctness and consistency score consisting of $(n_c) - (n_{cf}) \div N_T$; where N_T = total # vaginal or anal sex acts in 2 months, n_c = # acts protected by a condom, n_{cf} = # condom-protected acts where failure occurred due to method (breakage) or user errors (put on backwards, after sex started, or before sex ended). The ACASI tool was programmed using ACASI software, was piloted, and finalized.

Assessment of STI Prevalence

Serum antibodies to HSV-2 were detected by type-specific ELISA IgG antibody testing (Focus Technologies, Cypress CA) on blood specimens with Western blot confirmation of indeterminate results. Chlamydial and gonococcal infections were determined on first-void urine specimens using nucleic acid amplification tests comprising ligase chain reaction tests (Abbott Laboratories, Chicago, IL) on the first 411 specimens, and a transcription mediated amplification test (Gen-Probe Aptima, San Diego CA) on the remainder. Trichomoniasis was determined by culture (InPouch, Biomed, San Jose California) of vaginal fluid specimens.

We had the largest number of events for HSV-2, with fewer events occurring for the bacterial and protozoan STIs. Our focus was to identify predictors of viral and non-viral STI among asymptomatic individuals. For the analysis focusing on HSV-2, we

defined as symptomatic those individuals with genital lesions (sores or rashes), and excluded these individuals. We further excluded individuals who had already previously tested positive for HSV-2. This left a subset of 219 men and 191 women (n = 410) who did not have these specific symptoms suggestive of genital herpes. For the analysis focusing on non-viral STI, we defined as symptomatic those individuals with urethral or vaginal discharge, or abdominal pain in women (which is associated with pelvic inflammatory disease). We excluded these individuals and focused this analysis on those persons without these specific symptoms of bacterial STI. This left a subset of 145 men and 125 women (n = 270) who did not have these specific symptoms suggestive of bacterial or protozoan STI. Among these 270 individuals there were 11 cases of GC, CT or TV in women, but only eight cases of asymptomatic GC or CT among men. Therefore we only analyzed predictors of asymptomatic GC, CT, or TV among women.

Statistical analyses

ACASI data were exported into STATA 8.0 statistical software (STATA Corp, College Station Texas). The participant's lab results were stripped of identifiers and merged into the study database.

For univariate analyses continuous variables such as lifetime numbers and numbers of recent partners were assessed for skewness and these variables were dichotomized at the median. Years of sexual activity were calculated by subtracting age at coitarche

from age at interview. An age-mixing variable was created using ≥ 5 years younger or ≥ 10 years older for ages of the last two sexual partners, and was dichotomized as both partners versus neither partner older or younger to characterize age mixing. We created race mixing variables (white vs. nonwhite, the latter collapsed from six US Census racial categories) were created based on patterns with the last three sexual partners, dichotomized as all of last three partners the same versus all different. The respondent's sex partner concurrency was coded as 1 if overlap occurred by dates over any of the last three sexual partnerships. The respondent's sexual partners' concurrency was indicated by affirmative response to the question "Do you believe that he/she had sex with someone else during the time you two were together?"(86) and was noted if it occurred in any of the last three partnerships. Gap length was number of days between serial relationships 3rd to 2nd most recent, and 2nd to 1st by dates, dichotomized as short if < 55 days (the shortest mean duration of infectivity, for gonorrhea) (15). Condom correctness and consistency were calculated for use during the last two months with each of the last two sex partners (or over the total number of sexual episodes if together < 2 months). These scores were dichotomized at ≤ 50% versus > 50% correct and consistent use. Poverty was classified as income below the federal level of $793 per month for one person.

Characteristics were compared by sex and behavioral orientation (sex with men, women or both) using two-tailed Pearson's χ^2 or Fisher's exact tests for categorical

variable proportions, and Student's t-test for continuous variables. Nonparametric tests were used to compare skewed continuous variables.

Correlation matrices assessed multicolinearity of expected main effect variables within and across the individual, partnership, and biological domains. No two variables were included in the models if correlation between them was ≥ 0.50. We found that correlation coefficients were mostly < 0.35, suggesting little colinearity within domains.

We assumed potential effect modification of predictors by sex. To simplify the models for clinical use we ran each outcome separately for males and females, rather than including interaction terms. We expected that this also would facilitate patient-population applicability as some clinicians may only screen men or women. A limited number of predictors were selected from our conceptual model and tested based on the rule of having at least 10 events per variable for stability of prediction regression models (7). Candidate predictors within each domain of our risk model were assessed for their relationship with the study STIs and were considered statistically significant if $p \leq 0.05$ in a bivariate logistic regression. Where more than one variable was statistically significant within each domain, we applied Akaike's information criterion (AIC) penalty to identify the best subset of predictors that minimized overfitting (2). This purposive approach to the regression was designed to avoid the biases (101) that

are known to occur with stepwise selection procedures. The AIC procedure can select coefficients whose confidence bounds include 1.0, but whose inclusion results in the lowest score (88).

Multivariable models were developed by forcing into the regression those variables found to be independent predictors from each domain. The subset of predictors that produced the lowest AIC score was considered to be the final model. Odds ratios (ORs) do not approximate relative risks for outcomes with prevalence greater than 10%, so ORs here are assumed to be inflated estimates. The limitations of ORs to satisfactorily distinguish disease status in individuals, as opposed to populations, has recently been discussed by Pepe and colleagues. Classification accuracy is better addressed by comparing receiver operating characteristic curves (ROC) curves (84), which we did here. Model fit was assessed by the Hosmer-Lemeshow goodness-of-fit χ^2 and considered adequate if the p value was ≥ 0.05.

The sample on which the HSV-2 predictor models were developed consisted only of those individuals who did not report genital lesions ("asymptomatic" for genital herpes), and who had not previously tested positive for HSV-2. The sample on which the non-viral predictor model was developed consisted only of those women with no vaginal discharge or abdominal pain ("asymptomatic" for curable STI).

Predictors in the HSV-2 female and male models were developed into two asymptomatic HSV-2 prevalence risk scores. These self-weighted risk scores were created by dividing each log odds in the model by the smallest log odds, and rounding this to a whole number for a resulting, additive score. Each predictor was assigned its corresponding score (i.e., that predictor's logit divided by the lowest logit in the overall model, rounded to a whole number). The risk score for an individual was then the sum of these scores. Sensitivity, specificity, positive and negative predictive value (PPV, NPV), and ROC curves were calculated for each of these risk score models using the HSV-2 study prevalence as the cutoff threshold. The risk score models were bootstrapped for 10,000 iterations (23) to estimate the variability (95) in the area under the ROC curve confidence interval. Finally, we categorized the scores into low, medium and high HSV-2 risk, and assessed whether these reasonably discriminated low, medium, and high prevalence of asymptomatic HSV-2.

Results

Characteristics of Participants

Neither study eligibility nor enrollment varied appreciably by sex, age, or race between study participants and refusers. Comparison of the quota-sampled versus randomly-sampled participants' characteristics revealed no important differences in age, race, education, same-sex behavior, alcohol or substance abuse, depression, history of sexual abuse or previous STD diagnosis, current STI symptom or STI prevalence (data not shown). Therefore the populations were pooled in the analysis.

Table 1.2 outlines study participant characteristics by sex. About half the participants had current symptoms suggesting STI (54.0%). Over two-thirds had recent concurrent sexual partnerships themselves (69.2%), as did three-quarters of any of their last one to three sexual partners (72.2%). In the sample as a whole, 154 of 212 individuals (72.6%) who were positive for HSV-2, GC, CT, or TV were concurrent with other sexual partners, a proportion which was similar to those without STIs (67.3%; p = 0.17). Levels of alcohol and substance abuse (27.2%), depressive symptoms (48.0%), and history of incarceration (33.4%) were relatively high; a small proportion of study participants were homeless (4.1%). Approximately one in four study enrollees were African-American, and 11% were Latino. Ten men (3.2%) and 21 women (7.1%) were co-infected with two or three STIs.

One in three of all study participants tested seropositive for HSV-2. Among those individuals without genital lesion symptoms, 27.2% of men and 38.2% of women were seropositive for HSV-2. Only 70 of 193 HSV-2 seropositive individuals reported a history of genital herpes, most of whom reported being given this diagnosis based on a clinical exam (56.0%) rather than a test result (36.0%). The average number of outbreaks per year among these individuals was 2.6 (range 0 - 20, SD 3.4). Fourteen (15.7%) of 89 individuals who reported a history of genital herpes tested negative for both HSV-1 and HSV-2. Around one in five (18.6%) of the documented HSV-2 seropositives took medications on a daily basis or when they had prodromal outbreak symptoms; 64% did not take any antiviral medications.

Logistic Regression and Risk Scores, Asymptomatic HSV-2

In bivariate analysis restricted to asymptomatic men who did not already known they had genital herpes, both individual- and partnership-level factors were associated with HSV-2 seroprevalence. These included age and years of sexual activity, nonwhite race, high school education or less, a history of injecting drug use or sex with an injecting drug user, incarceration ever, and previous gonorrhea. Reason for visit to the clinic being contact to someone with genital herpes was not a predictor.

In the final model years of sexual activity, injecting drug use or sex with an injecting drug user, lower educational attainment (≤ high school), and nonwhite race predicted asymptomatic HSV-2 seropositivity in men, adjusting for all variables (Table 1.3).

The log odds for years of sexual activity was assigned a score of 1, high school education or less a score of 12 points, for injecting drug use or sex with an injecting drug user 15 points, and for nonwhite race 17 points. Area under the curve (AUC) of this male asymptomatic HSV-2 seropositivity risk score model was 0.7051 (95% CI 0.6259, 0.7844). The mean bootstrap-estimated AUC was 0.7220 (95% CI 0.5000, 0.8634). This risk score model was 50.0% sensitive and 80.7% specific, with a PPV of 41.8% and NPV of 85.4%. The ROC of the continuous risk score is shown at the top of Figure 1.1.

When we categorized this risk score by setting a score of 0 to low risk, 12 to18 corresponding to medium risk, or 27 to 45 for high risk, we found that these levels were associated with HSV-2 prevalence of 8.5% 21.3%, and 41.86% respectively in asymptomatic men (numbers, bottom of Figure 1.1). This is only one example of a categorization schema that may be meaningful to distinguish higher from lower risk patients for diagnostic testing; different clinical settings may choose different categorizations and testing thresholds.

A number of variables from the individual, partnership, and biological domains were significant bivariate predictors of asymptomatic HSV-2 seropositivity in women not already known to be HSV-2 seropositive. Number of years of sexual activity, age, high school education or less, ever having had non-HSV STIs, having been sexually abused as a child under age 14 or as an adult, having ever been in jail, a history of sex work, ever use of crack cocaine, and having a current drug or alcohol problem were all significant individual-level predictors. Contact to a sex partner with genital herpes as reason for the clinic visit was not associated with HSV-2 seropositivity.

Bivariate predictors at the partnership level included perception that any of the last three sexual partners were sexual concurrent with others, extent of cross-age mixing (i.e., recent sex partners being substantially older or younger than the participant), the perception that a recent partner was likely to transmit an STI, and whether the partner

ever tested for HIV. The biological variable ever douching also was bivariately associated.

Adjusting for all other variables in the final multivariable model, nonwhite race, douching, ever having had an STI other than herpes, and extensive age mixing (2/last 3 sex partners were ≥ 10 years older) predicted HSV-2 seropositivity among asymptomatic women.

The log odds for douching and nonwhite race were assigned a score of 2, and STI history and age mixing were each assigned a score of 1. As seen in Figure 1.2, the AUC of this female asymptomatic HSV-2 seropositivity risk score model used as a continuous measure was 0.7784 (95% CI 0.7062, 0.8506). The bootstrap-estimated AUC was 0.7771 (95% CI 0.6282, 0.8729). This risk score model was 86.3% sensitive and 59.4% specific, with a PPV of 50.6% and NPV of 90.0%.

Categorizing these risk scores as 0 to 2 for low risk, 3 to 4 for medium risk, and 5 to 6 for high risk was able to distinguish women with lower versus higher prevalence of infection (numbers, bottom of Figure 1.2).

Logistic Regression, Non-Viral STIs

Asymptomatic GC, CT or TV infection in women (Table 1.4) was predicted by never having tested for HIV, current alcohol and substance abuse, and current homelessness. Sensitivity of this model was 88.9%, specificity was 64.0%, PPV was 18.2%, and NPV was 98.5%. This model was based on only 11 positive cases out of 168 women who lacked symptoms suggestive of these infections, as is evident by the wide confidence intervals. There were too few cases of asymptomatic GC or CT in men to explore predictors in a stable regression model.

Discussion

Our goal in this aim of the study was to identify sensitive and specific STI predictors from the universe of items that one might consider, for public health and clinical reasons, including in an STD clinic sexual history. We hoped to find a limited number of predictors that could be used to identify persons at high risk for STI, as these then could be used to efficiently screen asymptomatic patients. We found that a small subset of individual-level and partnership-level variables did predict STIs, particularly asymptomatic HSV-2 seropositivity in women. Furthermore, these predictors could be used to develop scores to successfully discriminate between those with lower versus higher risk of HSV-2 seropositivity. If validated in other populations, such an approach can be used to target which individuals should get a diagnostic test, thus reducing the number of tests and saving health system resources.

Generally STI risk assessments or sexual histories assess individual characteristics or behaviors such as race, or number of recent sex partners. We found that race was a predictor for both incurable (HSV-2) and curable STIs (GC, CT, TV in women). Number of recent sexual partners was not predictive for these infections, perhaps due to limited heterogeneity (e.g., mean number of sex partners among STI-negative participants was 6.5 versus 7.6 among STI-positives). Other individual-level factors that were predictive included homelessness and lower educational attainment. These may help define the socioeconomic context in which patients engage in risk behaviors.

Age-mixing was found to help predict asymptomatic HSV-2 seropositivity in women. This is a sexual partnership-level characteristic which is not usually assessed in clinical sexual histories. Most studies show increasing HSV-2 seroprevalence with age. HSV recurrences decline over time, which may mean that older individuals are less infectious, while younger people with more recent seroconversion can be more infectious. Thus whether HSV-2 risk increases due to sexual mixing across age groups has not been definitively determined. Our finding that sexual mixing with older partners helped predict HSV-2 in female STD clinic attendees confirms the age-mixing HSV-2 risk seen in one previous household-probability sample (18). Correlates of any HSV-2 infection noted in other studies include lifetime number of partners, age of sexual debut, and a history of other STDs (26). In our study population some of these factors were bivariate but not multivariable predictors of asymptomatic HSV-2. Predictors of asymptomatic HSV-2 in men identified in our

study were all individual-level variables; this risk score model had a lower AUC than the female model.

Delineating predictors of HSV-2 among asymptomatic individuals may contribute to more focused screening of STD clinic attendees for this highly prevalent infection. Few if any STD clinics can afford to perform HSV-2 serological testing for all patients. Current practice in the Seattle clinic is to provide HSV type-specific testing to patients who present with symptoms suggestive of genital herpes, who report sexual exposure to a partner with genital herpes, or who ask for a herpes test. In practice even if the clinic used the HSV-2 screening criteria developed here, patients with lesions would still be tested. We found that recent contact to a sexual partner with herpes noted as a visit reason was not predictive of asymptomatic HSV-2 in men or women in this study population, but the numbers were small (n = 30). The categorized risk score performed at least as well among those who had no reported contact to a partner with herpes than among those who did, in men (AUC 71% vs. 68%).

To apply the risk score to women would necessitate asking questions about the characteristics of patients' recent sex partners. Testing only those women scored as medium or high risk would have identified 44 out of 51 true positives while unnecessarily testing 43 women. However, two-thirds fewer women would have needed to be tested than would have been the case with universal HSV-2 testing (87 versus 157). If only those women noted as high risk by the categorized risk score

model had been diagnostically tested, the prevalence of disease identified would have doubled (61.8% over the clinic pretest probability of 27.2%).

However, any benefits of identifying asymptomatic HSV-2 seropositive individuals through the use of screening criteria must be weighed against the emotional, financial, and other costs (116) of false or missed diagnoses. Risk score screening criteria must be validated in other patient populations before being implemented. The global performance of screening criteria is likely to be lower when applied to new patient populations — the ultimate test of any screening prediction rule (54, 68).

A small sample size and low prevalence of bacterial STIs limited the number of predictors we could detect for non-HSV-2 outcomes. Thus we were not able to definitively answer the question of whether partnership measures such as concurrency or short gap length between partners can help identify individuals with these STIs. Negative findings here do not discount that possibility, which may be more fruitfully explored with larger sample sizes in populations with a higher prevalence of bacterial STIs. Approximately one-third of the women in this study were asymptomatic for vaginal discharge or abdominal pain, some of whom were older than the age ≤ 25 cutoff that is recommended for universal CT screening. This suggests that identifying predictors of curable STIs in women asymptomatic for those conditions may still be useful.

Whether the specific individual and partnership variables we have identified as predictors of STIs should be included in clinicians' approach to the sexual history to identify the STIs we examined needs further validation in similar and dissimilar populations. If some of the measures in this study are found to be predictive of STI in other clinics, there may be ways to incorporate some of these measures without requiring extensive or cumbersome data collection. Items regarding sex work tend to be a standard part of many STI screens already. Other variables such as homeless status also may be part of a clinic's data collection, or could be asked as a specific question regarding domicile. Asking the patient the ages of recent sex partners ("ten or more years older than you?") can elicit the partnership age-mixing risk factor.
Our cross-sectional study design was reasonable for our clinical goal of identifying predictors of prevalent STI in asymptomatic STD clinic patients, for guidance in screening for these infections. This study would be generalizable only to similar STD clinics, where patients are more likely to have symptomatic disease and are not representative of behavioral exposure patterns among people who have not sought care in such clinics.

Strengths of our study include a comprehensive sexual history that was in use at a high-volume STD clinic, a theory-driven approach to instrument design, a randomized recruitment approach to minimize participation bias, and utilization of highly sensitive ascertainment methods for exposure and outcome. Study findings contribute to the

identification of efficient screening questions to ascertain the risk of asymptomatic STIs in an STD clinic population.

STD clinic attendees represent a legitimate high-risk group to target for screening for asymptomatic STI (44). Identifying the contribution of specific risk assessment items for this population has significant implications for management of the STI cases seen in public STD clinics (120). Our study shows that it is possible to identify a reduced but efficient number of STI predictors that can help target use of viral and non-viral diagnostic tests in individuals whose clinical presentation would otherwise not indicate these specific infections. If these items prove to be valid STI predictors in other STD clinic populations, future research could investigate what cutoffs would be best for testing and treatment thresholds in various settings (76).

Persons with STI are now seen in a variety of settings including private practice and other public clinics, emergency departments, and incarceration facilities (35, 74, 103). In these settings sexual histories may be even less standardized than the varying approaches to risk assessment used in STD clinics in the United States (63). Research on which variables are important to include in a sexual history screen is useful in STD clinics as well as other settings that care for individuals at high risk of STIs.

TABLE 1.1: Theoretical Model of STI Risk

Risk domain	Potential predictors: measures or proxies associated with STI risk	Specific measures tested in study models
INDIVIDUAL		
Demographics:		
Age	- Cutoff varies; ≤ 25 years for chlamydia	- Age
Race	- Proxy for sexual network prevalence	- Race
	- Marital status, including domestic partner	- Living w/ partner+
Relationship	- Unprotected anal, vaginal, oral sex	- Unprotected sex
Sexual Behaviors	- Among men who have sex with men (MSM): sexual & condom use behaviors by sex partners' HIV status	- Same-sex vs. opposite-sex partners
	- Among heterosexuals, behaviors by partners' HIV or perceived STI status	
	- Bisexual experience (for women)	- In last 12 months
	- Sex with known HIV+ partner	----------
Partner	- Number of recent sexual partners	- Last 2, 12 months
Change	- Age at coitarche	- Years of sex+
Patterns	- Number of lifetime sex partners	- Number
Protective	- Condom use by partner type (main vs. non-main)	- Condom use+
Behaviors	- HIV testing patterns (ever, dates, results)	----------
Substance Use	- Crack cocaine, amyl nitrates, methamphetamine	- Ever use
	- Alcohol/substance abuse	- CAGE-AID score+
Psychological	- Depression	- PRIME-MD score+
Factors	- History of sexual abuse at < or ≥ 13 years	- Sexual abuse+
	- Stage of change for condom use	----------
Economic	- Poverty	- Low income+
Factors:	- Homelessness	- Homeless +
	- Sells or trades sex	- Sells or trades sex
	- Incarceration	- ≥ 1 night+
	- Insurance or health payment source	----------
PARTNER		- Knew each other
Sexual Partner	- Partnership formation	<1 wk, or <1 day+
Characteristics	- Sex partner known to have HIV, HSV, other STI	- Contact to STD
	- Sex partner known or perceived risk of HIV/STI	- Last 3 partners +
	- Partner suspected to have other sexual partners (concurrency)	
Sexual Mixing	- Sex with partners ≥ 5-10 years younger /older	- Age mixing+
Patterns	- Sex with partners of other races	- Race mixing+
Gap Length	- Short time between serial partnerships	- <55 or < 90 days+
Prevalence in	- STI prevalence in population	----------
Network	- Stage of the STI epidemic	----------

+ = Reflects new variable not on STD Clinic chart

TABLE 1.1: (continued)

Risk domain	Potential predictors: measures or proxies associated with STI risk	Specific measures tested in study models
BIOLOGICAL	- Symptoms - Current or previous STI - Circumcision status - Cervical ectopy - Hormonal contraception - Vaginal douching - Duration of infectiousness (untreated) - Transmission probabilities - Host immune function - Sexual partner infectiousness	- HSV, or bacterial - History of STIs - Circumcised+ ---------- ---------- - Douching - Implicit in gap time ---------- ---------- ----------

+ = Reflects new variable not on STD Clinic chart

TABLE 1.2: Study Participant Characteristics by Gender

	Male N = 314	Female N = 295
	n (%)	n (%)
Age		
14 - 24	80 (26)	132 (45)
25 - 44	195 (62)	136 (46)
≥ 45	39 (12)	26 (9)
Race/Ethnicity		
African American	74 (24)	60 (20)
White	178 (57)	152 (52)
Other racial background	40 (13)	53 (18)
Latino/a	35 (12)	31 (11)
Education		
≤ High school	84 (28)	110 (38
Some college, or vocational-tech training	125 (41)	107 (37)
College graduate or post-graduate	100 (32)	75 (25)
Income (yearly)		
<10,000	113 (40)	164 (63)
10 - 49,999	132 (46)	87 (33)
≥50,000	39 (14)	11 (4)
History of STD	157 (50)	211 (72)
History of sexual abuse, ever	53 (17)	103 (36)
History of incarceration	106 (35)	89 (31)
Depressive symptoms, current	138 (45)	151 (52)
Alcohol or substance abuse, current	87 (28)	77 (26)
Same-sex sexual contact, ever	116 (37)	134 (45)
Current behavioral orientation		
Sex with men only	71 (23)	260 (88)
Sex with women only	230 (73)	6 (2)
Sex with both	13 (4)	27 (9)
Lifetime number of sexual partners Mean (± SD)	40.9 (90.2)	34.2 (76.5)
Participant concurrent with other partners	209 (68.1)	198 (70.2)
Participant's sex partners concurrent with others	208 (68.2)	217 (76.4)
Any STI symptoms at visit	146 (47)	153 (53)
STIs	168 (53.7)	160 (55.4)
Total:*		
Gonorrhea (n, %)	14 (4.6)	4 (1.4)
Chlamydia (n, %)	15 (4.9)	12 (4.1)
Trichomonas vaginalis (n, %)	---	17 (6.2)
HSV-2 (n, %)	80 (25.9)	116 (39.7)
Asymptomatic†:		
Gonorrhea (n, %)	1 (0.4)	0 (0.0)
Chlamydia (n, %)	7 (2.8)	5 (2.9)
Trichomonas vaginalis (n, %)	---	6 (3.9)
HSV-2 (n, %)	64 (27.3)	86 (38.2)

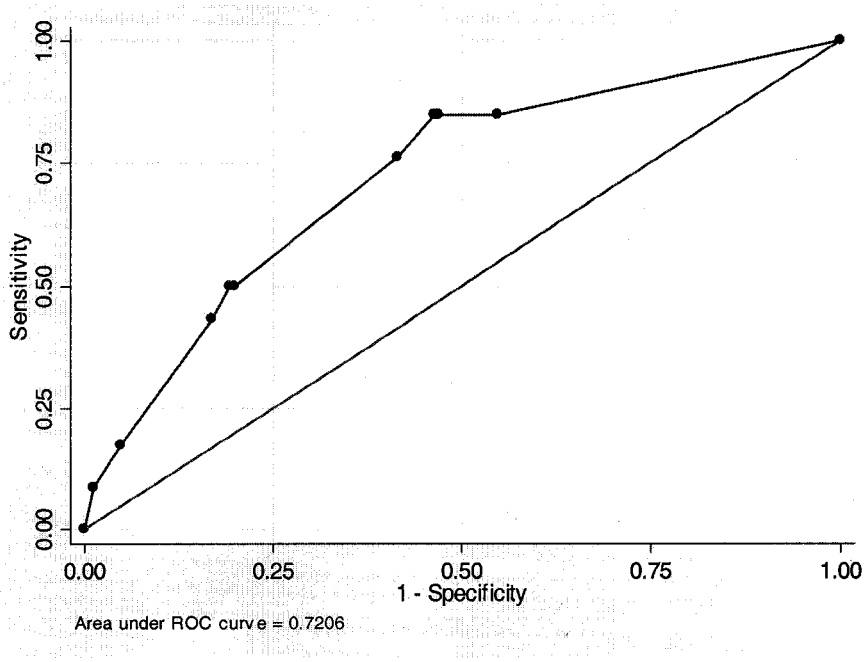
* Denominators exclude missing data

† For any of 3 symptoms associated with HSV-2, or any of 3 associated with bacterial STI

TABLE 1.3: Predictors of Prevalent HSV-2 among Asymptomatic Women and Men

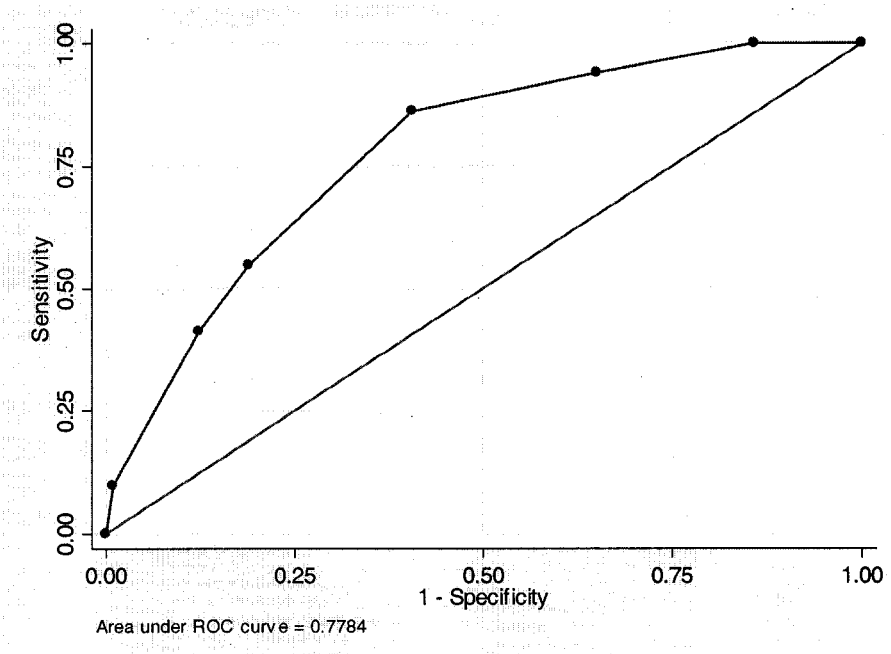
Variable by Domain	Females				Males			
	No.	No. with HSV (%)	Odds Ratio	95% CI	No.	No. with HSV (%)	Odds Ratio	95% CI
Individual								
Years of sexual activity	---	---	---	---	---	---	1.1	1.0 - 1.1
Injecting drug use (IDU) or sex with IDU								
No					183	33 (18%)	1	
Yes	---	---	---	---	35	15 (43%)	2.7	1.1 - 6.6
Education								
Beyond high school					158	27 (17%)	1	
High school or less	---	---	---	---	59	19 (32%)	1.9	0.8 -4.3
Race								
White	98	14 (14%)	1		115	14 (12%)	1	
Nonwhite	79	33 (42%)	9.2	1.9 - 44.9	94	32 (34%)	2.8	1.3 - 6.3
Douching ever								
No	115	16 (14%)	1					
Yes	73	36 (49%)	6.3	1.4 - 29.3	---	---	---	---
Ever any non-HSV STI	85	7 (8%)	1					
No	104	45 (43%)	5.8	0.8 - 40.9	---	---	---	---
Yes								
Partnership								
Two/last 3 sexual partners both ≥ 10 years older								
No	51	9 (18%)	1					
Yes	26	14 (54%)	4.4	0.9 - 19.9	---	---	---	---
Hosmer-Lemeshow χ^2 goodness-of-fit			0.31				0.40	

Multivariable logistic regression model adjusting for all other predictors in the model; analysis restricted to those individuals with no genital lesions, and who had not previously been diagnosed with genital herpes



Categorized Risk Score	Distribution	HSV-2 Prevalence
Low (0)	n = 7, 38.7%	8.5%
Medium (12 - 18)	n = 16, 35.4%	21.3%
High (27 - 45)	n = 23, 41.2%	41.9%
Area under curve (bootstrap estimation)		0.72 (0.50, 0.86)

FIGURE 1.1: Risk Score Model for Asymptomatic HSV-2 Infection in Men - Receiver Operating Characteristic Curve, and Performance When Score is Categorized (N = 212)



Categorized Risk Score	Distribution	HSV-2 Prevalence
Low (0 - 2)	n = 92, 37.2%	10.0%
Medium (3 - 4)	n = 90, 36.4%	43.3 %
High (5 - 6)	n = 65, 26.3%	61.8%
Area under curve (bootstrap estimation)		0.76 (0.68, 0.83)

FIGURE 1.2: Risk Score Model for Asymptomatic HSV-2 Infection in Women - Receiver Operating Characteristic Curve, and Performance When Score is Categorized (N = 157)

TABLE 1.4: Predictors of Gonorrhea, Chlamydia, or Trichomoniasis in Asymptomatic Women

Variable by Domain	No.	No. with STI (%)	Crude Odds Ratio	95% CI	Adjusted Odds Ratio	95% CI
Individual						
Ever HIV tested						
No	126	5 (4%)	1		1	
Yes	33	5 (15%)	4.3	1.2 - 15.9	5.1	1.2 - 21.4
Alcohol and substance abuse						
No	131	6 (5%)	1		1	
Yes	36	5 (14%)	3.4	0.9 - 11.7	3.8	0.9 - 15.5
Homeless currently						
No	162	8 (5%)	1		1	
Yes	6	3 (50%)	19.2	3.3 - 110.8	13.5	1.4 - 128.5
Hosmer-Lemeshow χ^2 goodness-of-fit					0.74	

Multivariable logistic regression model adjusting for all other predictors in the model; analysis restricted to those individuals with no vaginal discharge or abdominal pain

CHAPTER 2

A Comparison between Audio Computer-Assisted Self-Interviews and Clinician Interviews for Obtaining the Sexual History

Background

Accurate ascertainment of those behaviors and characteristics that help predict sexually transmitted infection (STI) is necessary both for epidemiologic research and clinical management. Measurement error and misclassification of exposures related to STIs can undermine the search for etiologic association, care of patients, and evaluation of prevention interventions. For this study aim we compared STI symptom and risk exposures reported by STD clinic patients in an audio computer-assisted self-interview (ACASI) with charted reports of a clinician sexual history interview. We sought to determine whether there were any advantages of ACASI over the standard clinician history (CH) in terms of data completeness and reporting of sensitive or socially desirable behaviors. A related goal was to assess interview mode effects on STI prediction.

Elicitation of symptoms can guide clinical diagnosis, and STI risk factors reported in a sexual history can help clinicians to appropriately focus screening and counseling. Traditionally clinicians assess STI risk by presenting a series of questions in face-to-face or self-administered questionnaire interviews; these may or may not be standardized. However, sexual and substance use behaviors related to STI risk may

not be accurately remembered or reported. Social desirability, self-presentation, recall, interviewer and other biases such as specific item non-response can lead to substantial measurement error in the reporting of sexual behaviors. While people can consistently report STI-risk-related information, there is ample evidence of error and bias in existing sexual behavior surveys (19, 115).

Under- and over-reporting can significantly modify the correlation between exposures and STI. If misclassification is differential by STI status, measures of association may be inflated or reduced. It is therefore important to consider the influence of data collection mode on exposure reporting. The privacy and perceived confidentiality afforded by a particular interview mode can dramatically affect reporting rates for non-normative or stigmatized behaviors (104). Self-administered interviews may be preferable to interviewer-administered questionnaires to collect socially sensitive exposure information such as injecting drug use (30), though the latter approach may elicit higher levels of reporting for factors such as psychological distress that result in empathetic interviewer reactions (81).

Computer-assisted self-interviews (CASI), sometimes with audio, video, or telephone enhancements, have been used to assess general health risks (1), patient histories (49, 53, 90, 96), and psychiatric illness (29) in a variety of clinical health settings. CASI formats have been found to be acceptable among low-income, minority, and low computer-literate populations (10, 105, 118), and among patients in clinical exam

settings (98). Older persons, those with hearing difficulties and those with low technology-exposure (110) may be less suitable for CASI interviews. STI and human immunodeficiency virus (HIV) risks have been surveyed using CASI among blood donors (72), university students (94), adolescents (77, 91, 114), and injecting drug users (47). Advantages of CASI include consistent administration of questions that eliminates interviewer bias; logic-based checks for inconsistent responses; automated response ranges, skip patterns, and conditional branching that ensure appropriate questions are asked of respondents. Fewer missing data have been noted in ACASI as compared with paper-and-pencil interviews in general population surveys. All questions and responses are available on audio files accessed through headphones, reducing literacy barriers. Limitations of ACASI include the linear format and insufficient number and depth of probes that some individuals may require in order to reveal sensitive information. Computerized interviews thus limit exploration of complex topics that may arise naturally in a clinician-patient dialogue.

In the United States higher levels of sensitive behaviors related to abortion history (71), drug use, and sexual risks (106) have been reported by ACASI compared with interviewer and self-administered paper interviews. However it is unclear whether ACASI's advantages regarding reporting and data completeness will hold true in STD clinics, where people coming in for STI-related care have a concomitant expectation of discussing sensitive behavior. Patients underreport socially sensitive behaviors for reasons including embarrassment, fear of incrimination for illegal activities, and

concerns about confidentiality (82). But the sensitivity of a question can depend upon the particular population and the care-seeking context. Several studies have assessed self-administered interviews versus face-to-face reporting of risk behaviors in a STD clinic. One of these used an audio cassette (11), and the other two used CASI instruments. Kissenger et al. found that female STD clinic patients reported 30% higher levels of socially sensitive questions in a video-CASI interview (59). Ghanem et al. found that in a Baltimore STD clinic patients were more likely to report sensitive sexual behaviors on ACASI compared with clinician interview, but were equally likely to report drug use (42). Our study extends these findings by comparing ACASI to clinician histories for STI risk screening in a public STD clinic.

Methods

Study population and data collection

As described in Chapter 1, this cross-sectional study enrolled 609 attendees of the Seattle, Washington public STD clinic who were 14 to 65 years old, being seen for a full exam, and able to understand spoken English. Participants completed the ACASI sexual history prior to their clinical exams. During the exam, clinicians (n = 15) conducted a sexual history using a standardized paper and pencil form that became part of an electronic medical record. The respondents' STI status was ascertained using HSV-2 serology, GC and CT nucleic acid amplification tests, and in women, TV culture.

The ACASI tool contained all the variables in the Public Health Seattle-King County (PHSKC) STD Clinic sexual history. This clinician-administered history has been developed over a number of years to assess risk on separate paper forms for women, heterosexual men, and men who have sex with men (MSM). It included queries about reasons for the visit, current symptoms, prior STD history, recent sexual activities (specific behaviors with main and other partners in the last two and 12 months), obstetrical-gynecologic history, and HIV risk surveillance questions. Patients indicated their race on a self-administered clinic registration form; this designation was labeled on the clinician history form and became part of the clinic database. The ACASI also contained additional items based on our theoretical model of STI risk (see Table 1.1) such as history of sexual abuse, depression and addiction screens, and information about the last three sexual partnerships.

Practicing clinicians from the STD Clinic provided input into the ACASI version of the PHSKC sexual history variables to ensure that the sequence of questions and question wording approximated typical clinical usage. We solicited introductory, transition and normalizing language and a variety of verbal probes for particularly sensitive questions, to structure the ACASI like an optimal patient-clinician dialogue. After review by six clinician experts for content validity, the ACASI tool was programmed in Ci3 ACASI software (Sawtooth Software, Sequim Washington). The ACASI was then piloted on 12 STD clinic patients (6 men, 6 women) to assess the acceptability and comprehension of the ACASI content and navigation of the tool.

Minor changes from these debriefings were incorporated into the final instrument. Both the PHSKC STD clinic form and the ACASI instrument can be viewed at http://depts.washington.edu/cfar/research tools.

The ACASI presented 162 items to all participants, with additional questions depending on the characteristics and risk behaviors of a participant (e.g., same-sex behavior, substance use). The session took a mean of 36 minutes to complete (range = 14 - 87, mode = 32 minutes). At the end of the ACASI session the participant completed on the computer two debriefing questions from other ACASI studies (Metzger et al., 2000) to assess interview preference and perception of reporting honesty.

Recruitment and enrollment took place as described in Chapter 1. Participants took the ACASI on a laptop computer in an exam room with a closed door. Upon completion of the ACASI participants underwent their clinical exam, during which the clinicians conducted the sexual history interview in their usual style.

Since only the ACASI interview was consistently administered, while the clinician history administration was heterogeneous, risk reporting and data completeness analyses were not strict interview mode comparisons. We did design the ACASI items to reflect the same domains and concepts that underlie the STD clinic interview variables, using wording recommended by clinicians. The hypothesis we tested was

whether specific risk reporting or documentation elicited by ACASI would differ substantially from the standard of care, i.e., a clinician-administered sexual history. If so, this might suggest practical utility for improved STI risk data collection and clinical assessment.

Statistical analyses

ACASI data and clinician history data were merged and analyzed using STATA 8.0 statistical software.

Analyses focused on a defined list of interview items that we postulated *a priori* would be reported more often in ACASI (11 socially sensitive items), or more often in the clinician history (4 socially desirable items). To help ensure that interview mode effects, if any, were not indiscriminate, we also identified six socially neutral variables expected to be reported equivalently between the ACASI and clinician history (see Table 2.1).

Few biochemical measures exist to document actual sexual practice or STI exposure; there is no gold standard for validating behavioral self-reports. Although attempts have been made to measure semen (108), Y-chromosome deposition (119), and prostate-specific antigen (113) in vaginal fluids as a way to validate penile-vaginal intercourse, these cannot readily distinguish frequency, multiple partners, or non-

vaginal intercourse sexual behaviors. Thus there are limitations in validating which interview report yields more accurate information.

Analyses were performed separately for women and men, given gender-based differences in anatomy and physiology, STI pathogens and syndromes, and risk characteristics.

Missing items between the ACASI and clinician history were compared using χ^2 tests. Most items in the ACASI interview required a specific response; don't know and refuse to answer responses were available choices for every question. Thus we were able to determine how the sensitivity of the question influenced non-response. This could not be ascertained in the clinician history, where data could be missing because the question was not asked, was not answered, was not noted on the form (97), or because a data entry error occurred. Discrepancies between patient report, clinician report (40), and medical chart documentation have been noted abundantly in the literature (52). Many items in the clinician history were formatted to be checked only yes, if present. For these types of questions, data were considered missing if there were no responses noted for related items in that particular domain of the clinician history. For example, the item anal sex was considered missing if a woman had nothing noted in the clinician history for any of four check-if-present sexual repertoire questions (of which anal sex was one).

The prevalence of each behavior or characteristic in the two datasets was compared using McNemar's χ^2 or one-sample paired t-tests. We established a threshold at which it would be reasonable to compare interview reports for statistical inference. If $\geq$ 16% of data were missing, we did not statistically compare the reporting between ACASI and clinician history. If $\leq$ 15 % of data were missing for a given item in either interview mode, we compared reported means or proportions using only those cases with the item available in both ACASI and CH (complete case comparison). For this analysis, missing responses for those clinician history items formatted to be checked yes only if present, were coded as 0 or no.

We stratified on several variables to assess reporting differences by characteristics of the respondents. These included clinic attendance status, to explore whether reporting between the interviews differed among first-time or new, versus return-visit, clinic patients. We also compared responses stratified on current STI symptoms and on prevalent STI status (HSV-2, gonococcal, chlamydial, or trichomonal infection) to assess differential misclassification.

Concordance between reported items in the two interviews was computed using a kappa statistic for categorical variables and intraclass correlation coefficients for continuous measures. Kappas of 81 to 100% were classified as almost perfect, 61 to

80% as substantial, 41 to 60% as moderate, 21 to 40% as fair, 0 to 20% as slight, and < 0% as poor concordance (66).

Finally, we explored whether reporting differences affected which variables predicted that someone had an STI. To do this we developed separate logistic regression prediction models for men and women, where the dependent outcome was any HSV-2 seropositivity, GC, CT, or (in women) trichomoniasis. We used only those items available in both the clinician history and the ACASI, and excluded *a priori* from consideration those items that were missing ≥ 16% of data. Variables meeting these criteria included age, race, sexual orientation (sex with men, women or both in last twelve months), number of sex partners in the last two or in the last 12 months, having anonymous sex partners, never having had an STD, ever having tested for HIV, current STD symptoms, history of injecting drug use or sex with an injecting drug user, sex with an HIV-positive individual, methamphetamine use, commercial sex work, and for women, ever douched or ever had sex with a man who has sex with men.

Those items with bivariate associations of $p < 0.05$ were put into a full model and Akaike's information criterion (AIC) was applied to determine the best predictors (24). We chose < 0.05 as the association level rather than $p < 0.25$ as is sometimes done, in order to conservatively reduce the number of items to be considered as efficient

predictors. This model was restricted to complete cases (i.e., those with non-missing data for the items in both ACASI and CH). We developed a model first using ACASI data. We ran the final model of best ACASI predictors on the entire available dataset and assessed the model fit. We then repeated the process using the analogous clinician history variables in a complete-case approach, applying AIC and fitting the final model to the entire dataset. We noted whether the same male and female STI predictors were selected using clinician history data as were selected using ACASI data.

Results

Study participant characteristics were outlined in Chapter 1 (Table 1.2). The prevalence of any of the study outcome STIs was 36.7% (n = 223).

Data Completeness

Table 2.1 summarizes interview data completeness and risk reporting comparisons. The first column denotes the amount of missing data by interview. The second column shows the means or proportions only of those individuals who reported the item in both the ACASI and the clinician history (complete case data), along with the statistical inference value.

For nearly every variable examined data were more complete in the ACASI (94.1%) than in the clinician history (74.5%), usually significantly so: overall 5.4% missing in ACASI versus 25.5% in the clinician history (Fisher's exact on proportions missing, $p < 0.001$). The mean proportion of missing data in ACASI was 6.1% among males and 4.6% among females, versus 31.7% among males and 20.8% among females in the clinician history.

Elicitation of symptoms is an important part of the diagnostic pathway for clinicians; about ten percent of the clinician histories were missing data regarding current STI symptoms. There were only ten HIV-positive men in the study population, so the amount of missing data involving that variable may not be representative. Clinicians routinely ascertained whether MSM had receptive anal intercourse in the last year, but those MSM who answered affirmatively less frequently reported about specific condom usage patterns: of 46 such men, only 8 had condom use information noted in the chart. Reported condom use at last sexual exposure was less often missing in the ACASI. The ACASI's more consistent elicitation and documentation of these kinds of sensitive questions might be expected since the items and response-specific branching are programmed rather than being dependent on human interviewers and data entry staff, as well as the patients themselves.

Risk Reporting by Type of Question

In general, reporting patterns corresponded to our hypothesis about which variables would be considered sensitive or desirable and thus, reported differently in the ACASI and the clinician history. Five interview items among men, and three items among women, were missing in the clinician history at levels that were too high to allow statistical comparison of interview reporting.

There were some unexpected patterns noted, some of which are reassuring from a clinical care perspective. For example, men who recently had sex with men were as apt to report this behavior on the computer as to the clinician, providing some evidence that this important risk factor can be accurately assessed during a clinician's sexual history, at least in this patient population. A report of men *ever* having had same-sex experience, however, was more likely in the ACASI than in the clinician history. Only a small number of MSM (n = 17) had data elements available in both interviews regarding unprotected anal sex, so we were unable to statistically compare reporting of this important risk behavior.

Women were more likely to report giving oral sex (both fellatio and cunnilingus) by ACASI; anal sex was reported equivalently. More women reported ever douching on the ACASI (risk ratio 4.6, 95% CI 2.7, 7.8). Approximately half of all women (47%) had ever douched, and 22% had douched sometime within the last year.

Of the socially desirable variables, condom use at last sex and poverty-level income were reported more often by participants in the clinician history than in the ACASI, though due to amounts of missing data we did not report statistical inference regarding these two items. Differences in self-reported race may have been a function of the relatively small numbers in this study, but are of interest given the prominence of race as an STI/HIV surveillance indicator (69).

Among the socially neutral variables, reported age did not vary by interview among women (mean 28.6 years in ACASI vs. 28.8, $p = 0.13$) although a few men stated ages that were younger by one to two years in the ACASI. More women reported symptoms in the clinician history than in the ACASI.

Risk Reporting by Respondent Characteristics

There were some reporting differences by characteristics of the study participants. Perhaps the most pronounced was the reporting of sensitive variables by gender. Higher levels of sensitive variable reporting on ACASI were observed among women more often than among men. Only one of the sensitive variables for which we had enough data to compare was reported significantly more often by ACASI among men. However, five out of eight comparable items (62%) were among women. We may have misclassified those variables that men actually find to be sensitive, however the pattern was notable.

A history of commercial sex – defined as exchanging "sex for drugs, money, or something you needed" – was reported twice as often by women in the ACASI as in the clinician history (n = 59 versus 28), but was reported equivalently by men in both interviews (n = 38 vs. 37). Women were more likely to report methamphetamine use by ACASI, while men reported this equivalently between the two modes.

Patterns of reporting by clinic attendance status and other characteristics (Table 2.2) suggested that it was often the return, rather than the new, clinic attendees who more often reported sensitive behaviors on the ACASI. Higher reporting of sensitive variables on the ACASI than on the clinician history also was noted more often for STI-negative than for STI-infected participants. There were differences in HIV testing history by behavioral orientation, with heterosexual men reporting HIV testing less often by ACASI than in the clinician history.

The more frequent reports of current STI symptoms among females by clinician history than by ACASI appeared to be driven by first-time clinic attendees. Because there were no symptom reporting differences among return female, or any male, attendees, we surmise that there may be a learning curve about STI symptomatology about which clinicians are more effective than the computer at discussing with women. Methamphetamine use – which has been found in this clinic population to correlate strongly with HIV seroconversion among men (45) – was reported more often in the clinician history than in the ACASI by return clinic-attendee males. There

was perfect concordance across interview modes for this variable among the small number of men who were HIV-positive (n = 10, data not shown).

Item Agreement Between Interviews

Table 2.3 summarizes the reporting agreement between ACASI and clinician history, which tended to vary by question type. For sensitive variables, concordance and intraclass correlation were moderate (mean 45.9%). Concordance or intraclass correlation was substantial for socially neutral variables (mean = 73.5%), as it was for socially desirable variables (mean 80.0%). The latter mean might have been lower had condom use and income comparisons been able to be included. It should be noted that there was a financial motivation for patients to under-report their income, given that clinic fees are administered on an income-based sliding fee scale. Participants assigned their racial category in both the clinician history data (taken from the self-administered clinic registration form) and the ACASI data; but less often classified themselves as white in the ACASI.

Interview Acceptability

Three questions assessed interview preference and beliefs about reporting. In response to the question "Which interview did you prefer for answering these questions?" 56% said they preferred the computer interview (ACASI), 10% preferred the clinician history during the exam, and 33% said it did not matter to them what type of interview was used. When asked "Which type of interview do you think would allow others to

answer questions more honestly?" 82% said the computer, 7% said the clinician history, and 9% said that either interview allowed people to be honest about the same. Although a higher percentage of patients who had been to the clinic before, as compared with new patients, said that they felt people were more honest with the clinician (10.5% v. 4.5%, $p = 0.01$), these percentages were still very low.

There were no statistically significant interview preference differences by gender or STI status. However there were by educational level: 63% of those with a high school education or less preferred the ACASI, compared with 52% among those with a college or higher education ($p < 0.001$).

When queried about the hypothetical approach of answering sexual history questions on the computer first and then reviewing their answers with the clinician, 49% said they would prefer talking to the computer first then to their clinician; 11% said they would prefer talking only to their clinician; and 38% said that either way was acceptable.

STI Prediction

Table 2.4 compares STI risk models developed using ACASI versus chart data. We restricted the model development to those individuals who had data for these variables available in both interviews (complete-case approach). ACASI predictors with significant bivariate association with GC, CT or TV in women included: a history of

douching, of any STD, of HIV-testing, or of commercial sex; age ≥ 35; being nonwhite; and having current STI symptoms. The final ACASI model of best complete-case STI predictors for females (n = 103) included having ever douched, age ≥ 35 years, and nonwhite race. Fit for this ACASI model was 0.35, and these variables correctly classified 77.7% of individuals as STI-positive or STI-negative (sensitivity 80.0%, specificity 75.5%). When the bivariate variables were run using the corresponding clinician history data, the best STI predictors selected included age ≥ 35 years, and nonwhite race; douching dropped out as a predictor, and history of sex work entered into the clinician history model (n = 104). Douching, race, and history of sex work were all reported statistically differently between ACASI and clinician history among women. The clinician history female model fit was 0.79; these variables correctly classified the STI status of 67.3% of individuals (sensitivity 70.6%, specificity 64.2%).

Predictors of STI among men included being age ≥ 45, nonwhite, having had sex with men in the last year, and ever having had gonorrhea. The same predictors were selected in both the ACASI and the clinician history regression models. Of these predictors, only nonwhite race was reported statistically differently by interview among men. The ACASI model goodness-of-fit was 0.41, and for clinician history was 0.11. The ACASI variables correctly classified 70.8% of individuals by STI

status (sensitivity 59.3%, specificity 64.2%); the clinician history model correctly classified 66.3% of individuals (sensitivity 56.5%, specificity 70.9%).

Discussion

In this aim of our study, we set out to explore within-person sexual history reporting in ACASI versus clinician interviews. One of the limitations of the approach is that it was not a strict modality comparison. The two interviews contained some items that were different, presented in a non-identical order. The impact of question wording and order (107) on sexual behavior measurement error has been mixed; some studies have found few order effects in selected subpopulations (19), while others have found that sexual behavior definitions can affect response (8).

Our primary analytic goal was to compare ACASI against the usual standard of clinician-administered STI risk screening in a clinical context. This was therefore an effectiveness study design, rather than an efficacy interview mode comparison (67). We used a well-developed sexual history administered by highly experienced clinicians in a public clinic that has 13,000 patient visits per year. Reporting disparity between ACASI and clinician histories may differ in other settings.

We noted higher reporting on ACASI for some, though not all, variables that we arbitrarily postulated to be prone to social desirability bias. Higher reporting of sensitive variables on ACASI was more often statistically significant among female

than among male respondents. Among males the ACASI obtained perhaps more accurate (i.e., lower) levels of socially desirable behaviors such as HIV testing. The clinician history was better than ACASI at eliciting symptoms from female respondents.

Reporting levels differed for some items depending on whether the participant had ever been seen at the STD clinic. The higher risk reporting on ACASI for several sensitive variables among return clinic patients might be explained by a desire not to disrupt an established self-presentation profile, or by cohort and period effects, given increasing openness about same-sex behavior in recent years. It could also be the case that new visit patients would give a lower response rate by both interview methods, and that it would take a second visit before they will open up, and then only by ACASI.

The gender-based differences in reporting by interview mode appeared to have a potential impact on STI prediction for women. However, there was no apparent impact of interview mode on STI prediction for men. This suggests that reporting differences may not always be meaningful for disease estimation, or that measurement error impact may vary by gender. Reporting for some important exposures associated with elevated STI risk, such as recent same sex behaviors among men, did not differ by type of interview. However, nearly two-thirds of the MSM data on condom use during receptive anal sex were missing from the clinician history dataset.

This specific example illustrates our more fundamental finding, which was that there were advantages to ACASI over clinician history in terms of data completeness and consistency of question administration. As such, ACASI sexual histories may provide a practical tool for the clinical goal of identifying persons at risk for STI. More accurate reporting of risk characteristics and behaviors could help clinicians to tailor their counseling messages to the patient's specific situation, as is recommended by the Centers for Disease Control and Prevention (32). Further, use of ACASI in conjunction with the electronic medical record may ultimately provide more valid data linking risk behaviors to STI/HIV prevalence for surveillance purposes.

The optimal interview mode for the clinical sexual history has not been determined. It has been conjectured that a multimodal approach to soliciting sexual behavior data might maximize participation across subpopulations (19). In terms of elicitation of STI exposure, our findings suggest support for exploring the use of both an ACASI and a clinician-administered sexual history approach.

A multi-mode interview for STI risk assessment could occur by having patients complete a computerized sexual history before their exam (perhaps even on the Web), then reviewing the printout with their clinician. Gerbert and colleagues found that among 459 primary care patients, the idea of using computerized HIV/STD risk assessment was acceptable and that these patients were willing to disclose HIV-risk behaviors even knowing that their physician would see this information (41).

Participants in our study appeared to be comfortable with the idea of reviewing an ACASI sexual history with their clinician. However, if the loss of privacy that this would necessitate changed patient reporting, little advantage would be gained. Likewise there would be no benefit if such an approach interfered with, rather than bolstered, clinicians' diagnostic inferences. However if such an approach saved clinicians time by allowing them to focus upon those key risks reported by the patient, measurement error may be reduced and clinical management enhanced, to the benefit of patients, clinicians, and researchers alike.

TABLE 2.1: Comparison of ACASI versus Clinician History (CH) Item Completeness and Reporting

MALES	% Missing Data ACASI	% Missing Data CH	Complete case proportion or mean ACASI N, %	Complete case proportion or mean CH N, %	χ^2 or t-test p value*
Neutral items					
Age (from birthdate)	0.0	0.6	mean 32.26	mean 32.35	0.02
Reason for visit:					
- Current symptoms	0.9	8.6†	149 (47.9)	136 (43.7)	0.18
Ever had an STD	0.0	0.0	157 (50.3)	150 (48.1)	0.31
Has STI symptoms	0.3	11.8†	168 (53.6)	157 (50.2)	0.19
Sensitive Items					
Number anonymous sex partners, last 2 months‡	17.8	80.5†	mean 7.3	mean 2.5	---§
Behavioral orientation:	0.0	7.9†			
- Sex with a man ever	----	----	116 (36.9)	90 (28.7)	<0.00
- Sex with a man in last year	----	----	82 (29.2)	80 (28.5)	0.75
Unprotected receptive anal intercourse, in last year‡	39.5	68.1†	15 (88.2)	13 (76.5)	---§
Injecting drug use (IDU) or sex with an IDU ever	1.3	7.0**	50 (16.1)	40 (12.9)	0.14
Methamphetamine use	0.9	7.0**†	18 (5.9)	26 (8.4)	0.15
HIV+ sex with HIV- or HIV status unknown‡	0.0	87.5†	5 (62.5)	0 (0.0)	---§
Desirable items					
Condom use last sexual episode	0.3	86.3†	24 (55.8)	32 (74.4)	---§
Ever HIV tested	9.6	7.3	209 (79.8)	220 (83.9)	0.01
Income below poverty ($793/month)	9.6	62.7†	44 (38.9)	90 (79.6)	---§
Race (white)	5.0	9.0	158 (57.2)	188 (68.1)	<0.00

* Compares only those participants with both ACASI and CH data for item (complete case approach)
† Difference in interview mode proportions of missing data, 1-sided Fisher's exact p <0.001
‡ Asked only of men who have sex with men (MSM)
§ Statistical comparison not done since ≥ 16% missing data in CH
** Represents missing CH data for any of 11 HIV risk questions ('check if present' format)

TABLE 2.1: (Continued)

FEMALES	% Missing Data ACASI	% Missing Data CH	Complete case proportion or mean ACASI N, %	Complete case proportion or mean CH N, %	χ^2 or t-test *p* value
Neutral items					
Gravidity	2.4	10.7*	mean 2.02	mean 2.09	0.75
Has STI symptoms	0.0	7.5*	160 (55.4)	184 (63.7)	<0.00
Sensitive Items					
Number of new sex partners, last 2 months	3.6	15.2*	mean 1.46	mean 1.69	0.44
Sex with a woman, last 12 months	0.7	6.2*	51 (19.6)	30 (11.5)	<0.00
Anal sex†	11.5	11.8‡	37 (14.6)	29 (11.5)	0.23
Oral sex - gave fellatio or cunnilingus†	10.1	11.8‡	175 (67.3)	130 (50.0)	<0.00
IDU or sex with an IDU ever	12.5	15.0§	43 (15.0)	36 (12.5)	0.29
Methamphetamine use	1.0	15.0§*	14 (4.9)	2 (0.7)	<0.00
Sex work	1.2	13.5*	59 (20.7)	28 (9.8)	<0.00
Douching	2.1	---**	51 (47.2)	11 (10.2)	<0.00
Induced abortion ever	3.2	31.2††*	127 (44.2)	107 (37.2)	---‡‡
Desirable items					
Condom use last sexual episode	0.8	71.0*	27 (32.5)	26 (31.3)	---‡‡
Ever HIV tested	7.9	10.0	195 (81.5)	198 (82.8)	0.51
Income below poverty ($793/month)	8.3	60.2*	68 (68.0)	90 (90.0)	---‡‡
Race (white)	6.2	8.0	142 (56.5)	166 (66.1)	<0.00

* Difference in interview mode proportions of missing data, 1-sided Fisher's exact p <0.001

† ACASI = during last episode for sex occurring in last 2 months; CH = during any sexual episode in last 2 months

‡ Represents missing CH data for any of 4 sexual repertoire questions ('check if present' format)

§ Represents missing CH data for any of 11 HIV risk questions ('check if present' format)

** Can't compare CH missingness since asked as a single 'check if present' item

†† Represents missing CH data among women who were ever pregnant

‡‡ Statistical comparison not done since ≥ 16% missing data in CH

TABLE 2.2: ACASI versus Clinician History (CH) Item Reporting Stratified on Clinic Attendance (New vs. Return), Sexually Transmitted Infection, and Other Characteristics

	ACASI vs. CH report risk ratio (95% CI)
MALES	
Neutral items	
Age (from birthdate)	No significant differences
Reason for visit:	
- Current symptoms	1.3 (1.1, 1.6) new clinic patients
Ever had an STD	No significant differences
Has STI symptoms	1.1 (1.0, 1.3) STI-negative
Sensitive items	
Behavioral orientation:	
Sex with a man ever	Higher on ACASI among all patients and regardless of STI status
Sex with a man in last year	1.1 (1.1, 1.3) return clinic patients
Number anonymous sex partners, last 2 months*	----†
Unprotected receptive anal intercourse, last year*	----†
Injecting drug use (IDU) or sex with an IDU ever	1.5 (1.1, 2.1) return patients
Methamphetamine use	0.5 (0.3, 0.9) return patients
HIV+ sex with HIV- or HIV status unknown*	----†
Desirable items	
Condom use last sexual episode	----†
Ever HIV tested	0.9 (0.9, 0.9) among men who have sex with women; reporting by men who have sex with men did not differ by interview
Income below poverty ($793/month)	----†
Race (white)	0.8 (0.7, 0.9) new & 0.9 (0.8, 0.9) return patients

* Asked only of men who have sex with men (MSM)

† Statistical comparison not done since ≥ 16% missing data in CH

TABLE 2.2: (Continued)

	ACASI vs. CH report risk ratio (95% CI)
FEMALES	
Neutral items	
Gravidity	No significant differences
Has STI symptoms	0.8 (0.7, 0.9) new patients, 0.9 (0.8, 0.9) STI-negatives
Sensitive items	
Sex with a woman, last 12 months	3.0 (1.7, 5.3) return clinic patients, 4.0 (1.6, 10.0) STI-positives
Number of new sex partners, last 2 months	No significant differences
Anal sex*	1.7 (1.1, 2.5) STI-negatives
Oral sex - gave fellatio or cunnilingus*	ACASI higher for all pt & STI categories
IDU or sex with an IDU ever	1.8 (1.1, 2.8) STI-negatives
Methamphetamine use	ACASI higher for return patients
Sex work	ACASI higher for all pt & STI categories
Douching	ACASI higher for all pt & STI categories
Induced abortion ever	----†
Desirable items	
Condom use last sexual episode	----†
Ever HIV tested	No significant differences
Income below poverty ($793/month)	----†
Race (white)	ACASI lower for all pt & STI categories

* ACASI = during last sexual episode for sex occurring in last 2 months; chart = during any sexual episode in last 2 months

† Statistical comparison not done since ≥ 16% missing data in CH

TABLE 2.3: Comparison of ACASI versus Clinician History (CH) Item Reporting Agreement

	Kappa or ICC *p* value	A+ CH + %	A+CH - %	A-CH + %	A-CH - %
MALES					
Neutral items	A+ CH+:	14-24 yrs	25-34 yrs	35-44 yrs	45+
Age (from birthdate)	ICC 0.99	99	97	100	95
Reason for visit:					
- Current symptoms	κ 0.48	33	15	11	41
Ever had an STD	κ 0.78	44	7	5	45
Has STI symptoms	κ 0.70	44	9	6	41
Sensitive Items					
Number anonymous sex partners, last 2 months*	---†	---	---	---	---
Behavioral orientation:					
Sex with a man ever	κ 0.77	28	9	1	62
Sex with a man in last year	κ 0.91	27	1	2	69
Unprotected receptive anal intercourse, last year*	---†	---	---	---	---
Injecting drug use (IDU) or sex with an IDU ever	κ 0.64	10	6	3	81
Methamphetamine use	κ 0.42	3	3	5	89
HIV+ sex with HIV- or HIV status unknown*	---†	---	---	---	---
Desirable items	---†	---	---	---	---
Condom use last sexual episode					
Ever HIV tested	κ 0.78	79	1	5	15
Income below poverty ($793/month)	---†	---	---	---	---
Race (white)	κ 0.77	57	0	11	32

* Asked only of men who have sex with men (MSM)

† Statistical comparison not done since ≥ 16% missing data in CH

TABLE 2.3: (Continued)

FEMALES	A, CH pregnancy # difference:	≤-2	-1	0	+1	≥ 2
Neutral items						
Gravidity	ICC 0.89	2	2	89	3	4
Has STI symptoms	κ 0.57	49		6	14	30
Sensitive Items						
Number of new sex partners, last 2 months	ICC 0.63	Less in A		O Diff		More in A
		17		69		14
Sex with a woman, last 12 months	κ 0.58	10	10	2	79	
Anal sex*	κ 0.41	6	8	5	81	
Oral sex - gave fellatio or cunnilingus*	κ 0.18	38	29	12	21	
IDU or sex with an IDU ever	κ 0.52	8	7	4	80	
Methamphetamine use	κ 0.11	<1	4	<1	95	
Sex work	κ 0.48	8	12	1	78	
Douching	κ 0.23	10	37	0	53	
Induced abortion ever	---†	---	---	---	---	
Desirable items						
Condom use last sexual episode	---†	---	---	---	---	
Ever HIV tested	κ 0.87	80	1	2	16	
Income below poverty ($793/month)	---†	---	---	---	---	
Race (white)	κ 0.78	56	1	10	33	

* ACASI = during last episode for sex occurring in last 2 months; CH = during any sexual episode last 2 months

† Statistical comparison not done since ≥ 16% missing data in CH

TABLE 2.4: STI Prediction by ACASI versus Clinician History (CH) Data*

	ACASI		CH	
	Odds Ratio	95% CI	Odds Ratio	95% CI
FEMALES		N = 103		N = 104
Douching, ever	6.8	2.6 - 18.1	------†	------†
Age ≥35	10.6	2.1 - 54.5	8.1	2.7 - 24.5
Nonwhite	2.7	1.0 - 7.2	3.1	1.2 - 7.9
Ever had STD	------†	------†	2.4	0.9 - 6.5
Sex work, ever	------†	------†	3.7	0.8 - 16.9
Hosmer-Lemeshow χ^2 goodness-of-fit	0.35		0.79	
MALES		N = 274		N = 267
Age ≥ 45	4.7	2.1 - 10.4	2.3	1.3 - 4.1
Nonwhite	2.2	1.2 - 4.0	2.4	1.2 - 4.4
Gonorrhea, ever	2.1	1.1 - 4.0	2.9	1.5 - 5.8
Sex with men in last yr	2.4	1.3 - 4.6	1.7	0.9 - 3.3
Hosmer-Lemeshow χ^2 goodness-of-fit	0.41		0.11	

* Logistic regression model restricted to individuals with data in ACASI & CH (complete case approach), adjusting for all other variables in the model

† Dropped from model as not predictive

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Kurth A. Sexual health promotion in the age of HIV/AIDS. *Journal of Nurse-Midwifery*, 1998; 43(3): 162-181.

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