



Published in final edited form as:

*Sex Transm Infect.* 2015 November ; 91(7): 473–478. doi:10.1136/sextrans-2014-051952.

## High Prevalence of Sexually-Transmitted Infections in Pregnant Adolescent Girls in Tanzania: a Multi-Community Cross-Sectional Study

Adolfine Hokororo, MD, MMED<sup>1,2</sup>, Albert Kihunrwa, MD, MMED<sup>2,3</sup>, Pytsje Hoekstra, MSc<sup>4</sup>, Samuel E. Kalluvya, MD, MMED<sup>2,5</sup>, John M. Chagalucha, MSc<sup>6</sup>, Daniel W. Fitzgerald, MD<sup>7</sup>, and Jennifer A. Downs, MD<sup>2,5,7</sup>

<sup>1</sup>Department of Pediatrics, Bugando Medical Centre, Mwanza, Tanzania <sup>2</sup>Catholic University of Health and Allied Sciences, Mwanza, Tanzania <sup>3</sup>Department of Obstetrics and Gynecology, Bugando Medical Centre, Mwanza, Tanzania <sup>4</sup>Vrije Universiteit, Amsterdam, the Netherlands <sup>5</sup>Department of Medicine, Bugando Medical Centre, Mwanza, Tanzania <sup>6</sup>National Institute for Medical Research, Mwanza, Tanzania <sup>7</sup>Center for Global Health, Department of Medicine, Weill Cornell Medical College, New York, NY

### Abstract

**Background**—Limited data document sexually-transmitted infections (STIs) among pregnant adolescents in sub-Saharan Africa, where prenatal screening typically includes only HIV and syphilis. Given that HIV incidence in this population is among the world’s highest, we sought to assess the prevalence and factors associated with STIs in a population of rural pregnant adolescents in Tanzania.

**Methods**—We enrolled 403 pregnant adolescent girls from 10 antenatal clinics near Mwanza, Tanzania. Girls answered structured interviews about sexual health and risk factors and were tested for six common STIs.

---

Corresponding Author: Dr. Adolfine Hokororo \*, MD, MMED, MSc; Box 1370, Bugando Medical Centre, Mwanza Tanzania Tel no: +255 78 4382616, [adolfineh@gmail.com](mailto:adolfineh@gmail.com).

\*The corresponding author has the right to grant on behalf of all authors and does grant on behalf of all authors an exclusive licence on a worldwide basis to the BMJ Publishing Group Ltd to permit this article (if accepted) to be published in STI and any other BMJ PGL products and sub-licences such use and exploit all subsidiary rights, as set out in our licence <http://group.bmj.com/products/journals/instructions-for-authors/licence-forms>.

**Financial Disclosure:** The authors declare that they have no financial interests to disclose.

**Conflicts of Interest:** The authors declare that they have no conflicts of interest to disclose.

#### Contributors’ Statement:

Adolfine Hokororo: conceptualized and designed the study, carried out all data collection, performed analysis, drafted the manuscript, and approved the final manuscript.

Albert Kihunrwa: assisted with designing the study, data collection, performed the analysis, revised the manuscript, and approved the final manuscript.

Pytsje Hoekstra: assisted with data collection, data entry, data analysis, and approved the final manuscript.

Samuel Kalluvya: assisted with study design, data analysis, and approved the final manuscript.

John Chagalucha: designed the study, assisted with data analysis, and revised and approved the final manuscript.

Daniel Fitzgerald: conceptualized and designed the study, supervised the data analysis and manuscript drafting, and revised and approved the final manuscript.

Jennifer Downs: conceptualized and designed the study, supervised data collection and data entry, supervised data analysis and manuscript drafting, and approved the final manuscript.

**Results**—One hundred ninety-nine girls (49.4%) had at least one STI. HSV-2 was most prevalent (34.5%), followed by trichomoniasis (12.4%), chlamydia (11.4%), gonorrhoea (6.7%), syphilis (5.2%), and HIV (4.7%). Of note, 53/199 (26.6%) of girls with laboratory-proven STIs were asymptomatic. On multivariable analysis, presence of any STI was associated with being in a long-term (as opposed to short-term) relationship (odds ratio (OR)=2.6 [1.4–4.9] p= 0.004), younger age at first sexual debut (OR =0.9 per year [0.8–0.99], p= 0.034), increasing age difference between the girl and her partner (OR=1.1 [1.0–1.1] per year, p= 0.03), and history of prior pregnancy (OR=1.6 [1.0–2.6], p=0.04).

**Conclusion**—STIs affected half of rural pregnant adolescents in Tanzania. Our work demonstrates the urgent need to incorporate routine STI testing into antenatal care in Tanzania to prevent morbidity and mortality in young girls and their babies. We also identify behavioural and demographic risk factors that can be used to target interventions to those at highest risk.

### Keywords

adolescent; pregnancy; sexually-transmitted diseases; Tanzania; HIV; prenatal care

---

## INTRODUCTION

Pregnancy and childbirth complications are the second-leading cause of death among 15–19-year-old girls worldwide.[1,2] Adolescents also experience 30% more obstructed labor and account for 80% of vesico-vaginal fistulae worldwide.[3,4] Sexually-transmitted infections (STIs) may also contribute to this morbidity and mortality. Adolescents are at higher risk for STIs due both to increased biologic susceptibility to STIs, as well as to behavioural and social factors that may lead adolescent girls to more risky sexual encounters.[5–7] Various hospital and community-based studies in Tanzania suggest that both pregnant women and adolescent girls have high STI rates,[8–10] though these studies did not focus on pregnant adolescents, in whom the confluence of two risk factors likely amplifies infection rates. Undiagnosed and untreated STIs in adolescents have the potential for inflicting greater disability over more life-years, as well as causing irreversible effects including infertility, miscarriage, congenital abnormalities, and stillbirths.[11–13]

Pregnant women in Tanzania are routinely screened only for HIV and syphilis.[14] The standard of care for diagnosis and treatment of other STIs is symptom-based. This leads to untreated infections in asymptomatic women. Adolescents, even if symptomatic, may be less likely to receive treatment due to barriers to seeking care or difficulties disclosing their symptoms to health care workers.[8,15,16] We sought to bridge this gap by performing a large, multi-community survey of pregnant adolescent girls to determine the prevalence and the clinical, demographic, behavioural, and knowledge factors associated with common STIs. We hypothesized that the burden of STIs would be elevated in this high-risk group, and that girls' knowledge about STI prevention and treatment would be poor. Our goal was to identify patterns and risk factors that would allow optimization of prevention efforts in addressing the reproductive health needs of this vulnerable population.

## PATIENTS AND METHODS

### Setting and Study Population

This was a cross-sectional study conducted over a nine-month period in Mwanza city and its surrounding rural districts in northwest Tanzania. The study enrolled girls aged 20 years and below who were pregnant and attending antenatal clinics in the Magu, Misungwi, Ngudu, Ilemela, Nyamagana, Geita, and Ukerewe districts of the Mwanza region. The fertility rate in this age group in Tanzania is 139/1000 for rural girls and 75/1000 for girls living in urban areas [17]. We invited all adolescents who were attending the antenatal clinic on study days to participate. In order to maximize our efficiency, we enrolled adolescents on Mondays and Tuesdays as these days had the highest antenatal clinic attendance. Adolescents were excluded if they refused counseling and testing for HIV, if they were currently receiving antimicrobial treatment for an STI or HIV, or if they did not complete all study procedures.

### Procedures

After providing written informed consent, adolescent girls first underwent a private interview in which they were asked socio-demographic, medical, behavioural, and knowledge questions. The interview tools were developed in English and then translated into Kiswahili. Prior to data collection, all tools were pre-tested in a group of girls at one of the study sites and additional adjustments were made as necessary. Interviews were conducted in Kiswahili by the female principal investigator or by a female nurse trained to provide HIV counseling and testing. Based on the World Health Organization's "10 facts on STIs" [18], study participants were asked questions that assessed their knowledge of STIs.

Girls were asked to provide urine for *Neisseria gonorrhoeae* (NG)/*Chlamydia trachomatis* (CT) testing. A swab of vaginal secretions was collected from the vaginal introitus for wet preparation and microscopic examination for diagnosis of *Candida* (using a potassium hydroxide solution), *Trichomonas vaginalis* (using a normal saline wet mount), and bacterial vaginosis by Nugent's criteria.[15,19] Results for candidiasis and trichomoniasis were given on the screening day, together with treatment for STIs as indicated according to Tanzanian national guidelines.[20] Girls with genital ulcers were started on oral acyclovir and injection Benzathine penicillin.

HIV voluntary counseling and testing was offered to all participants by the nurse counsellor. For those who agreed, a total of 5 milliliters of whole blood was collected, and a drop of this blood was used for on-site HIV rapid testing by the Determine HIV-1/HIV-2 test kit (Abbott Laboratories, Abbott Park, IL, USA). Determine-positive tests were confirmed using the Uni-Gold Recombigen rapid HIV test (Trinity Biotech PLC, Wicklow, Ireland). Girls were classified as HIV-infected if both Determine and Unigold Test were positive, and as HIV-uninfected if the Determine was negative. Testing was performed in the field and patients received their results immediately. Those with confirmed positive tests were referred to HIV Care and Treatment Clinics for further care and prevention of Mother to Child Transmission of HIV services. In case of discordant results (positive Determine with negative Uni-Gold test) blood samples were retested using DNA PCR at the Bugando Medical Center reference laboratory. Those found to be positive by DNA PCR were considered positive for HIV.

The rest of the blood sample was centrifuged to separate serum each afternoon upon return to Bugando Medical Centre. Serum was transported to the National Institute for Medical Research laboratory to be screened for syphilis using the Rapid Plasma Reagin test (RPR, Becton Dickinson, MD, USA). RPR-positive samples were confirmed with the *Treponema pallidum* Particle Agglutination assay (TPPA, Serodia Fujirebio Inc, Japan), with a positive result for both TPPA and RPR regarded as indicative of active syphilis. HSV-2 antibody was detected by the type-specific HSV-2 ELISA test (Kalon Biologicals, Guilford, UK).

DNA was purified from urine and tested for CT/NG using Amplicor CT/NG specimen preparation, amplification, internal control, and detection kits (Roche Molecular Systems, Branchburg, NJ). Gonorrhoea results were confirmed by 16S rRNA PCR testing.

### **Ethical considerations**

Permission to conduct this study was obtained from the Mwanza Regional Medical Officer and District Medical Officers and clinicians stationed at participating district hospitals and health centers. Ethical approval was granted by the research ethics committee at Bugando Medical Centre (BREC/001/02/2012), by the Medical Research Coordinating Committee of the National Institute for Medical Research in Tanzania (NIMR/HQ/R.8a/Vol. IX/826), and by the Institutional Review Board at Weill Cornell Medical College (WCMC Protocol #0811010105). The study was explained to girls in a large group and subsequently one-on-one by a trained study nurse fluent in Kiswahili and the local languages (Kisukuma, Kikerewe). In order to participate in the study, girls were asked to provide written informed consent. Pregnant adolescents younger than 18 years provided written assent and their parent or guardian provided written assent. Those unable to write were asked to place their thumb print on the consent form.

### **Statistical Analysis**

Study data were managed using REDCap electronic data capture tools hosted at Weill Cornell Medical College and analysed using Stata version 12 (College Station, Texas, USA). Continuous variables were summarised by median and interquartile range and categorical variables were summarised by frequency and percentage. Factors significantly associated with STIs on univariable analysis were examined by multivariable logistic regression. We used backward elimination, deleting the least significant factor one by one, to reach the final model that included significant factors only. Associations between factors were summarised as odds ratios (ORs) along with 95% confidence intervals (CIs) and associated p-values.

## **RESULTS**

### **Patient Characteristics**

From April to December 2012, a total of 1298 women attended antenatal clinics on enrollment days and out of these 442 (34%) were adolescents. Our team invited 426 out of 442 girls to participate in the study; the other 16 girls left the clinic prior to invitation. Twenty chose not to participate and were excluded, and three girls were unwilling to provide a vaginal swab sample. None of the girls reported prior history of HIV or any STI.

Therefore, a total of 403/426 (95%) girls consented or assented with parent/guardian consent for study participation and completed all study procedures.

Characteristics of study participants are shown in Table 1. Girls' ages ranged from 14 to 20 years, with the majority of girls being age 17 and above. Approximately two-thirds (64%) had completed primary school (seven years) and had no further education, while 8.2% of the girls had never attended any formal school. The majority of girls reported cohabiting with their partner, with only 11% in formal marriages. Over one-fourth of girls knew that their partner had other partner(s) outside of their relationship; this was not significantly different among girls of different religions. Forty-one percent of girls had previously been pregnant. Approximately three-fourths of girls reported having had more than one sexual partner in their lives, and girls' sexual partners were a median of 7 years (IQR, 4–9) older than they were. More than half of girls (230, 57.1%) presented with signs and symptoms suggesting genital tract infection.

### Prevalence of STIs

A total of 199/403 (49.4%) girls were found to have at least one STI (Table 2). HSV-2 was the most common STI found in 139 (34.7%) girls. Prevalence of other STIs were as follows: HIV 19 (4.7%), gonorrhoea 27 (6.7%), chlamydia 46 (11.6%), syphilis 21(5.2%), and trichomoniasis 54 (13.4%). A total of 30 girls had HIV, syphilis, or both of these and would have been diagnosed during routine prenatal care. The remaining 169/403 (42%) would not likely have received diagnosis or treatment. Apart from STIs, many girls also presented with other genital infections including candidiasis (71, 17.6%) and bacterial vaginosis (102, 25.3%).

### Patterns of STIs

Among 199 girls with STIs, 7 (3.5%) had an ulcerative STI, 108 (54.3%) presented with vaginal discharge and 69 (34.7%) presented with other symptoms, the next most common of which were vaginal itching and painful micturition (Table 2). Having more than one STI simultaneously occurred in 77/199 girls (38.7%), and was particularly common among those with gonorrhoea, chlamydia, and syphilis. Nearly all girls with candidiasis (85.7%) reported discharge, itching, dysuria, or other symptoms. Of note, 53 (26.6%) presented with no symptom at all and therefore would not have received any STI screening or treatment according to the Tanzanian national guidelines.

### Knowledge of STIs

Most girls lacked basic information about STIs (Table 3). Although 86% of girls knew that STIs exist, only 43% knew that gonorrhoea, HIV or syphilis are STIs, and 99% had not heard of genital herpes. Although 66% knew that condoms prevent STIs, and 42% of the girls admitted thinking that they were at risk of STIs and HIV, only 6% of the girls reported regularly using condoms. Only 97 girls (24.1%) knew that they could transmit STIs to their unborn children, and 162 (40.2%) knew that STIs could cause infertility. Fifty-four girls (11.4%) did not know how STIs are transmitted and 77 girls (19.1%) did not know that STIs can be prevented. The most common misperceptions about STI prevention related to condoms, with 106 girls (26%) stating that condoms were “useless” to prevent STIs or

pregnancy. Others asserted that condoms were not effective in permanent couples (110, 27.3%), and more than one-fourth believed that they did not need to use condoms while pregnant because they were not susceptible to STIs (105, 26%).

### Factors Associated with STIs

We examined associations between the characteristics presented in Table 1 and presence of any of the six STIs. All characteristics that were associated with STIs with p-values <0.10 on univariable analysis are presented in Table 4. When subjected to multivariable analysis, factors that remained significantly associated with STIs included larger age difference between a girl and her partner (OR=1.1 [1.0–1.1] per increasing year difference, p=0.03), characterising the relationship as long-term as opposed to short-term (OR=2.6 [1.4–4.9], p=0.004), and a history of prior pregnancy (OR=1.6 [1.0–2.6], p=0.04).

## DISCUSSION

One-half of pregnant adolescent girls in northwest Tanzania had at least one sexually-transmitted infection. In a setting in which screening only for HIV and syphilis is routinely offered at antenatal clinic visits, this would have meant that over 40% of the entire study population would have remained undiagnosed and untreated. These infections could have major, irreversible health ramifications for these young girls and their unborn babies. Our work suggests that screening this vulnerable population for STIs needs to be incorporated as a routine part of adolescent prenatal care.

The most commonly diagnosed STI in this study, HSV-2 (34.5% prevalence), is also one of the most devastating for neonates. Our findings, with over 30% of girls being HSV-2 seropositive a median of three years after initiation of sexual activity, corroborate a prospective study from Mwanza in 2002 that demonstrated annual HSV-2 incidence among adolescent girls to be ~10%. [21] We found that seven girls had active genital ulcers potentially attributable to HSV-2. When present during vaginal delivery, viral shedding from HSV-2 genital ulcers transmits infection to ~40% of neonates during primary maternal HSV-2 infection and ~3% during recurrence. [22] HSV in neonates, particularly when not diagnosed and treated early, typically has catastrophic effects including permanent neurological damage and death. [23] Because neonatal transmission can be lessened with oral acyclovir for mothers and Caesarean sections when genital ulcers are present, [24] aggressive identification and treatment for mothers with symptomatic HSV-2 infection should be a major public health priority.

Furthermore, our findings highlight the importance of adding routine screening for other STIs, such as gonorrhoea and chlamydia, to current antenatal clinic procedures in Tanzania. Over 15% of girls in this study had gonorrhoea and/or chlamydia, and ~30% of these girls were asymptomatic, suggesting that, even if pregnant girls did routinely receive treatment for symptomatic STIs, at least 30% would have remained undiagnosed. Dangers to babies of pregnant women with untreated gonorrhoea and chlamydia include prematurity (both infections), conjunctivitis and pneumonia (chlamydia), and ophthalmia neonatorum and disseminated infection (gonorrhoea). With the development of rapid CT/NG test capability using the Gene Xpert format [25] and the increasing dispersal of these machines in resource-

limited settings, same-day testing and treatment for these infections is becoming an achievable goal to improve both maternal and child health. As an illustrative model, the implementation of routine point-of-care syphilis testing for pregnant women in sub-Saharan Africa has been recently estimated to reduce stillbirths, neonatal deaths, and congenital syphilis cases by 64,000, 25,000, and 32,000 per year, respectively and to reduce disability-adjusted life years by 2.6 million.[26] Our data suggests that similar efforts now have the potential to reduce disease burden from undiagnosed CT/NG infections in newborns and in their mothers in Africa.

Our work identifies several important social characteristics that were associated with higher odds of having STIs in our study population. The presence of STIs was associated with a larger age difference between the girl and the partner and, interestingly, with a girl characterising her relationship with her partner as “long-term.” Evidence demonstrates that, in both of these situations, girls may feel that they have less need (or less negotiating ability) to request condom use.[27–29] Girls who had already been pregnant at least once were also more likely to have an STI—again, possibly reflecting their inadequate use of condoms. It may be possible to use these findings to target screening, if resources are limited, to higher-risk adolescent girls who have older partners, “long-term” relationships, and history of prior pregnancy.

Of large public health importance, we noted that many adolescent girls possess minimal or erroneous knowledge about STIs. This corresponds with other local work that has demonstrated that myths and incorrect beliefs regarding STIs and childbearing are widespread in this region.[30] Notably, nearly 80% of girls have at least attended primary school, suggesting that intensifying efforts to provide health education to girls in late primary school may be a simple way to provide vital reproductive health information to the large majority of girls. Important teaching topics highlighted by our study findings include signs, symptoms, and side effects of STIs and methods of both STI and pregnancy prevention. As others have suggested, for this to be successful, teachers will need to be empowered to discuss sensitive health topics.[31] Increasing adolescents’ knowledge of STI symptoms and sequelae may lead those with symptoms (who, in our study, were the majority of infected girls) to be more bold in admitting their symptoms and seeking treatment.

In conclusion, we identified disturbingly high rates of STIs in adolescent pregnant girls, and revealed numerous possibilities for action. We suggest, for a start, that antenatal clinics urgently need more support so that routine STI screening with genital examination becomes standard for adolescents. Girls should be asked directly about symptoms and treated aggressively, whether syndromically in the absence of testing capabilities or with pathogen-directed therapy when more advanced diagnosis is possible. Clinical protocols should include screening women for genital ulcers beginning by week 36 with referrals for Caesarean section if present. Educational strategies could include teaching girls about STI symptoms and long-term risks, including to their babies, as well as the potential risks of dating men far older than themselves. Further studies are currently underway to gather more qualitative information from girls who participated in this study in order to learn how to

make reproductive healthcare more accessible for adolescents in order to begin to stem the large tide of STIs in this vulnerable population.

## Acknowledgments

The authors wish to thank the patients at health centers for their willing participation in this study. Sincere thanks also to Mrs Theresia Matulile and Mrs Juliana Dogani for their extensive work during data collection, and to the BMC and NIMR laboratories for sample processing and testing.

**Funding Source:** This work was supported in part by grants from the United States National Institutes of Health [National Institute of Allergy and Infectious Diseases (K24 AI098627 and K23AI110238); National Center for Advancing Translational Sciences UL1 TR000457-06); Fogarty International Center (TW00018)] and by a United States Agency for International Development (USAID) leadership development program.

## References

1. Patton GC, Coffey C, Sawyer SM, et al. Global patterns of mortality in young people: a systematic analysis of population health data. *Lancet*. 2009; 374:881–92.10.1016/S0140-6736(09)60741-8 [PubMed: 19748397]
2. World Health Organization. [accessed 20 Nov 2014] Adolescent Pregnancy, Fact sheet No. 364. 2014. <http://www.who.int/mediacentre/factsheets/fs364/en/>
3. Eure CR, Lindsay MK, Graves WL. Risk of adverse pregnancy outcomes in young adolescent parturients in an inner-city hospital. *Am J Obstet Gynecol*. 2002; 186:918–20. [PubMed: 12015513]
4. Tsui AO, Creanga AA, Ahmed S. The role of delayed childbearing in the prevention of obstetric fistulas. *Int J Gynaecol Obstet*. 2007; 99 (Suppl 1):S98–107.10.1016/j.ijgo.2007.06.024 [PubMed: 17868676]
5. Moss GB, Clemetson D, D'Costa L, et al. Association of cervical ectopy with heterosexual transmission of human immunodeficiency virus: results of a study of couples in Nairobi, Kenya. *J Infect Dis*. 1991; 164:588–91. [PubMed: 1869844]
6. McCleary-Sills J, Douglas Z, Rwehumbiza A, et al. Gendered norms, sexual exploitation and adolescent pregnancy in rural Tanzania. *Reprod Health Matters*. 2013; 21:97–105.10.1016/S0968-8080(13)41682-8 [PubMed: 23684192]
7. Chacko MR, Lovchik JC. Chlamydia trachomatis infection in sexually active adolescents: prevalence and risk factors. *Pediatrics*. 1984; 73:836–40. [PubMed: 6547226]
8. Obasi AI, Balira R, Todd J, et al. Prevalence of HIV and Chlamydia trachomatis infection in 15–19-year olds in rural Tanzania. *Trop Med Int Health*. 2001; 6:517–25. [PubMed: 11469944]
9. Yahya-Malima KI, Evjen-Olsen B, Matee MI, et al. HIV-1, HSV-2 and syphilis among pregnant women in a rural area of Tanzania: prevalence and risk factors. *BMC Infect Dis*. 2008; 8:75.10.1186/1471-2334-8-75 [PubMed: 18513451]
10. Msuya SE, Mbizvo E, Stray-Pedersen B, et al. Reproductive tract infections among women attending primary health care facilities in Moshi, Tanzania. *East Afr Med J*. 2002; 79:16–21. [PubMed: 12380865]
11. Coeytaux F, Bingham D, Langer A. Reducing maternal mortality : a global imperative. *Contraception*. 2011; 83:95–8.10.1016/j.contraception.2010.10.009 [PubMed: 21237332]
12. Mindel, A.; Dwyer, D.; Herring, B., et al. Global Epidemiology of Sexually-Transmitted Diseases. In: Stanberry, L.; Rosenthal, S., editors. *Sexually Transmitted Diseases: Vaccines, Prevention, and Control*. San Diego: Elsevier Inc; 2013. p. 3-43.
13. Mullick S, Watson-Jones D, Beksinska M, et al. Sexually transmitted infections in pregnancy: prevalence, impact on pregnancy outcomes, and approach to treatment in developing countries. *Sex Transm Infect*. 2005; 81:294–302.10.1136/sti.2002.004077 [PubMed: 16061534]
14. Ministry of Health and Social welfare- Tanzania Mainland. . National Sexual Reproductive Health Policy. Dar Es Salaam; Tanzania: 2005.
15. World Health Organization. WHO Discussion Paper On Adolescent Pregnancy. 2004.



16. Hokororo A, Kihunrwa AF, Kalluvya S, et al. Barriers to access reproductive health care for pregnant adolescent girls: a qualitative study in Tanzania. *Acta Paediatr*. Published Online First: 4 December 2014. 10.1111/apa.12886
17. National Bureau of Statistics and ICF Macro. Tanzania Demographic and Health Survey 2010. Dar es Salaam; Tanzania: 2011.
18. World Health Organization. [accessed 15 Jul 2014] 10 facts on sexually transmitted infections. 2008. [http://www.who.int/features/factfiles/sexually\\_transmitted\\_diseases/en/](http://www.who.int/features/factfiles/sexually_transmitted_diseases/en/)
19. Nugent, RP.; Krohn, MA.; Hillier, SL. Reliability of Diagnosing Bacterial Vaginosis Is Improved by Standardized Method of Gram Stain Interpretation. 1991. p. 29
20. United Republic of Tanzania. Ministry of Health and Social Welfare. Standard Treatment Guidelines. Dar Es Salaam; Tanzania: 2009.
21. Del Mar Pujades Rodríguez M, Obasi A, Mosha F, et al. Herpes simplex virus type 2 infection increases HIV incidence: a prospective study in rural Tanzania. *AIDS*. 2002; 16:451–62. [PubMed: 11834958]
22. Brown ZA, Benedetti J, Ashley R, et al. Neonatal herpes simplex virus infection in relation to asymptomatic maternal infection at the time of labor. *N Engl J Med*. 1991; 324:1247–52.10.1056/NEJM199105023241804 [PubMed: 1849612]
23. Kimberlin DW, Lin CY, Jacobs RF, et al. Natural history of neonatal herpes simplex virus infections in the acyclovir era. *Pediatrics*. 2001; 108:223–9. [PubMed: 11483781]
24. Brown ZA, Wald A, Morrow RA, et al. Effect of serologic status and cesarean delivery on transmission rates of herpes simplex virus from mother to infant. *JAMA*. 2003; 289:203–9. [PubMed: 12517231]
25. Dize L, West S, Williams JA, et al. Comparison of the Abbott m2000 RealTime CT assay and the Cepheid GeneXpert CT/NG assay to the Roche Amplicor CT assay for detection of Chlamydia trachomatis in ocular samples from Tanzania. *J Clin Microbiol*. 2013; 51:1611–3.10.1128/JCM.00519-13 [PubMed: 23486714]
26. Kuznik A, Lamorde M, Nyabigambo A, et al. Antenatal Syphilis screening using point-of-care testing in Sub-Saharan African countries: a cost-effectiveness analysis. *PLoS Med*. 2013; 10:e1001545.10.1371/journal.pmed.1001545 [PubMed: 24223524]
27. Mushi DL, Mpembeni RM, Jahn A. Knowledge about safe motherhood and HIV/AIDS among school pupils in a rural area in Tanzania. *BMC Pregnancy Childbirth*. 2007; 7:5.10.1186/1471-2393-7-5 [PubMed: 17456230]
28. Exavery A, Lutambi AM, Mubyazi GM, et al. Multiple sexual partners and condom use among 10 – 19 year-olds in four districts in Tanzania : What do we learn? *BMC Public Health*. 2011; 11:490.10.1186/1471-2458-11-490 [PubMed: 21696581]
29. Matasha E, Ntembelea T, Mayaud P, et al. Sexual and reproductive health among primary and secondary school pupils in Mwanza, Tanzania: need for intervention. *AIDS Care*. 1998; 10:571–82.10.1080/09540129848433 [PubMed: 9828954]
30. Wamoyi J, Fenwick A, Urassa M, et al. “Women’s bodies are shops”: beliefs about transactional sex and implications for understanding gender power and HIV prevention in Tanzania. *Arch Sex Behav*. 2011; 40:5–15.10.1007/s10508-010-9646-8 [PubMed: 20652390]
31. Plummer ML, Wight D, Wamoyi J, et al. Are schools a good setting for adolescent sexual health promotion in rural Africa? A qualitative assessment from Tanzania. *Health Educ Res*. 2007; 22:483–99.10.1093/her/cyl099 [PubMed: 17018766]

### Key Messages

- Half of pregnant adolescents in Tanzania had at least one sexually-transmitted infection, and 40% of all girls would have remained undiagnosed under current care standards.
- Antenatal clinics urgently need more support to provide routine STI screening for pregnant adolescents in order to prevent neonatal morbidity and mortality.
- Girls at highest risk are those who may have little negotiating power, such as those in longer-term relationships and those whose partners are substantially older.

**Table 1**

Sociodemographic, Relationship, and Sexual History Characteristics of 403 Pregnant Adolescent Girls Presenting for Antenatal Care in Mwanza, Tanzania.

Characteristic	Value* Number (%) or Median (IQR)
<b>Demographic Characteristics</b>	
Age (years)	19 (17–20)
14	2 (0.5%)
15	15 (3.7%)
16	35 (8.7%)
17	66 (16.4%)
18	68 (16.9%)
19	86 (21.3%)
20	131 (32.5%)
Current educational status	
Never attended school	33 (8.2)
Completed primary school	240 (59.6)
Dropped out of school	101 (25.1)
Completed secondary school	4 (1.0)
Still in school	23 (5.7)
Highest educational level initiated	
None	33 (8.2)
Primary	258 (64.0)
Secondary and above	112 (25.8)
Religion	
Catholic	180 (44.7)
Protestant	151 (37.5)
Muslim	45 (11.2)
Other/none	27 (6.7)
<b>Current Relationship</b>	
Marital status	
No current partner	43 (10.7)
Married	46 (11.4)
Co-habiting	234 (58.1)
Divorced	2 (0.5)
In relationship but not living together	78 (19.4)
Number of months of current relationship	12 (8–24)
Characterizes relationship as “long-term”	296 (73.5)
Partner has other women outside of the relationship	87 (22.7)
Number of years by which sexual partner is older	7 (4–9)
<b>Sexual Behavior and History</b>	

Characteristic	Value* Number (%) or Median (IQR)
Age at first sexual encounter	16 (15–17)
14 years and below	68 (16.9)
15–17 years	285 (70.7)
18 years and above	48 (11.9)
Number of lifetime sexual partners	
1	103 (25.6)
2	150 (37.2)
3 or more	147 (36.5)
First sexual encounter was forced	45 (11.2)
Number of previous pregnancies	
0	239 (59.3)
1	106 (26.3)
2	42 (10.4)
3 and above	16 (4.0)
Planned pregnancy	227 (56.3)
Considered terminating this pregnancy	350 (86.9)
Ever used contraception	66 (16.4)
Ever exchanged sex for money or goods	284 (70.5)
Presence of symptoms suggesting current Reproductive Tract Infection (RTI)	230 (57.1)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 2**  
Symptoms and overlap of sexually-transmitted infections among pregnant adolescent girls.

Infection (Number, %)	Asymptomatic Number (%)	Ulcerative Number (%)	Discharge Number (%)	Other symptoms* Number (%)	Co-infection with additional STIs Number (%)
HSV-2 (139, 34.5)**	41 (29.5)	6 (4.3)	41 (29.5)	52 (37.4)	59 (42.4)
Gonorrhea (27, 6.7)**	9 (33.3)	1 (3.7)	11 (40.7)	7 (25.9)	20 (74.1)
Chlamydia (46, 11.4)	11 (23.9)	1 (2.2)	21 (45.7)	13 (28.3)	33 (71.7)
Syphilis (21, 5.2)	3 (14.3)	1 (4.8)	8 (38.1)	9 (42.9)	19 (90.5)
Trichomoniasis** (55, 13.6)	4 (8.0)	2 (30)	39 (78.0)	10 (20.0)	35 (64.8)
At least one STI*** (199, 49.4)	53 (26.6)	7 (3.5)	108 (54.3)	69 (34.7)	77 (38.7)

\* Other symptoms included lower abdominal pain, painful micturition, dyspareunia, and vaginal itching.

\*\* At least one girl with these infections had both ulcers and discharge.

**Table 3**

Knowledge, perceptions, and behaviours of girls regarding STIs.

Variable	N (%)
Factual knowledge	
Ever heard of STI	348 (86.4%)
Knew at least gonorrhoea, HIV, syphilis are STIs	175 (43.4%)
Knew at least one sign of STI	149 (37.0%)
Knew at least one complication of STI	266 (66.0%)
Perceptions and behaviour	
Perceived self as at risk of STIs	121 (30.0%)
Knew that condoms prevent STIs	168 (41.7%)
Currently do use condoms	25 (6.2%)
Believed that condoms are useless (do not help to prevent pregnancies and STIs)	106 (26.3%)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 4**

Univariable and Multivariable logistic regression for factors associated with presence of any STIs in 403 pregnant adolescent girls.

<b>Variable</b>	<b>Univariable analysis OR [95% CI]</b>	<b>p-value</b>	<b>Multivariable analysis OR [95% CI]</b>	<b>p-value</b>
No formal education	1.9 [0.9–3.9]	0.092	1.6 [0.7–3.6]	0.30
Characterises relationship as long-term	1.6 [1.0–2.5]	0.047	2.6 [1.4–4.9]	0.004
Age difference between the girl and the partner	1.1 [1.0–1.1]	0.019	1.1 [1.0–1.1]	0.03
Age at first sexual contact	0.9 [0.8–0.99]	0.034	0.9 [0.8–1.1]	0.20
Number of sexual partners	1.2 [1.0–1.5]	0.016	1.1 [0.9–1.4]	0.32
History of prior pregnancy	1.8 [1.2–2.7]	0.005	1.6 [1.0–2.6]	0.04

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript