ORIGINAL ARTICLE

Prevalence of Sexually Transmitted Infections (STIs) among Adolescents Attending Genitourinary Medicine Clinic Hospital Kuala Lumpur between 2014 and 2018

Vijayaletchumi Krishnasamy, *Dip. STD/AIDS*, Suganthi Thevarajah, *MMed*, Min Moon Tang, *AdvMDerm*

Department of Dermatology, Hospital Kuala Lumpur Kuala Lumpur, Malaysia

Abstract

Background

Adolescents, who aged between 10 and 19 years old, comprise about 20% of the world's population. They are vulnerable to acquisition of sexually transmitted infections (STIs). Here, we aim to determine the demography and pattern of STIs among adolescents attending Genito-Urinary Medicine (GUM) Clinic, Hospital Kuala Lumpur (HKL).

Methods

This is a retrospective study on all adolescents attending GUM clinic between 2014 and 2018. Data was obtained from case notes and further analysed.

Results

A total of 111 adolescents attended GUM clinic between 2014 and 2018. The mean age was 18 years (range 12-19). The male to female ratio was 2.26:1. All patients were Malaysian. Only 2 were foreign nationals. The majority were Malays (85.3%) followed by Indians (11%) and Chinese (3.7%). About 46.8% were still schooling, 28.8% were employed and 23.4% were unemployed. About 8.3% had a history of substance abuse. The majority (67.6%) were heterosexual, about 17.1% were homosexual and 3.6% were bisexual. Nearly 95% engaged in unprotected sex. Majority (46%) had casual sex. The most frequent presenting symptoms for male and female adolescents were discharge (43.2%) followed by swelling/growth (23.4%). About 83% had confirmed STIs. The most common STIs among the male were gonorrhoea (44.1%), genital warts (23.4%) and non-gonococcal urethritis (14.7%). The most common STIs among the female were herpes genitalis (50%), genital warts (33.3%) and syphilis (8.3%). Six patients were infected with the human immunodeficiency virus (HIV).

Conclusion

The most common STI among adolescents between 2014 and 2018 was gonorrhoea for male and herpes genitalis for female.

Key words: *Adolescent, Sexually transmitted infections, Gonorrhoea, Herpes genitalis, Genital warts, Syphilis*

Corresponding Author
Dr Vijayaletchumi Krishnasamy
Department of Dermatology,
Hospital Kuala Lumpur,
Jalan Pahang,
50586 Kuala Lumpur, Malaysia
Email: vkrishnasamy44@gmail.com

Introduction

Adolescents, defined as persons between 10 and 19 years old by WHO, are among of the most frequent group reported with STIs. Those who are sexually active account for approximately half of reported STI cases annually.[1,2] It is estimated that about 333 million new cases of curable sexually transmitted infections occur worldwide each year, with the highest rates

among 20-24 year-old followed by 15-19 year-old age group.[1] In Malaysia, adolescents comprise of 18% of the total population.[3] The improved surveillance system in Malaysia has reported an increasing trend of syphilis and gonorrhoea. The incidence rate of syphilis was reported at 3.46 per 100,000 population in 2011 but had tripled to 10.75 per 100,000 population in 2019.[4,5] On the other hand, the incidence of gonorrhoea has doubled from 4.71 per 100,000 population in 2011 to 9.25 per 100,000 population in 2019.[4,5] In 2018, about 3% of new HIV cases were reported among people age those aged between 13 and 19 years old in Malaysia.[6]

Adolescents are more likely to engage in high-risk sexual behaviour such as multiple partners or engaging in sexual activities without a condom. This is due in part to the fact that the prefrontal cortex, responsible for executive function, is still developing throughout adolescence.[7] Furthermore, adolescents are less likely than adults to access to sexual health services due to confidentiality issues.[2] These factors lead to a higher chance of exposure and a lower chance of diagnosis and treatment. From a biological perspective, adolescent females are particularly susceptible to STIs like *Chlamydia trachomatis* and human papilloma viruses due to lower production of cervical mucus and increased cervical ectopy.[7,8] Therefore, if exposed to an STI, adolescent females are more likely than adults to get infected.[7,8]

STI guidelines from the CDC United States highlight that youth who are at highest risk of sexually transmitted infections include those in detention facilities, injection drug users, and teens with history of sexual molestation and males who have had anal sex with other males.[2,9] Female victims of childhood sexual abuse are at increased risk for STIs possibly due to younger age at sexual initiation and unsafe sex practices.[9] Sexually transmitted infections among adolescents in Malaysia is largely underreported. Thus there is limited data and studies on STIs in adolescents.

The aim of this study is to describe the demography and pattern of STIs among adolescents attending Genito-Urinary Medicine (GUM) Clinic, Hospital Kuala Lumpur (HKL).

Materials and Methods

This is a retrospective study on all adolescents attending GUM clinic between 2014 and 2018. Data was obtained from case notes and further analyzed.

Results

There were 111 adolescents who has attended Genitourinary Medicine clinic from the year 2014 till 2018 (Table 1). Majority were referred from the outpatient and emergency department. Five cases were from the Suspected Child Abuse and Neglect (SCAN) team. There were more males (69.3%) than females (30.6%). The mean age of these patients was 18 years and most of the adolescent were in the age group of 15 to 19 years (89%). The youngest male was 13 years while the youngest female was 14 years. Majority were Malaysian of which (85.3%) were Malays followed by Indians (11.1%) and Chinese (3.7%). Only one was married. There were 2 adolescents, unmarried presented to us during pregnancy. There were 2 single mothers.

Less than half were still school going (46.5%), 28.8% were employed and 23.4% were unemployed. Eleven (1.3%) of them had history of substance abuse. These substances included marijuana, glue, amphetamines/ methamphetamines, smoking and alcohol. Majority (67.6%) were heterosexual. About 17.1% and 3.6% were homosexuals and bisexuals respectively. About a tenth of the adolescents denied having any kind of sexual activity. Majority (95%) had engaged in unprotected sex. Those who used condom claimed to use them inconsistently.

The most common presentation to the GUM clinic was genital discharge (43.2%) followed by genital growths (23.4%). Following clinical assessment and laboratory investigations, 83% of adolescents were confirmed to have sexually transmitted infections. The most common STIs among the males were gonorrhoea (45.6%), genital warts (17.6%) and non-gonococcal

urethritis (17.6%), as shown in Table 2. The most common STIs among female adolescents were herpes genitalis (50%), genital warts (33.3%) and syphilis (8.3%). Non-STI causes that were diagnosed in this study included bacterial vaginosis, candidiasis, balanitis and molluscum contagiosum. Six male adolescents were diagnosed to have the human immunodeficiency virus (HIV).

Table 1. Demographic data and sexual behaviour of 111 adolescent attending GUM clinic Hospital Kuala Lumpur between 2014 and 2018

Characteristics		Male n=76	Female n=35	Total n= 111
Mean age in years (range)				18 (13-19)
Age group in years (%)	<10	0	0	0
	10-14	6	6	12 (10.8%)
	15-19	70	29	99 (89%)
Ethnicity among Malaysian (%)	Malay	65	28	93 (85.5%)
	Chinese	3	1	4 (3.6%)
	Indians	7	5	12 (10.8%)
	Others	1	1	2(1.8%)
Occupation	Student	34	18	52(46.8%)
	Employed	26	5	31(28.0)
	Unemployed	16	11	27(24. %)
	Self employed	1	-	1(0.9%)
Sexual Orientation	Heterosexual	46	29	75(67.5%)
	Homosexual	19	-	19(17.1%)
	Bisexual	4	-	4(3.6%)
	Denied	6	7	13(11.7%)
Type of sexual partner (%)	Casual	40	11	51(46%)
	Steady	25	17	42(37.8%)
	Sex worker	4	-	4(3.6%)
	No partner	6	7	13(11.7%)
Number of sexual partner in the last 6 months (%)	1	45	24	69(62%)
	>1	24	5	29(26%)
Numbers with documented substance abuse (%)		10	1	11 (1.3)
Condom usage (%)	Never	2(1.8%)		105(89%)
	Occasional	1(0.9%)		
	Always	3(2.7%)		
	Missing data			
Presenting symptoms (%)	Genitalia pain	3	2	5(4.5%)
	Discharge	41	7	48(43.2%)
	Genital ulcers	10	11	21(18.9%)
	Swelling/ growth	18	8	26(23.4%)
	Asymptomatic	2	3	5(4.5%)
	Contact	0	3	3(2.7%)
	Genital itch	2	1	3(2.7%)
	Scrotal swelling	4	-	4(3.6%)
True sexually transmitted diseases at final diagnosis (%)		68	24	92 (82.8%)

Table 2. Pattern of Sexually Transmitted Infections (STI) in 92 adolescents

Types of sexually transmitted infections		Male n=68(%)	Female n=24 (%)
Genital warts		12 (17.6)	8 (33.3)
Herpes genitalis		5 (7.4)	12 (50)
Syphilis		10 (14.7)	2 (8.3)
Urethral discharge	*Neisseria gonorrhea (NG)*	30(44.1)	
	Non gonococcal urethritis (NGU)	10 (14.7)	
	NG and *Chlamydia trachomatis* coinfection	1 (1.5)	
Epididymo-orchitis		4 (5.9)	
Vaginal discharge	*Neisseria gonorrhea*		1 (4.2)
	Chlamydia trachomatis		1 (4.2)

Discussion

The increasing trend of sexually transmitted infections (STIs) among the young population is a significant public health problem. The magnitude of STI prevalence in those age 10 to 19 years is difficult to ascertain in our local setting as data tend to be aggregated with adults and rarely analysed as a distinct group. Neighbouring countries like Singapore had reported an 8% increase in STI among young people aged 10–19 years old from the year 2014 to 2015, with more than 90% of the cases being in the age group of between 15 and 19 years.[10] Youth with acute STIs are at increased risk of HIV because of both non–condom-protected sexual behaviour and genital tract inflammation. Over one's life span, each STI episode increases one's susceptibility to HIV infection.[11]

In our study there was a male preponderance amongst adolescents who had attended the GUM clinic. This was probably because majority of male adolescent were symptomatic. A large proportion of male adolescents in our cohort presented with urethral discharge and had NGU or gonorrhoea. Local studies showed that more upper secondary male students in Penang and Negeri Sembilan had engaged in sexual activities[12-14]. In the Prevalence of HIV, STD, Drug Use, and Risk Behaviours in Adolescents and Young Adults (PHRAYA) study conducted in Thailand in 1999, it was shown that adolescents and young adults in Chiang Rai are

at high risk of unprotected intercourse, being coerced to have sex, unwanted pregnancies, sexually transmitted diseases, and drug use.[16] Sexual abuse during childhood or adolescence is often associated with the adoption of high-risk sexual behaviours including sex with multiple partners and prostitution, later in life.[1,17,18]

Interestingly, the male adolescents in our cohort had multiple sexual partners with a preference for casual partners when compared to female adolescents. This finding was similar to a study done in Thailand.[18] Over the years there was a transition from sex workers to casual partners among the youth in Thailand. They tend to use less protection with casuals as compared with sex workers, probably under the impression that sexual activity with a casual contact may not pose a STI risk as compared to a sex worker.

Based on previous studies on sexual behaviour in Malaysia 15-20 years ago, the mean age at first sexual intercourse among Malaysia teens was 15 years.[12-14] This was comparable to the studies from the Western countries for instance in US, where it was found that the majority had engaged in sexual activity by age 17.[19] Initiation of sex at an earlier age would expose teens to longer periods of sexual activity thus exposing them to unintended pregnancies and STIs.[12] In another study of urban females in US found that the median interval between first intercourse and first STI was 2 years.[19] Although nearly 90% of our cohort were in the age group of 15 to 19 years, the youngest patients who presented with a STI were 13 and 14 years of age for male and female respectively. This shows that our adolescents may have engaged in sexual activities at much younger age and this should be reinvestigated again in our population.

About 1.3% of our adolescent cohort reported the use of recreational drugs. Adolescent drug use has been significantly associated with higher rate of STIs. The [20-23] National Health and Morbidity Survey 2017 done in Malaysia reported that 3.4% of adolescents were current drug users. About 1 in 25 school students in Malaysia claimed to have used substances such as amphetamines, methamphetamines and marijuana.[22] Studies have shown that prior substance use increases the probability of an adolescent initiating sexual activity, having more sexual partners, less consistent use of condoms, more sexually transmitted diseases, and greater prevalence of human immunodeficiency virus.[24,25]

The effectiveness of condom for prevention of non-viral STI has been well studied.[26-28] It is disturbing to note that majority of the teens in our study did not use condoms during sexual intercourse. Inconsistent condom usage has been a major concern among the adolescents and youth in Malaysia and it has given rise to unintended adolescent pregnancies and STIs.[22] The main reason for unprotected sex, however, is that men of all ages, including adolescents, do not like to use condoms.[16] Adolescent girls are commonly disengaged from safe-sex practices as more often than not, the power dynamics within a couple are dominated by the male partner. This disparity provides for men to control or determine the use of protection i.e. condoms, birth control etc, especially with older partners.[1,16] In addition, adolescent girls may have inadequate knowledge on the risk of STI and HIV infection via unprotected sex. Based on a local study done by Shiely et al, only 2% of women in their cohort used contraception to protect against STI or HIV.[29]

According to a study in US, the lack of availability was a frequent cited barrier to condom usage.[26] Other reasons given were cost of condom and the embarrassment associated with purchasing them.[26] Zulkifli et al also reported similar findings whereby 72% of teens reported not using any kind of contraception at first intercourse (76% of boys, 61% of girls), despite the fact that condoms are freely available in convenient stores and pharmacies.[14] Barriers for Malaysian teen and youth to access contraceptive information and methods include social or cultural taboos, legal restrictions, health care provider (HCP) attitudes, and healthcare systems.[27] A teenager approaching a health care professional for contraception

may sometimes get a judgemental or biased opinion regarding contraception.[27] Long acting reversible contraception like intrauterine contraceptive device are normally inserted by trained medical personnel and require consent of parents or guardians for those less than 18 years. The cost of contraception services and methods is another potential barrier for adolescents. HCPs should counsel on available contraceptive options without bias to adolescents. Counselling must include the effectiveness, advantages and disadvantages. Adolescents should be informed that failure rates are the highest for user dependent methods (e.g. natural family planning, withdrawal, condoms, and oral contraceptives).[28]

In view of these barriers and with heavy burden of STIs amongst the youth and adolescents, a condom availability program was started in some schools in United States for students to have free access to condoms.[30] This is in addition to a comprehensive sexual education.[30] Critics have argued that such programs would "promote" sexual activity but studies have shown the reverse. The rates of *Chlamydia* and gonorrhoea infection in US decreased significantly since the implementation of these programs.[25,20] It has led to increase condoms usage and improved sexual health.[25,30] Hence, schools proved to be an excellent venue for provision of reproductive health services to teens.[1] It should be considered in our local secondary schools. A robust and comprehensive scholastic approach to sex, in tandem with practical and discerning educators, can help mitigate risky sexual practices among students.[1,30]

Studies have shown that confidentiality is a key concern among adolescents in seeking STI testing for fear of stigmatization, embarrassment in revealing sexual behaviour to medical providers and the fear of parents finding out.[9,20,31] Homosexuality and bisexuality were only reported among the males in our cohort. A few have denied their sexual orientation or having had any partners despite being diagnosed with a STI. Fear of disclosure of their behaviour to the parents is one of the reasons for this denial especially in teens younger than 18 years. This brings us to the question of confidentiality which is a huge barrier to STI testing. It is important to for us to address this issue when working with adolescents. Female adolescents who had time alone with a medical provider during consultation were twice more likely to receive a STI screening than those whose parents were in the consultation room with them. This suggests that private discussions are important.[15] To improve young people's health, adolescent health services in Malaysia were introduced by the Ministry of Health Malaysia (MOH) since 1996 and were primarily available in health clinics and in schools through school health units (MOH, 2018c).[32] These adolescent friendly clinics could be utilized to provide opportunistic STI screening for adolescents.

The comparisons of the STIs among adolescents with other countries are shown in Table 3. In the US,[21] the most prevalent reported STI among adolescents between 14 and 19 years were genital warts and chlamydia. In Thailand[33] the prevalence of STIs was 28% amongst pregnant teenagers attending antenatal care and the risk of acquiring STIs was significantly related to prior sexual contact and multiple partners.[20] Spain noted a rising trend of STI cases among adolescents from 2012 to 2017 especially *Chlamydia trachomatis* infection, gonorrhoea and syphilis.[34]

Malaysian data in 2007 showed that the prevalence of chlamydia was highest in the age group of 15 to 19 years of age.[35] In our setting *Chlamydia* infection is detected using Direct fluorescent antibody (DFA) test (MicroTrak Chlamydia trachomatis Direct Specimen Test, Trinity Biotech, Ireland). This assay has a sensitivity of 50% to 80% if performed on vaginal and urethral smear specimens collected from symptomatic individuals. Only 2 cases of *Chlamydia* were detected among the patients in our cohort. This is because DFA for chlamydia detection was no longer available during the end of the 2017. Symptomatic adolescents were treated presumptively based on the presence of leucocytes in gram stains done on urethral and

vaginal smears. Another reason for the small number of chlamydia infections detected was the refusal on speculum examination by parents and patients.

Our DFA was later replaced by Xpert CT/NG only in end of 2018. This is a qualitative in vitro PCR test for the automated detection and differentiation of genomic DNA from *Chlamydia trachomatis* (CT) and *Neisseria gonorrhoea*. This assay aids in the diagnosis of chlamydia and gonorrhoeal obtained from urogenital sample like urine, urethral and vagina swabs, as well as swabs obtained from extra genital (pharynx and rectum) sites.[36] Studies have shown that chlamydia and gonorrhoea infection in females are often asymptomatic and the best and non-invasive screening test to detect them would be nucleic acid amplification test.[2,9,16,19,21]

The burden of STIs is higher among HIV-infected young men who have sex with men (YMSM) than among HIV-uninfected YMSM.[37] They are particularly at higher risk of syphilis infection, chlamydia and gonorrhoea specifically antibiotic resistant *Neisseria gonorrhoea (NG)*. We would like to note that extra genital examination is very important especially in MSM with HIV and those on pre-exposure prophylaxis. Rectal *Chlamydia trachomatis (CT)* and *NG* testing, as well as pharyngeal *NG* testing, are recommended in YMSM.[37-39] Studies have shown that 26.4% of extra genital *CT* infections and 63.2% of extra genital *NG* infections would have been missed if only urogenital examination was conducted.[38] Another study found that patient reported exposure was not necessarily a reliable indicator for anogenital *CT* and *NG* screening in young black MSM.[39] While reported anal sexual exposure predicted rectal infection, 19.4% of rectal infections would have been missed in men who denied receptive anal sex.[38,39]

Genital herpes simplex virus (HSV) is also common among adolescents shown in our study and it is difficult to assess epidemiological trends because it is not a notifiable disease. Although HSV-2 typically causes genital herpes and HSV-1 typically causes orolabial herpes, several studies have shown that the prevalence of genital HSV-1 in adolescents has increased significantly. In USA, 60% of genital herpes are caused by HSV-1.[20] The increase was postulated as result of the decreasing prevalence of orolabial HSV-1 in adolescents and thus a lack of HSV-1 antibodies upon sexual debut.[20] The increase of HSV-1 anogenital infection is especially more prevalent among women and MSM.[20]

HPV infection is the second most common STI reported among male adolescents in our study. Again, there is not much local data of HPV in our local adolescents as it is not a notifiable disease. HPV vaccination had been integrated in the national school immunization program since 2010 and is given to all female students age 13 years. The exclusion of vaccination for male adolescents in the program probably accounts for the increasing numbers of anogenital warts in males.[40] It has been proven that prophylactic administration of quadrivalent HPV vaccine is efficacious in preventing the development of external genital lesions associated with infection with HPV-6, 11, 16, or 18 in boys and men 16 to 26 years of age.[24] Therefore, efforts should be made to introduce HPV vaccination for male students. An interesting local study done by Wong et al showed a low perceived susceptibility to HPV infection among boys.[41] This is because mass media has selectively emphasized cervical cancer prevention in women without revealing the consequences of HPV infection in males. The public should be made aware that HPV infection in men can be associated with penile, oral and anal cancer and the benefits of vaccination should be highlighted to boys or men.[41]

Sexual coercion or non-consensual sexual activity is something that we should bear in mind when managing female adolescents as we have SCAN team. A significant minority of cases have been pressured or forced into non-consensual sexual activity by their peers or adults. Female victims of childhood sexual abuse are at increased risk for STI possibly due

to younger age at sexual initiation and unsafe sex practices.[1, 16]

We cannot generalize the findings of this study to the entire adolescent population because most of the adolescents who had attended the GUM clinic were symptomatic. Evidence has shown that most STIs are asymptomatic therefore substantial number of infections are missed especially in young MSM and females.[2,16,20,38]

Some adolescents may have sought advice or treatment at general practitioners or alternative medicine centers. Ideally, a rapid, cost-effective screening method which is non-invasive should be used to diagnose STIs in adolescents.[8,16,20,42] Rapid point of care testing is the most ideal method as patients could be screened and treated in the same day, hence reducing loss to follow up.[20,42]

Table 3. Comparisons of STI among adolescents in different countries

Author, year, country	Age in years	Sexual behaviour	Prevalence of STI
Present study, Malaysia	13-19	Homosexual 17.1% Casual 51% > 1 Partner 26.1%	Male: NG 45.6%, HPV 17.6% NGU 17.6%, HSV 7.4% Female: HSV 50%, HPV 33.3%
Vives N et al[34] 2020, Spain			

13 to 19 years	CT (13.4%)	Gonorrhoea (7.0%)	Syphilis (1.8%)
Mean age	17.7	18.3	18.5
Heterosexual female	87.8%	39.3%	16.7%
Heterosexual male	6.7%	23.1%	13.1%
Homosexual	1.6%	18.8%	60.7%
Unknown	3.8%	18.8%	9.5%
HIV	2.0%	2.8%	8.5%

Ayerdi Aguirrebengoa et al[43]
2020, Spain

%(n)	MSM 39.8% (149)	Heterosexual 22.7% (85)	Women 37.4% (140)
Gonorrhoea	30.2 (45))	22.4(19))	12.2(17)
Chlamydia	10.1 (15))	25.9 (22)	19.3 (27)
Syphilis	0.1(15)	1.2(1)	1.4(2)
HIV	7.4(9)	0	0

Park JJ, et al[42] 2017, Korea	16.1 ± 1.5	Substance abuse 8.4% >1 partner 25%	CT 13.9% NG 1.7% TVS 0.8% HSV 0.4% Syphilis 0.8% HIV 0 *Ureaplasma urealyticum* (24.7%)
Asavapiriyanont et al[33], 2016 Thailand	17.16 + 1.3(Mean + SD) -	Age of first sexual contact (years) Mean + SD 15.38+1.81 >1 partner 48.2%	Prevalence of STI 28.0% (*CT* 19.8%. *NG* 1.7%, Hep B 3.3%, TVS 1.7%, HSV 0.8%, HPV 0.8%)
Forhan et al[21], 2009, USA	14-19	NA	HPV 18.3% CT 3.9%
Bunnel et al[19] 1999, USA	14 -19	>1 partner 72%	Females with STI 40% CT 27%, HSV 14%, gonorrhoea 6% TVS 3%

USA – United States of America; NG- *Nesseria gonorrhoea*; CT - *Chlamydia trachomatis*; HPV – human papilloma virus; NGU – non gonococcal urethritis; HSV – herpes simplex virus; HIV- human immunodeficiency virus; MSM – men who have sex with men; TVS – *Trichomonas vaginalis*; STI – sexually transmitted infections; SD – standard deviation

Conclusion

Sexually transmitted infections are an ongoing concern among our adolescents. We have managed STIs in those as young as 13 years of age. The most common STI among adolescents in our cohort between 2014 and 2018 was gonorrhoea in male and herpes genitalis in females. STI preventive efforts for adolescents should encompass contributions, cooperation and support from all parties including parents, schools, health care providers and social media.

Conflict of Interest Declaration

All authors have no financial/conflict of interest to disclosed.

Acknowledgement

The authors would like to thank the Director of Health Malaysia for permission to publish this paper.

References

1. Dehne KL, Riedner G. Sexually transmitted infections among adolescents: the need for adequate health services. Reprod Health Matters 2001;9:170-83.
2. Workowski KA, Bolan GA; Centers for Disease Control and Prevention. Sexually transmitted diseases treatment guidelines, 2015. MMWR Recomm Rep 2015;64:1-137. Erratum in: MMWR Recomm Rep 2015;64:924.
3. Ministry of Health Malaysia. National Adolescent Health Plan of Action 2015-2020 available at https://fh.moh.gov.my/v3/index.php/component/jdownloads/send/21-sektor-kesihatan-remeja/345-nahpoa-2015-2020. Accessed on 1/11/2021
4. Ministry of Health Malaysia (MOH). Health Facts 2012. Available at https://www.moh.gov.my/moh/resources/auto%20download%20images/589d6c0e2095f.pdf. Accessed on 1/11/2021
5. Ministry of Health Malaysia (MOH). Health Facts 2020. Available at https://www.moh.gov.my/moh/resources/Penerbitan/Penerbitan%20Utama/HEALTH%20FACTS/Health%20Facts%202020.pdf . Accessed on 1/11/2021.
6. Ministry of Health Malaysia (MOH). Country Progress Report On HIV/AIDS 2019 Malaysia. Available at https://www.moh.gov.my/moh/resources/Penerbitan/Laporan/Umum/Report_GAM_2019_(Final).pdf. Accessed on 1/11/2021
7. Steinberg L. Cognitive and affective development in adolescence. Trends Cogn Sci 2005;9:69-74.
8. Burchell AN, Winer RL, de Sanjosé S, Franco EL. Chapter 6: Epidemiology and transmission dynamics of genital HPV infection. Vaccine 2006;24(3):52-61.
9. Carmine L, Castillo M, Fisher M. Testing and treatment for sexually transmitted infections in adolescents--what's new? J Pediatr Adolesc Gynecol 2014;27:50-60.
10. Lee RMK, How CH, Rajasegaran K. Sexual matters among teenagers. Singapore Med J 2019;60:439-45.
11. Petsis D, Min J, Huang YV, Akers AY, Wood S. HIV Testing Among Adolescents With Acute Sexually Transmitted Infections. Pediatrics 2020;145:e20192265.
12. Zulkifli SN, Low WY: Sexual practices in Malaysia: determinants of sexual intercourse among unmarried youths. J Adolesc Health 2000;27:276-80.
13. Anwar M, Sulaiman SA, Ahmadi K, Khan TM. Awareness of school students on sexually transmitted infections (STIs) and their sexual behavior: a cross-sectional study conducted in Pulau Pinang, Malaysia. BMC Public Health 2010;10:47.
14. Zulkifli SN, Low WY, Yusof K. Sexual activities of Malaysian adolescents. Med J Malaysia 1995;50:4-10.
15. Lee LK, Chen PC, Lee KK, Kaur J. Premarital sexual intercourse among adolescents in Malaysia: a cross-sectional Malaysian school survey. Singapore Med J 2006;47:476-81.
16. van Griensven F, Supawitkul S, Kilmarx PH, Limpakarnjanarat K, Young NL, Manopaiboon Cet al. Rapid assessment of sexual behavior, drug use, human immunodeficiency virus, and sexually transmitted diseases in Northern Thai youth using audio-computer-assisted self-interviewing and noninvasive specimen collection. Pediatrics 2001;108:E13.
17. Crockett LJ, Bingham CR, Chopak JS, Vicary JR. Timing of first sexual intercourse: the role of social control, social learning, and problem behavior. J Youth Adolesc 1996;25:89-111.
18. Latimore AD, Aramrattana A, Sherman SG, Galai N, Srirojn B, Thompson N, Ellen JM, Willard N, Celentano DD. Sexually transmitted infection risk behaviors in rural Thai adolescents and young adults: support for sex- and age-specific interventions. Sex Transm Dis 2013;40:216-20.
19. Bunnell RE, Dahlberg L, Rolfs R, Ransom R, Gershman K, Farshy C et al. High prevalence and incidence of sexually transmitted diseases in urban adolescent females despite moderate risk behaviors. J Infect Dis 1999;180:1624-31.
20. Shannon CL, Klausner JD. The growing epidemic of sexually transmitted infections in adolescents: a neglected population. Curr Opin Pediatr 2018;30:137-43.
21. Forhan SE, Gottlieb SL, Sternberg MR, Xu F, Datta SD, McQuillan GM et al. Prevalence of sexually transmitted infections among female adolescents aged 14 to 19 in the United States. Pediatrics 2009;124:1505-12.
22. Ministry of Health Malaysia. National Health And Morbidity Survey (NHMS) 2017: Key Findings from the Adolescent Health and Nutrition Surveys. Available at https://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2017/NHMS2017Infographic.pdf. Accessed on 1/11/2021.
23. Tapert SF, Aarons GA, Sedlar GR, Brown SA. Adolescent substance use and sexual risk-taking behavior. J Adolesc Health 2001;28:181-9.
24. Giuliano AR, Palefsky JM, Goldstone S, Moreira ED Jr, Penny ME, Aranda C et al. Efficacy of quadrivalent HPV vaccine against HPV Infection and disease in males. N Engl J Med 2011;364:401-11.
25. Charania MR, Crepaz N, Guenther-Gray C, Henny K, Liau A, Willis LA et al. Efficacy of structural-level condom distribution interventions: a meta-analysis of U.S. and international studies, 1998-2007. AIDS Behav. 2011;15:1283-97.
26. Warner L, Newman DR, Kamb ML, Fishbein M, Douglas JM Jr, Zenilman J et al. Problems with condom use among patients attending sexually transmitted disease clinics: prevalence, predictors, and relation to incident gonorrhea and chlamydia. Am J Epidemiol 2008;167:341-9.
27. Abdul Mutalip MH, Mishkin K, Paiwai F, Sulaiman J, Yoep N. Factors Associated with Sexual Intercourse, Condom-Use, and Perceived Peer Behaviors Among

Adolescents in Malaysia: A School-Based Cross-Sectional Study. MJSSH 2019;4:8-18.
28. Todd N, Black A. Contraception for Adolescents. J Clin Res Pediatr Endocrinol 2020;12(1):28-40.
29. Shiely F, Saifuddin MS. Contraceptive choice and acceptability: the future for STI risk in Kelantan, Malaysia. Int J STD AIDS 2014;25:219-27.
30. Society for Adolescent Health and Medicine. Condom Availability in Schools: A Practical Approach to the Prevention of Sexually Transmitted Infection/HIV and Unintended Pregnancy. J Adolesc Health 2017;60:754-7
31. Leichliter JS, Copen C, Dittus PJ. Confidentiality Issues and Use of Sexually Transmitted Disease Services Among Sexually Experienced Persons Aged 15-25 Years - United States, 2013-2015. MMWR Morb Mortal Wkly Rep 2017;66:237-41.
32. Awang H, Ab Rahman A, Sukeri S, Hashim N, Nik Abdul Rashid NR. Making Health Services Adolescent-Friendly in Northeastern Peninsular Malaysia: A Mixed-Methods Study. Int J Environ Res Public Health 2020;17:1341.
33. Asavapiriyanont S, Chaovarindr U, Kaoien S, Chotigeat U, Kovavisarach E. Prevalence of Sexually Transmitted Infection in Teenage Pregnancy in Rajavithi Hospital, Thailand. J Med Assoc Thai 2016;99(2):S153-60.
34. Vives N, Garcia de Olalla P, González V, Barrabeig I, Clotet L, Danés M et al. Recent trends in sexually transmitted infections among adolescents, Catalonia, Spain, 2012-2017. Int J STD AIDS 2020;31:1047-54.
35. S Norashikin, HB Gangaram, Hussein S. Prevalence of *Chlamydia trachomatis* in Genito-urinary Medicine Clinic, Hospital Kuala Lumpur: A 5 – year Retrospective Analysis Malaysian J Dermatol 2007;20:101-4.
36. Khalid K, Pudzi N, Krishnasamy V, Razali SNO, Nawi S. GeneXpert CT/NG test for Chlamydia and Gonorrhoea diagnosis used at point of care: A single tertiary care centre experience, Int J Infect Dis 2021;101(1):444.
37. Mayer KH. Sexually transmitted diseases in men who have sex with men. Clin Infect Dis 2011;53(3):S79-83.
38. Drinkard LN, Huxta RA, Halbritter A, Nguyen GT, Malebranche D. The Case for Extragenital Screening of Chlamydia trachomatis and Neisseria gonorrhoeae in the College Health Setting. Sex Transm Dis 2017;44:274-7.
39. Chamberlain N, Crosby RA, Mena L, Chan PA, Mayer KH. Is Patient-Reported Exposure a Reliable Indicator for Anogenital Gonorrhea and Chlamydia Screening in Young Black Men Who Have Sex with Men? Sex Transm Dis 2017;44:390-2.
40. Centers for Disease Control and Prevention. Sexually Transmitted Disease Surveillance 2016. Atlanta: U.S. Department of Health and Human Services; 2017.
41. Wong LP, Alias H, Yusoff RNARM, Sam IC, Zimet GD. Are Boys Ready for Human Papillomavirus Vaccine? A National Study of Boys in Malaysia. Sex Transm Dis 2019;46:617-24.
42. Park JJ, Seo YB, Jeong S, Lee J. Prevalence of and Risk Factors for Sexually Transmitted Infections among Korean Adolescents under Probation. J Korean Med Sci 2017;32:1771-8.
43. Ayerdi Aguirrebengoa O, Vera Garcia M, Rueda Sanchez M, D Elia G, Chavero Méndez B, Alvargonzalez Arrancudiaga M et al. Risk factors associated with sexually transmitted infections and HIV among adolescents in a reference clinic in Madrid. PLoS One 2020;15:e0228998.