Female-to-Male Patients Have High Prevalence of Unsatisfactory Paps Compared to Non-Transgender Females: Implications for Cervical Cancer Screening

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BACKGROUND: Little is known about whether and how screening for cancers of natal reproductive structures, including cervical cancer, in female-to-male (FTM) transgender individuals differs from cancer screening among non-transgender females.

OBJECTIVE: To investigate anecdotal reports from clinicians of high rates of inadequate Papanicolaou (Pap) tests among transgender men.

DESIGN: Results of Pap tests performed on 233 FTM and 3,625 female patients at an urban community health center between 2006 and 2012 were extracted from an electronic medical record.

KEY RESULTS: Compared to female patients, FTM patients were more likely to have an inadequate Pap, with prevalence of inadequate samples 8.3 times higher among tests of FTM patients (10.8 % vs. 1.3 % of tests). FTM patients had over ten times higher odds of having an inadequate Pap after adjusting for age, race, and body mass index (AOR=10.77, 95 % CI=6.83, 16.83). When years on testosterone therapy was added to the model, the relationship between transgender identity and Pap inadequacy was attenuated, but remained strongly associated (AOR=6.01, 95 % CI=3.00, 11.50), and time on testosterone was also associated (AOR= 1.19, 95 % CI 1.04, 1.36). FTM patients were more likely than females to have had multiple inadequate tests, and had longer latency to follow-up testing.

CONCLUSIONS: The high unsatisfactory sample prevalence among FTM patients is likely due to a combination of physical changes induced by testosterone therapy and provider/patient discomfort with the exam. Clinicians should receive training in increasing comfort for FTM patients during the exam. FTM patients should be alerted that high rates of inadequate screening may require follow-up testing. Alternatives to repeated Pap testing, such as cytologic reprocessing of inadequate samples or primary human papillomavirus (HPV) DNA screening, should be studied for efficacy and acceptability among FTM patients.

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INTRODUCTION

Female-to-male (FTM) transgender individuals, also known as transgender men, are persons born with female reproductive organs who identify as male. The majority of FTMs either do not undergo complete sex reassignment surgery or undergo total hysterectomy later in life, and therefore have a cervix for a substantial portion of their lives.[1] Therefore, cancers of natal reproductive organs, including the cervix, can still occur and have been documented.[2] The American College of Obstetricians and Gynecologists (ACOG) recommends that transgender men with a cervix follow the same screening guidelines as non-transgender females.[3]

Although cervical cytology testing remains an important part of preventive health care for FTMs, Papanicolaou (Pap) tests can be challenging due to a disconnect between biological sex and gender identity; a desire to ignore the existence of natal reproductive structures; lack of awareness that the cervix is still present after supracervical hysterectomy; a frequent history of trauma; heightened anxiety about undergoing genital examinations; and a high incidence of nulliparity.[2–8] In addition, long-term intramuscular androgen administration induces vaginal atrophy[5,7] that may make speculum insertion more painful and cause cervical epithelial atrophy that mimics dysplasia.[9] A qualitative study with six transgender men found that "gynecologic exams are often a unique time when extreme emotional conflict between self-perceptions and physical anatomy are heightened because of physical touch," suggesting unique barriers to screening in this population.[10] No data exist regarding the prevalence of cervical cancer or cervical cancer screening among transgender men.

Fenway Health (FH) is the largest community healthcare and research facility serving the needs of the lesbian, gay,

bisexual, and transgender (LGBT) community in the greater Boston, Massachusetts area.[11] The current transgender patient population numbers approximately 1,000. Anecdotally, FH clinicians noticed a high incidence of unsatisfactory Pap test results in the FTM patient population. Unsatisfactory (or "inadequate") Paps are tests that cannot be evaluated by the laboratory due to a lack of sufficient cells or obscuring factors such as blood that render the test unreadable by the cytologist. The American Society for Colposcopy and Cervical Pathology (ASCCP) recommends rescreening of unsatisfactory Pap tests within 2 to 4 months.[12] Inadequate Pap tests have been shown to cause increased anxiety in non-transgender females, which is associated with lower likelihood of returning for a repeat test within the recommended time frame.[13] There is also evidence that non-transgender women with inadequate Pap tests are more likely to develop cancer, and that women diagnosed with cervical cancer are more likely to have had an inadequate Pap test in the past.[14,15] Inadequate tests are thus of clinical significance. This study investigated whether the prevalence of inadequate Pap tests was higher among FTM compared to non-transgender female patients. We also examined correlates of unsatisfactory Pap tests and length of time between receiving an inadequate Pap and returning for a repeat test.

METHODS

Design and Procedures

An observational chart review study was conducted through query of the electronic medical record (EMR) to identify FTM patients (assigned a female sex at birth who identify as male, man, or genderqueer) and non-transgender female patients receiving Pap tests at FH. FH uses an electronic flag in the EMR to indicate patients engaged in the Transgender Health Program. Eligible patients were ages 21–64 and active patients at FH for at least a 1-year period between 1 January 2006 and 31 December 2012, defined as having at least two medical appointments at least 1 year apart. All cervical Pap tests performed on these patients for which a laboratory report was available, or for which a clinician entered results into the EMR after reading a laboratory report, were identified. Self-reported Pap results without a substantiating lab report were not included. A total of 8,009 Pap tests were identified from 3,858 unique patients. All Pap tests were evaluated with liquid-based cytology. The study was approved by the FH Institutional Review Board.

Measures

Data extracted from the EMR included: age (in years); race; HIV status; primary care provider; primary health insurance; dates of prescription of any testosterone medication; most recent weight; height; and dates of first and last medical visit and number of visits during the study period.

Data on Pap results and specimen adequacy were extracted from the EMR via electronic query. The query results were validated by reading a random sample of 300 lab reports and ensuring they matched the query results. Lab reports unable to be categorized by the query, and reasons for unsatisfactory tests were read and categorized manually.

Time on testosterone therapy was calculated by taking the difference between the date of the patient's last medical appointment before 31 December 2012 and the date they were first prescribed testosterone at FH. Charts were manually reviewed to capture data on transgender patients who came to FH with a history of hormone use and on non-transgender patients who only used testosterone therapy transiently.

Data Analysis

Data were extracted into a study database and analyzed with R statistical computing environment v. 2.15.2 and Microsoft Excel. Bivariate analyses examined proportional differences between FTM and non-transgender female patients using chi-squared tests ($\chi 2$) for categorical variables, two-proportion z tests for binary variables, and Fisher's exact tests (cell sizes < 5). Two-tailed t-tests were used for comparisons using normally distributed continuous variables. A Mann–Whitney U test was used for variables with a non-normal distribution. A multivariable logistic regression model was fit with the primary outcome of having ever received an inadequate Pap test (yes/no). Also tested were differences between groups in reasons for unsatisfactory Pap tests and length of time after receiving inadequate Pap test before returning for another test.

RESULTS

Demographics

Table 1 presents characteristics of the FTM and non-transgender female patients. The two groups did not differ significantly by HIV status, health insurance status, or time in care at FH during the study period. FTM patients had a significantly higher mean number of medical visits (22.0 vs. 12.2) and were more likely to be prescribed testosterone (90.6 % vs. 0.2 %), as well as higher body mass index (BMI) (29.2 vs. 26.2), younger mean age (31.0 vs. 35.4 years), and a different racial distribution.

PAP RESULTS

Table 2 presents the distribution of Pap results for FTM and non-transgender female patients, which were significantly

Table 1. Demographic Characteristics of the Sample (*N*=3,858): Comparing Female-to-Male (FTM) Transgender and Female Patients

	FTM transgender (*n*=233) 6.0 %	Female (*n*=3625) 94.0 %	*p* value
Mean			
Age (in years)*	31.0	35.4	< 0.0001†
Body Mass Index (BMI)	29.2	26.2	< 0.0001†
Number of medical visits during study period	22.0	12.2	< 0.0001†
Duration between first and last visit during study period (in years)	3.4	3.2	0.10†
% (n/N)			
Race			0.001§
White	67.3 % (157/233)	67.1 % (2434/3625)	
Black	5.6 % (13/233)	9.3 % (338/3625)	
Latino	5.6 % (13/233)	6.0 % (217/3625)	
Asian	2.6 % (6/233)	6.2 % (226/3625)	
Other	5.2 % (12/233)	3.8 % (136/3625)	
Unknown	13.7 % (32/233)	7.5 % (274/3625)	
HIV-Positive	0.9 % (2/233)	1.1 % (41/3625)	1.00‡
Had Health Insurance	90.7 % (186/205)	91.3 % (2575/2820)	0.88‖
Ever prescribed testosterone at Fenway Health	90.6 % (211/233)	0.2 % (8/3625)	<0.0001‖

**Age in years was reported on 12/31/2012*
†*two-tailed t-test*
‡*Fisher's exact test*
§*chi-squared test*
‖*test of two proportions*

different ($p<0.0001$). Out of 322 FTM patients who met the inclusion criteria, 233 FTM patients were identified who received a total of 415 Pap tests. Thirty-eight FTM patients received a total of 45 inadequate Paps, or 16.3 % of patients received at least one inadequate Pap and 10.8 % of tests with an inadequate result. Of the 38 patients who had an inadequate Pap, 34 (89.5 %) had been prescribed testosterone at FH or by an outside provider, or had taken hormones acquired through friends or online pharmacies, before the date of their first inadequate Pap. Of these 34 patients, the majority (82 %) had taken testosterone for more than 12 months. FTM patients with at least one inadequate Pap had a mean age of 29 years on the date of their first (or only) inadequate Pap.

Of 5,016 female patients who met the inclusion criteria, 3,625 female patients were identified who had received a total of 7,594 Pap tests. Ninety-three female patients received a total of 97 inadequate Paps, or 2.6 % of patients receiving at least one inadequate Pap and 1.3 % of tests with an inadequate result. Of the 93 patients who had an inadequate Pap, none had received testosterone at FH or from an outside provider before the date of their first inadequate Pap. Female patients with at least one inadequate Pap had a mean age of 40 years on the date of their first (or only) inadequate Pap.

Of those who received an inadequate Pap test result, FTM patients were significantly more likely to have two inadequate tests than females, with 18.4 % (n=7/38) of FTM patients with an inadequate test having two inadequate tests and 7.3 % (n=4/93) of female patients with an inadequate test having two inadequate tests (Fisher's exact test, p=0.01).

Comparative reasons for unsatisfactory Pap results provided by the interpreting cytologist are shown in Table 3. Differences by gender only approached statistical significance (p=0.057).

Table 2. Prevalence of Inadequate Pap Tests: FTM Transgender and Female Patient Pap Tests

	FTM transgender (*N*=415) *n* (%)	Female (*N*=7594) *n* (%)
Inadequate	45 (10.8 %)	97 (1.3 %)
Negative	345 (83.1 %)	6,546 (86.2 %)
ASCUS*	13 (3.1 %)	493 (6.5 %)
ASC-H†	0 (0 %)	6 (0.1 %)
Atypical glandular cells	0 (0 %)	4 (0.1 %)
LSIL‡ and LSIL-H§	12 (2.9 %)	435 (5.7 %)
HSIL‖	0 (0 %)	13 (0.2 %)
Total	415 Paps	7,594 Paps

Out of 322 FTM patients who met the inclusion criteria, 233 patients were identified who had received a total of 415 Pap tests. Out of 5016 female patients who met the inclusion criteria, 3625 female patients were identified who had received a total of 7594 Pap tests
Fisher's exact test, global test, p value < 0.0001
**Atypical Squamous Cells of Undetermined Significance*
†*Atypical Squamous Cells – cannot exclude high-grade intraepithelial lesion*
‡*Low-grade squamous intraepithelial lesion*
§*Low-grade squamous intraepithelial lesion, with cells suggestive of high-grade squamous intraepithelial lesion*
‖*High-grade squamous intraepithelial lesion*

Factors Associated with Inadequate Pap Tests

After adjusting for age, race, and BMI, FTM patients had a 10.77 increased odds (95 % CI=6.83, 16.83) of ever receiving an inadequate Pap test compared to females (Table 4). Older age was associated with increased likelihood (AOR=1.04, 95 % CI=1.03, 1.06) and higher BMI was associated with decreased likelihood (AOR=0.96, 95 % CI=0.93, 0.99) of ever receiving an inadequate Pap test.

To examine the effects of testosterone therapy, years on testosterone was added to the above model. The relationship

Table 3. Reasons for Unsatisfactory Pap Tests

	FTM transgender Pap tests	Female Pap tests
Scant cellularity, acellular, or insufficient squamous cells	55.6 % (25/45)	43.3 % (42/97)
Obscured by blood, scant cellularity	6.7 % (3/45)	21.6 % (21/97)
Obscured by inflammatory cells, scant cellularity	11.1 % (5/45)	6.2 % (6/97)
Interference by lubricant, scant cellularity	24.4 % (11/45)	28.9 % (28/97)
No reason given	2.2 % (1/45)	0 % (0)

Fisher's exact test, global test, p value= 0.05747

between transgender identity and Pap inadequacy was attenuated, but FTMs remained more likely to have an inadequate Pap compared to females (AOR=6.01, 95 % CI=3.00, 11.50). Length of time (duration in years) on testosterone was also associated with an increased odds of Pap inadequacy (AOR=1.19, 95 % CI=1.04, 1.36). Table 5 shows the proportion of FTM patients with at least one inadequate test by length of time on testosterone during the study period. This proportion was approximately 5 % for transgender men who had not taken testosterone or whose exposure was less than 6 months, and was approximately 20 % for transgender men who had taken testosterone for longer than 6 months.

Returning to Care After an Unsatisfactory Pap Test

Of those who received at least one inadequate Pap result (38 FTM patients and 93 female patients), FTM patients were somewhat less likely to return and re-test until receiving a satisfactory test (52.6 %; 20/38) than female patients (67.7 %; 63/93), but this difference was not statistically significant (p=0.153).

Because transgender patients were significantly more likely to have multiple inadequate tests (see above), we also examined whether any individual inadequate test was followed by a re-test, regardless of the re-test's adequacy. Of 45 inadequate tests among FTM patients, 27 (60 %) of those tests were followed by the patient returning to care and receiving another test during the study period (unsatisfactory or satisfactory). Of 97 inadequate tests among female patients, 67 (69.0 %) were followed by the patient receiving another test (difference not statistically significant) (Table 6).

FTM patients were therefore approximately as likely as female patients to return for additional testing following an unsatisfactory test. However, the median number of days elapsed between an inadequate and a follow-up test was five times longer for FTM patients than for females, 418 days versus 80 days (p=0.002). FTM patients were significantly less likely to return for any test within 1 year of an inadequate test (p=0.,01) and marginally less likely to return within 4 months (p=0.09), as recommended by ASCCP guidelines.

Table 5. Testosterone Therapy and Inadequate Paps Among Transgender Patients

	At least one inadequate Pap n/N (%)
No testosterone use	1/22 (4.5 %)
0–6 months testosterone use	1/18 (5.6 %)
6–12 months testosterone use	2/10 (20.0 %)
12+ months testosterone use	34/183 (18.6 %)

DISCUSSION

Disparities surrounding Pap adequacy for FTM compared to female non-transgender patients included: an 8.3 times higher inadequate test prevalence; a ten-fold increased odds of ever having an inadequate Pap after adjusting for demographic factors; a higher likelihood of multiple inadequate tests; and a longer latency to follow-up testing

Table 4. Multivariable Logistic Regression Model: Ever Received an Inadequate Pap Test

	Model 1		Model 2	
	AOR (95 % CI)	*p*-value	AOR (95 % CI)	*p* value
Gender				
Female	1.00 (Ref)	–	1.00 (Ref)	–
FTM Transgender	10.79 (6.84, 16.85)	< 0.0001	6.01 (3.00, 11.50)	< 0.0001
Age (in years)	1.04 (1.03,1.06)	0.0001	1.04 (1.03,1.06)	< 0.0001
Body Mass Index (BMI)	0.96 (0.93, 0.99)	0.011	0.96 (0.93, 0.99)	0.0096
Race				
White	1.00 (Ref)	–	1.00 (Ref)	–
Black	1.68 (0.89, 2.97)	0.09	1.76 (0.93, 3.11)	0.065
Latino	1.60 (0.78, 3.00)	0.17	1.63 (0.79, 3.06)	0.16
Asian	0.65 (0.20, 1.61)	0.42	0.67 (0.20, 1.66)	0.45
Other	0.82 (0.24, 2.05)	0.71	0.88 (0.26, 2.20)	0.81
Unknown	1.14 (0.58, 2.09)	0.68	1.14 (0.58, 2.09)	0.69
Years on testosterone	–	–	1.19 (1.04, 1.36)	0.011

AOR adjusted odds ratio; 95% CI 95 % confidence interval

Table 6. Length of Time After Receiving Inadequate Pap Test Before Returning for Another Test

	FTM Pap tests	Female Pap tests	*p* value
Unsatisfactory test followed by any further Pap test, regardless of result or adequacy	60.0 % (27/45)	69.0 % (67/97)	0.38*
Of those tests that did have a follow-up test:			
Median days to return to care	418	80	0.002†
Came ≤ 365 days	40.7 % (11/27)	71.6 % (48/67)	0.01*
Came ≤ 120 days	33.3 % (9/27)	55.2 % (37/67)	0.09*

*Test of two proportions
†Mann–Whitney U test

after an inadequate Pap. After adding length of time on testosterone therapy to the analysis, longer testosterone use and transgender identity were associated with Pap inadequacy. Unsatisfactory sample rates for non-transgender female patients were similar to those reported in the literature. For instance, the National Health Service in the UK reported an unsatisfactory Pap rate of 2.4 % during 2011–2012.[16] Data are not available at the national level in the U.S., but a sample of 197 laboratories using ThinPrep Paps reported a median unsatisfactory rate of 1.1 % in 2006 (Moriarty 2009). These data suggest that provider, laboratory, and organizational skills surrounding cervical cancer screening for non-transgender women are adequate, and that there is a disparity for FTM patients. Older age is a known predictor of Pap inadequacy and was also strongly associated in our study.[17,18] Higher BMI was negatively associated with inadequacy, which is surprising, as performing a Pap on obese patients is often more difficult due to prolapse of the vaginal wall between the speculum bills which can impede visualization of the cervix.[19] Testosterone therapy, used by the majority of transgender patients in this study, alters body composition and waist and hip circumference, though impact on BMI is not clear.[20,21] The relationship between BMI and fat composition is known to vary between males and females,[22] and it may be that BMI, a measure developed without transgender bodies in mind, may not be directly comparable between transgender and non-transgender patients. Importantly, after adjustment for all demographic variables, transgender identity remained strongly associated with Pap inadequacy.

It is possible to recalculate the proportion of Pap tests among transgender and non-transgender patients that are abnormal while looking only at evaluable samples (e.g., excluding all inadequate tests). Such an analysis would suggest that FTM patients are more likely to have negative Pap tests than female patients (93.2 %, n=345/370 compared to 87.3 %, n=6546/7497; p<0.001). It is conceivable that FTM patients are at reduced risk of cervical abnormalities, as there is some indication that the testosteronized cervix is a less hospitable environment for persistent human papillomavirus (HPV) infection due to decreased turnover of cervical cells or changes to cellular receptors.[23–25] Alternatively, data show that non-transgender women with inadequate tests are more likely to later have abnormal Pap tests[15], so FTMs may actually be at increased risk of abnormalities. We therefore caution against drawing any conclusions from the results of the evaluable tests, as the high prevalence of inadequate tests essentially constitutes "missing data" that differentially affects our ability to determine the true proportion of abnormal Pap tests among FTMs. Until evidence of elevated, reduced, or equal risk for cervical abnormalities is available, we concur with ACOG that FTM patients with a cervix should continue to follow the same screening guidelines as non-transgender females.

We speculate that the high unsatisfactory sample proportion among FTM patients is due to a combination of histological changes induced by testosterone and provider/patient discomfort with the exam. As discussed in the introduction, long-term testosterone therapy administered intramuscularly (IM) induces vaginal and cervical atrophy that can alter Pap results and make the exam more difficult.[6,9] Vaginal and cervical atrophy in post-menopausal women results in an elevated proportion of inadequate Pap tests and is ameliorated by short-course topical estrogen cream prior to the Pap; efficacy and acceptability of this treatment in FTMs should be investigated.[26]. FTM patients may also experience emotional distress during the genital exam, which may interfere with collection of an optimal sample. It was not possible to collect information on provider or patient discomfort from the EMR during this study, but the study team is currently conducting qualitative research to examine this further.

Reasons for unsatisfactory samples differed somewhat between FTM and non-transgender female patients. A lower proportion of unsatisfactory tests for FTM patients was obscured by blood, likely as a result of amenorrhea following testosterone therapy. A higher proportion was unsatisfactory due to scant cellularity, perhaps also due to testosterone-induced changes to the cervical epithelium. The proportion of inadequate tests due to lubricant use was not higher among FTM patients; in fact, it was somewhat lower. Only carbomer-containing lubricant has been shown to interfere with Pap tests.[27] Non-interfering types of lubricant are not contraindicated, and should be used by providers to ease the exam for both FTM and non-transgender female patients.[28]

The likelihood of eventually getting re-tested following an inadequate Pap was equivalent between the two groups,

but the length of time that elapsed before receiving another Pap was much longer for transgender patients. Several transgender patients were told by their providers that unsatisfactory Paps were common for transgender men on testosterone therapy, and repeat Pap testing was not recommended until 12 months later; providers appeared more likely to recommend to female patients that they return for retesting within 2 to 4 months, as recommended by ACOG guidelines. The fact that both FTM and non-transgender female patients eventually return for re-testing at equivalent rates should reassure clinicians with concerns that Pap tests are sufficiently uncomfortable that transgender patients will not return to care. The mean number of medical visits completed by transgender patients during the study period was nearly twice that of non-transgender patients, which may be due in part to nursing visits for testosterone injection and quarterly to semi-annual blood work to monitor hormones. Providers should consider using this increased engagement in care to educate and encourage patients on the need for adequate cervical cancer screening follow-up.

Additionally, FTM patients should be informed before undergoing a Pap test that they may have an unsatisfactory specimen and may need to return for additional testing. Although cell sizes were small, our data suggest that the effect of testosterone use on Pap inadequacy may begin at around 6 months of use. Providers should therefore encourage FTM patients to undergo baseline Paps before or shortly after initiating testosterone if they have not been recently screened. Provider training should focus on acquiring the technical skill to perform adequate cervical sampling in a variety of challenging circumstances, and on facilitating comfort during the pelvic examination for diverse populations of patients, including transgender men.[19] For FTM patients who desire hysterectomy, total hysterectomy is preferable to supracervical hysterectomy, as this procedure obviates the need for Pap tests.

Limitations of this single-site, retrospective chart review include not being able to collect information to support or disprove our speculation that patient or provider discomfort with the exam affected sampling technique. A qualitative study with providers to understand their confidence and technique during exams with transgender men is currently being conducted, as is a qualitative study with transgender men to understand their experiences with Paps. Concerning the analysis of follow-up care, it was not possible to ascertain whether a patient went to another facility for a Pap unless the cytology report was shared with FH. Length of time on testosterone was estimated by assuming continuous use after it was first prescribed, even though many FTMs may have interruptions in therapy.

Alternatives to repeated cervical cytology should be investigated for efficacy and acceptability in screening for cervical cancer among transgender men, given what appears to be a reduced efficacy of Pap tests in this population and a higher prevalence of repeat inadequate tests. The efficacy of cytologic reprocessing, shown in one study to obtain a result in 40 % of unsatisfactory cervical samples collected from non-transgender women, should be investigated for FTMs to reduce the need to repeat what can be a particularly challenging exam.[29] Human papilloma virus (HPV) DNA testing has also been shown to be a better approach than repeated Pap tests in resolving unsatisfactory results.[30] HPV DNA testing should be investigated as a potentially patient-centered and clinically effective method of primary cervical cancer screening for transgender men. Use of stand-alone HPV DNA testing for primary cervical cancer screening has been studied in non-transgender women, and has been found to have some advantages, including increased sensitivity with only slightly reduced specificity.[31] Until alternative strategies can be tested, it is particularly important that age-eligible FTM patients be a priority population for HPV vaccination for mitigation of cervical cancer risk.

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Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

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REFERENCES

1. **Bauer GR, Travers R, Scanlon K, Coleman TA.** High heterogeneity of HIV-related sexual risk among transgender people in Ontario, Canada: a province-wide respondent-driven sampling survey. BMC Public Health. 2012;12(1):292.
2. **Driák D, Samudovsky M.** Could a man be affected with carcinoma of cervix?- The first case of cervical carcinoma in trans-sexual person (FtM)-case report. Acta Medica (Hradec Kralove). 2005;48(1):53–55.
3. American College of Obstetricians and Gynecologists. Committee Opinion: Healthcare for Transgender Individuals. 2011: Report Number 512.
4. **Kaufman R.** Introduction to transgender identity and health. In: Makadon H, Mayer K, Potter J, Goldhammer H, eds. Fenway Guide to Lesbian, Gay, Bisexual, and Transgender Health. Philadelphia: American College of Physicians; 2008:331–363.
5. **van Trotsenburg MA.** Gynecological aspects of transgender healthcare. Int J Transgenderism. 2009;11(4):238–246.
6. **Feldman J.** Medical and surgical management of the transgender patient: what the primary care clinician needs to know. In: Makadon H, Mayer K, Potter J, Goldhammer H, eds. Fenway Guide to Lesbian, Gay, Bisexual, and Transgender Health. Philadelphia: American College of Physicians; 2008:365–392.
7. **O'Hanlan KA, Dibble SL, Young-Spint M.** Total laparoscopic hysterectomy for female-to-male transsexuals. Obstet Gynecol. 2007;110(5):1096–1101.

8. **Kenagy GP.** Transgender health: findings from two needs assessment studies in Philadelphia. Health Soc Work. 2005;30(1):19–26.
9. **Miller N, Bedard YC, Cooter NB, Shaul D.** Histological changes in the genital tract in transsexual women following androgen therapy. Histopathology. 1986;10(7):661–669.
10. **Dutton L, Koenig K, Fennie K.** Gynecologic care of the female-to-male transgender man. J Midwifery Womens Health. 2008;53(4):331–337.
11. **Mayer KH, Mimiaga MJ, VanDerwarker R, Goldhammer H, Bradford JB.** Fenway Community Health's model of integrated community based LGBT care, education and research. In: Meyer IH, Northridge ME, editors. The Health of Sexual Minorities. Springer US; 2007:693-715.
12. **Massad LS, Einstein MH, Huh WK, Katki HA, Kinney WK, Schiffman M, Solomon D, Wentzensen N, Lawson HW.** 2012 updated consensus guidelines for the management of abnormal cervical cancer screening tests and cancer precursors. Obstet Gynecol. 2013;121(4):829–846.
13. **French DP, Maissi E, Marteau T.** Psychological costs of inadequate cervical smear test results. Br J Cancer. 2004;91(11):1887–1892.
14. **Bofin AM, Nygård JF, Skare GB, Dybdahl BM, Westerhagen U, Sauer T.** Papanicolaou smear history in women with low-grade cytology before cervical cancer diagnosis. Cancer. 2007;111(4):210–216.
15. **Hock YL, Ramaiah S, Wall ES, Harris AM, Marston L, Marshall J, Kendall K, Teale A.** Outcome of women with inadequate cervical smears followed up for five years. J Clin Pathol. 2003;56(8):592–595.
16. NHS Cervical Cancer Screening Programme Annual Review 2012. http://www.cancerscreening.nhs.uk/cervical/publications/cervical-annual-review-2012.pdf. Accessed November 19, 2013.
17. **Paulin H, Geldenhuys L, Naugler C.** Predictors of an unsatisfactory conventional cervical cytology smear. J Obstet Gynaecol Can. 2011;33(7):725–728.
18. **Castle PE, Bulten J, Confortini M, Klinkhamer P, Pellegrini A, Siebers AG, Ronco G, Arbyn M.** Age-specific patterns of unsatisfactory results for conventional pap smears and liquid-based cytology: Data from two randomised clinical trials. BJOG. 2010;117(9):1067–1073.
19. **Bates CK, Carroll N, Potter J.** The challenging pelvic examination. J Gen Intern Med. 2011;26(6):651–657.
20. **Van Caenegem E, Wierckx K, Taes Y, Dedecker D, Van de Peer F, Toye K, Kaufman JM, T'Sjoen G.** Bone mass, bone geometry, and body composition in female-to-male transsexual persons after long-term cross-sex hormonal therapy. J Clin Endocrinol Metab. 2012;97(7):2503–2511.
21. **Mueller A, Haeberle L, Zollver H, Claassen T, Kronawitter D, Oppelt PG, Cupisti S, Beckmann MW, Dittrich R.** Effects of intramuscular testosterone undecanoate on body composition and bone mineral density in female-to-male transsexuals. J Sex Med. 2010;7(9):3190–3198.
22. **Camhi SM, Bray GA, Bouchard C, Greenway FL, Johnson WD, Newton RL, Ravussin E, Ryan DH, Smith SR, Katzmarzyk PT.** The relationship of waist circumference and BMI to visceral, subcutaneous, and total body fat: Sex and race differences. Obesity. 2010;19(2):402–408.
23. **Noel J, Bucella D, Fayt I, Simonart T, Buxant F, Anaf V, Simon P.** Androgen receptor expression in cervical intraepithelial neoplasia and invasive squamous cell carcinoma of the cervix. Int J Gynecol Pathol. 2008;27(3):437–441.
24. **Suh-Burgmann E, Sivret J, Duska LR, Del Carmen M, Seiden MV.** Long-term administration of intravaginal dehydroepiandrosterone on regression of low-grade cervical dysplasia—Aa pilot study. Gynecol Obstet Invest. 2003;55(1):25–31.
25. **van der Kwast TH, Dommerholt HB, van Vroonhoven CC, Chadha S.** Androgen receptor expression in the cervix of androgen-treated female-to-male transsexuals: association with morphology and chain-specific keratin expression. Int J Gynecol Pathol. 1994;13(2):133–138.
26. **Bateson DJ, Weisberg E.** An open-label randomized trial to determine the most effective regimen of vaginal estrogen to reduce the prevalence of atrophic changes reported in postmenopausal cervical smears. Menopause. 2009;16(4):765–769.
27. **Evantash E.** Re: lubricant use during Pap sample collection. http://www.thinprep.com/pdfs/ThinPrep_Customer_Lubricant_Letter.pdf. Accessed November 19, 2013.
28. **Hill DA, Lamvu G.** Effect of lubricating gel on patient comfort during vaginal speculum examination: a randomized controlled trial. Obstet Gynecol. 2012;119(2, Part 1):227–-31.
29. **Rosa M, Pragasam P, Saremian J, Aoalin A, Graf W, Mohammadi A.** The unsatisfactory ThinPrep® Pap test™: analysis of technical aspects, most common causes, and recommendations for improvement. Diagn Cytopathol. 2013;41(7):588–594.
30. **Giorgi Rossi P, Carozzi F, Collina G, Confortini M, Dalla Palma P, De Lillo M, Del Mistro A, Ghiringhello B, Gillio-Tos A, Maioli P.** HPV testing is an efficient management choice for women with inadequate liquid-based cytology in cervical cancer screening. Am J Clin Pathol. 2012;138(1):65–71.
31. **Mayrand MH, Duarte-Franco E, Rodrigues I, Walter SD, Hanley J, Ferenczy A, Ratnam S, Coutlée F, Franco EL.** Human papillomavirus DNA versus Papanicolaou screening tests for cervical cancer. N Engl J Med. 2007;357(16):1579–1588.