Short communication

Abnormal cervical cancer screening results among US Veteran and non-Veteran participants in the National Health Interview Survey (NHIS)☆

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ARTICLE INFO

ABSTRACT

Female Veterans report cervical cancer risk factors at higher rates than non-Veterans. Using data from the National Health Interview Survey (NHIS), we tested whether Veterans with a recent cervical cancer screening test were more likely than non-Veterans to have received an abnormal result. NHIS is a population-based cross-sectional household survey with a stratified, multistage sampling design. We pooled screening data from 2010, 2015, and 2018, and restricted the sample to female participants without a hysterectomy who had a cervical cancer screening test in the prior 3 years. The primary outcome was self-reported abnormal result on a Pap and/or HPV test in the prior 3 years. Our main predictor was Veteran status. We used survey-weighted multivariable logistic regression to estimate odds of an abnormal screening result in the prior 3 years as a function of Veteran status, controlling first for age and survey year, then adding sociodemographic and health factors in subsequent models. The sample included 380 Veterans and 25,102 non-Veterans (weighted total population 104.9 million). Overall, 19.0% of Veterans and 13.7% of non-Veterans reported an abnormal cervical cancer screening test result in the prior 3 years (unadjusted p = 0.03). In the adjusted regression model, the previously observed association between Veteran status and abnormal screening result was explained by differences in sociodemographic and health factors between Veterans and non-Veterans (aOR 1.21, 95%CI 0.78–1.87). Nearly 1 in 5 Veterans with a recent cervical cancer screening test received an abnormal result. Clinicians should address modifiable risk factors and provide evidence-based follow-up for abnormal results.

1 Introduction

An abnormal cervical cancer screening result (cervical dysplasia or high-risk human papillomavirus (HPV) infection) raises a person's risk of developing cervical cancer and often initiates a cascade of surveillance testing and potentially invasive treatments (Perkins et al., 2020). A minority of patients with an abnormal screen will go on to develop cancer (Baseman and Koutsky, 2005), but many more experience stigma, shame, anxiety, and fear associated with an abnormal result (McBride et al., 2020).

Female US Veterans report cervical cancer risk factors at higher rates than non-Veterans. For example, cigarette smoking (U.S. Department of Health and Human Services, 2001) and past sexual assault (Coker et al., 2009; Sadler et al., 2011) are both associated with cervical dysplasia and cancer, and are more common among Veterans than civilians (Sadler et al., 2011; Brown, 2010). US cervical cancer rates are highest among Black women in the South (Yoo et al., 2017). and black women and southerners are both disproportionately represented in military and Veteran populations (Frayne et al., 2018).

Previously, estimates in separate studies suggested lifetime prevalence of an abnormal cervical cancer screening result may be nearly-*three times as high* among US Veterans (57 %) (Sadler et al., 2011) compared to the general US population (20 %) (Sirovich and Welch, 2004). This observed disparity may be attributable to (1) an actual difference in cancer risk (see above), (2) different screening behaviors (including differences between Veterans enrolled in the Veterans Health Administration (VA) and those using non-VA care), or (3) different data sources: 2008 VA survey (Sadler et al., 2011) versus 2000 National Health Interview Survey (NHIS) (Sirovich and Welch, 2004). To compare the risk of an abnormal screen more precisely, we evaluated Veterans and non-Veterans in the same data source (pooling multiple years of NHIS data to obtain a sufficient sample of female Veterans). We also assessed a single recent screening test result rather than lifetime abnormal screen prevalence, while controlling for healthcare utilization, VA coverage, and insurance. Our aim was to test whether Veterans had a higher prevalence of abnormal cervical cancer screening results on a recent test compared to non-Veterans.

2 Methods

NHIS is a population-based cross-sectional household survey with a stratified, multistage sampling design. We pooled data collected in non-consecutive years (2010 and 2015 Cancer Screening Supplement and 2010, 2015, and 2018 Household, Family, and Sample Adult files), and then restricted the sample to female participants without a hysterectomy who self-reported a cervical cancer screening test in the prior 3 years. We used publicly available, de-identified data under a waiver of IRB oversight.

The primary outcome was self-reported abnormal result on a Pap and/or HPV test in the prior 3 years. Our main predictor was Veteran status. We included covariates previously associated with abnormal screening results, including sociodemographics (age, race, ethnicity, geographic region, marital status, income, insurance, VA coverage, healthcare utilization, sexual orientation) and health factors (smoking, receipt of HPV vaccine, time since last screening test). We compared sociodemographic and health factors between Veterans and non-Veterans. We then used survey-weighted multivariable logistic regression to estimate odds of an abnormal screening result in the past 3 years as a function of Veteran status, controlling first for age and survey year, then adding sociodemographic and health factors in subsequent models. Participants with hysterectomy were excluded in the main model because most do not require subsequent cervical cancer screening (Saraiya et al., 2001). However, hysterectomy is more common among Veterans (Ryan et al., 2016), and details about the timing, indication for hysterectomy, and removal of the cervix are not available in NHIS (Solomon et al., 2007), so we also performed a sensitivity analysis including participants who reported hysterectomy. Finally, we calculated the predicted probability of an abnormal cervical cancer screening test for Veterans and non-Veterans to provide a practical and tangible estimate of screening abnormality rates, after adjusting for covariates. All analyses used NHIS complex survey design and weighting and were conducted using STATA (Stata, version 15).

3 Results

The sample included 380 Veterans and 25,102 non-Veterans

(weighted total population 104.9 million); both groups had mean age 43 years (though age distributions differed) and were majority non-Hispanic White, with a higher proportion of Black women and fewer Hispanic women in the Veteran group than non-Veteran group (Table 1). Compared to non-Veterans, Veterans were more likely to reside in the South, be unmarried, have attended college, have public insurance, attend > 10 outpatient visits/year, identify as lesbian or gay, be a current or former smoker, and to have received an HPV vaccine. Most Veterans had insurance other than VA (70 %); 23 % had VA coverage.

Overall, 19.0% of Veterans and 13.7% of non-Veterans reported an abnormal cervical cancer screening result (unadjusted p = 0.03). Controlling for survey year and age, Veterans had greater odds of an abnormal result compared to non-Veterans (OR 1.46; 95 %CI 1.02–2.09; Table 2). Adding sociodemographic and health factors to the model eliminated the statistical association between Veteran status and abnormal screening result (aOR 1.21, 95 %CI 0.78–1.87). In the fully adjusted model, participating in 2015 and 2018 survey years (versus 2010), Black race, being unmarried, having public insurance, being uninsured, smoking, and having been HPV-vaccinated were all associated with higher odds of abnormal screening results. Age >45, income >400% FPL, and last Pap >1 year ago were associated with lower odds of abnormal results. In a sensitivity analysis including participants who reported hysterectomy (88 additional Veterans and 3,845 non-Veterans), the odds of abnormal screening test for Veterans compared to non-Veterans were of a similar magnitude and direction (OR 1.14, 95 %CI 0.76–1.70) in the final model.

After adjusting for demographic and health factors, the predicted probability of an abnormal cervical cancer screen in the past 3 years was 15.3% (95%CI 9.8–20.8) for Veterans and 13.1% (95%CI 12.4–13.7) for non-Veterans.

4 Discussion

We provide the first estimate of abnormal cervical cancer screening test prevalence among Veterans independent of VA healthcare use. In this pooled 2010–2018 national sample, prevalence of a recent abnormal cervical cancer screening test among Veterans was significantly higher than prevalence among non-Veterans, and approached the previously reported lifetime rate of abnormal screen in the general population (Sirovich and Welch, 2004).

We evaluated abnormal screening prevalence among VA healthcare users and non-users to provide a clearer picture of risk for abnormal screens that is not attributable to VA-specific screening access and practices. Clinicians in all healthcare systems should therefore be aware that Veterans have an elevated prevalence of abnormal cervical cancer screening results, as patients with a past abnormal screen often require individualized surveillance and management, including earlier interval exams or referral to a specialist. Within VA, healthcare leaders and policymakers are already investing in cervical cancer prevention through the $75 million annual Women's Health Innovation and Staffing Enhancement (WHISE) initiative to address care coordination (WHISE, 2022). Additionally, a regional centralized nurse navigation model for management of cervical screening results has been implemented across several VA facilities in the upper Midwest, and was recently nominated as a VA Diffusion of Excellence Shark Tank finalist (Pap Hub and Spoke Program, 2023). Our findings indicate that abnormal cervical screens are more common among Veterans than the general population, and support continued investment in cervical cancer screening care coordination and investigation of care delivery models for management of abnormal screening results.

Differences between Veterans and non-Veterans with respect to largely non-modifiable sociodemographic characteristics and potentially modifiable health factors (e.g., smoking) explained Veterans' observed elevated risk for an abnormal screen. Attention to modifiable risk factors can help reduce Veterans' cervical cancer risk. Female Veterans smoke at rates higher than non-Veteran men and women (Brown,

Table 1

Sociodemographic and health factors comparing female Veterans and Non-Veterans in NHIS (Combined 2010, 2015, 2018), without a hysterectomy who had a cervical cancer screening test in the past 3 years.

	Veterans Observed n = 380 (weighted %)	Non-Veterans Observed n = 25,102 (weighted %)	p-value
Sociodemographics			
Age			
Mean (SD)	43.0 (13.1)	42.9 (15.2)	
18–29	60 (16.2)	5,229 (23.3)	<0.001
30–44	143 (39.3)	8,441 (33.2)	
45–64	158 (41.2)	8,425 (33.9)	
>65	19 (3.4)	3,007 (9.6)	
Race/Ethnicity			
Non-Hispanic White	261 (70.5)	14,803 (64.0)	<0.001
Non-Hispanic Black	87 (23.2)	3,936 (13.2)	
Hispanic	17 (3.4)	4,685 (16.1)	
Non-Hispanic Asian	7 (1.1)	1,409 (5.8)	
Non-Hispanic AIAN/Other	8 (1.8)	269 (0.9)	
Geographic region			
Northeast (VISNs 1–4)	45 (10.0)	4,352 (19.0)	0.001
Midwest (VISNs 10–12, 15, 23)	84 (20.6)	5,370 (22.0)	
South (VISNs 5–9, 16–17)	153 (45.8)	8,913 (35.8)	
West (18–22)	98 (23.6)	6,467 (23.3)	
Marital status			
Married	163 (48.8)	11,692 (56.1)	0.01
Not Married	214 (50.7)	13,361 (43.8)	
Education			
High School Graduate or Less	49 (13.8)	7,963 (30.1)	<0.001
Some College/ College Graduate	276 (71.2)	13,631 (55.3)	
Graduate Degree	54 (14.8)	3,446 (14.3)	
Household income			
<200 % FPL	89 (20.8)	8,238 (26.8)	0.1
200–399 % FPL	122 (33.8)	6,893 (28.3)	
>400 % FPL	157 (40.9)	8,522 (38.8)	
Unknown or Missing	12 (4.5)	1,449 (6.1)	
Insurance (does not include VA coverage)			
Private only	171 (46.9)	14,338 (62.4)	<0.001
Any Public insurance (e.g., Medicaid) except Medicare (with or without Private)	110 (28.9)	3,708 (13.6)	
Any Medicare (with or without Private)	38 (8.6)	3,490 (11.1)	
Uninsured	16 (5.4)	2,578 (9.4)	
Missing	45 (10.3)	988 (3.5)	
VA Coverage			
Yes, VA Coverage	89 (22.8)	8 (0.03)	<0.001
No VA Coverage, had other type of insurance	269 (70.4)	21,532 (87.1)	
Uninsured	16 (5.4)	2,578 (9.4)	
Missing	6 (1.4)	984 (3.5)	
Usual Source of Care			
Yes	346 (90.1)	22,308 (89.1)	0.43
No	31 (9.5)	2,469 (9.7)	
>1 place or don't know/refused	3 (0.4)	325 (1.2)	
Office Visits in the Past Year			
0	33 (9.1)	2,458 (9.5)	0.008
1	45 (13.2)	3,953 (15.9)	
2–5	167 (40.8)	11,495 (46.4)	
6–9	45 (11.0)	2,939 (11.6)	
10+	90 (25.9)	4,220 (16.5)	

Table 1 (*continued*)

	Veterans Observed n = 380 (weighted %)	Non-Veterans Observed n = 25,102 (weighted %)	p-value
Sexual orientation (*2015 & 2018 only, n = 16,996*)			
Straight	257 (91.7)	15,977 (95.8)	0.004
Lesbian or gay	11 (4.3)	219 (1.2)	
Bisexual	6 (1.8)	270 (1.6)	
Something else/refused	5 (2.2)	251 (1.3)	
Health Factors			
Smoking status			
Ever smoker	154 (38.9)	8,045 (30.8)	0.01
Never smoker	226 (61.1)	17,034 (69.1)	
Received HPV vaccine (ever) (*Age < 65 only, n = 22,436*)			
Yes	58 (18.8)	2,567 (12.8)	0.03
No/Doctor Refused	293 (79.2)	18,949 (84.5)	
Unknown	10 (2.0)	559 (2.7)	
Time since last Pap			
A year ago or less	243 (62.9)	15,966 (64.5)	0.79
Greater than 1 year, less than 2	88 (25.5)	5,855 (23.1)	
Greater than 2 years, less than 3	49 (11.7)	3,254 (12.3)	

*Refused/don't know responses or unknown/missing data under each variable were included in bivariate comparisons, but are only shown in table if greater than 2%.

2010). In our final model, smoking was independently associated with statistically significantly higher odds of an abnormal cervical cancer screening result. Smoking cessation holds many health benefits, and the link between smoking and cervical cancer can be a particularly motivating teachable moment (McBride et al., 2003) for women with an abnormal cervical screen (Bishop et al., 2005).

Vaccination also represents a critical avenue for cervical cancer prevention: immunization against high-risk strains of HPV effectively prevents cervical dysplasia and cancer (Lei et al., 2020). Veterans in this study were more likely than non-Veterans to have received any immunization for HPV, though overall vaccination rates were low for both groups, consistent with prior studies (Wiener et al., 2020). The slight positive association between vaccination and abnormal screening results in our regression analysis is likely confounded by age and screening behaviors (i.e., vaccinated women are younger and more likely to be screened) (Watson et al., 2017). Though HPV vaccination is most effective when given to adolescents prior to initiation of sexual activity (French et al., 2007), recent research has suggested immunization at the time of treatment for cervical dysplasia can reduce recurrence (Di Donato et al., 2021). Veterans who were not previously immunized may benefit from vaccination at the time of treatment for cervical dysplasia.

The present study has several limitations, including self-report, variations in NHIS questions, and changing screening practices over time. NHIS questions do not address whether a woman had a prior abnormal cervical cancer screening test, which could influence the likelihood of a subsequent abnormality. If Veterans had a higher rate of past abnormal screen, this could contribute to the abnormality seen on the most recent screening test. NHIS does not include questions about sexual assault, which may disproportionately contribute to cervical cancer risk for Veterans (Coker et al., 2009; Sadler et al., 2011). While population-level interventions should focus on common modifiable risk factors, individual clinicians must consider the potential role of past sexual trauma on a Veteran's screening experience, screening participation, and management of abnormal screening results.

Table 2

Age-adjusted odds of abnormal Pap test for Veterans, compared to non-Veterans, in 3 combined NHIS years (2010, 2015, and 2018), accounting for sociodemographics and health factors that vary significantly by Veteran status.

Explanatory Variables	Odds of abnormal Pap result in the past 3 years (OR, 95%CI)		
	Base model	*Add demographics*	*Add demographics and health factors*
	N = 25,482	*N = 23,984*	*N = 23,423*
Veteran status (main predictor)			
Non-Veterans	Ref	Ref	Ref
Veterans	1.46 (1.02–2.09)	1.18 (0.76–1.84)	1.21 (0.78–1.87)
Survey year			
2010	Ref	Ref	Ref
2015	1.67 (1.50–1.87)	1.64 (1.46–1.86)	1.68 (1.49–1.90)
2018	1.53 (1.35–1.75)	1.50 (1.31–1.71)	1.54 (1.34–1.77)
Age			
18–29	Ref	Ref	Ref
30–44	0.86 (0.76–0.98)	1.01 (0.88–1.15)	1.04 (0.90–1.19)
45–64	0.63 (0.55–0.71)	0.73 (0.64–0.84)	0.76 (0.65–0.88)
65+	0.43 (0.36–0.53)	0.47 (0.35–0.63)	0.19 (0.06–0.60)
Sociodemographics			
Race			
Non-Hispanic White		Ref	Ref
Non-Hispanic Black		1.12 (0.97–1.28)	1.16 (1.01–1.34)
Other (incl Hispanic, Asian, AI/PI, other)		0.99 (0.87–1.12)	1.06 (0.93–1.20)
Geographic Region			
Northeast (VISNs 1–4)		Ref	Ref
Midwest (VISNs 10–12, 15, 23)		1.03 (0.87–1.22)	1.03 (0.87–1.23)
South (VISNs 5–9, 16–17)		1.01 (0.87–1.18)	1.00 (0.85–1.16)
West (18–22)		0.98 (0.83–1.15)	1.00 (0.85–1.18)
Marital Status			
Married		Ref	Ref
Not Married		1.34 (1.22–1.48)	1.28 (1.16–1.42)
Income			
<200 % FPL		Ref	Ref
200–399 % FPL		0.92 (0.81–1.05)	0.93 (0.81–1.06)
>400 % FPL		0.85 (0.74–0.98)	0.85 (0.73–0.98)
Insurance			
Private only		Ref	Ref
Any Public insurance (eg, Medicaid) except Medicare (+/- Private)		1.22 (1.05–1.42)	1.19 (1.03–1.39)
Any Medicare (+/- Private)		1.14 (0.89–1.48)	1.16 (0.89–1.50)
Uninsured		1.20 (1.00–1.43)	1.20 (1.00–1.43)
VA Coverage			
No VA, had other type of insurance OR Uninsured		Ref	Ref
Yes, VA Coverage		0.97 (0.36–2.65)	0.92 (0.34–2.50)
Office Visits in the Past Year			
0		Ref	Ref
1		1.04 (0.85–1.28)	0.97 (0.79–1.19)
2–5		1.18 (0.99–1.41)	1.06 (0.88–1.27)
6–9		1.27 (1.03–1.56)	1.11 (0.89–1.37)
10+		1.39 (1.14–1.69)	1.21 (0.98–1.48)
Sexual orientation			
Straight		Ref	Ref
Not straight (incl lesbian, gay, bisexual, something else, don't know, and refused)		1.18 (0.90–1.54)	1.13 (0.86–1.49)
Health factors			
Smoking status			
Never smoker			Ref
Ever smoker			1.27 (1.15–1.41)
Received HPV vaccine (ever)			
No/Doctor Refused			Ref
Yes			1.17 (1.00–1.37)
Time since last Pap			
A year ago or less			Ref
Greater than 1 year, less than 2			0.77 (0.68–0.87)
Greater than 2 years, less than 3			0.66 (0.56–0.77)

5 Conclusions

Given that nearly 1 in 5 Veterans with a recent cervical cancer screening test received an abnormal result, providers of Veterans' healthcare should address modifiable risk factors and provide evidence-based follow-up of abnormal results. We found an elevated prevalence of abnormal cervical screens among Veterans compared to non-Veterans, and this result supports ongoing and planned VA investments in cervical cancer screening care coordination, as well as further exploration of innovative models of care delivery to ensure that patients with an abnormal result receive appropriate clinical management.

CRediT authorship contribution statement

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Publicly available NHIS data

References

Baseman, J.G., Koutsky, L.A., 2005. The epidemiology of human papillomavirus infections. J. Clin. Virol. 32, 16–24.

Bishop, A.J., Marteau, T.M., Hall, S., Kitchener, H., Hajek, P., 2005. Increasing women's intentions to stop smoking following an abnormal cervical smear test result. Prev. Med. 41 (1), 179–185. https://doi.org/10.1016/j.ypmed.2004.09.046.

Brown, D.W., 2010. Smoking prevalence among US Veterans. J. Gen. Intern. Med. 25 (2), 147–149. https://doi.org/10.1007/s11606-009-1160-0.

Coker, A.L., Hopenhayn, C., DeSimone, C.P., Bush, H.M., Crofford, L., 2009. Violence against women raises risk of cervical cancer. J. Womens Health 18 (8), 1179–1185.

Di Donato, V., Caruso, G., Petrillo, M., et al., 2021. Adjuvant HPV vaccination to prevent recurrent cervical dysplasia after surgical treatment: a meta-analysis. Vaccines. 9 (5), 410.

Frayne, S.M., Phibbs, C.S., Saechao, F., Friedman, S.A., Shaw, J.G., Romodan, Y., Berg, E., Ananth, L., Iqbal, S., Hayes, P.M., Haskell, S., 2018. Volume 4: Longitudinal Trends in Sociodemographics, Utilization, Health Profile, and Geographic Distribution. In: Sourcebook: Women Veterans in the Veterans Health Administration, 4. Affairs DoV. (Accessed February 2018).

French, K.M., Barnabas, R.V., Lehtinen, M., et al., 2007. Strategies for the introduction of human papillomavirus vaccination: modelling the optimum age- and sex-specific pattern of vaccination in Finland. Br. J. Cancer 96 (3), 514–518. https://doi.org/10.1038/sj.bjc.6603575.

Pap Hub and Spoke Program. Accessed September 22, 2023, https://marketplace.va.gov/innovations/pap-hub-and-spoke-program.

Lei, J., Ploner, A., Elfström, K.M., et al., 2020. HPV vaccination and the risk of invasive cervical cancer. N. Engl. J. Med. 383 (14), 1340–1348.

McBride, C.M., Emmons, K.M., Lipkus, I.M., 2003. Understanding the potential of teachable moments: the case of smoking cessation. Health Educ. Res. 18 (2), 156–170.

McBride, E., Tatar, O., Rosberger, Z., et al., 2020. Emotional response to testing positive for human papillomavirus at cervical cancer screening: a mixed method systematic review with meta-analysis. Health Psychol. Rev. 1–35.

Perkins, Rebecca B. MD, MSc1; Guido, Richard S. MD2; Castle, Philip E. PhD3; Chelmow, David MD4; Einstein, Mark H. MD, MS5; Garcia, Francisco MD, MPH6; Huh, Warner K. MD7; Kim, Jane E. PhD, MSc8; Moscicki, Anna-Barbara MD9; Nayar, Ritu MD10; Saraiya, Mona MD, MPH11; Sawaya, George F. MD12; Wentzensen, Nicolas MD, PhD, MS13; Schiffman, Mark MD, MPH14; for the 2019 ASCCP Risk-Based Management Consensus Guidelines Committee. 2019 ASCCP Risk-Based Management Consensus Guidelines for Abnormal Cervical Cancer Screening Tests and Cancer Precursors. Journal of Lower Genital Tract Disease 24(2):p 102-131, April 2020. | https://doi.org/10.1097/LGT.0000000000000525.

Ryan, G.L., Mengeling, M.A., Summers, K.M., et al., 2016. Hysterectomy risk in premenopausal-aged military veterans: associations with sexual assault and gynecologic symptoms. Am. J. Obstet. Gynecol. 214 (3), 352 e1-352. e13.

Sadler, A.G., Mengeling, M.A., Syrop, C.H., Torner, J.C., Booth, B.M., 2011. Lifetime sexual assault and cervical cytologic abnormalities among military women. J. Womens Health 20 (11), 1693–1701.

Saraiya, M., Lee, N.C., Blackman, D., Smith, M.-J., Morrow, B., McKenna, M.A., 2001. Self-reported Papanicolaou smears and hysterectomies among women in the United States. Obstet. Gynecol. 98 (2), 269–278.

Sirovich, B.E., Welch, H.G., 2004. The frequency of Pap smear screening in the United States. J. Gen. Intern. Med. 19 (3), 243–250.

Solomon, D., Breen, N., McNeel, T., 2007. Cervical cancer screening rates in the United States and the potential impact of implementation of screening guidelines. CA Cancer J. Clin. 57 (2), 105–111.

U.S. Department of Health and Human Services, 2001. Women and Smoking: A Report of the Surgeon General. U.S Department of Health and Human Services.

Watson, M., Benard, V., King, J., Crawford, A., Saraiya, M., 2017. National assessment of HPV and Pap tests: changes in cervical cancer screening, National Health Interview Survey. Prev. Med. 100, 243–247.

Wiener, R.C., Findley, P.A., Shen, C., Dwibedi, N., Sambamoorthi, U., 2020. Human papillomavirus (HPV) vaccine utilization among adults (18–29 years), BRFSS 2015. Vaccine 38 (33), 5119–5122.

Women's Health Innovation and Staffing Enhancement (WHISE) 2.1. Memorandum. (2022).

Yoo, W., Kim, S., Huh, W.K., et al., 2017. Recent trends in racial and regional disparities in cervical cancer incidence and mortality in United States. PLoS one 12 (2), e0172548.