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Impact of HPV test results and emotional responses on psychosocial burden among Taiwanese women: a cross-sectional study



Chia-Chun Li^{1*}, Ting-Chang Chang^{2,3}, Chun-Hsia Huang^{1,4}, Chi-Wen Chang^{1,5}, Yun-Fang Tsai¹ and Lynn Chen⁶

Abstract

Background HPV is a sexually transmitted virus and is the cause of virtually all cervical cancers. Women undergoing HPV testing may experience significant psychosocial burdens, particularly those with a higher negative affect who test positive for the virus. This study investigates the relationships among test results, anxiety/depression, positive affect (PA), negative affect (NA), and psychosocial burden in women receiving their HPV test reports.

Methods This was a cross-sectional, observational study design. The data were collected after women received their HPV test reports. A total of 273 women were recruited for this survey study from June 2018 to April 2020 in a medical center in North Taiwan. Data were collected on an author-designed demographic-disease survey, the European Quality of Life Index Version 5D 5-Level–Anxiety/Depression, the International Positive and Negative Affect Schedule–Short Form, and the HPV Impact Profile questionnaire. Data were analyzed by descriptive statistics, independent-sample *t*-tests, analysis of variance, Pearson correlations, and hierarchical multiple linear regression models.

Results Among 273 women, 171 (62.6%) received HPV-positive results. Women with positive HPV test results reported significantly higher levels of anxiety/depression and NA compared to those with negative results. Additionally, those with positive results experienced greater psychosocial burden and worse sexual impact. Furthermore, age, NA, and PA were significant predictors of psychosocial burden in women who tested positive for HPV. Specifically, younger age, higher NA, and lower PA were significantly associated with increased psychosocial burden in women who received positive test results.

Conclusion Health-care providers should pay attention to the test results and women's emotional status, especially for women who have positive results and exhibit negative moods. To alleviate the psychosocial burden in women who have positive test results and high negative moods, professionals could provide timely HPV information and reserve time for women to ask questions, which could decrease their distress after receiving the report.

Keywords HPV testing, Testing results, Positive affect, Negative affect, Psychosocial burden

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Introduction

Human papillomavirus (HPV) infection is a major cause of cervical cancer [1]. Consequently, the diagnosis itself could have serious additional consequences, significantly impacting psychosocial well-being [2]. For some women, receiving a positive HPV result could trigger feelings of depression, anger, and shame, negatively affecting their sexual enjoyment and activity [2]. Moreover, women with positive HPV results often experience higher anxiety, greater general distress, and increased emotional turmoil, and may feel worse about their gynecological health, fertility, and sexual interest. They also harbor greater fears about cervical cancer compared to those with negative or unknown HPV statuses [3]. Furthermore, women who receive positive results are likely to experience heightened concerns about developing cervical cancer and greater worry about their test outcomes compared to women with negative or unknown HPV results [3]. As HPV testing becomes a preferred screening method alongside Pap tests, understanding the psychosocial effects of receiving HPV test results is increasingly crucial.

Background

HPV is the most common sexually transmitted infection [4], with nearly all sexually active individuals exposed to the virus at some point [5]. In response to the significant risk of cervical cancer associated with persistent highrisk HPV (HR-HPV) infections [6], Taiwan introduced cytology-based screening for women aged 30 and older in 1995 [7]. This initiative has successfully reduced the mortality rate from cervical cancer by 70% [7]. However, HPV testing has been shown to be more sensitive than cytology-based screening at all ages [8], particularly in detecting cervical intraepithelial neoplasia (CIN) [9]. Moreover, negative HPV test results offer high negative predictive values, providing substantial reassurance against the development of cervical lesions [10]. Despite these advantages, a review of global practices revealed that 69% of countries (139 out of 202 countries) follow cervical screening guidelines, with 78% using cytology as the primary screening method and only 35% recommending primary HPV-based screening [11]. Furthermore, studies have shown that HPV testing, especially using selfsampling kits, is more cost-effective due to lower costs and greater efficiency [12], making it an effective alternative for monitoring women with HPV. Although HPV testing is not the primary method of cervical screening in Taiwan at present, it is increasingly being considered as a complementary or alternative option to the existing procedures.

The psychological impact of the widespread adoption of HPV testing raises concerns, as positive HPV results are associated with psychological distress [13]. The psychosocial burden on women related to HPV is extensive, affecting their emotional and sexual well-being, selfimage, relationships with partners, interactions with health-care providers, and overall life control and health [14]. In an online survey of 1,004 Australian women, those with HPV-positive results reported higher levels of anxiety, increased distress about their test results, concerns about cancer, and greater worry compared to those who tested negative [3]. The need for subsequent actions, such as disclosure and follow-up testing or treatment, can further exacerbate stress and cancer-related fears [13]. Moreover, concerns about test results and cancer were most pronounced in women who tested positive for HPV, leading to significant anxiety and distress [3]. A qualitative study in Taiwan involving 20 women infected with HR-HPV revealed concerns about affecting their partners, which compounded fears of transmission [15]. Women with positive results often felt "disgusting," "contaminated," and "sexually unattractive," severely affecting their body image [13] and negatively impacting their sexual lives [16]. Similarly, a qualitative study among Iranian women with HPV found that some reduced or ceased sexual activity due to transmission uncertainties [16]. These changes in their sexual interactions and self-image made women feel dissatisfied with their sexual lives [16], which influenced their psychosocial health.

Adverse psychosocial effects in women with HPV can be mitigated through appropriate informational and emotional support [13]. Although doctors are trusted sources of related information, their attitudes can sometimes hinder fulfilling women's informational needs [17]. While most women feel respected when receiving their diagnosis or treatment, some report feeling stigmatized by health-care providers due to perceived engagement in risky sexual behaviors [13]. Additionally, a qualitative study in Australia involving 19 women with HPV infection highlighted that inadequate time for explaining results and unsatisfactory communication styles also impacted the interaction between women and healthcare providers [18]. Single women expressed greater concerns about emotional support and issues of infidelity [16]. Typically, women find emotional support from significant others or online groups consisting of similarly affected individuals, which helps to alleviate their distress [13]. However, a qualitative study with 40 Iranian women with HR-HPV revealed feelings of powerlessness when they learned that an HPV infection cannot be cured, leading to a sense of lost control over their health [19]. Therefore, both HPV testing and receiving a diagnosis have been shown to have adverse psychosocial impacts [20-21], affecting women across various psychosocial dimensions. While many studies using qualitative methodologies have explored the impact of HPV testing or diagnosis on women's psychosocial status [13, 15, 22], few quantitative studies have examined the comprehensive

psychosocial effects on women upon receiving HPV test results, especially among Taiwanese women. This study, therefore, employs the HPV Impact Profile (HIP) [14] to investigate the psychosocial burden on women receiving HPV test results.

Positive affect (PA) is exhibited in feelings of alertness, an active nature, and enthusiasm [23], and it can predict positive emotions such as happiness [24]. Women with higher PA have higher energy, better concentration, and more interactions with other people than those with lower PA [23]. Some women with PA tended to have positive attitudes toward dealing with HPV infection [15]. Negative affect (NA) is a kind of subjective distress that leads to unpleasant interactions with other people and is related to adverse emotions such as anger, disgust, fear, guilt, nervousness, and contempt [23]; NA can predict negative emotions such as disgust [24]. PA and NA influence personal behaviors such as a person's approach to rewards and withdrawal from threats [24]. Receiving an HPV-positive result is distressing for most women [13]; however, it could be an opportunity for improving health because affected women pay more attention to their physical, psychosocial, and sexual health behaviors [13]. Women with positive attitudes may cherish their HPV testing results because they prevent worse outcomes such as cervical cancer, and they may think of regular follow-up checks as a kind of blessing [13]. However, few studies have explored the effects of PA and NA directly on women's psychosocial impact when receiving the HPV test results. Therefore, this study assesses the effects of PA and NA on Taiwanese women's psychosocial burden when they receive HPV test results.

Most Taiwanese women undergoing HPV testing receive abnormal results from cytology-based screenings, leading to varying levels of psychosocial burden influenced by several factors. Single women with a positive HPV diagnosis tend to exhibit stronger emotional responses compared to married women [15]. Additionally, younger women with a positive diagnosis report a poorer quality of life compared to their older counterparts [25]. Smoking increases not only the risk of acquiring an HPV infection but also the risks of HPV persistence and progression from persistent HPV infection to CIN or cervical cancer [26], all of which can further impact women's psychosocial burden. This study aims to measure anxiety/depression, NA, PA, and psychosocial burden among Taiwanese women receiving HPV test results. It also investigates demographic-clinical characteristics, test results, and emotional states on the psychosocial burden associated with HPV testing. Additionally, we hypothesize that younger age, higher levels of anxiety/ depression, high NA, and low PA would increase psychosocial burden in women who test positive for HPV.

Methods

Study design

The cross-sectional, observational study was part of a project that assessed psychosocial status, moods, sexual functioning, and quality of life (QoL) among women who underwent cervical HPV testing. This study was conducted between May 2018 and October 2020 at LinKou Chang Gung Memorial Hospital (CGMH), one of the largest medical centers in North Taiwan.

Study procedure

Data collection for the study commenced after receiving approval from the Institutional Review Board (IRB) of CGMH (IRB No.: 201701477B0). All participating women were referred by their physicians from the gynecology clinics at CGMH. Women who underwent an HPV test either as a follow-up for previously abnormal results or through opportunistic screening were invited to participate. Physicians provided a brief explanation of the study's purposes before referring their patients to the interviewer. Data collection occurred after the women received their HPV test reports, with the results being communicated by their physicians two weeks after testing. Prior to conducting the interviews, written informed consent was obtained from all participants, who were assured of the confidentiality of the collected data.

Participants

Participants were included in the study based on the following criteria: (1) at least 20 years old, (2) had an HPV test, (3) were able to read and understand Mandarin Chinese, and (4) were willing and able to provide informed consent and health information authorization. The G*Power 3.1.4 software [27] was used to calculate the required sample size. According to the study purpose, the linear multiple regression with a medium effect size of 0.15, alpha level of 0.05, power of 0.8, and 6 predictors requires 98 women. In addition, the attrition rate was predicted to be 5% based on a previous study [28]. Therefore, the minimum required sample size was 103.

Instruments

Four instruments were used in this study, including one that collected demographic and disease characteristics information; the European Quality of Life Index Version 5D 5-Level (EQ-5D-5 L)–Anxiety/Depression; the International Positive and Negative Affect Schedule–Short Form (I-PANAS-SF); and the HPV Impact Profile (HIP) questionnaire.

Psychosocial burden

The HIP instrument is a 29-item questionnaire used to assess the psychosocial burden in women with HPV-related diseases [14]. The questionnaire consists of seven

dimensions: worries and concerns, emotional impact, sexual impact, self-image, partner issues/transmission, interaction with doctors, and control/life impact. Each item is rated from 0 (no impact) to 10 (worst impact). Higher scores indicate a higher impact of HPV. The questionnaire has good reliability and validity [14]. The validity of the Taiwanese version of the questionnaire has been confirmed and used in a population of women with an HPV-related diagnosis or intervention [28]. Cronbach's α value of the HIP questionnaire was 0.81 in this study.

Positive and negative affect

The I-PANAS-SF is a self-report scale used to assess positive affect (PA) and negative affect (NA) [29]. The scale includes 10 items rated on a 5-point scale, ranging from 1 (never) to 5 (always). Higher scores on PA and NA indicate a more positive mood or a more negative mood, respectively. The NA subscale of I-PANAS-SF includes negative moods of upset, hostile, ashamed, nervous, and afraid, and the PA subscale includes positive moods of alert, inspired, determined, attentive, and active [29]. The scale has been tested in different populations of nonnative English speakers and has demonstrated good reliability and validity [29]. The English version of the I-PANAS-SF has been translated into a traditional Mandarin Chinese version following the recommendations of Bracken and Barona [30]. The Cronbach's alpha reliability coefficients of the subscales of I-PANAS-SF positive affect and negative affect were 0.80 and 0.70, respectively, in this study.

Anxiety/depression

Women's anxiety and depression was measured using the anxiety/depression item of the EQ-5D-5 L questionnaire [31]. Higher scores represent higher anxiety/depression levels. The Taiwanese version of the EQ-5D has been validated and used in women with cervical cancer [32].

Demographic and disease characteristics

Demographic characteristics included age, marital status, level of education, and smoking. Disease characteristics included the results of HPV testing, which were extracted from medical records.

Statistical analysis

Statistical analyses were performed using SPSS 22.0 (IBM Corporation, Armonk, NY, USA), with the significance threshold set at $p \le 0.05$. Data sets with more than 5% missing values were excluded, and the remaining missing values were imputed using the means of the respective variables. Descriptive statistics were used to analyze demographic-disease characteristics, EQ-5D-5 L-Anxiety/Depression, I-PANAS-SF, and HIP scores. The reliability of these scales was evaluated using Cronbach's

alpha coefficients. Relationships among demographicdisease characteristics, EQ-5D-5 L-Anxiety/Depression, I-PANAS-SF, and HIP scores were assessed using independent-sample *t*-tests, analysis of variance (ANOVA), and Pearson correlations. Hierarchical multiple linear regression models were utilized to identify predictors of total HIP scores in women with HPV-positive results, with significant variables entered in the following sequence: (1) age, (2) anxiety/depression levels, and (3) NA and PA.

Results

A total of 300 women undergoing HPV testing were invited to participate in the study, with 273 completing the instruments. Among these participants, the average age was 44.39 years (SD = 11.64), with the majority being partnered (80.2%) and over half (52%) holding college or university degrees. One hundred seventy-one of the women tested positive for HPV (62.6%), with an average age of 43.33 years (SD = 12.24). Detailed demographic and clinical characteristics of the participants are presented in Table 1.

Scores for anxiety/depression, PA and NA, and psychosocial burden in women undergoing HPV testing

The mean EQ-5D anxiety/depression score among all women undergoing HPV testing was 1.48 (SD=0.74) as shown in Table 2. Anxiety/depression levels varied significantly with smoking status (t = -2.36, p ≤ 0.05) and HPV test results (t = -2.39, p ≤ 0.05). Women who smoked reported higher levels of anxiety/depression (*mean* = 1.85, SD=0.93) compared to nonsmokers (*mean* = 1.45, SD=0.72). Similarly, women with positive HPV test results experienced higher anxiety/depression (*mean* = 1.55, SD=0.82) than those with negative results (*mean* = 1.35, SD=0.56). However, anxiety/depression levels were not significantly influenced by age, marital status, or educational level among the women tested.

The mean I-PANAS-SF scores for NA and PA among all women receiving HPV testing were 10.60 (SD = 3.48) and 15.43 (SD = 3.58), respectively, as shown in Table 2. Women's age significantly correlated with NA (r = -0.18, $p \le 0.01$) and PA scores (r = 0.19, $p \le 0.01$), indicating that older women experienced significantly lower NA and higher PA upon receiving their HPV results. Additionally, NA varied significantly with smoking status (t = -2.01, $p \le 0.05$) and HPV test results (t = -2.15, $p \le 0.05$). Smokers reported higher NA (*mean* = 12.10, SD = 3.42) compared to nonsmokers (*mean* = 10.48, SD = 3.47). Women with positive HPV results also reported higher NA (*mean* = 10.95, SD = 3.50) compared to those with negative results (*mean* = 10.01, SD = 3.39). However, smoking and HPV test results did not significantly influence PA

Page 5 of 1	1
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Characteristics	HPV (+) (n = 171)		HPV (-) (<i>n</i> = 102)		Total (<i>N</i> = 273)	
	n (%)	Mean (SD)	n (%)	Mean (SD)	n (%)	Mean (SD)
Age (years)		43.33(12.24)		46.18(10.39)		44.39(11.64)
Marital status						
With a partner	131(76.6)		88(86.3)		219(80.2)	
Without a partner	40(23.4)		13(12.7)		53(19.4)	
Educational level						
Under junior high school	29(17.0)		14(13.7)		43(15.8)	
High school	51(29.8)		37(36.3)		88(32.2)	
College/university	91(53.2)		51(50.0)		142(52.0)	
Smoking						
No	157(91.8)		96(94.1)		253(92.7)	
Yes	14(8.2)		6(5.9)		20(7.3)	

Table 1	Demographic and	I clinical characteristics of	participants

Note SD = Standard Deviation. HPV (+) including HPV 11,16,18,31,32,33,35,39...

Table 2	Descriptive data for EQ-5D-Anxiety/Depression,
I-PANAS-	SF, and HIP scores

Scales	HPV (+)	HPV (-)	Total
	(<i>n</i> = 171)	(<i>n</i> = 102)	(N=273)
	Mean (SD)	Mean (SD)	Mean (SD)
EQ-5D_Anxiety/Depression	1.55(0.82)	1.35(0.56)	1.48(0.74)
I-PANAS-SF			
Negative affect	10.95(3.50)	10.01(3.39)	10.60(3.48)
Positive affect	15.39(3.56)	15.49(3.63)	15.43(3.58)
Total HIP scores	37.65(16.75)	25.28(16.27)	32.81(17.60)
Worries and concerns	39.99(23.11)	31.48(22.88)	36.84(23.35)
Emotional impact	35.09(19.33)	20.94(18.50)	29.79(20.20)
Sexual impact	52.41(24.33)	37.36(26.24)	46.62(26.08)
Self-image	34.47(18.84)	23.04(17.14)	30.18(19.02)
Partner and transmission	31.86(24.28)	20.35(22.82)	27.34(24.33)
Interactions with doctors	29.47(18.68)	18.04(20.66)	25.18(20.18)
Control of life impact	34.50(19.64)	21.47(20.00)	29.63(20.73)

Note I-PANAS-SF=International Positive and Negative Affect Schedule–Short Form; HIP=HPV Impact Profile; *SD*=Standard Deviation

levels, nor did marital or educational status significantly affect NA or PA levels among the women tested.

For the total HIP scale, women undergoing HPV testing had a mean score of 32.81 (SD = 17.60). Among the seven HIP subscales, the highest was sexual impact (mean = 46.62, SD = 26.08), and the lowest was interaction with doctors (mean = 25.18, SD = 20.18), as shown in Table 2. The mean score for sexual impact was significantly correlated with women's age $(r = -0.18, p \le 0.01)$, indicating that younger women experienced greater sexual impact upon receiving HPV testing. Additionally, the mean score for sexual impact varied significantly by smoking status (t = -2.17, $p \le 0.05$) and HPV test results (t = -4.39, $p \le 0.001$). Smokers had a higher sexual impact (mean = 59.71, SD = 21.76) compared to nonsmokers (mean = 45.55, SD = 26.16). Women with positive HPV results also reported a greater sexual impact (mean = 52.41, SD = 24.33) than those with **Table 3** Hierarchical multiple regression for predictors of the outcome variable, psychosocial burden, in women who are HPV positive (n = 131)

Variables	Standardized regression estimates				
	Model 1	Model 2	Model 3		
Age (years)	-0.25**	-0.21**	-0.15*		
Anxiety/depression		0.39***	0.15		
Negative affect			0.37***		
Positive affect			-0.23**		
F	8.55**	17.36***	17.26***		
Total R ²	0.06	0.21	0.35		
Adjusted R ²	0.06	0.20	0.33		
R ² change	0.06**	0.15***	0.14***		

Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

negative results (*mean* = 37.36, SD = 26.24). Furthermore, women with positive HPV results exhibited significantly higher mean scores across the total HIP and all its subscales compared to those with negative results.

Factors influencing psychosocial burden in women with HPV-positive results

Among women with HPV-positive results, significant associations were observed between the total mean HIP scale score and several factors: age (r = -0.23, $p \le 0.01$), anxiety/depression (r=0.41, $p \le 0.000$), NA (r=0.49, $p \le 0.000$), and PA (r = -0.34, $p \le 0.000$). Conversely, smoking, marital status, and educational level did not show significant relationships with the total mean HIP score in these women. Therefore, only age, anxiety/ depression, NA, and PA, which demonstrated significant correlations with the total mean HIP scale scores, were included in the hierarchical multiple linear regression models. These models, which predict the total HIP scale scores for women with HPV-positive results, are presented in Table 3.

The three hierarchical multiple linear regression models were significant, explaining 6–35% of the variance in the total psychosocial burden among women with HPV-positive results. Age emerged as a significant predictor, accounting for 6% of the variance and indicating that older women experienced lower levels of total psychosocial burden upon receiving positive results. After controlling for age, anxiety/depression explained an additional 15% of the variance in total psychosocial burden, with higher levels of anxiety/depression associated with increased burden. Finally, NA and PA significantly influenced the outcome after controlling for age and anxiety/ depression, where higher NA and lower PA were linked to higher total psychosocial burden. Together, NA and PA accounted for 14% of the variance in the outcome. In the final model, age, NA, and PA were significant predictors of the total psychosocial burden in women who received HPV-positive results.

Discussion

Our results enrich the understanding of HPV-related psychosocial burden in women who undergo HPV testing and receive positive results, demonstrating that this burden is significantly and independently predicted by younger age, higher NA, and lower PA.

The mean score for anxiety/depression on the EQ-5D instrument among the participating women was 1.48 (SD = 0.74), which was lower than the scores observed in a similar study conducted in India (mean = 2.29, SD = 1.24) [33]. The difference in these findings might be due to the relatively heterogeneous sample populations with different diseases. Women with cervical cancer reported higher anxiety and depression than women who obtained HPV test results. Our findings also demonstrated that women who smoked reported higher anxiety and depression than those who did not smoke. This might be due to the relationship between smoking and the risk of HPV infection. Women who smoked had significantly higher odds of HPV infection compared to nonsmoking women [34]. Furthermore, tobacco smoking was significantly related to an increased risk of persistent, low-grade cervical abnormalities [35]. As expected, women in this study who received positive HPV test results reported significantly higher anxiety and depression than those who received negative results, which was in line with the previous study's findings that women who were HPV positive had higher anxiety scores than women in the control group when receiving their results [36].

To contextualize the scores of I-PANAS-SF NA (*mean* = 10.60, SD = 3.48) and PA (*mean* = 15.43, SD = 3.58) in our study, only a few studies used the scale for women undergoing HPV testing or receiving the results. A recent study using I-PANAS-SF on Australian psychotherapists during the coronavirus disease pandemic resulted in mean scores of NA and PA of 8.76 (SD = 2.06) and 16.03 (SD = 3.27) [37], respectively.

However, the differences in the I-PANAS-SF scores in the two studies made them hard to compare because of the differences in populations, situations, and cultural backgrounds. For further analyses, we found that younger women reported higher NA and lower PA when receiving HPV test results. This might be due to the fear surrounding HPV, fertility, and pregnancy outcomes [38]. Moreover, younger women might find it difficult to reveal their status, and thereby gain support from partners and their communities, because they fear being stigmatized as being too sexually active or engaging in risky sexual behaviors [22]. However, it would be beneficial and open the door to increased support for these women if they could disclose their status to someone close to them such as sexual partners, close friends, or their parents [38]. Interestingly, we also found that women who smoked reported significantly higher NA when receiving HPV test results compared to those who did not smoke. A previous study found that serious psychological distress was significantly related to current smoking in women of all ages but especially for women aged 20-49 years [39]. Moreover, HPV-16 and HPV-18 DNA loads have been proven to be statistically significantly higher among women who are current smokers than among women who never smoked [40], which might be another reason that women who smoke reported higher NA. Therefore, we should pay more attention to smokers, especially current smokers, who report higher NA. Furthermore, women who received a positive HPV result had significantly higher NA than those who received a negative result, which is consistent with the findings of another study indicating that women who tested positive for HPV reported higher distress than women in the control group [20]. A previous study, using in-depth interviews with women who were HPV positive, also demonstrated that themes related to NA include stigma, fear, self-blame, powerlessness, and anger [38].

The mean score of women receiving the HPV testing in this study for the HIP scale (mean = 32.81) was lower than that of the population of Taiwanese women who were at high risk of being HPV positive and had abnormal Pap results (mean = 48.8) [28]. The difference in these findings might be due to the women's disease characteristics. Women who were found to be at high risk of HPV infection reported higher psychosocial burden than women who had already received the results of their HPV tests. Among the mean scores on HIP subscales for women in this study, sexual impact was the highest. This finding was consistent with that for Chinese women who had HPV-related lesions or underwent HPV-related screening interventions; that is, the sexual impact subscale had the highest mean score of all HIP subscales [41]. Further analysis showed that women of younger ages tended to experience higher sexual impact. These findings were in

line with those of another study indicating that younger women who had genital warts reported significantly worse potential negative impacts on sexual functioning than the general population [25]. Also, our findings indicated that sexual impact was higher in women who smoked than in nonsmokers. Although previous research has shown that smoking increases the risk of HPV infections [42] and that HPV-positive women often feel worse about their sexual relationships compared to HPV-negative women [43], few studies have explored the relationship between smoking and its sexual impact on women concerning HPV issues. As expected, women with HPV-positive results reported higher sexual impact than women with HPV-negative results in this study. This finding is similar to a report showing that women deemed their sexual lives unusual and less satisfying, and sometimes with reduced sexual frequency, after receiving HPV-positive results [16]. Moreover, the quality of intimacy and sexual relationships was also influenced by women's concerns and uncertainty about transmitting HPV [16]. Therefore, women who tested positive would need more information about sexual transmission because they would need to communicate the results to their sexual partners, a discussion that could include issues of infidelity, a lack of trust, and risk of reinfection [44]. However, women may develop intentions for positive behavioral changes after receiving the results of HPV or Pap tests, including changing or continuing their sexual behaviors, monitoring sexual partners, taking other HPV or Pap tests, and changing smoking behaviors [45]. Therefore, undergoing testing could be perceived as an imperative, health-promoting behavior [45] because early detection of abnormalities could prompt women to take action to prevent later diseases [45].

Our study confirmed that HPV-positive results significantly impact women's psychosocial burden, consistent with findings from previous research [43]. Receiving an HPV diagnosis can trigger adverse psychosocial responses [20–21]. Additionally, recent research which investigated the psychosocial effects of using HPV testing, colposcopy, and Pap smears as triage strategies following a Pap smear indicating atypical squamous cells of undetermined significance (ASCUS) found that women with HPV-positive results experienced worse HIP scores, trait anxiety, and state anxiety than those with HPV-negative results [46]; however, the psychosocial outcomes did not significantly differ among the triage strategies for women with ASCUS [46]. Furthermore, an online survey, involving 1,003 women with positive HPV tests or abnormal Pap smears, highlighted that anxiety, worry, and fear were prevalent emotions during the initial testing and the intervals between follow-up procedures [47]. A qualitative study with 100 participants revealed that women typically felt relief or happiness if their HPV tests or Pap smears were negative and anxiety or distress if positive [45]. Given these findings, it is crucial to address the psychosocial aspects not only for women with HPV-positive test results but also for those with abnormal Pap smear outcomes.

The HIP scale uses a comprehensive set of dimensions, including worries and concerns, emotional impact, sexual impact, self-image, partner and transmission, interactions with doctors, and control of life impact, to explore women's psychosocial burden related to HPV testing [14]. Patients who tested positive for HPV expressed that their major concern was stress of living, which developed in the context of stigma [48]. Strong stigma and fear responses have been found in women after receiving results of the tests or receiving HPV-positive results [15, 38]. A positive HPV result was related to stigma distress resulting from the belief that having multiple sexual partners or failing to get screening tests leads to HPV infection [49]. Women even expressed that HPV infection was a shameful disease due to its sexually transmitted nature [13, 48]. Abnormal results, HPV infection, and cervical cancer diagnoses make women suffer because of altered self-image due to perceived or anticipated stigma [49]. Moreover, patients who were infected with HPV had concerns about the spread of the virus and issues of unfaithfulness [48]. Psychosexual and informative counseling for HPV-positive women have become necessary and important so they can communicate and deal with the reactions of their sexual partners [44, 50]. Also, women worry about being infected, the possibility of reinfection after recovery, and the development of cancer [15, 48]. Some women might decide to abstain from sex completely to prevent HPV contagion [13]. However, for women who have chosen this route, the tension in their marital relationships increased to the point of possible separation or divorce [13, 48]. Therefore, the emotional impact of HPV testing is strong, and identification of women's emotional consequences and psychosocial issues arising from HPV testing and diagnosis is a high priority for healthcare professionals [38] because prevention measures are ongoing. Moreover, women with an HPV-positive result will become more active observers of health-care professionals' confidentiality and privacy practices. In turn, this will make health-care professionals more inclined to use nonjudgmental language and behaviors, comply with ethics in research and practice, and consider patients' financial issues [19].

We also found that the psychosocial burden on women with HPV-positive results was inversely related to their age. Even in the final model of women with HPV-positive results, age remained a significant predictor of psychosocial burden, with younger women reporting higher levels of distress. Few studies have previously examined the relationship between a woman's age and her psychosocial burden upon receiving HPV-positive results. Young age has been indicated to be a risk factor of HPV infection [50] because younger women tend to be more sexually active. Also, younger women generally have greater concern about the effects of HPV on fertility [44] since it has been shown to have such an impact [51], which might increase their psychosocial burden. An increased risk of adverse pregnancy outcomes among HPV-positive women has also been demonstrated, including miscarriage, preterm birth, low birth weight, intrauterine growth restriction, and fetal death [52]. Therefore, health-care professionals should pay close attention to younger women with fertility concerns to provide adequate and timely information related to HPV to meet their psychosexual needs and alleviate their psychosocial burden.

Our study also found that women's psychosocial burden was significantly predicted by NA and PA, with NA being the strongest predictor of women's psychosocial burden when receiving positive results of HPV testing. However, it is hard to compare this study's results with previous literature because few studies explored the effects of NA and PA on psychosocial burden related to women with positive HPV tests. Women with more positive moods reported lower HPV-related psychosocial burden in this study. The reason is thought to be that women with positive moods might be more active in searching for HPV knowledge and have more positive attitudes about handling HPV-related issues, which would alleviate their psychosocial burden related to those issues. According to the literature, women with higher levels of HPV-related knowledge had lower anxiety, fewer concerns about the test results, and better quality of life [50]. Our study did not evaluate women's knowledge levels of HPV before they received the test results. However, based on a previous study focusing on Taiwanese women infected with HPV, most women do not know about HPV infection before discussing it with their physicians or reading about it in newspapers and on the Internet [15]. Women's knowledge level is expected to increase in the next few years as a result of the Taiwanese government's promotion of the HPV vaccine and development of new technology such as HPV self-sampling. Having adequate information about HPV helps women feel less stressed [48]. Regardless of HPV test results, patients with better knowledge of HPV would have higher self-confidence in their abilities to deal with health problems related to sexually transmitted infections (STIs) and to prevent cervical cancer [45]. In addition, positive attitudes or moods associated with strength, calm, relaxation, cherishing, blessing, and sympathy could help women positively adjust their sexual behaviors-limiting the number of sexual partners, using condoms, avoiding oral or anal sex, and having regular check-ups—to prevent worse outcomes like the development of cervical cancer [13, 15].

As expected, our findings indicated that women with more-negative moods tended to have higher psychosocial burden related to HPV issues. The reasons are that most women had higher fear and anxiety after learning about HPV [53], and higher awareness of HPV was significantly associated with higher concerns about the test results and perceived risk of developing cervical cancer [54]. HPV testing and colposcopy were associated with psychological distress and anxiety, and most women were unprepared for an HPV-positive result [54]. Further, low levels of HPV-related knowledge contribute to psychological distress and consequently negatively influence adherence to further gynecological treatment after the testing [55]. On the contrary, women who obtained helpful information and support from their health-care professionals felt particularly comfortable, especially when receiving statistical health information that made them feel less alone [22]. Therefore, increasing the awareness of HPV infection as a common condition and encouraging women to limit potentially negative consequences by attending regular follow-up checks and obtaining appropriate medical interventions would alleviate women's negative feelings and moods when receiving the test results [56]. Placing emphasis on the differences between HPV and other sexually transmitted infections might also decrease negative moods and facilitate the normalization of HPV infection and the acceptance of HPV testing [56–57]. However, health-care professionals should also understand that HPV is still surrounded by stigma because it is sexually transmitted, and women's perceptions and feelings at the time of diagnosis remain the central factor in their understanding and following recommendations, such as disclosure, follow-up testing, and gynecological procedures [38]. Furthermore, Taiwanese women generally adhere to the traditional Chinese culture regarding love, sex, and marriage, which is relatively conservative; sex is still a taboo issue even within a couple [58]. Therefore, the roles of health-care professionals become increasingly important, and more attention should be paid to communicating and providing information related to HPV, especially for women with high negative moods who are infected with HPV.

Study limitations

We should acknowledge that there are a few limitations in this study. First, the study findings may not be generalized to other populations because the women who participated were recruited from one medical center in North Taiwan. Second, the cross-sectional study design did not allow for observing changes in participants' psychosocial burdens from pre-HPV test to post-HPV test results, even when following the HPV-positive women for a year. Future longitudinal studies will help to assess the changes in the variables over time and clarify the effects of an HPV-positive result on women's psychosocial burden. Third, the study used a quantitative study design, which did not allow for ascertaining the deeper feelings and experiences of women who obtained reports of their HPV tests. A qualitative study design would obtain additional information that would help women improve the sexual impact, mitigate effects on their self-images, and alleviate their worries and concerns, as well as decrease their total psychosocial burden related to HPV testing.

Conclusions

Because the HPV test is administered as a primary screening test or follow-up test, the number of women undergoing HPV testing is growing. Women's psychosocial burden related to HPV issues increases when obtaining the test's results, especially regarding their sexual impact. Health-care professionals should volunteer sexual information related to HPV infection because women might hesitate to raise such questions due to embarrassment. Furthermore, health-care professionals should also be more aware of the effects of younger age and a positive HPV result combined with lower PA and higher NA on women's psychosocial burden after receiving the reports. To help alleviate women's psychosocial burden, healthcare providers could give them timely and appropriate knowledge of HPV infection to satisfy their informational needs and reserve time for their questions, especially for those with higher NA.

Abbreviations

HPV	Human papillomavirus
HR-HPV	High-risk HPV
HIP HPV	Impact Profile
PA	Positive affect
NA	Negative affect
QoL	Quality of life
CGMH	Chang Gung Memorial Hospital
IRB	Institutional Review Board
EQ-5D-5L	European Quality of Life Index Version 5D 5-Level
I-PANAS-SF	International Positive and Negative Affect Schedule-Short
	Form
SD	Standard deviation

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Author contributions

C. C. Li and T. C. Chang developed the study design and concept. L. Chen and C. C. Li conducted the data analysis and interpretation. C. C. Li, C. H. Huang, and C. W. Chang were responsible for drafting and revising the manuscript. Finally, C. C. Li, T. C. Chang, and Y. F. Tsai gave their final approval of the manuscript version to be published.

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Data availability

The data sets are available from the corresponding author upon reasonable request with proper approval by the IRB.

Declarations

Ethics approval and consent to participate

The Institutional Review Board at the Chang Gung Memorial Hospital approved all study procedures (IRB No.: 201701477B0), and informed consent was obtained from all women who participated in this study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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