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Healthcare Information and the Utilization of Pap-smear Testing amongst Taiwanese Women

Yen-ju Lin
Department of Public Finance and Taxation, National Taichung University of Science and Technology

Tsai-ching Liu
Department of Public Finance, National Taipei University, Taiwan

Chin-shyan Chen
Department of Economics, National Taipei University, Taiwan

Abstract

This study is to investigate the determinants of healthcare information amongst women in Taiwan aged between 25 and 69 years, and the association with cervical cancer screening.A two-stage estimation model was adopted for this investigation. In the first stage, the determinants of healthcare information were estimated by the OLS method, with the predicted values of the healthcare information then being linked to the decision to undergo Pap-smear testing. The nationwide survey dataset was obtained from the 2002'Health Promotion of Knowledge, Attitudes and Practice' (HPKAP) in Taiwan, provided by the Bureau of Health Promotion. A total of 9,106 individuals were included in the analysis. The results reveal that the variations in the level of healthcare information are an important contributory factor to the utilization of cervical cancer screening in Taiwan. Therefore, in addition to providing free screening under the NHI, it is important for the healthcare authorities to place greater effort into strengthening the knowledge and information on cervical cancer screening and Pap-smear testing, for those who are currently less informed, so as to enhance the overall efficiency of the screening program.

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Contact: Yen-ju Lin - yenru@nutc.edu.tw, Tsai-ching Liu - tching@mail.ntpu.edu.tw, Chin-shyan Chen - stan@mail.ntpu.edu.tw.
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1. Introduction

As the most common form of female malignancy and the leading cause of death amongst women in many countries, cervical cancer clearly poses a major health problem. Papnicolaou (Pap) smear testing has been identified as the most effective method available for reducing both the incidences and the mortality rate arising from this extremely invasive form of cancer. If detected and treated sufficiently early, through the use of Pap-smear testing, the cure rate for cervical cancer can be as high as 70 to 90%. Many countries have therefore developed appropriate methods for the early detection of cervical cancer and are striving to achieve high levels of adoption of such preventive healthcare services.

The prior studies have revealed a variety of factors associated with Pap-smear testing rates, including socio-demographic characteristics, the cognition of preventive healthcare, geographical location and the accessibility of medical healthcare services. Those women regarded as being in the lower socioeconomic status (SES) category, including older women (≥ 60 years), those who are less educated, and those on lower incomes, are less likely to undergo cervical smear examinations. Similar analyses have also demonstrated that poor accessibility, women who are unmarried, those living in rural areas and those lacking health insurance coverage were major predictors of low cervical cancer screening rates.

Numerous studies, going as far back as Arrow (1963), have found healthcare information to be a key determining factor in the demand for medical healthcare services, with Kenkel (1990) representing the first study of its kind to undertake direct measurement of medical healthcare information in the estimation of the demand for such services.

Hsieh and Lin (1997) also used direct measurement to examine the linkage between healthcare information and the demand for preventive care amongst the elderly in Taiwan, whilst Parente et al. (2005) similarly explored the impact of knowledge on the demand for preventive healthcare amongst the elderly. All of these studies have provided support for the notion that individuals with greater levels of information are significantly more likely to use medical healthcare or preventive services.

There are, however, no empirical studies which have specifically set out to explore the relationship between healthcare information and the demand for Pap-smear testing. Whilst there are those studies which have confirmed that women with higher education are more likely to be screened (Hou et al. 2002; McFarland, 2003; Sabates and Feinstein, 2006), these studies have tended to use only the level of education as an indirect proxy for measuring information, and have generally failed to directly measure the determinants of women's healthcare information. Educational attainment has been shown to have an impact on cervical cancer screening utilization (Hou et al. 2002; McFarland, 2003; Sabates and Feinstein, 2006), however, it is very difficult to raise the level of education for adult women (over 20 years of age); it is, nevertheless, much easier to promote higher levels of healthcare information.

Therefore, in this study we aim to directly examine the determinants of female healthcare

information and the linkage between such information and the utilization of Pap-smear testing amongst Taiwanese women between the ages of 25 and 69 years.

Of those prior studies within which exploration of the factors contributing to cervical cancer screening utilization was undertaken, the majority have tended to be heavily reliant upon statewide samples or sub-populations, adopting region-specific or group-specific data. As opposed to the adoption of such potentially biased samples, we adopt nationwide survey data in this study in an effort to improve on some of the shortcomings of the prior studies.

2. Methodology

2.1 Database and Study Sample

The dataset adopted for this investigation was obtained from the 2002 survey of 'Health Promotion of Knowledge, Attitudes and Practice' (HPKAP) carried out by the Bureau of Health Promotion (BHP) at the Department of Health (DOH) in Taiwan. The survey were collected by face-to-face interviews and using a multi-stage stratified systematic sampling design method within Taiwan's 23 administrative districts. The 2002 HPKAP provides in-depth information on personal demographic and socioeconomic characteristics, including age, gender, highest educational attainment, marital status, occupation and individual income, as well as detailed information on the utilization of medical resources, the health status of individuals and other types of health-related behavior.

The 2002 HPKAP obtained a total of 32,660 observations on individuals above the age of 15 years on 30 June 2002. After discarding unusable observations, the HPKAP survey ultimately provided observations on 26,755 people during the five-month period from late October 2002 to March 2003, representing 81.9% of the target population.

However, the dataset does not provide details on Pap-smear examinations undertaken by women below the age of 25 years, nor does it contain data on females over the age of 70 years given that women of such age will rarely use Pap-smear testing, essentially because of the very low incidence rate of cervical cancer amongst women in this particular age group. Women between the ages of 25 and 69 years were therefore selected for our study sample.

After excluding all male observations ($n = 13{,}707$), all female individuals below the age of 25 ($n = 2{,}388$), those above the age of 70 years ($n = 1{,}328$) and those with missing data ($n = 226$), we were ultimately left with a total sample of 9,106 individuals for inclusion in our analysis.

2.2 Analytical Method

In order to ensure greater accuracy of the empirical results, two-stage estimation method being applied in the econometric model to explore the impact of healthcare information on the utilization of Pap-smear testing. Two equations were constructed within the empirical model,

the first of which was a measure of the determinants of health information, whilst the second provided the estimations of Pap-smear testing.

The endogenous variable of the first equation is a measure of health information (I_i) and assumed to be a function of a vector of characteristics (X_i) and a random error term $\varepsilon_{1i.}$ In the second equation, we estimate the decision to undergo Pap-smear testing ($Paptest_i$), which is clearly affected by health information (I_i), other observable individual characteristics (Y_i) and a random error term $\varepsilon_{2i.}$ These two equations can be expressed as:

$$I_i = \alpha_0 + \alpha_1 X_i + \varepsilon_{1i} \tag{1}$$

$$Paptest_i = \beta_0 + \beta_1 I_i + \beta_2 Y_i + \varepsilon_{2i} \tag{2}$$

where α_0, β_0 are constants; X_i, I_i, Y_i represent factors (independent variables) which are seen as influencing the decision to accept the healthcare information provided and undergo a Pap-smear test; α_1, β_1, β_2 are the respective sets of coefficients for X_i, I_i, Y_i; and ε_{1i}, ε_{2i} are the residuals.

Since $Paptest_i$ is unobserved, what is observed in this study is a dummy variable, $Paptest_i$, defined by:

$$Paptest_i = \begin{cases} 1 & \text{if } Paptest_i^* > 0 \\ 0 & \text{otherwise.} \end{cases} \tag{3}$$

In the first stage, the reduced-form equation on healthcare information is estimated by the ordinary least squares (OLS) method. Then, in the second stage, Equation (2) is estimated by means of logistic regression analysis after the predicted value for health information is replaced; this is obtained using the reduced-form, two-stage estimation method suggested by Maddala (2004). The major characteristic of the econometric model is that in Equation (2) we treat healthcare information as an endogenous explanatory variable.

2.3 Principal Variables

The first study within which an attempt was made to directly measure healthcare information was provided by Kenkel (1990). The approach developed by Kenkel is similarly applied in this study to undertake the measurement of healthcare information. Responses to a total of nine questions on information and knowledge about cervical cancer and Pap-smear testing services were collected in the HPKAP survey. We allocated a value of 1 if the answer was correct or known, a value of 0 if the answer was unknown, and a value of −1 for each incorrect answer. The *Health Information* dependent variable, defined in this study as I_i, is the sum of these nine responses reflecting the extent of the respondents' healthcare information on cervical cancer and Pap-smear testing. Another dependent variable, defined as the *Pap-smear test*, indicates whether or not a respondent had undergone cervical cancer screening within the past year. The *Pap-smear test* variable was dichotomous, with a score of 1 being allocated if the woman had undergone screening within the past year; otherwise 0.

In the exploration of the healthcare information factors (X_i), the explanatory variables applied comprised of (i) socio-demographic factors of the respondents, including age, individual monthly income, marital status, educational attainment and healthcare occupation; (ii) geographical factors, including residential location and urban/rural strata; and (iii) health behavior factors, including smoking and drinking.

The *Age*, *Individual Monthly Income*, *Marital Status*, *Residential Location* and *Urban/Rural Strata* variables were also used in the decision to utilize cervical cancer screening (Y_i). Two additional important factors, a history of gynecological disease and whether or not advice notes had been received from the health authorities, were also included in the determinants of Pap-smear test utilization. Owing to the gynecological disease is likely to be identified by an obstetrician or gynecologist, the doctor's suggestions could come in through the variable of history of gynecological disease to influence the Pap-smear testing. The interaction term "health information*gynecologic disease" also added in Equation (2) to clarify the issue regarding whether doing more pap-smear testing is due to more accurate information of the productivity or a physician's demand inducement or both. Full details of the dependent and independent variables are provided in Table 1, along with their definitions.

The *Education* variable is excluded from Y_i because, as suggested by Kenkel (1990)**,** the primary role of education in this context is through healthcare information; this is also consistent with the theoretical model of Grossman (1972).

3. Results

The descriptive statistics of the variables are provided in Table 2, where the mean of the *Health Information* variable in this sample was about 5.38, ranging between −2 and 9. Over 50 % of the total study sample ($n = 9{,}106$) was aged between 30 and 49 years. Approximately three-quarters of the study sample were married or were cohabiting with a partner. Table 2 also reveals that 43.09% of the sample had reported that they had undergone a Pap-smear test within the past year, whilst around 36% reported that they had received advice notes on cervical cancer screening and Pap-smear testing from the health authorities.

The largest component of the sample, about 37%, had graduated from primary school or below, with only 1.7% of the total sample being engaged in a healthcare occupation. The majority of the respondents came from the Southern and Northern regions of Taiwan, with greater numbers of the women being located in the city regions than in villages and towns.

Details of the regression results on healthcare information and the utilization of cervical cancer screening are summarized in Table 3. The results of the OLS analyses on the determinants of healthcare information indicate that younger women had a significant and positive correlation with higher levels of healthcare information; this may be simply explained by those respondents with higher incomes having greater incentives to acquire healthcare information and knowledge on the merits of Pap-smear testing. We also found that

married women generally tended to be better informed than those who were unmarried.

As anticipated, those with higher educational attainment and those working in healthcare occupations, such as doctors or nurses, were significantly more likely to acquire more healthcare information. However, it was very interesting to note that whilst those living in the Southern regions were less informed about the merits of cervical cancer screening, those who were located in the Eastern and Penghu regions tended to be better informed. As expected, current smokers or drinkers were also found to have significantly lower levels of healthcare information. As Table 3 reveals, after adjusting for other factors, women who were more informed were significantly more likely to undergo cervical cancer screening; this major finding suggests that healthcare information does play a crucial role in the decision by women to utilize Pap-smear testing.

The results also show that women who were aged between 25 and 29 years, unmarried, residing in the Southern regions and living in city areas had a significantly negative association with the utilization of Pap-smear testing. Finally, those women who had previously suffered from any type of gynecological disease and those who received advice notes from the health authorities also had a highly positive correlation with the utilization of Pap-smear testing. We also found that the interaction variable (health information*gynecologic disease) has significant and positive effect on the probability of receiving Pap-smear test. It indicates that the more informed women suffered from gynecological disease had higher probability of undergoing the cervical cancer screening services.

4. Discussion and Conclusions

The primary aim of this study was to examine those factors associated with the determinants of healthcare information and the role of healthcare information in the demand for cervical cancer screening through Pap-smear testing. Generally, we find that consumers who were more informed had a better evaluation of the marginal product of medical healthcare; thus, the effect of information on medical healthcare demand is regarded as being positive. Similarly, the healthcare information gained by consumers is also seen as playing a crucial role in the determinants of demand for preventive healthcare services.

Although the empirical results obtained by some of the prior studies have confirmed that educational level has a significant positive effect on the utilization of Pap-smear testing (Hou et al. 2002; McFarland, 2003; Sabates and Feinstein, 2006), these studies invariably failed to undertake any direct measurement of healthcare information, and indeed, they simply used the education variable to represent the level of healthcare information.

We believe that the two-stage empirical method adopted for use in this study succeeds in making this the first study of its kind to attempt to explore the association between healthcare information and the utilization of the Pap-smear testing. Our empirical results are in line with

the findings of Kenkel (1990) and Hsieh and Lin (1997).

We find that younger respondents, those who are married, with higher individual monthly incomes, better education and working in a healthcare field have a significant correlation with more healthcare information. This implies that the payoff term for younger individuals is longer, that healthcare information is a normal good, and that the opportunity costs of receiving information are lower for highly educated individuals and those in healthcare occupations. As a result, these individuals have greater incentives to gather and process healthcare information. Conversely, as suggested by Kenkel (1990) and Hsieh and Lin (1997) those individuals who engage in smoking or drinking seem to pay less attention to their general health, and hence have lower incentives to acquire healthcare information.

We further find that women living in the Southern regions are less informed than those living in the Northern region, the most highly developed and populated area of Taiwan. This finding suggests that the Northern region has more extensive medical facilities, such that it is easier to obtain healthcare information. One striking finding, however, is that women living in the Eastern and Penghu regions of Taiwan are better informed than those living in the Northern region. The probable major explanation for this is the establishment by the government authorities of a series of public education policies, involving leaflets and posters on Pap-smear testing, within the mountainous, sparsely populated Eastern areas of Taiwan (Department of Health, 2002).

The major finding of this study is that after adjusting for other factors, healthcare information is an important factor contributing to the utilization of cervical cancer screening; that is, better informed women are more likely to undergo Pap-smear testing. Essentially, those respondents who were better informed also tended to be more health conscious and had greater awareness of the importance of cervical cancer screening, whereas women lacking knowledge and information on the subject would have less incentive to undergo such screening. Healthcare information therefore has a significant and positive correlation with cervical cancer screening check-ups.

One thing needs to be addressed is that the interaction of health information*gynecologic disease has positive effect on the utilization of Pap-smear screening. That is those women with more informed, specifically as a result of their prior history of gynecological disease, tend to have a greater likelihood of receiving cervical cancer screening. This implies that the obstetrician or gynecologist offer some suggestions for women on Pap-smear testing, and Pap-smear screening is due to both more accurate information of the productivity and physician's demand inducement.

In 2002, for every 100,000 women in Taiwan, the morbidity for cervical cancer was 51.88, whilst the mortality rate stood at 8.53, reflecting the highest incidence rate and fifth highest cause of death from all female malignancies (Taiwan Cancer Registry, 2002). In July 1995, in an attempt to promote better utilization of Pap-smear testing, free annual cervical

cancer screening was provided under the NHI for all women aged ≥30 years. Thereafter, in their efforts to raise accessibility to Pap-smear testing, more than 90% of all eligible obstetric and gynecological hospitals and clinics subsequently signed agreements with the NHI for the provision of these services (Department of Health, 2002). Thus, the government authorities' attempts to eliminate financial barriers so as to enhance accessibility to Pap-smear testing resulted in the testing rate under the NHI rising to 30-40% between 1996 and 2002 (Taiwan Cancer Registry, 2002); however, this testing rate still remains much lower than in the developed countries, where 70-80% usage rates are being reported.

Although educational attainment has been shown to have a significantly positive correlation with cervical cancer screening utilization, it is very difficult to raise the level of education for adult women (over 20 years of age); it is, nevertheless, much easier to promote higher levels of healthcare information. Our empirical results confirm that healthcare information has a crucial role in raising both awareness and the utilization of Pap-smear testing in Taiwan. Thus, it is of significant importance that in addition to free insurance coverage under the NHI for the provision of annual Pap-smear testing for women aged ≥30, and balancing the access to Pap-smear testing throughout the various regions, the health authorities should also aim to strengthen the knowledge and information on cervical cancer screening and Pap-smear testing for those who have less knowledge on the subject as a whole.

If we are to achieve high levels of utilization of Pap-smear testing, we cannot simply rely upon the free screening program provided by the NHI and the various regional promotional strategies; more effort will clearly be required to raise information levels amongst older, lower income and unmarried females in non-healthcare occupation, who are inherently less informed.

The major inherent limitation of this study is that the questionnaire began in October 2002, after the launch of the NHI program, hence resulting in all of the pre-NHI data being unavailable to us. We cannot, therefore, explore any comparison of the impact of healthcare information on cervical cancer check-ups in the pre-NHI and NHI implementation period. Nevertheless, this empirical study should prove useful in providing guidelines for health authorities in their attempts to achieve high levels of cervical cancer screening, over and above the free screening provided by the NHI program and the elimination of the barriers to access to screening in the more remote areas.

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Table 1: Definitions of dependent and independent variables

Variable	Definition
Dependent variables	
Health Information	Sum of scores for 9 questions about the information and knowledge associated with cervical cancer and Pap-smear test
Pap smear test	Dummy variable=1 if woman accept Pap smear test, other=0
Independent variables	
Socio-demographic factors	
Age	
25-29	Dummy variable=1 if woman's age in this range, other=0
30-39	Dummy variable=1 if woman's age in this range, other=0
40-49	Dummy variable=1 if woman's age in this range, other=0
50-59	Dummy variable=1 if woman's age in this range, other=0
60-69	（Woman's age in this range is the reference category）
Individual monthly income	Woman's income including salary, rent revenue, capital gain and pension
NT $ 0-4,999	（Woman's income is 0 is the reference category）
NT $ 5,000-19,999	Dummy variable=1 if woman's income in this range, other=0
NT $ 20,000-39,999	Dummy variable=1 if woman's income in this range, other=0
NT $ ≥ 40,000	Dummy variable=1 if woman's income in this range, other=0
Marital status	Dummy variable=1 if woman have married or live with cohabitant, other=0
Education	
Primary school and below	（Primary school and below is the reference category）
Junior high	Dummy variable=1 if woman finished Junior high school, other=0
Senior high	Dummy variable=1 if woman finished Senior high school, other=0
College and above	Dummy variable=1 if woman finished College and above, other=0
Health occupation	Dummy variable=1 if woman in health occupation such as doctor, dentist, pharmacist, nurse, medical technician or optician, other=0

Economics Bulletin, 2012, Vol. 32 No. 1 pp. 67-79

Variable	Definition
Geographic factors	
Residential locations	
North	Dummy variable=1 if the household is located in: Taipei Hsien, Keelung city, Ilan Hsien, Taoyuan Hsien, Hsinchu Hsien, Miaoli Hsien, Taipei Municipality（North is the reference category）
Center	Dummy variable=1 if the household is located in: Taichung Hsien, Changhwa Hsien, Nantou Hsien, Yunlin Hsien, Taichung City
South	Dummy variable=1 if the household is located in: Chiayi Hsien ,Tainan Hsien, Kaohsiung Hsien, Pingtung Hsien, Kaohsiung Municipality, Chiayi City, Tainan City
East and Penghu	Dummy variable=1 if the household is located in: Taitung Hsien, Hwalien Hsien, Penghu Hsien
Urban/rural strata	
City	Dummy variable=1 if woman lives in the megalopolis, other=0
Village/Town	（Woman lives in the village or town is the reference category）
Health behavior factors	
Smoking	Dummy variable=1 if woman smokes cigarettes currently, other=0
Drinking	Dummy variable=1 if woman drinks alcohol currently, other=0
Gynecologic disease	Dummy variable=1 if woman have gynecologic disease, other=0
Advice note	Dummy variable=1 if woman have received advice note of Pap-smear test service from health authorities, other=0

Economics Bulletin, 2012, Vol. 32 No. 1 pp. 67-79

Table 2: Descriptive statistics of the variables (n=9,106)

Variables	Mean	Standard Deviation	Minimum	Maximum
Dependent variables				
Health Information	5.3755	2.7463	-2	9
Pap smear test	0.4309	0.4952	0	1
Independent variables				
Socio-demographic factors				
Age	44.2316	12.4239	25	69
25-29	0.1338	0.3404	0	1
30-39	0.2717	0.4449	0	1
40-49	0.2577	0.4374	0	1
50-59	0.1783	0.3828	0	1
60-69	0.1585	0.3652	0	1
Individual monthly income				
NT $ 0-4,999	0.3342	0.4717	0	1
NT $ 5,000-19,999	0.2809	0.4495	0	1
NT $ 20,000-39,999	0.2517	0.4340	0	1
NT $ ≥ 40,000	0.1332	0.3398	0	1
Marital status (Married)	0.7583	0.4281	0	1
Education				
Primary school and below	0.3671	0.4821	0	1
Junior high	0.1517	0.3587	0	1
Senior high	0.2708	0.4444	0	1
College and above	0.2104	0.4076	0	1
Health occupation	0.0168	0.1285	0	1
Geographic factors				
Residential locations				
North	0.3002	0.4584	0	1
Center	0.2495	0.4328	0	1
South	0.3389	0.4734	0	1
East and Penghu	0.1114	0.3146	0	1
Urban/rural strata				
City	0.5768	0.4941	0	1
Health behavior factors				
Smoking	0.0502	0.2183	0	1
Drinking	0.2297	0.4207	0	1
Gynecologic disease	0.0584	0.2346	0	1
Advice note	0.3553	0.4786	0	1

Table 3: Regression analyses for information and decisions of Pap-smear test acceptance

Variables	Health Information		Pap-smear test	
	Coefficient	P -value	Odds ratio (95% CI)	P -value
Health Information	--	--	0.077 (0.045～0.110)	＜0.0001
Socio-demographic factors				
Age				
25-29	1.392	＜0.0001	0.496 (0.381-0.634)	＜0.0001
30-39	1.810	＜0.0001	1.002 (0.801-1.275)	0.901
40-49	1.706	＜0.0001	1.091 (0.892-1.325)	0.372
50-59	1.198	＜0.0001	1.101 (0.894-1.233)	0.217
60-69	reference category		reference category	
Individual monthly income				
NT $ 0-4,999	reference category		reference category	
NT $ 5,000-19,999	0.182	0.002	1.011 (0.985-1.129)	0.995
NT $ 20,000-39,999	0.351	＜0.0001	1.024 (0.904-1.082)	0.510
NT $ ≥ 40,000	0.279	0.001	1.084 (0.921-1.269)	0.219
Marital status (Married)	0.772	＜0.0001	2.433 (2.241-2.773)	＜0.0001
Education				
Primary school and below	reference category		reference category	
Junior high	1.696	＜0.0001	-- --	--
Senior high	2.369	＜0.0001	-- --	--
College and above	2.540	＜0.0001	-- --	--
Health occupation	1.328	＜0.0001	-- --	--
Geographic factors				
Residential locations				
North	reference category		reference category	
Center	0.030	0.653	0.882 (0.780-1.002)	0.080
South	-0.124	0.036	0.781 (0.701-0.832)	＜0.0001
East and Penghu	0.305	＜0.0001	1.012 (0.825-1.169)	0.766
Urban/rural strata				
City	0.136	0.007	0.801 (0.699-0.836)	＜0.0001
Health behavior factors				
Smoking	-0.555	＜0.0001	-- --	--
Drinking	-0.140	0.013	-- --	--
Gynecologic disease	--	--	2.243 (1.913-2.783)	＜0.0001
Advice note	--	--	1.239 (1.128-1.299)	＜0.0001
Interaction term				
Health information*Gynecologic disease			1.143 (1.114-1.172)	＜0.0001