Original Research Article

Comparison of Healthcare Resource Utilization (HcRU) Between Age Groups of Women Diagnosed with Gynecological Cancers in the U.S.

Abstract

Objective: Previous studies have shown that older women are more likely to be diagnosed with gynecological cancers (GC) setting precedent for more attention to be given to older women than younger women with GC. This study sought to compare nationally representative healthcare use among younger women and older women diagnosed with gynecological cancer in the United States.

Methods: A retrospective cross-sectional repeated measures design was used to make comparisons between baseline characteristics of two age groups of women diagnosed with gynecological cancers. Data were extracted from the National Health Interview Survey (NHIS). A weighted sample of 2633569 responses who reported having at least one kind of GC was included from 2015 to 2018. GC was defined as those who reported having uterine, cervical, or ovarian cancer. Characteristics of patients were compared across two age groups. 1. Women less than 50 considered to be most likely premenopausal. 2. Women more than 50 considered to be most likely postmenopausal. Nine health services use were also quantified between both age groups and a multivariable logistic regression model was used to determine the likelihood of health care use among both age groups with the older women being the reference group.

Results: Among the baseline characteristics, alcohol use and smoking were seen to be most prevalent among the younger women with the following proportions 88% and 79.93% for alcohol use and 59.79% and 50.26% for smoking at $p<0.01$. Younger women had higher obstetrics and gynecologic visits Odds Ratio (OR) 2.13 (1.59-2.84), Emergency room visits OR 1.55 (1.17-2.06), Hospitalization OR 1.57 (1.15-2.14), Preventive care OR 2.49 (1.88-3.31). Adjusting for Alcohol use and smoking yielded similar odds ratio. Patterns of hospitalization increased over time for younger women and use of surgery and surgical procedures was not statistically significant among both age groups.

Conclusion: Based on this study, younger women tend to use comparable healthcare services as older women diagnosed with gynecologic cancer. Therefore, more studies should be conducted with the inclusion of younger women.

Keywords: Healthcare Resource Utilization, Uterine neoplasm, Cervical neoplasm, Ovarian neoplasm, Menopausal.

Introduction

According to Centers for Disease Control and Prevention (CDC), gynecological cancer (GC) refers to when malignant cells originate from the female reproductive organs. There are five major types: cervical, ovarian, uterine, vaginal, and vulvar cancers 1. All women are at risk of developing one or more types of GC and the risk increases with age. Between 2012-2016, about 94,000 women were diagnosed with gynecological cancer each year 1. It is interesting to note that Uterine cancer is the fourth most common cancer for women in the U.S with about 66% diagnosed at an early stage due to the abnormal vaginal bleeding that occurs as an early symptom 2. Incidence rate for cervical cancer has dropped by more than 50% in the past 50 years due to screening exercises that can detect changes in the cervix before they become malignant 3. There has been an upward trend in the incidence of Ovarian cancer owing to the increasing use of oral contraceptives and hormonal therapy for menopausal women 4.GC generally accounts for about 11.2% of all female deaths 5.

Over the years, it has been discovered that GC is more prevalent in older, mostly post-menopausal women 6. This has gathered much attention in the scientific community, encouraging research that could improve health outcomes for older women with GC 7,8. However, little research attention has focused on the clinical burden of GC among younger, mostly premenopausal women 9. This research focuses on self-reported use of health care resource of younger women with GC when compared to older women to improve their health outcomes and general survivorship.

The main objective of this study was to compare healthcare use among two distinct age groups of women with GC. i.e., women most likely to be pre-menopausal and women most likely to be post-menopausal.

Materials and Methods

1. Study design and data source

A retrospective cross-sectional repeated measures study was conducted to compare all patient-reported demographics and HcRU related to GC in women most likely to be pre-menopausal and women most likely to be post-menopausal using the sample adult file of NHIS (National Health Interview Survey) data from 2015 to 2018. NHIS is the principal source of information on the health of the civilian noninstitutionalized population of the United States. It is one of the major data collection programs of the National Center for Health Statistics (NCHS) which is part of the Centers for Disease Control and Prevention (CDC). The main objective of NHIS is to monitor the health of the United States population through the collection and analysis of data on a broad range of health topics 10.

2. Study Sample

We identified women who reported having a diagnosis of either of the following: Cervical, Ovarian or Uterine cancer. Few women in the cohort had more than one GC. In this study, women most likely to be premenopausal were defined as those who are less than 50 years old

while women who are most likely to be post-menopausal were defined as those more than 50 years old.

3. Baseline demographics, Clinical and Behavioral Characteristics

According to the systematic review conducted by Phillips et al., we utilized the behavioral model of health services utilization as a framework 11. we selected our covariates based on individual and population level factors of patients in the cohort. These include Risk factors (race, marital status, obesity, pregnancy 12, 13, 14) Enabling factors (health insurance coverage, region in the U.S 15,16), Behavioral factors (smoking, drinking 17).

4. Health Care Resource Utilization

We focused on nine areas of HcRU which are: obstetrics and gynecological visit, specialist visit, general practitioner visit, hospitalization or in-patient admissions, emergency room visit, office-based services, home healthcare services, surgery and surgical procedures, preventive healthcare. Preventive health care focused on women in the cohort who have ever undergone pap smear or who have received HPV vaccination. The number of individuals who reported utilizing any of the above health service was recorded at baseline and proportions were also taken by age group.

5. Statistical Analysis

Baseline characteristics and outcome measures of interest were obtained for individuals in the cohort. We reported count and column percentage for categorical variables. The covariates were: race, census region, marital status, obesity, smoking, alcohol, health insurance, and pregnancy. Comparison between defined age groups of the women in the cohort was done for baseline characteristics using the Pearson's chi square (χ^2) test.

For HcRU, values for the nine areas mentioned above was computed and stratified amongst age group. Pearson's chi square (χ^2) test was used as a measure of association. Annual trends in health care resource utilization Fig.1. was extrapolated to give an insight on the independent changes happening across each year within the study period.

A univariate logistic regression model was used to compare HcRU between women most likely to be pre-menopausal (defined as women < 50 years) and women most likely to be post-menopausal (defined as women >50 years) across nine areas of health services mentioned above. Only predictors with $p<0.05$ were utilized for multivariate logistic regression model.

All statistical analysis were performed using SAS v9.4 ((SAS Institute Inc, Cary, NC), and statistical significance was set at $\alpha = 0.05$.

6. Classification of Evidence

This study provides a class IV evidence that women most likely to be premenopausal diagnosed with GC can use comparable health care resources with postmenopausal women diagnosed with GC despite GC being more prevalent in women most likely to be postmenopausal. link

Results

Based on our data, Gynecological cancers were discovered in 1518 responses representative of 2633569 responses who reported having at least one kind of GC. We had 1047 women (1742470 weighted) who are most likely to be post-menopausal and 471 women (891099 weighted) who are most likely to be pre-menopausal. The following cases were found for the individual types of GC: 577 women reported having Uterine cancer, 728 women with Cervical cancers, and 323 Ovarian cancers. The mean age and standard deviation of the women with GC was: Uterine (64 ± 13), Cervical (53 ± 15) and Ovarian (60 ± 15). Overall, the mean age of women in the cohort was (58 ± 16). Statistical significance at $p<0.05$ was achieved for behavioral factors in the study which includes alcohol consumption and smoking.

Based on this study, Table 1 displays the baseline characteristics of women in the cohort. Alcohol use and smoking was associated with the two age groups being compared at $p<0.05$. In simpler terms, pre-menopausal women were more likely to consume alcohol when compared to post-menopausal women with approximate values of 88% and 79.93% respectively. For smoking, the approximate values are 59.79% and 50.26%.

Health Care Resource Utilization

Table 2 displays percentage values for HcRU of interest across age groups considered to be premenopausal and most likely postmenopausal. Based on our data, Premenopausal women utilized more healthcare for Obstetrics and Gynecological visits (51.78% vs 33.51%), Emergency room visits (41.29% vs 31.19%), Hospitalization (30.59% vs 21.9%) and Preventive care (46.33% vs 25.72%). Surgery/surgical visits was the only HcRU parameter of interest that was not statistically significant at $p<0.05$.

Figures (A-I) illustrated annual trends in HcRU. A clear distinction was marked for premenopausal women in the four areas mentioned above where they tend to use more healthcare than postmenopausal women. One notable outcome of this research was the upward trend in hospitalization for premenopausal women.

Table 3 displays results from the logistic regression models comparing premenopausal women with GC and postmenopausal women with GC. Out of nine parameters of interest, premenopausal women showed significant HcRU in four of the parameters. With the following results: Obstetrics and Gynecological visits (OR 2.38, (95% CI 1.89-2.97)), Emergency room visits (OR 1.73, (95% CI 1.39-2.17)), In-patient hospitalization (OR 1.92 (95% CI 1.51-2.43)), Preventive care (OR 2.695 (95% CI 2.14-3.39)). Surgery/surgical visits was not consistent with an association between premenopausal and postmenopausal women. Comparable results were observed in the sensitivity analysis displayed in Table 4.

Table 1: Sample demographic characteristics of women with gynecologic cancers, 2015-2018.

Baseline		**Overall n= 2.63 * 10^6**	**Post-menopausal n= 1.74 * 10^6**	**Pre-menopausal n=0.89 * 10^6**	**P**
Race n(%)	White	2.25 (85.3)	1.5 (86.26)	0.74 (83.43)	0.2636
	Not White	0.38 (14.7)	0.23 (13.74)	0.15 (16.57)	
Marital Status n(%)	Married	1.28 (48.63)	0.86 (49.13)	0.42 (47.67)	0.68
	Not Married [a]	1.35 (51.36)	0.89 (50.87)	0.47 (52.33)	
Alcohol n(%)	Never	0.46 (17.34)	0.35 (20.07)	0.11 (12)	**<0.01***
	Drinker	2.17 (82.66)	1.39 (79.93)	0.78 (88)	
Census region n(%)	Northeast	0.44 (16.79)	0.33 (18.83)	0.11 (12.81)	0.1076
	Midwest	0.68 (25.94)	0.44 (25.24)	0.24 (27.28)	
	South	0.96 (36.4)	0.61 (34.97)	0.35 (39.18)	
	West	0.55 (20.87)	0.36 (20.93)	0.19 (20.72)	
BMI n(%)	Obesity	1.18 (44.71)	0.79 (45.34)	0.39 (43.47)	0.5893
	Non-Obese	1.46 (55.29)	0.95 (54.66)	0.5 (56.52)	
Smoking n(%)	Never	1.23 (46.52)	0.87 (49.74)	0.36 (40.21)	**<0.01***
	Smoker	1.4 (53.48)	0.88 (50.26)	0.53 (59.79)	
Pregnancy n(%)	Never	0.21 (7.83)	0.13 (7.39)	0.08 (8.67)	0.45
	≥1	2.43 (92.17)	1.61 (92.6)	0.81 (91.32)	
Insurance n(%)	Unchanged [b]	1.48 (56.05)	0.99 (57.36)	0.48 (53.49)	0.2593
	Changed	1.15 (43.95)	0.74 (42.64)	0.41 (46.51)	

N/B: * refers to p-values that are <0.05 which entails statistical significance.

[a] refers to women who have never been married (i.e., excluding widowed, divorced, separated)

[b] refers to women who had the same insurance as the previous year.

Table 2: Health services use among two distinct age group of women with gynecological cancer using NHIS data.

HcRU	Overall n= 2.63 * 10^6	Post-menopausal n= 1.74 * 10^6	Pre-menopausal n=0.89 * 10^6	P
ObGyn[c] visits n(%)	1.05 (39.69)	0.58 (33.51)	0.46 (51.78)	<.0001*
Specialist visits n(%)	1.17 (44.44)	0.86 (49.13)	0.31 (35.28)	<.0001*
GP visits n(%)	2.11 (80.17)	1.47 (84.63)	0.64 (71.45)	<.0001*
Emergency room n(%)	0.91 (34.6)	0.54 (31.19)	0.37 (41.29)	0.0021*
Home health care n(%)	0.19 (7.26)	0.16 (9.09)	0.03 (3.69)	0.0014*
Office-based visits n(%)	2.43 (77.47)	1.64 (94.06)	0.79 (88.89)	0.0016*
Surgery n(%)	0.65 (24.68)	0.43 (24.76)	0.22 (24.51)	0.9352
Hospitalization n(%)	0.65 (24.84)	0.38 (21.9)	0.27 (30.59)	0.0039*
Preventive care n(%)	0.86 (32.69)	0.45 (25.72)	0.41 (46.33)	<.0001*

N/B: * refers to p-value considered to be statistically significant at $p<0.05$.

[a] refers to Healthcare Resource Utilization of patients in the cohort

[b] refers to receipt of preventive care defined as those in the cohort who have ever had pap smear or have ever received HPV vaccination.

[c] refers to Obstetrics and Gynecologist

Figure 1: Annual trends in Health Care Resource Utilization (A-I) across women with gynecological cancer stratified by age group.

A. B.

C. D.

E. F.

H.

G.

I.

Table 3: OR comparing health care resource utilization among women most likely to be premenopausal and women most likely to be postmenopausal who have gynecological cancer.

	OR (95% Cl)	*p* value
ObGyn visits	2.13 (1.59 - 2.84)	<0.001
Specialist visits	0.56 (0.43 - 0.75)	<0.001
General Practitioner visits	0.45 (0.32 - 0.63)	<0.001
Emergency room	1.55 (1.17 - 2.06)	<0.001
Home health care	0.38 (0.21 - 0.71)	0.0022
Office-based visits	0.51 (0.33 - 0.78)	<0.001
Surgery/Surgical visits	0.99 (0.72 - 1.36)	0.9354
Hospitalization	1.57 (1.15 - 2.14)	0.0044
Preventive care	2.49 (1.88 - 3.31)	<0.001

N/B: Reference group is the older women (women most likely to be postmenopausal)

OR: Odds Ratio, CI: Confidence Interval.

Table 4: OR comparing health care resource utilization among women most likely to be premenopausal and women most likely to be postmenopausal who have gynecological cancer (controlling for alcohol use and smoking).

	adj OR (95% Cl)	*p* value
ObGyn visits	2.23 (1.67 - 2.96)	<0.001
Specialist visits	0.57 (0.43 - 0.76)	<0.001
General Practitioner visits	0.46 (0.33 - 0.63)	<0.001
Emergency room	1.52 (1.14 - 2.02)	<0.001
Home health care	0.39 (0.21 - 0.73)	0.003
Office-based visits	0.54 (0.35 - 0.83)	0.0052
Surgery	0.97 (0.69 - 1.36)	0.8581
Hospitalization	1.55 (1.13 - 2.11)	0.0065
Preventive care	2.54 (1.91 - 3.38)	<0.001

N/B: Reference group is the older women (women most likely to be postmenopausal)

OR: Odds Ratio, CI: Confidence Interval.

Discussion

This retrospective cross sectional repeated measures study used NHIS data from 2015-2018 to compare HcRU among women most likely to be premenopausal and women most likely to be post-menopausal who have had at least one diagnosis of ovarian cancer, uterine cancer, or cervical cancer.

From our baseline statistics, race wasn't statistically significant when compared with both age groups, but it is known from previous studies that being white increases the risk of gynecologic cancer 18. It is also interesting to note that both age groups had similarity in being obese which interesting because there is an association between obesity and age 19. Behavioral factors like drinking and smoking were found to be strongly associated with younger women with gynecological cancer which isn't surprising because of past literatures pointing out drinking and smoking as a coping mechanisms for young adult women 20.

To improve the understanding of longitudinal use patterns, we quantified HcRU changes using a combination of descriptive statistics and regression models. Overall, of nine essential area of health care use in gynecological cancer, premenopausal women were seen to significantly use preventive health care such as pap smear and HPV vaccination which is known to prevent cervical cancer or detect it at an earlier stage. This utilization pattern is consistent with a paper written by Sirovich et al. 21. Premenopausal women were also observed to have been more hospitalized. The trend for hospitalization was also observed to have had a continuous increase throughout the study period. Although younger women are expected to have lesser hospitalization due to expected less comorbidities of certain diseases that could be predictors of increased hospitalization 22. Premenopausal women also had more frequent emergency room visits and visits to Obstetrics and Gynecologist maybe due to the fact that most of them are within reproductive age and are most likely to have a partner or be willing to have children as described by Schramm et al. 23. Surgery/surgical visits was not associated with the age group. This could be due to hysterectomy performed as a choice treatment for gynecologic cancer. Although in past literatures 22 24, younger women were seen to visit general practitioners more than older women, the reverse was the case for our current study.

Our study has several strengths, first we utilized the NHIS (National Health Interview Survey) which is the principal source of information on the health of civilian noninstitutionalized population in the United States. This survey data can capture the many demographic and socioeconomic characteristics of participants. It also finds its use in monitoring trends in illness and disability. To the best of our knowledge, this study is the first to make comparison between healthcare resource utilization of women who are most likely to be premenopausal and women most likely to be postmenopausal diagnosed with gynecological cancer in the U.S. As such, this could serve as the basis for other study to be conducted.

There are few limitations to this study. First, some important variables were missing in the previous years. As a result of missing variables, our study was limited to four years. One notable inconsistency in covariates was use of chemotherapy and absence of specific procedures like hysterectomy. Pap smear and HPV vaccination were coded differently in the 2018 data and with all the response missing. Second, given the nature of this study as self-reported questionnaire, it is subject to non-response and reporting bias. However, according to Rosenman et al. 25, there is

some agreement between self-reported questionnaires and medical records. Third, due to the short survival rate and late detection of some gynecological cancers, this population-based survey may have underestimated the prevalence.

Conclusion

This study presents some evidence that younger women who are most likely to be premenopausal utilize healthcare in a comparable way as older women who are most likely to be postmenopausal does. As such, research relating to gynecological cancer should not be limited to the most prevalent group.

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

Consent

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

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