Cardiovascular Disease Risk Factors in Menopausal Jamaican Black Women after Hysterectomy and Bilateral Oophorectomy: An Observational Study

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ABSTRACT

Objective: *To determine differences in prevalence of cardiovascular risks and diseases in black Jamaican postmenopausal women who had hysterectomy (hysgroup) compared with those without (control).*

Method: *Eight hundred and nine (809) women (hysterectomized (HYSGRP) = 403; non-hysterectomized (controls) = 406) were enrolled. Sociodemographic information and lifestyle history, measured blood pressure, waist hip ratio, body mass index, fasting blood glucose, total and HDL cholesterol were obtained.*

Results: *Of the 809 women, complete cardiovascular risk data were available in 341 controls and 328 in the HYSGRP group. There was no difference in mean age, blood pressure and body mass indices between the subjects excluded and the subjects in the data analytical sample. A significantly lower proportion of women in the control group exercised, attained post-secondary education and were of higher parity. Systolic (mean difference with 95% CI; 6 (3, 9) mmHg and diastolic (3 (1, 5) mmHg) blood pressure were lower in the HYSGRP compared with controls but total cholesterol (0.2 (0.07 to 0.4) mmol/L was greater. HDL cholesterol was not different between both groups 1.3 mmol/L (SD 0.3) vs 1.3 mmol/L [SD 0.4] (*p = *0.8435). There was no difference in the prevalence of diabetes, hypertension and high waist-hip ratio in hysterectomized women compared with controls adjusting for hormone replacement therapy usage, cigarette smoking, exercise and educational status. Within the HYSGRP, there was also no difference in cardiovascular disease or risk in women who had bilateral oophorectomy compared with women who had at least an ovary preserved at time of operation.*

Conclusion: *Hysterectomy was not associated with an increased risk of cardiovascular disease. This must be taken cautiously since data did not allow for analysis on duration of menopause.*

Keywords: Cardiovascular disease risk, hysterectomy

Factores de Riesgo de la Enfermedad Cardiovascular en Mujeres Negras Jamaicanas en la Menopausia tras Histerectomía y Ooforectomía Bilateral: un Estudio Observacional

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RESUMEN

Objetivo: *Determinar las diferencias en la prevalencia de riesgos y enfermedades cardiovasculares en mujeres negras jamaicanas menopáusicas con histerectomía, en comparación con las que no tuvieron esta operación (control).*

Método: *Se enrolaron ochocientas nueve (809) mujeres (histerectomizadas (HYSGRP) = 403; no histerectomizadas (controles) = 406). Se obtuvo información sobre datos demográficos e historia del estilo de vida, mediciones de la presión arterial, índice cintura/cadera, glucemia en ayunas, así como el colesterol total y HDL.*

Resultados: *De 809 mujeres, había disponible datos completos sobre el riesgo cardiovascular en 341 controles, y 328 en el grupo HYSGRP. No hubo diferencias significativas en relación con la edad*

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promedio, la presión arterial, y el índice de masa corporal entre los sujetos excluidos y los sujetos en las muestras del análisis de datos. Una proporción significativamente menor de mujeres en el grupo de control practicado, tuvo educación post-secundaria y fueron de paridad más alta. La presión arterial sistólica (diferencia promedio con 95% CI; 6 (3 a 9 mmHg)) y la presión arterial diastólica (3 (1 a 5 mmHg)) fueron más bajas en el grupo de la histerectomía HYSGRP en comparación con el grupo de control, pero el colesterol (0.2 (0.07 a 0.4)) fue mayor.

*El colesterol HDL no fue diferente entre los dos grupos: 1.3 mmol/L (SD 0.3) frente a 1.3 mmol/L [SD 0.4] (*p = *0.8435). No hubo diferencia en cuanto a la prevalencia de la diabetes, la hipertensión, y el alto índice cintura/cadera en las mujeres histerectomizadas, en comparación con los controles ajustándose en relación con el uso de la terapia de reemplazo hormonal, el hábito de fumar, el ejercicio, y el nivel educacional. Dentro del grupo HYSGRP tampoco hubo diferencias con respecto a las enfermedades cardiovasculares o riesgos en mujeres operadas de ooforectomía bilateral, en comparación con las mujeres a las que se les preservó por lo menos un ovario en el momento de la operación.*

Conclusión: *La histerectomía no estuvo asociada con un aumento de riesgo de la enfermedad cardiovascular. No obstante, esta conclusión debe tomarse con cautela, ya que los datos no permitieron el análisis en el período de duración de la menopausia.*

Palabras claves: Riesgo de enfermedad cardiovascular, histerectomía

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INTRODUCTION

Cardiovascular disease risk (CVD) is assessed by hypertension, diabetes mellitus, obesity as estimated by body mass index (BMI), waist circumference (WC) and waist-to-hip ratio (WHR). Adverse lipid profile and elevated fasting blood glucose are most important health problems faced by postmenopausal women. Additionally, the main risk factors for cardiovascular disease are more prevalent after the menopause. Risk factors for cardiovascular disease include ethnicity, lifestyle (diet, exercise and social habits) and oestrogen deficiency [ageing or surgery] (1). In the United States of America (USA), where most of the data on the subject has been collected, it has been reported that 500 000 women die annually from cardiovascular disease with 95% of these women over age 65 years (2). Cardiovascular disease is recognized as the leading cause of death in the postmenopausal age group. Women of Afro-Caribbean origin have, twice the cardiovascular mortality of Caucasian females according to the American Heart Association Statistics of 1994 (3).

The incidence of cardiovascular disease increases during menopause but there appears to be marked ethnic variability in its epidemiology. Cardiovascular death rates are twice as high among black women, compared to white women up to age 75 years in the USA (4) and among black women, the burden of risk factors vary between countries (5). The impact of oral contraceptives on the risk of ischaemic stroke has been found to vary with oestrogen dose in Caucasian women, while no such differences were seen among women in developing countries (6). We therefore believe that the impact of an additional factor like the menopause on cardiovascular disease cannot be assumed to be the same in different countries and ethnic groups. With cardiovascular disease now listed as the leading cause of death among women in Jamaica (7), it is imperative that the impact of all possible risk factors be estimated in order to design appropriate interventions. Despite the failure of the Women's Health Initiative Observational Study to show an independent effect of hysterectomy on cardiovascular risk among menopausal women (8), it is important that these associations be assessed in other populations where the mix of risk factors may be different. In Jamaica, hysterectomy is very common, because of the high incidence of large uterine fibroids, bilateral oophorectomy is also a common practice in women over age 45 years and hormone replacement therapy is only prescribed to women with symptoms of the menopause. This study aimed to assess the impact of hysterectomy among black Jamaican women in a country where CVD is common. This study sought to test the hypothesis that among Jamaican women, hysterectomy is associated with increased CVD risk factors compared to controls.

SUBJECTS AND METHODS

Study Design, Recruitment of Sample and Sample Size

This was a cross-sectional observational study among women who had hysterectomy with or without bilateral oophorectomy compared to age matched controls menopausal within one year of these women but who had not had the above procedures. Women were eligible for the study if they had had hysterectomy with and without bilateral oophorectomy before menopause (artificial menopause) over age 40 years. These women were compared with a group of a similar age and from similar neighbourhood that had not had hysterectomy and oophorectomy (natural menopause). Menopause was de-fined as not having menses for 1 year in women less than 55 years old or in women older than 55 years (who were assumed to be menopausal). The two groups were compared on the prevalence of hypertension,

diabetes mellitus, obesity as estimated by body mass index (BMI), waist circumference (WC) and waist-to-hip ratio (WHR), adverse lipid profile including elevated total and LDL cholesterol and reduced HDL cholesterol and elevated fasting blood glucose. Based on the estimated prevalence of 10%, 28% and 65% for diabetes (5), hypertension and obesity (9, 10) in this age group of women, a sample size of 400 per group would allow us to detect a difference in prevalence of 10% for hypertension and obesity and 5% for diabetes at 80% power.

Procedures

The clinical records of women who had hysterectomy from 1980 to 2000 at the University Hospital of the West Indies were reviewed. The addresses of the hysterectomized women were obtained and eligible women were invited by mail to participate in the study. In addition, women were invited to participate from health fairs and by posters. Non-hysterectomized controls were recruited from among the relatives of patients from the gynaecology clinic and from health fairs.

Recruited women had their measurements done at the Gynaecology Department, University Hospital of the West Indies, Mona, after an overnight fast. Evaluation consisted of the completion of an interviewer administered questionnaire to obtain sociodemographic data, lifestyle practices and past medical history information. For women who had hysterectomy, data on oophorectomy status were corroborated by pathology records where possible. This was followed by anthropometry, blood pressure records and venepuncture for fasting glucose and lipids.

Anthropometry

Weight was recorded to the nearest 0.1 kg using a balance scale (Delta meter Mechanical balance scale) after each participant removed shoes and outer clothes. Height was measured to the nearest 0.1 cm using standard technique on a stadiometer. Waist and hip circumferences were measured to the nearest cm using anthropometric tape according to standard techniques. Body mass index was computed as weight in kilograms *per* metre squared, and waist-hip ratio as ratio of waist measurement in centimetre to hip measurement in centimetre.

Blood pressure

Participants were seated for 10 minutes and thereafter three blood pressure measurements at two-minute intervals were performed on the right arm using an automated blood pressure device (Accutorr Plus Datascope, USA). The mean of the three measurements were used in subsequent analyses. Hypertension was defined as systolic pressure $\geq$ 140 mmHg and/or diastolic pressure $\geq$ 90 mmHg or on anti-hypertensive medication.

Anthropometry and blood pressure measurements were done by either a registered nurse, a doctor or by a research assistant who was taught to do the procedures.

Venepuncture

Blood samples were collected in sodium fluoride impregnated tubes for glucose and in plain tube for total and HDL cholesterol measurements. Samples were centrifuged at 2000 rpm and plasma stored at -20ºC until analysis.

Ethical Considerations

The study proposal and the instruments were reviewed and approved by the Faculty of Medical Sciences, University of the West Indies/University Hospital of the West Indies Ethics Committee. The women were given full explanation of the purpose of the study and all participants gave written informed consent.

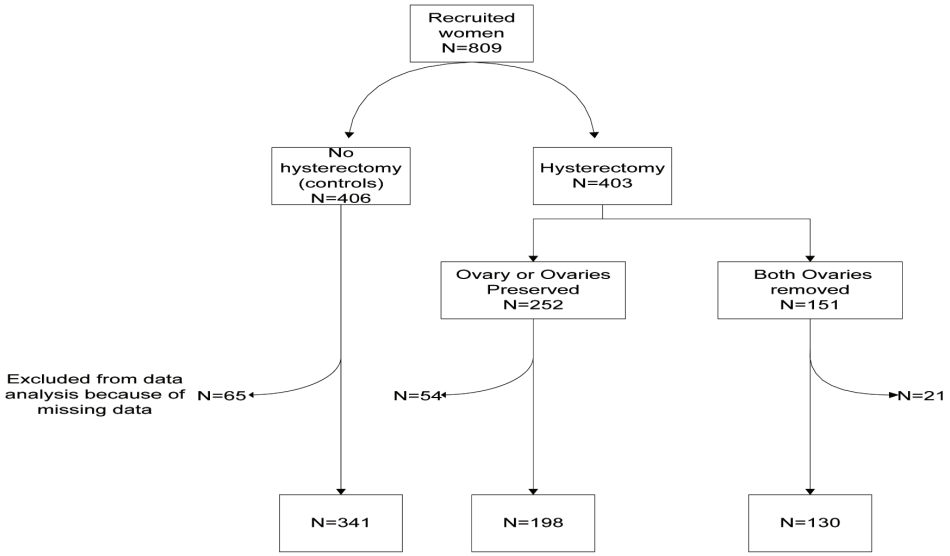
Data Analysis

The data were entered into SPSS, verified and cleaned. The Stata statistical software for Windows version 9 (StataCorp, College Station, TX 77845) was used for the analysis. The sample consisted of two groups, a control group who did not have hysterectomy (Control) and a group of women who had hysterectomy (Hysgroup). Results are expressed as counts, medians with ranges or means with standard deviations as appropriate. Independent *t*-test was used to compare means of continuous variables whilst the Mann-Whitney test was used to compare distributions of skewed continuous variables between groups. Differences between categorical variables and the hysterectomy group were tested with chi-square statistic and two sample test of proportion.

Multiple linear regressions were used to explore differences between the groups for blood pressure and total cholesterol adjusting for sociodemographic, lifestyle and anthropometry predictors. The study further explored whether adjustments for anthropometry, lifestyle factors and sociodemographic factors would expose differences in odds of cardiovascular disease risk factors *ie* hypertension, diabetes and obesity between controls and the hysterectomy group using logistic regression models.

RESULTS

A total of 809 postmenopausal black Jamaican women were recruited of which 406 (50.19%) had no surgery (Control) and 403 had hysterectomy (Hysgroup) with 252 having had Total Abdominal Hysterectomy (TAH) (31.15%) and 151 Total Abdominal Hysterectomy and Bilateral Salpingo-oophorectomy (TAHBSO) (18.67%). However, the sample for data analysis consisted of 679 as 130 women (65 women from the control group and 75 women with hysterectomy) had missing laboratory data (Fig. 1) or because they presented to the clinical research unit in a non-fasted state. Within the control group and the hysterectomized group, there was no difference in parity, as well as mean values for blood pressure and anthropometry in the group of women excluded compared with women included in the data analysis.



Variables	Controls		p value	Variables	Hysgroup		p value
	Excluded N=65	Included N=341			Excluded N=75	Included N=328	
Age yrs	59.9±10.2	59.3±9.4	ns	Age yrs	57.4±7.9	58.4±8.7	ns
Systolic blood pressure mmHg	141.3±19	144.3±23.1	ns	Systolic blood pressure mmHg	138.1±20.6	138.4±20.2	ns
Diastolic blood pressure mmHg	84.3±11.5	85.6±11.4	ns	Diastolic blood pressure mmHg	83.7±11.7	82.4±11.2	ns
Weight kg	73.3±16.4	73.6±17.3	ns	Weight kg	73.1±13.9	73.8±14.9	ns
Height cm	158.9±6.4	159.8±6.5	ns	Height cm	158.6±6.7	159.7±6.9	ns
Body mass index kg/m^2	29±5.9	28.8±6.2	ns	Body mass index kg/m^2	29.1±5.5	29±5.6	ns

Fig. 1: Flow chart of sample

There was no difference in age, anthropometry, fasting blood glucose and triglyceride concentrations as well as past medical history of cerebrovascular accidents, hypertension and diabetes between the control and hysgroup groups (Table 1). However mean systolic blood pressure (137 ± 21 *vs* 142 ± 23 mmHg, mean ± sd, $p < 0.001$), and diastolic blood pressure were lower in the Hysgroup (82 ±11 *vs* 86 ± 11, $p < 0.004$) compared with the Control group but total cholesterol concentration (6.0 ± 1.1 *vs* 5.7 ± 1.1 mmol/L, $p < 0.005$) was higher. Additionally, a higher than expected proportion of women in the Hysgroup completed post-secondary education ($\chi^2 = 14.2$, df (1), $p < 0.001$). The proportion of women who 'ever-smoked' was 15% in the Control group compared with 10% in the Hysgroup. This difference was not statistically significant ($p = 0.06$).

The difference in systolic blood pressure, diastolic blood pressure and cholesterol concentrations between the Control group and Hysgroup remained after adjusting for age, hypertension diagnostic category, lifestyle factors (ever-smoked cigarette and exercise) and anthropometry (body mass index, waist-hip ratio) and educational attainment (Fig. 2). In contrast, the difference in waist- hip-ratio was no longer significant after adjustments for these factors (Fig. 2).

There was no difference in the prevalence of hypertension, diabetes mellitus, obesity and high triglyceride levels between the Control group and the Hysgroup (Table 2). However, a significantly greater proportion of women in the Hysgroup had elevated cholesterol levels. We further explored whether adjustments for hormone replacement therapy use, cigarette smoking, exercise status and educational status would expose differences in odds of cardiovascular disease outcome *ie* hypertension, diabetes and obesity between controls and Hysgroup using logistic regression

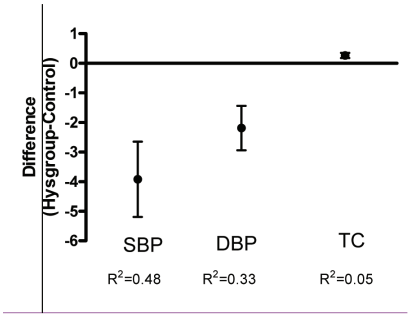


Fig. 2: Difference between Hysterectomized group and Control group adjusting for age, sociodemographic and anthropometry.

Annotations: Mean differences estimated by multiple linear regression model. Outcome SBP, systolic blood pressure mmHg, DBP, diastolic blood pressure (mmHg). TC, Total cholesterol concentrations (mmol/L). Predictors include Hypertension diagnostic category, age, body mass index, waist-hip ratio, exercise category, post-secondary education, ever smoked cigarette and fasting blood glucose. R^2 is adjusted R^2.

Table 1: Clinical and social characteristics of the participants

Variables	No Hysterectomy (n = 341)	Hysterectomy (328)	Mean difference with 95% CI	*p* value
Age (yrs)	58.8 ± 9.4	57.9 ± 9.3	0.9 (-0.5 to 2.9)	
Systolic blood pressure mmHg	144 ± 23	138 ± 20	6.0 (3.0 to 9.0)	< 0.001
Diastolic blood pressure mmHg	86 ± 11	82 ± 11	3.0 (1.0 to 5.0)	< 0.004
Weight kg	73.6 ± 17.3	73.8 ± 14.9	-0.2 (-2.7 to 2.2)	ns
Height cm	159.8 ± 6.5	159.7 ± 6.9	0.1 (-0.9 to 1.1)	ns
Body mass index kg/m^2	28.8 ± 6.2	29 ± 5.6	-0.2 (-1.1 to 0.7)	ns
Waist cm	91.1 ± 13.3	90.1 ± 11.6	1.0 (-0.9 to 2.9)	ns
Hip cm	104.7 ± 12.4	105.1 ± 10.7	-0.4 (-2.1 to 1.4)	ns
Waist hip ratio	0.9 ± 0.1	0.9 ± 0.1	0.01 (-0.01 to 0.02)	ns
Waist height ratio	0.6 ± 0.1	0.6 ± 0.1	0.006 (-0.006 to 0.017)	ns
Total cholesterol mmol/L	5.7 ± 1.1	6 ± 1.1	-0.2 (-0.4 to -0.07)	< 0.005
Fasting blood glucose mmol/L*	5.2 (5.1,5.4)	5.3 (5.2,5.5)	1.0 (0.9 to 1.0)	ns
Triglyceride concentrations mmol/L*	0.96 (0.92, 1.01)	1 (0.96, 1.05)	1.0 (0.9 to 1.0)	ns
Parity§	3^{+0} (0^{+1}, 3^{+0})	1^{+2} (0^{+1}, 7^{+3})	–	0.001
Single/divorced/separated†	187	178	0.007 (-0.06 to 0.08)†	ns
Post secondary education†	77	117	-0.13 (-0.2 to -0.06)†	0.001
Employed†	175	193	-0.06 (-0.14 to 0.013)†	ns
Exercise†	214	174	0.1 (0.02 to 0.17)†	0.01
Sexually active†	133	128	-0.008 (-0.008 to 0.06)†	ns
Ever cigarettes†	52	34	0.04 (0.002 to 0.1)†	0.06
Alcohol†	74	67	0.012 (-0.05 to 0.074)†	ns
History of hypertension†	150	150	-0.017 (-0.09 to 0.06)†	ns
History of diabetes†	55	59	-0.02 (-0.08 to 0.04)†	ns
History of CVA†	8	8	-0.001 (-0.02 to 0.02)†	ns
Hormone replacement therapy use†	28	84	-0.18 (-0.23 to -0.12)	0.001

Values are means ± SD; *values are geometric means with 95%CI; §values are medians with minimums and maximums; †values are counts with mean difference in proportions with 95% CI; ns not significant ($p > 0.1$)

models. The results of these analyses showed that having a hysterectomy was not a significant predictor of the risk of cardiovascular disease adjusting for these factors (Table 2).

A secondary outcome was whether there were differences in cardiovascular risks in the Hysgroup due to bilateral oophorectomy. The analyses showed that there was no

Table 2: Cardiovascular disease and risks by hysterectomy status

Variables	No hysterectomy (n = 341)	Hysterectomy (n = 328)	Unadjusted odds ratio with 95% CI	Adjusted odds ratio with 95% CI*
Hypertension	236 (69%)	209 (64%)	0.78 (0.57 to 1.08)	0.88 (0.62 to 1.23)
Diabetes mellitus	63 (18%)	64 (20%)	1.07 (0.73 to 1.57)	1.31 (0.86 to 1.97)
Obesity	130 (38%)	122 (37%)	0.96 (0.7 to 1.31)	1.04 (0.74 to 1.45)
High waist-height ratio	215 (63%)	208 (63%)	1.02 (0.74 to 1.39)	1.11 (0.79 to 1.55)
High waist-hip ratio	284 (83%)	256 (78%)	0.72 (0.49 to 1.05)	0.81 (0.53 to 1.24)
High total cholesterol	214 (63%)	242 (74%)	1.67 (1.2 to 2.32)†	1.7 (1.19 to 2.43)†
High triglyceride concentrations	11 (3%)	10 (3%)	0.95 (0.4 to 2.27)	1.1 (0.45 to 2.71)

Hypertension (systolic blood pressure > = 140 and or diastolic blood pressure > = 90 or on antihypertensive medications)
Diabetes (fasting blood glucose > 7.0 mmol/L or on diabetic medications
Obesity (BMI >30 kg/m^2)
High waist-height ratio (> 0.54)
High waist hip ratio (> 0.8)
High total cholesterol (> 5.2 mmol/L)
High triglyceride (> 2.26 mmol/L)

* Adjusted for hormone replacement therapy use, cigarette smoking, exercise status and educational status

† $p < 0.003$

difference in cardiovascular disease or risk in women who had bilateral oophorectomy compared to women who had at least an ovary preserved at time of operation (Table 3).

Table 3: Cardiovascular disease and risk by oophorectomy status variables

Variables	Hysterectomy with ovaries preserved (n =198)	Hysterectomy with BSO (n = 130) intervals	Unadjusted Odds ratio with 95% Confidence intervals	Adjusted Odds ratio with 95% Confidence
Hypertension	125	84	1.1 (0.6,1.7)	1.1 (0.7 to 1.8)
Diabetes mellitus	36	28	1.2 (0.7, 2.2)	1.2 (0.7 to 2.1)
Obesity	76	46	0.9 (0.5, 1.4)	0.9 (0.5 to 1.4)
High waist-height ratio	129	79	0.8 (0.5,1.3)	1.1 (0.6 to 1.8)
High waist-hip ratio	150	106	1.4 (0.8,2.6)	0.9 (0.5 to 1.4)
High total cholesterol	146	96	1.0 (0.6, 1.7)	1.6 (0.9 to 2.8)
High triglyceride concentrations	5	5	1.5 (0.3,6.8)	2.3 (0.6 to 8.9)

Hypertension (systolic blood pressure > = 140 and or diastolic blood pressure > = 90 or on antihypertensive medications)
Diabetes (fasting blood glucose > 7.0 mmol/L or on diabetic medications
Obesity (BMI > 30 kg/m^2)
High waist-height ratio (> 0.54)
High waist-hip ratio (> 0.8)
High total cholesterol (> 5.2 mmol/L)
High triglyceride (> 2.26 mmol/L)

* Adjusted for hormone replacement therapy use, cigarette smoking, exercise status and educational status

DISCUSSION

Cardiovascular disease is the leading cause of death in menopausal women (11). Women tend to develop the manifestation of CVD 10-20 years later than men and this is consistent across the world (12). The findings in this study of lower blood pressure and waist-hip ratio in the hysterectomized group, are in some ways surprising, as it has always been believed that hysterectomy with or without oophorectomy before age 50 years puts patients at risk for cardiovascular disease and lower bone density, because of artificial premature menopause. Thus the recommendation that these women should be put on hormone replacement therapy.

The effect of surgical *versus* natural menopause is confounded by three intersecting variables, age, hysterectomy alone and bilateral oophorectomy (13). Women who experience premature menopause *ie* natural menopause at age less than 40 years or women who experience natural menopause before age 50 years are at an increased risk of cardiovascular disease (14). This is supported by ultrasound studies that have reported that the prevalence of carotid atherosclerosis was statistically related to age at menopause (15).

Bilateral oophorectomy or surgical menopause is associated with an immediate fall in serum oestradiol. This acute fall has been shown to be associated with increased carotid pulsatility index (16) and accelerated changes in unfavourable lipid profile (17).

Hysterectomy without oophorectomy has been reported to acutely affect ovarian function accelerating the onset of ovarian failure (18). Others have stated that as many as 30% of women have postmenopausal symptoms within 24 months of hysterectomy with preservation of the ovaries (19).

However, the findings in this study are supported by a larger study done recently in the USA as a part of the Women's Health Initiative. In that study, over 89 000 women were studied and the findings were that women with a hysterectomy had a worse risk profile prior to surgery and higher prevalence and incidence of CVD. However, multivariate models showed that hysterectomy was not the major determinant of this outcome; rather, CVD risk may be due to the more adverse initial risk profile of women who had undergone hysterectomy (8). This may explain the results of the present study as it is possible that women in Jamaica undergoing hysterectomy have a better initial risk profile for cardiovascular disease than controls. This may be because most women in Jamaica undergo hysterectomy for uterine fibroids which is an oestrogen dependent condition. Very few have hysterectomy for prolapse which is far more common in Caucasian women and is a condition associated with oestrogen deficiency. This was confirmed in a hysterectomy audit in the USA where, although 62% of the patients who had hysterectomy were Caucasian, only 19% of Caucasian women had hysterectomy for fibroids compared to 51% non-Caucasian women (20). There is further evidence that the epidemiology of hysterectomy in the USA may be different from that found in Jamaican women. Brett *et al* found that

in American women, hysterectomy appears to be associated with low education and high parity (21), which was the opposite to what we found. Uterine fibroids are well known to arise with lower parity and prolapse with higher parity, while higher education is associated with fibroids as women delay child bearing while they pursue their education and careers.

This present study also revealed that the hysterectomized group was less likely to smoke, a factor known to increase cardiovascular risk. They were also less likely to exercise, also a known factor which should increase the cardiovascular risk. The impact of exercise was noted in the Anglo-Scandinavian Cardiac Outcomes Trial (ASCOT) where patients with high physical activity were younger, and had lower mean diastolic blood pressure 10-year Framingham stroke risk when compared with those with low physical activity (22). The finding in this study is therefore more difficult to explain but may be related to the higher waist-hip-ratio in the non-hysterectomised women who are probably exercising more in an attempt to get in shape. This argument is further strengthened by the finding in the overall group of a positive relationship between obesity and exercise.

Prophylactic oophorectomy is practised by many surgeons to prevent epithelial ovarian cancer which is difficult to diagnose and treat (19). Bilateral oophorectomy has been reported to be associated with cardiovascular disease risk and this is especially so if the ovaries are removed before the age of 45 years (23). The exact cause is related to changes in lipoproteins. It has also been recently pointed out that there is no data implicating hypertension and diabetes as direct effects of oophorectomy (13) although theoretically, these can result from oestrogen deficiency (24). This study did not find that bilateral oophorectomy was associated with the occurrence of higher systolic and diastolic blood pressure and blood sugar when compared to hysterectomy only and natural menopause. In another study looking at 1501 participants of the Women's Health Initiative, women with hysterectomy had fewer years of education than those without hysterectomy (30% with college degree *vs* 41%, $p < 0.0001$) which was a total contrast to what was found in this sample. That study also found higher body mass index (29 *vs* 28 kg/M^2), $p < 0.0001$) and less alcohol consumption which were also different from our finding. However, similar to the present study, they found that hysterectomized women exercised less and they also concluded that using multivariate analysis, TAHBSO was an independent predictor of Framing-ham risk while TAH was not (25). The lack of an effect with oophorectomy in our study may be due to the timing of oophorectomy in this population as oophorectomy before age 45 years is very uncommon in these women. However, the lack of effect could also be due to the same factors explained above for hysterectomy, with pre-existing protective effect of high oestrogen in these women with fibroids. However, also important may be the small sample size in this group, with lack of statistical power to show an effect.

The time elapsed from the onset of menopause as well as the use and type of hormone replacement therapy will influence cardiovascular risks. For example, the complex conjugated equine oestrogens have less predictable actions on the vasculature compared with 17 β-Oestradiol (26) and older women had less benefit and increased cardiovascular risk compared with women in whom HRT was initiated at/or close to menopause. In this study, data on the time elapsed from onset of menopause was not collected and represents a limitation. Seventeen per cent of the subjects in this study were taking HRT with a significantly higher proportion in the hysterectomized group. Consequently all outcome measures in this study were adjusted for HRT use.

In conclusion, hysterectomized women in this Jamaican sample are not at risk of cardiovascular disease from the procedure and also they should not be given HRT after hysterectomy for prevention of this problem. They should be treated for the other risk factors for CVD if these are found. More research needs to be done in women with early bilateral oophorectomy (below age 45 years) to determine if they are at increased risk and to see if these women would benefit from hormone replacement therapy.

Women should also be advised to adapt a healthy lifestyle with a proper diet and exercise to avoid cardiovascular risk.

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REFERENCES

1. Grundy SM, Balady GJ, Criqui MH, Fletcher G, Greenland P, Hiratzka LF et al. Primary prevention of coronary heart disease: guidance from Framingham: a statement for healthcare professionals from the AHA Task Force on Risk Reduction. American Heart Association. Circulation 1998; **97**:1876–87.
2. Becker RC, Alpert JS. Cardiovascular disease in women (Foreword). Cardiology 1995; **86:** 263.
3. Bakhai A, Foale R. Cardiovascular disease in the older woman. Post Grad Doc 1997; **13:** 136–40.
4. Thom M, White P, Williams R, Sturdee P, Paterson M, Wade-Evans T et al. Prevention and treatment of endometrial disease in climacteric women receiving estrogen. Lancet 1979; ii: 455.
5. Cooper RS, Rotimi CN, Kaufman JS, Owoaje EE, Fraser H, Forrester T. Prevalence of NIDDM among populations of the African diaspora. Diab Care 1997; **20:** 343–8.
6. WHO collaborative study of cardiovascular disease and steroid hormone contraception. Lancet 1996; **348:** 498–505.
7. Escoffery CT, Shirley SC. Causes of sudden natural death in Jamaica: a medicolegal (coroner's) autopsy study from the University Hospital of the West Indies. Forensic Sci Int 2002; **129:** 116–21.
8. Howard BV, Kuller L, Langer R, Manson JE, Allen C, Assaf A et al. Risk of cardiovascular disease by hysterectomy status, with and without oophorectomy. The women's health initiative observational study. Circulation 2005; **111:** 1462–70.
9. Wilks R, Bennett F, Forrester T, McFarlane-Anderson N. Chronic diseases: the new epidemic. West Indian Med J1998; **47 (Suppl 4):** 40–4.

10. Wilks R, Rotimi C, Bennett F, McFarlane-Anderson N, Kaufman JS, Anderson SG et al. Diabetes in the Caribbean: results of a population survey from Spanish Town, Jamaica. Diabet Med 1999; **16:** 875–83.
11. Bakir S, Oparil S. Estrogen replacement and heart disease. Clin 2000 Rev 67–72.
12. Kalin MF, Zumoff B. Sex hormones and coronary disease: a review of clinical studies Steroids 1990; **55:** 330–52.
13. Lobo R. Surgical menopause and cardiovascular risk. Menopause 2007; **14:** 562–6.
14. Atsma F, Grobbee DE, van der Schouw YT. Postmenopausal status and early menopause as independent risk factors for cardiovascular disease: a meta-analysis. Menopause 2006; **13:** 265–79.
15. Joakimsen O, Bonaa KH, Mathiesen EB, Stensland-Bugge E, Arnesen E. Prediction of mortality by ultrasound screening of a general population for carotid stenosis: the Tromsø Study. Stroke 2000; **31:** 1871–6.
16. Mihmanli V, Mihmanli I, Kantarci F, Aydin T, Yilmaz MH, Ogut G. Carotid pulsatility indices in surgical menopause. Arch Gynecol Obstet 2002; **266:** 96–100.
17. Cheung LP, Pang MW, Lam CW, Tomlinson B, Chung TK, Haines CJ. Acute effects of a surgical menopause on serum concentrations of lipoprotein (a). Climacteric 1998; **1:** 33–41.
18. Siddle N, Sarrel P, Whitehead M. The effect of hysterectomy on the age at ovarian failure: identification of a subgroup of women with premature loss of ovarian function and literature review. Fertil Steril 1987; **47:** 94–100.
19. Piver MS. Prophylactic oophorectomy: Reducing the US death rate from epithelial ovarian cancer. A continuing debate Oncologist 1996; **1:** 326–30.
20. Weaver F, Hynes D, Goldberg JM, Khuri S, Daley J, Henderson W. Hysterectomy in veterans affairs medical centers. Obstet Gynecol 2001; **97:** 880–4.
21. Brett KM, Marsh JV, Madans JH. Epidemiology of hysterectomy in the United States: demographic and reproductive factors in a nationally representative sample. J Women's Health 1997; **6:** 309–16.
22. Felmeden DC, Spencer CG, Blann AD, Beevers DG, Lip GY. Physical activity in relation to indices of endothelial function and angiogenesis factors in hypertension: a sub-study of the Anglo-Scandinavian Cardiac Outcomes Trial (ASCOT). J Intern Med 2003; **253:** 81–91.
23. Rocca WA, Grossardt BR, de Andrade M, Malkasian GD, Melton LJ 3rd. Survival patterns after oophorectomy in premenopausal women: a population-based cohort study. Lancet Oncol 2006; **7:** 821–8.
24. Uwe-Hollihn K. Hormone replacement therapy and the menopause. Schering Publication 1997. 76–7.
25. Hsia J, Barad D, Margolis K, Rodabough R, McGovern PG, Limacher MC et al. Women's Health Initiative Research Group. Usefulness of prior hysterectomy as an independent predictor of Framingham risk score (The Women's Health Initiative). Am J Cardiol 2003; **92:** 264–9.
26. Dubey RK, Imthurn B, Barton M, Jackson EK. Vascular consequences of menopause and hormone therapy: importance of timing of treatment and type of estrogen. Cardiovasc Res 2005; **66:** 295–306.