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Use of Hormone Replacement Therapy by Postmenopausal Women in the United States

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Background: The benefits and risks of hormone replacement therapy (HRT) in postmenopausal women are not fully defined, and individual characteristics and preferences may influence decisions to use this therapy. Previous studies of postmenopausal women who use HRT have been conducted in local or highly selected cohorts or have not focused on current use.

Objective: To examine sociodemographic, clinical, and psychological factors associated with current use of HRT in a national population-based cohort.

Design: Random-digit telephone survey.

Setting: Probability sample of U.S. households with a telephone.

Participants: 495 postmenopausal women 50 to 74 years of age in 1995.

Measurements: Current use of HRT.

Results: Current use of HRT was reported by 37.6% of women (58.7% of those who underwent hysterectomy and 19.6% of those who did not undergo hysterectomy; $P = 0.001$). In multivariable analyses, use of HRT was more common among women in the South (adjusted odds ratio, 2.67 [95% CI, 1.08 to 6.59]) and West (odds ratio, 2.76 [CI, 1.01 to 7.53]) than the Northeast. Use was more common among college graduates (odds ratio, 3.72 [CI, 1.29 to 10.71]) and less common among women with diabetes mellitus (odds ratio, 0.17 [CI, 0.05 to 0.51]). Other cardiac risk factors and most psychological characteristics were not associated with HRT use.

Conclusions: Sociodemographic factors, such as region and education, may be more strongly associated with use of HRT than clinical factors, such as risk for cardiovascular disease. Future efforts should focus on understanding sociodemographic variations, defining which women are most likely to benefit, and targeting therapy to them.

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Postmenopausal hormone replacement therapy (HRT) is a subject of major interest in the field of women's health. Although HRT has a clear role in the treatment of menopausal symptoms (1), uncertainty exists about its long-term use to prevent disease and prolong life (2). In randomized, controlled trials, HRT has been shown to improve lipid profiles (3) and increase bone density in postmenopausal women (4) but not to decrease the rate of subsequent coronary events in women with established coronary artery disease (5). Observational studies have shown that women who use HRT have a substantially decreased risk for coronary artery disease (6–8), osteoporosis and fractures (8–10), and death (12), but they may also have an increased risk for breast cancer (13).

In 1992, guidelines from the American College of Physicians advised that postmenopausal women who have had hysterectomy and women at risk for coronary heart disease are likely to benefit from preventive HRT (14, 15). A more recent decision analysis suggested that almost all postmenopausal women will benefit from HRT, especially those with risk factors for coronary heart disease (16).

Despite these recommendations, the benefits and risks of HRT are not fully defined. The decision to use preventive HRT is usually not simple and is probably influenced by the personal characteristics and beliefs of women and their physicians. Previous studies have sought to characterize women who use postmenopausal HRT (17–27), but most of these studies examined local or highly selected cohorts of patients. A recent report on HRT use in a national sample of women in the United States analyzed past and current use together and last collected data in 1992 (26). To our knowledge, only one study has

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assessed psychological factors that may influence the decision to use HRT (27).

Therefore, we examined patterns of HRT use in a national sample of postmenopausal women during 1995 to understand how sociodemographic, clinical, and psychological characteristics were associated with current use of this treatment. We also assessed patterns of use in women at risk for cardiovascular disease who may benefit most from this therapy. Finally, we sought to identify potential selection effects that may be present in observational studies while randomized clinical trials of this therapy are in progress (28).

Methods

Study Sample

In 1995, the John D. and Catherine T. MacArthur Foundation Research Network on Successful Midlife Development conducted a random-digit telephone survey of a probability sample of adults in the United States from 25 to 74 years of age to identify physical, psychological, and social factors that promote good health, psychological well-being, and social responsibility. The study protocol was approved by the human subjects committee of Harvard Medical School. The survey was conducted by using a multistage sampling design. For the first stage, an equal probability sample of telephone numbers, stratified by county in proportion to population, was selected from more than 70 million directory-listed residential numbers. After determining household eligibility, respondents were selected on the basis of age and sex and were offered a stipend for participation. The response rate for this telephone survey was 70%. United States Census data from 1990 for each telephone exchange were used to assess for response bias, and no statistically significant differences were found between eligible households for which the telephone interview was completed and other households by age, education, income, Hispanic ethnicity, other ethnicity, and residence in a Metropolitan Statistical Area.

Participants who completed the telephone interview were also mailed a self-administered questionnaire. We limited our cohort to women 50 to 74 years of age; 93% of these women also completed the self-administered questionnaire and were eligible for our sample, yielding an estimated response rate of 65% for the combined telephone survey and questionnaire. Compared with women who responded to the telephone interview only, these women were younger (mean age, 60.1 compared with 62.7 years; $P = 0.02$), more likely to be married (56% compared with 35%; $P = 0.004$), and more likely to have completed at least 12 years of education (84% compared with 61%; $P = 0.001$).

From this cohort ($n = 668$), we identified all postmenopausal women with no personal history of breast cancer ($n = 495$). A woman was considered postmenopausal if she reported that her menses had stopped permanently. Because by 50 years of age, most women with a uterus in our sample had undergone natural menopause, women who had undergone hysterectomy were considered postmenopausal whether or not they had undergone bilateral salpingo-oophorectomy.

Data Collection

Current users of HRT were women who reported "use of hormone replacement, such as estrogen, in the past 30 days." Women were also asked about sociodemographic, clinical, and psychological factors that had previously been associated with use of HRT in other studies or that we postulated might influence its use.

Sociodemographic variables included age (denoted by indicator variables for 5-year increments), ethnicity (white or nonwhite), education (<12 years, high school graduate or general education diploma, or college graduate), household income (in quartiles), marital status (currently married), children (one or more), employment status (full-time job), rural residence (not living in a Metropolitan Statistical Area), and geographic region (Northeast, Midwest, South, and West) as defined by the U.S. Census.

Clinical variables included a history of hysterectomy, having a regular physician, use of supplemental calcium, physical activity (vigorous activity one or more times per week), and a waist-to-hip ratio of 0.85 or less as a measure of body habitus; all of these factors were previously associated with use of HRT. We also examined self-report of diabetes, cigarette smoking (current, former, or never smoker), family history of myocardial infarction, hypertension, high cholesterol level, personal history of myocardial infarction or angina (based on the Rose criteria [29]), sexual activity, alcohol use, multivitamin use, and use of alternative therapies.

Psychological variables included perceived risk for heart disease and cancer (above average compared with average or below), self-perceived physical and mental health (excellent, very good, or good compared with fair or poor), depression (based on the Composite International Diagnostic Interview [30]), self-report of depression or anxiety, perceived control over health, and thought and effort put into health. Women were also asked whether they worry about becoming less attractive or developing illness as they age. Measures of six major personality characteristics—agency (self-confident, forceful, assertive, outspoken, and dominant), agreeableness (helpful, warm, caring, softhearted, and sympathetic), openness (creative, imaginative, intelligent, curious, so-

pshisticated, and adventurous), neuroticism (moody, worrying, nervous, and not calm), extroversion (outgoing, friendly, lively, active, and talkative), and conscientiousness (organized, responsible, hardworking, and not careless)—were adapted from standard scales (31–34). Finally, we used the Somatic Amplification Scale (35) to assess somatosensory amplification (experiencing somatic sensation as intense, noxious, and disturbing).

Statistical Analysis

Data were weighted to adjust for differing probabilities of contacting households, sampling persons within each household, and obtaining completed surveys from designated participants (36) and to approximate the U.S. population on the basis of the Current Population Survey (October 1995). First, we adjusted for differing probabilities of successfully contacting households in geographic areas by mapping 1990 U.S. Census data on age, ethnicity, income, education, and urban location to telephone exchanges. Second, we adjusted for the higher probability of sampling persons in smaller households when their household was contacted. Third, we adjusted for differing probabilities of obtaining self-administered questionnaires from persons who completed the telephone interview by using numerous variables from the telephone interview. Finally, we created post-stratification weights so that the sample more closely approximated the U.S. population on the basis of 1995 Current Population Survey data. Thus, the weighted sample resembles the U.S. population by geographic region, ethnicity, age, education, marital status, and residence in a Metropolitan Statistical Area.

We used the Pearson chi-square test to compare rates of HRT use by categorical variables and the Mantel–Haenszel chi-square test for the same comparison after stratifying by hysterectomy status (37). We converted values of each continuous psychological variable to ranks and compared users and non-users of HRT by using two-way analysis of variance to control for hysterectomy status.

We conducted multivariable logistic regression analyses in two stages. Because we had large numbers of sociodemographic, clinical, and psychological variables, we first created three separate models for each of these types of variables. Each model included all variables of a particular type with a *P* value of 0.2 or less in bivariable analyses. Finally, all variables with *P* values of 0.2 or less in the intermediate models were included in a final composite main-effects model. Because we also wished to ensure that the final model controlled for key demographic and clinical variables that might confound the effect of statistically significant variables, we also forced the following select variables to enter the

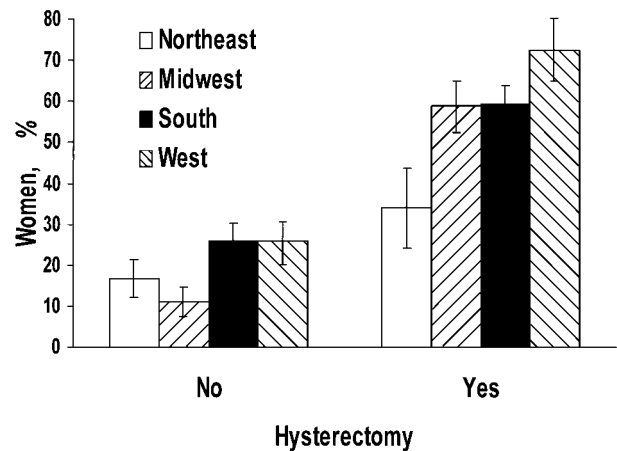


Figure 1. Use of hormone replacement therapy among postmenopausal women 50 to 74 years of age by U.S. region in 1995. Bars represent frequencies \pm SD. *P* = 0.02 for comparison of the four regions by the stratified Mantel–Haenszel chi-square test.

final model: ethnicity, marital status, waist-to-hip ratio, income, hypertension, high cholesterol, family history of myocardial infarction, smoking, and personal history of coronary artery disease. Only this final composite multivariable logistic regression model for current use of HRT is presented. We conducted sensitivity analyses by adding several additional variables (employment, perceived risk for disease, control over health, and assertiveness) to the final composite model to determine whether omitted variables explained the associations that we found, particularly the association with education. Finally, we assessed the variables in our main-effects model for statistical interaction or effect modification with hysterectomy status.

Descriptive analyses were performed by using SAS statistical software, version 6.12 (SAS Institute, Inc., Cary, North Carolina). Because of the complex sampling design, SUDAAN statistical software was used to calculate standard errors for the multivariable analyses (38). Multiple imputation (39–41) was used to impute values for income and waist-to-hip ratio, for which data were missing for 12% and 8% of the sample, respectively. We used the software implementation method of Schafer (42) and combined the imputations for inference as described by Rubin (40). Adjusted odds ratios and 95% CIs are reported. The study had 80% power to detect an absolute difference of 12% (for example, 44% versus 32%) in HRT use between groups of equal size with a two-tailed α error of 0.05.

Results

The sample included 495 women with a mean age (\pm SD) of 61.4 ± 6.7 years. In this cohort, 89% of women were white, 65% were married, 12% were

Table 1. Unadjusted Rates of Postmenopausal Use of Hormone Replacement Therapy by Sociodemographic, Clinical, and Psychological Factors, Stratified by Hysterectomy Status*

Variable	Current Hormone Use		P Value†
	No Hysterectomy (n = 270)	Hysterectomy (n = 225)	
	% (n/n)		
Sociodemographic			
Age			
50–54 years	31 (13/42)	67 (30/45)	0.005
55–59 years	25 (16/65)	67 (42/63)	
60–64 years	11 (7/66)	66 (28/43)	
65–69 years	23 (10/46)	44 (19/43)	
70–74 years	13 (6/51)	41 (13/32)	
Ethnicity			
White	21 (49/231)	61 (121/200)	0.03
Nonwhite	12 (5/38)	43 (11/25)	
Education			
College graduate	40 (13/33)	74 (19/26)	0.001
High school graduate or holder of a general education diploma	18 (34/187)	61 (89/146)	
Not a high school graduate	13 (6/49)	44 (24/54)	
Household income			
Highest quartile (>\$39 000)	29 (17/60)	70 (36/51)	0.04
Middle two quartiles (\$7500–\$39 000)	16 (18/109)	53 (58/108)	
Lowest quartile (<\$7500)	16 (10/65)	60 (26/44)	
Missing	23 (8/36)	56 (12/22)	
Currently married			
Yes	22 (38/170)	64 (97/151)	0.01
No	16 (16/99)	48 (36/74)	
Number of children			
≥1	21 (49/233)	60 (127/213)	0.08
0	12 (5/37)	41 (5/13)	
Employment status			
Full-time	22 (19/86)	59 (60/102)	>0.2
Part-time or not employed	19 (34/183)	58 (72/123)	
Rural residence			
Yes	26 (17/64)	56 (37/65)	>0.2
No	18 (37/205)	60 (96/160)	
Clinical			
Have a regular physician			
Yes	24 (52/221)	61 (118/193)	0.001
No	3 (1/49)	45 (15/33)	
Vigorous physical activity			
Once or more per week	28 (22/80)	66 (48/72)	0.01
Less than once per week	17 (31/189)	55 (84/153)	
Waist-to-hip ratio			
≤0.85	25 (34/139)	67 (70/105)	0.01
>0.85	15 (16/109)	51 (53/104)	
Missing	13 (3/22)	58 (9/16)	
History of angina or myocardial infarction			
Yes	9 (2/24)	63 (13/21)	>0.2
No	21 (51/246)	58 (119/204)	
Sexual activity			
Once or more per month	21 (22/105)	64 (71/111)	0.16
Less than once per month	20 (32/161)	52 (55/106)	
Alcohol use			
Current or past use	20 (34/168)	60 (89/149)	>0.2
No current or past use	19 (19/102)	57 (43/76)	
Regular calcium use			
Yes	29 (32/112)	75 (54/73)	0.001
No	14 (21/158)	51 (78/153)	
Regular multivitamin use			
Yes	26 (31/120)	64 (57/89)	0.02
No	15 (23/150)	55 (76/136)	
Use of alternative therapies‡			
Yes	23 (11/48)	66 (24/36)	>0.2
No	19 (40/216)	57 (107/186)	
Psychological			
Perceived risk for heart attack			
Higher than average	20 (9/46)	63 (26/40)	>0.2
Average or lower than average	20 (44/223)	58 (107/185)	
Perceived risk for cancer			
Higher than average	19 (8/43)	60 (18/30)	>0.2
Average or lower than average	20 (45/227)	59 (115/195)	
Physical health status			
Fair or poor	18 (11/60)	58 (34/60)	>0.2
Good, very good, or excellent	20 (43/210)	59 (98/165)	
Mental health status			
Fair or poor	18 (5/25)	79 (18/23)	0.15
Good, very good, or excellent	20 (49/244)	56 (114/202)	

Continued on following page

Table 1—Continued

Variable	Current Hormone Use		P Value†
	No Hysterectomy (n = 270)	Hysterectomy (n = 225)	
	% (n/n)		
Depression			
Positive on CIDI screening‡	15 (4/26)	72 (18/25)	>0.2
Negative on CIDI screening‡	20 (49/244)	57 (114/200)	
Self-report of anxiety or depression			
Yes	23 (13/57)	75 (47/63)	0.005
No	19 (40/212)	52 (85/162)	
Worry about becoming less attractive with aging			
Yes	23 (26/111)	72 (87/121)	0.001
No	18 (28/158)	43 (45/105)	
Worry about having more illness with aging			
Yes	22 (42/186)	63 (111/176)	0.004
No	14 (12/84)	43 (21/49)	

* Numbers for each variable may not total 495 because of rounding, statistical weights, or missing data; corresponding percentages reflect weighted data before rounding.

† Rates of hormone replacement therapy were compared between subgroups of each variable by using the Mantel-Haenszel chi-square test, after controlling for hysterectomy status.

‡ Use of one or more of the following therapies in the past year: acupuncture, biofeedback, chiropractic, energy healing, herbal therapy, high-dose megavitamins, homeopathy, or hypnosis.

§ Based on the Composite International Diagnostic Interview (CIDI), version 2.0 (30).

college graduates, 67% were high school graduates, and the median household income was \$22 500. The overall rate of current HRT use was 37.6%, with rates of 58.7% among women who had undergone hysterectomy and 19.6% among women who had not undergone hysterectomy ($P = 0.001$).

Sociodemographic Variables

Use of HRT varied statistically by geographic region; the highest rates were seen in the South (45%) and West (42%) and lower rates were seen in the Midwest (32%) and Northeast (22%) ($P = 0.003$). Although the proportion of women who had undergone hysterectomy was higher in the South (58%) and Midwest (44%) than the West (35%) and Northeast (31%), regional differences in HRT use were evident both among women who had undergone hysterectomy and among those who had not had this procedure (**Figure 1**). Younger age, higher education and income levels, white ethnicity, and marital status were also statistically associated with use of HRT after stratification by hysterectomy status (**Table 1**).

Clinical Variables

Use of HRT was statistically associated with having a regular physician, a waist-to-hip ratio of 0.85 or less, regular use of calcium supplements, and physical activity (**Table 1**). When we examined use of HRT in relation to cardiac risk factors (**Figure 2**), substantially fewer diabetic women than nondiabetic women used HRT (17% compared with 39%; $P = 0.004$). Rates of HRT use did not significantly differ by smoking status, family history of myocardial infarction, personal history of hypertension, or elevated cholesterol level (**Figure 2**), nor did it differ between women with a personal history of an-

gina or myocardial infarction and other women (**Table 1**).

Psychological Variables

Use of HRT was statistically associated with worry about becoming less attractive and developing more illness with aging. Women who were depressed according to the Composite International Diagnostic Interview were not more likely to use HRT, but women who reported having experienced or been treated for anxiety or depression in the past 12 months were more likely to use HRT (**Table 1**). Women who were current users of HRT had slightly higher scores on the neuroticism scale and on the Somatic Amplification Scale and slightly lower scores on the agreeableness scale than nonusers (**Table 2**).

Multivariable Logistic Regression Model for Current Use of Hormone Replacement Therapy

Characteristics associated with use of HRT in the multivariable model of main effects are shown in **Figure 3**. A history of hysterectomy was strongly associated with current use (adjusted odds ratio, 7.04 [95% CI, 3.95 to 12.54]). Compared with women in the Northeast, women in the South and the West were more likely to use HRT (odds ratio, 2.67 [CI, 1.08 to 6.59] and 2.76 [CI, 1.01 to 7.53], respectively). Women in the South and West also tended to use HRT more often than women in the Midwest, although this finding was of borderline statistical significance (odds ratio, 1.87 [CI, 0.96 to 3.62] for the South and 1.93 [CI, 0.90 to 4.14] for the West). College graduates were more likely than women who had not graduated from high school to be current users of HRT (odds ratio, 3.72 [CI, 1.29 to 10.71]).

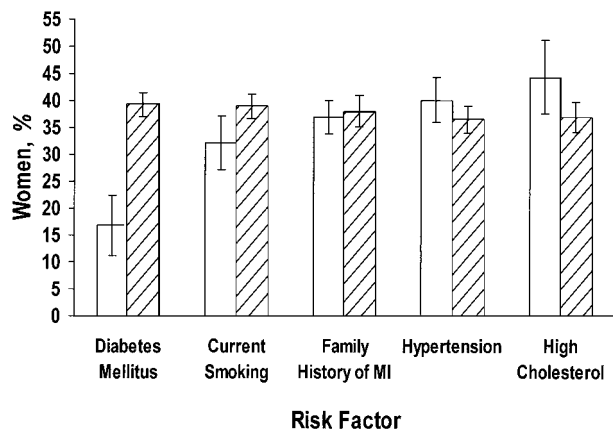


Figure 2. Use of hormone replacement therapy among postmenopausal women 50 to 74 years of age by cardiac risk factors in 1995. Bars represent frequencies \pm SD. $P = 0.004$ for comparison of the four regions by the stratified Mantel-Haenszel chi-square test. White bars represent the presence of a cardiac risk factor; striped bars represent the absence of a cardiac risk factor. MI = myocardial infarction.

Women 55 to 59 years of age did not significantly differ from those 50 to 54 years of age in rates of HRT use. Women 60 to 64 years of age and those 65 to 69 years of age were approximately half as likely to use HRT, although these differences were not statistically significant (odds ratio, 0.53 [CI, 0.25 to 1.10] and 0.44 [CI, 0.17 to 1.13]). Women 70 to 74 years of age were statistically less likely to use HRT (odds ratio, 0.33 [CI, 0.13 to 0.85]).

Women with diabetes mellitus were less likely than other women to use HRT (odds ratio, 0.17 [CI, 0.05 to 0.51]), as were women who reported having no regular physician (odds ratio, 0.22 [CI, 0.11 to 0.47]). Women who used supplemental calcium were more likely than other women to use HRT (odds ratio, 2.09 [CI, 1.18 to 3.69]). Women with hypertension were somewhat (but not statistically) more likely to use HRT (odds ratio, 1.79 [CI, 0.95 to 3.36]). In the final model, use of HRT was not associated with smoking status (odds ratio, 0.69 [CI, 0.35 to 1.39]), waist-to-hip ratio (odds ratio, 0.63 [CI, 0.34 to 1.18]), history of coronary artery disease

(odds ratio, 0.79 [CI, 0.31 to 2.00]), high cholesterol level (odds ratio, 1.66 [CI, 0.62 to 4.45]), or a family history of myocardial infarction (odds ratio, 0.97 [CI, 0.57 to 1.64]).

Women who sometimes or frequently worry about becoming less attractive as they age were more likely to use HRT than women who denied having this concern (odds ratio, 1.97 [CI, 1.15 to 3.36]). Only this variable showed statistically significant effect modification by hysterectomy status ($P = 0.01$). Among women who had undergone hysterectomy, worry about becoming less attractive with age was strongly associated with HRT use (odds ratio, 4.31), whereas among women who had not had hysterectomy, this variable was not associated with HRT use (odds ratio, 0.93). Depression, worry about illness, and somatic amplification were not associated with use of HRT in the final composite model.

Discussion

In this national sample in the United States, almost 38% of postmenopausal women 50 to 74 years of age were current users of HRT in 1995. This rate is higher than that noted in some (19, 20, 43) but not all (44) previous studies. Trends of increasing use (45) and expanding evidence of the potential benefits of long-term HRT may account for this higher rate, as may the hysterectomy rate of 45% in our cohort, which is higher than previous estimates of 37% to 40% (46, 47). In an earlier national survey, 45% of postmenopausal women had ever used HRT and 20% had ever used it for at least 5 years (26).

In our sample, having undergone hysterectomy was the characteristic most strongly associated with HRT use. Guidelines published by the American College of Physicians suggest that women who have undergone hysterectomy are likely to benefit from

Table 2. Comparison of Differences among Psychological Variables by Use of Hormone Replacement Therapy, Using Two-Way Analysis of Variance*

Variable	Women Currently Using HRT (n = 186)	Women Not Currently Using HRT (n = 309)	P Value†
Control over health (scale, 0–10)	7.39 \pm 0.15	7.54 \pm 0.12	>0.2
Thought and effort put into health (scale, 0–10)	7.81 \pm 0.15	7.70 \pm 0.12	>0.2
Personality characteristics (scale, 1–4)			
Agency	2.58 \pm 0.05	2.60 \pm 0.04	>0.2
Agreeableness	3.60 \pm 0.03	3.68 \pm 0.02	0.04
Openness	2.88 \pm 0.04	2.94 \pm 0.03	0.16
Neuroticism	2.29 \pm 0.05	2.08 \pm 0.04	0.001
Extroversion	3.15 \pm 0.04	3.23 \pm 0.04	0.06
Conscientiousness	3.39 \pm 0.03	3.45 \pm 0.03	>0.2
Somatic amplification (scale, 1–4)	2.69 \pm 0.04	2.57 \pm 0.03	0.04

* All values are given as the mean \pm SE, adjusted for hysterectomy status. HRT = hormone replacement therapy.

† The ranks of users and nonusers of HRT were compared for each psychological variable by using two-way analysis of variance to control for hysterectomy status.

preventive HRT (15). This procedure eliminates the possibility of vaginal bleeding or uterine cancer and obviates the need to take a progestin with estrogen.

Use of HRT varied by geographic region: Women in the South and the West were more likely to be current users than women in the Northeast. This finding complements previous evidence of similar regional variation among women who have ever used hormone therapy (26) and in data on prescribing patterns from pharmaceutical surveys (48). In our sample, the proportion of women who had undergone hysterectomy varied substantially by region, as did levels of education; worry about attractiveness; rural residence; diabetes; and use of alternative therapies, multivitamins, and calcium supplements. However, in sensitivity analyses, none of these differences explained the regional differences in use of HRT. Previous studies of geographic variations in medical care suggest that differences in practice are most evident when uncertainty exists about the relative benefits and risks of a therapy or procedure (49, 50).

Women who were college graduates were more likely than women with less education to use HRT. This finding is consistent with results of other studies that have found an association between education and HRT use (17, 18, 20, 24, 26, 27). Although education may be correlated with such factors as income, access to care, employment, perceived risk for disease, control over health, and assertiveness, we controlled for income and having a regular physician in the final composite model; in sensitivity analyses, none of these other variables explained the strong association that we saw between HRT use and education. Well-educated women may be more likely to read articles about HRT, have more substantive discussions with physicians about personal benefits and risks, and seek this treatment.

Use of HRT decreased with increasing age, possibly because older women experienced menopause at a time when HRT was less commonly prescribed. In addition, many women may have begun this therapy to treat menopausal symptoms and discontinued it as symptoms resolved. Recent data suggest that long-term estrogen therapy initiated after 60 years of age seems to offer bone-conserving benefit almost equal to that gained by starting estrogen therapy at menopause (51). Given that the incidence of coronary heart disease and osteoporosis increases with age and that increased risk for breast cancer is associated with more than 5 years of HRT use (13), initiating HRT later in life might enable many women to obtain the preventive benefits of this therapy with less risk for breast cancer.

Although the Heart and Estrogen/progestin Replacement Study (5) did not demonstrate benefit of HRT for secondary prevention of coronary artery

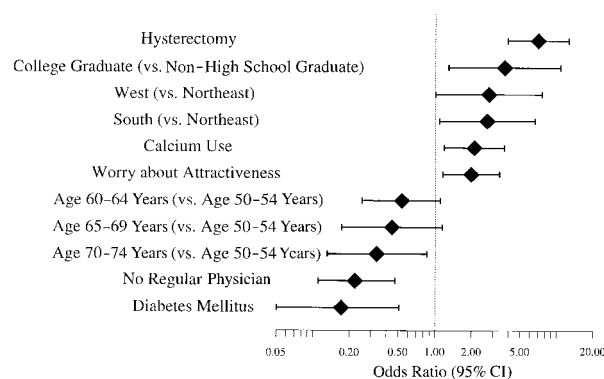


Figure 3. Multivariable correlates of use of postmenopausal hormone replacement therapy. A main-effects logistic regression model was used to adjust for all variables shown, as well as ethnicity, marital status, number of children, waist-to-hip ratio, income, somatic amplification, self-reported depression, worry about illness, hypertension, high cholesterol level, smoking, family history of myocardial infarction, and personal history of angina or myocardial infarction. Adjusted odds ratios are shown with corresponding 95% CIs on a logarithmic scale.

disease, other evidence in the past decade has suggested that women with risk factors for ischemic heart disease may derive the greatest benefit from this therapy (12, 14, 16). However, except for women with hypertension, among whom we found a trend of borderline statistical significance toward higher rates of HRT use, women with cardiac risk factors were not statistically more likely than women without such risk factors to use HRT. In fact, women with diabetes mellitus—the only common condition that increases the risk for coronary heart disease in women to a level approaching that in men (52)—were substantially less likely than women without diabetes to use HRT, a result consistent with that of another recent report (53). A preliminary report from the Nurses' Health Study has suggested that diabetic women who use HRT have about half the risk for coronary heart disease compared with diabetic nonusers (54).

Unmeasured selection effects may explain some of the decreased risk for coronary heart disease attributed to HRT use (55-57) in many (but not all [58]) observational studies. We evaluated a wide range of psychological characteristics that might be associated with HRT use to identify potential selection effects. We hypothesized that HRT users might be more likely to report better health status, put more thought and effort into their health, or feel more responsibility for their health, but we found no association between these characteristics and use of HRT. Compared with nonusers, current HRT users did not differ in their perceived risk for heart disease or cancer, nor were they more assertive. Users of HRT who had undergone hysterectomy worried more than nonusers about future attractiveness. These women may believe that HRT will make them feel and look younger. In addition, recent data

suggest that estrogen use may prevent dry skin and wrinkling (59).

Our study has several limitations. First, although our response rate was comparable to that expected for households contacted by random-digit dialing (60), women without telephones were not eligible for participation (61), and women who were willing to participate in this survey may have differed from those who declined to participate. However, recent data indicate that only 2.7% of households in the United States do not have a telephone (62). Furthermore, when we used 1990 Census data for telephone exchanges, we found no sociodemographic differences between households for which the telephone interview was completed and other households.

Second, our survey findings were subject to reporting bias because HRT use and other variables were self-reported. Third, we lacked information on the reasons why these women were using HRT, the specific regimens, and the duration of use. Fourth, we had limited power to detect small differences in rates of use between subgroups. Fifth, some data were missing for income and waist-to-hip ratio. We used the best available method of multiple imputation to estimate these missing data (40), assuming that these data were missing at random (40, 41). This approach allowed us to account for observable characteristics of women with missing data. Although we cannot be certain that unobserved characteristics associated with "missingness" for these variables might not alter our findings, we believe the missing-at-random assumption is plausible because of the diverse set of variables on which we based our multiple imputation.

Finally, we had no data about discussions of HRT between patients and physicians, nor did we know the specialty or sex of treating physicians. Several studies have shown that gynecologists are more likely than other physicians to prescribe HRT (63–65), and female gynecologists are more likely than other female physicians to use HRT themselves (66). However, even after women are counseled and given a prescription for HRT, many patients do not fill their prescription or discontinue use without notifying their physician (44, 67). Thus, the effects of patient characteristics on HRT use are important independent of the effect of physician characteristics.

In summary, we found threefold differences in the adjusted odds of postmenopausal HRT use by region, education level, and age in a national, population-based cohort. Despite these large variations, women at increased risk for cardiovascular disease were not more likely to use HRT, and diabetic women were substantially less likely than other women to report use.

Our findings have important implications for clinical practice. They suggest that use of HRT may be more strongly related to sociodemographic factors than to cardiovascular risk factors, even though the potential benefit of HRT on survival may be greatest for women at risk for coronary heart disease (12, 16). If ongoing randomized clinical trials confirm the benefits of HRT seen in observational studies, future efforts should focus on identifying and educating the women who are most likely to benefit. In addition, a better understanding of these sociodemographic variations may enable physicians to address HRT use more effectively with eligible women, particularly with new decision-making tools (68, 69) to facilitate discussions about its benefits and risks.

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