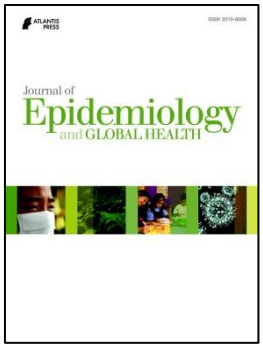

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Mammography use among women with and without diabetes: Results from the Southern Community Cohort Study

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Abstract Studies have shown an increased risk of breast cancer associated with diabetes which may be due to differences in mammography use among women who have diabetes compared with women who do not have diabetes. Baseline data was used from the Southern Community Cohort Study — a prospective cohort study conducted primarily among low-income persons in the southeastern United States — to examine the association between diabetes and mammography use. In-person interviews collected information on diabetes and mammography use from 14,665 white and 30,846 black women aged 40—79 years between 2002 and 2009. After adjustment for potential confounding, white women with diabetes were no more likely (odds ratio [OR] 0.95, 95% confidence interval [CI] 0.85—1.06) to undergo mammography within the past 12 months than white women without diabetes. Nor was there an association between diabetes and mammography use among black women (OR 1.00, 95% CI 0.93—1.07). An increase in mammography use was seen within one year following diabetes diagnosis, more so among white than black women, but this was offset by decreases thereafter. Although there was some

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evidence of an increase in mammography use within one year of diabetes diagnosis, these results suggest that mammography use is not related to diabetes.

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1. Introduction

Meta-analyses of the association between diabetes and breast cancer have reported a summary relative risks (RRs) of approximately 1.20, with 95% confidence intervals (CIs) ranging from 1.12 to 1.30 [1—4]. Three of the four meta-analyses were stratified by menopausal status at breast cancer diagnosis, and reported an increased breast cancer risk associated with diabetes among women diagnosed post-menopause, but not among women diagnosed prior to menopause [2—4]. One of the meta-analyses restricted to more recent studies found stronger RRs in studies conducted among European women (RR 1.88, 95% CI 1.56—2.25) than among American women (RR 1.16, 95% CI 1.12—1.20), and no association among Asian women (RR 1.01, 95% CI 0.84—1.21) [4]. The increase in post-menopausal breast cancer risk associated with diabetes has been reported also in more recent, large cohort studies conducted since the meta-analyses [5]. In particular, Bowker and colleagues reported that the risk for breast cancer diagnosed among women at age 55 years or older, and presumably postmenopausal, was non-significantly increased for 0—3 months following a diagnosis of diabetes (HR 1.31, 95% CI 0.92—1.86), but then returned to baseline from 3 months to 10 years following the diabetes diagnosis (HR 1.00, 95% CI 0.90—1.11) [6]. The authors concluded that the initially elevated post-menopausal breast cancer risk may have been due to detection bias.

Possible explanations for the positive association between diabetes and post-menopausal breast cancer have included a direct effect of diabetes on increased breast cancer growth by altering levels of insulin, insulin-like growth factors and endogenous sex hormones [3], residual confounding by obesity [7], or an indirect effect due to differences in mammography use among women who have diabetes compared with women who do not have diabetes [6]. Initial increases followed by reductions in RRs with increasing time since diabetes diagnosis have been reported for several other cancers (lung, cervical, ovarian, pancreatic and prostate), but not all cancers (colorectal, liver and endometrial) examined and no pattern with regard to the availability of screening tests [8]. Three studies conducted in the United States [9—11] and one in Canada [12] reported that women with diabetes were less likely than women without diabetes to have received a recent mammogram, but an analysis restricted to black women [11] found no difference in mammography use by diabetes status. In contrast, a previous study in the Southern Community Cohort Study (SCCS) population that investigated the association between obesity and mammography use reported, for both blacks and whites, a higher percentage of self-reported mammography within the past two years among women with diabetes (black 78.4%; white 71.5%) than among women without diabetes (black 71.1%; white 67.9%) [13]. In this SCCS-based study, after adjustment for health insurance coverage and other confounders, black women who were overweight or obese were more likely to have undergone recent mammography, while white women who were obese were less likely. It was hypothesized that recent mammography would be most prevalent near the time of diabetes diagnosis, and the association would differ among black and white women. Unlike previous studies, adjustments will be made for obesity in investigating the associations of diabetes and mammography use and the timing of mammography after diabetes diagnosis.

2. Materials and methods

Detailed methods of the SCCS appear elsewhere [14]. Briefly, the cohort included a total of 14,890 white women, 31,527 black women, and 2501 women of other racial/ethnic groups who enrolled between March 2002 and September 2009. Approximately 88% of women completed in-person interviews at Community Health Centers in 12 Southeastern States of the United States, with the remaining women randomly sampled from the general population and completing mailed questionnaires. Women of other racial/ethnic groups, women with a history of breast cancer, and women whose mammography history was not available were excluded from the analysis, resulting in 14,665 white women, and 30,846 black women for analysis.

Institutional Review Boards of the Vanderbilt University and Meharry Medical College approved this study's protocol. Trained interviewers con-

Table 1 Characteristics of white women who did and did not receive a mammogram within the past 12 months, Southern Community Cohort Study, 2002–2009.

Characteristic	Received mammogram		Did not receive mammogram		*p*-value
	n	%	*n*	%	
Age (years)					<0.0001
40–49	1451	30.2	4158	42.4	
50–59	1830	38.1	3415	34.7	
60–69	1200	25.0	1758	17.8	
70–79	326	6.8	527	5.4	
Total household income					<0.0001
<$15,000	1835	38.9	5332	54.9	
$15,000–$49,999	1777	37.7	3393	34.9	
⩾$50,000	1101	23.3	994	10.2	
Educational level					<0.0001
<12 years	901	18.7	2668	27.1	
Completed high school or GED	1452	30.2	3352	34.0	
Vocational/some college	1327	27.6	2578	26.2	
Graduated from college	1124	23.4	1259	12.8	
Marital status					<0.0001
Single	336	7.1	779	8.0	
Married/living with a partner	2367	49.9	4203	42.9	
Divorced/widowed/separated	2038	43.0	4809	49.1	
Family history of breast cancer					<0.0001
No	3826	84.7	8172	88.4	
Yes	691	15.3	1078	11.7	
Health insurance coverage					<0.0001
None	1130	23.6	4221	43.0	
Medicare/medicaid only	1218	25.4	2671	27.2	
Any private/champus/other	2443	51.0	2925	29.8	
Recruitment source					<0.0001
Community health centers	3508	73.0	8427	85.5	
General population	1299	27.0	1431	14.5	
Body mass index (kg/m^2) maximum					<0.0001
<25	797	16.8	1439	14.8	
25–29.99	1222	25.8	2277	23.4	
30–39.99	1824	38.4	3735	38.4	
⩾40	903	19.0	2285	23.5	
Hypertension					0.05
No	2382	49.6	5057	51.3	
Yes	2424	50.4	4796	48.7	
Cholesterol medications					<0.0001
No	3480	72.6	7747	78.7	
Yes	1314	27.4	2099	21.3	
Alcohol intake					0.05
No	837	17.7	1853	19.1	
Yes	3883	82.3	7869	80.9	
Menopausal status					<0.0001
Premenopausal	972	20.3	2544	25.9	
Post-menopausal	3818	79.7	7297	74.2	
Hormone replacement therapy					<0.0001
No	2248	47.0	6140	62.7	
Yes	2537	53.0	3655	37.3	
Moderate physical activity (hours per week during 30s)					0.06
0	116	2.5	227	2.4	
0.01–4.99	102	2.2	149	1.5	
⩾5	4472	95.4	9246	96.1	

(*continued on next page*)

Table 1 (*continued*)

Characteristic	Received mammogram		Did not receive mammogram		*p*-value
	n	%	*n*	%	
Vigorous physical activity (hours per week during 30s)					<0.0001
0	1226	26.2	2662	27.6	
0.01—4.99	720	15.3	1081	11.2	
⩾5	2741	58.5	5911	61.2	

ducted in-person interviews with subjects who provided written informed consent. All variables in the present analysis are based on self-report. Women were considered to have diabetes if they reported having been told by their doctor they had diabetes or high blood sugar. Information on time since diagnosis (<1-year and then 5-year categories) and use of diabetes medications (oral or insulin, results were similar for both types of medication and were collapsed) was used to further categorize diabetes. Mammography use was categorized as having occurred within the 12 months prior to entry into the study. This study stratified by race *a priori*, since a previous study reported a lower likelihood of a recent mammogram among white diabetic patients than non-diabetic patients, but no association among black women [11]. Potential confounders of the diabetes and mammography use associations included: age, total annual household income, educational level, marital status, family history of breast cancer, health insurance coverage, recruitment source, maximum BMI (kg/m^2) based on self-report, hypertension, cholesterol medication use (previously associated with mammography) [15], alcohol intake, menopausal status, hormone replacement therapy, and leisure-time moderate and vigorous physical activity in hours per week during their 30s, as categorized in Tables 1 and 2. Based on previous studies of diabetes or metabolic syndrome and breast cancer, menopausal status [2—6,16], age [16] and maximum BMI [16] were assessed as effect modifiers of the diabetes and mammography use association prior to being assessed as confounders. Health insurance coverage was also examined as an effect modifier since it was strongly associated with mammography in this study. For the assessment of effect modification, menopausal status was categorized as premenopausal or postmenopausal, age was categorized as <65 years or ⩾65 years, maximum BMI was categorized as <30 or ⩾30, and health insurance coverage was categorized as none or any (Medicare/Medicaid/private/CHAMPUS/other).

Statistical analyses were performed in SAS version 9.2. This study assessed statistically significant (two-sided, $p < 0.05$) differences between women with diabetes and women without diabetes for potential confounders using chi-square tests. Unconditional logistic regression was used to estimate the odds ratios (Ors) and 95% CIs for mammography use associated with diabetes. Interaction terms, the product of diabetes and the putative effect modifiers (menopausal status, age, maximum BMI, and health insurance coverage), were added to logistic regression models and likelihood ratio tests were performed to test for effect modification. Variables were considered confounders if their addition to the model changed the unadjusted OR by 10% or more.

3. Results

Table 1 presents demographic and other characteristics of white women who did ($n = 4807$, 32.8%) and did not ($n = 9858$) receive a mammogram in the past 12 months. In comparison with women who did not receive a mammogram, women who did receive a mammogram tended to be older, have a higher household income, have a higher education level, be married or living with a partner, have a family history of breast cancer, have private health insurance, have a lower maximum BMI, be taking cholesterol medications, be never or former smokers, be post-menopausal, have taken hormone replacement therapy, and engaged in less vigorous physical activity during their 30s. With the exception of engaging in less moderate physical activity during their 30s, similar patterns were seen in comparing black women who did ($n = 9145$, 29.6%) and did not receive a mammogram ($n = 21{,}701$), as seen in Table 2.

Table 3 presents ORs for the association between diabetes measures and mammography within the past 12 months among white and black women. There was no evidence of effect modification by menopausal status, age, maximum BMI, or health insurance coverage so models are adjusted

Table 2 Characteristics of black women who did and did not receive a mammogram within the past 12 months, Southern Community Cohort Study, 2002–2009.

Characteristic	Received mammogram		Did not receive mammogram		*p*-value
	n	%	*n*	%	
Age (years)					<0.0001
40–49	3679	40.2	11,044	50.9	
50–59	2434	37.6	7013	32.3	
60–69	1571	17.2	2701	12.5	
70–79	463	5.1	943	4.4	
Total household income					<0.0001
<$15,000	4833	53.6	13,240	61.8	
$15,000–$49,999	3496	38.8	7406	34.6	
⩾$50,000	686	7.6	784	3.7	
Educational level					<0.0001
<12 years	2411	26.4	6799	31.3	
Completed high school or GED	2894	31.7	7234	33.4	
Vocational/some college	2544	27.8	5595	25.8	
Graduated from college	1288	14.1	2056	9.5	
Marital status					<0.0001
Single	1929	21.2	5659	26.2	
Married/living with a partner	2671	29.4	5598	25.9	
Divorced/widowed/separated	4502	49.5	10,368	47.9	
Family history of breast cancer					<0.0001
No	7416	88.0	17,690	90.6	
Yes	1012	12.0	1871	9.4	
Health insurance coverage					<0.0001
None	2622	28.8	8950	41.4	
Medicare/medicaid only	3255	35.7	7231	33.5	
Any private/champus/other	3240	35.5	5439	25.2	
Recruitment source					<0.0001
Community health centers	8034	87.9	20,193	93.1	
General population	1111	12.2	1508	7.0	
Body mass index (kg/m^2) maximum					<0.0001
<25	667	7.5	2138	10.0	
25–29.99	1850	20.6	4378	20.6	
30–39.9	4187	46.5	9484	44.6	
⩾40	2292	25.5	5287	24.8	
Hypertension					<0.0001
No	3089	33.8	8660	39.9	
Yes	6053	66.2	13,035	60.1	
Cholesterol medications					<0.0001
No	7099	77.7	18,331	84.6	
Yes	2033	22.3	3344	15.4	
Alcohol intake					<0.0001
No	2060	22.9	4351	20.3	
Yes	6953	77.1	17,097	79.7	
Menopausal status					<0.0001
Premenopausal	2674	29.3	8335	38.5	
Post-menopausal	6442	70.7	13,308	61.5	
Hormone replacement therapy					<0.0001
No	6386	70.1	17,399	80.4	
Yes	2721	29.9	4240	19.6	
Moderate physical activity (hours per week during 30s)					0.45
0	275	3.1	733	3.5	
0.01–4.99	181	2.0	426	2.0	
⩾5	8426	94.9	20,040	94.5	

(*continued on next page*)

Table 2 (*continued*)

Characteristic	Received mammogram		Did not receive mammogram		*p*-value
	n	%	*n*	%	
Vigorous physical activity (hours per week during 30s)					0.0002
0	2883	32.4	7406	34.8	
0.01–4.99	1312	14.7	2877	13.5	
⩾5	4714	52.9	10,977	51.6	

Table 3 Odds ratio for receiving a mammogram within the past 12 months associated with diabetes among white and black women, Southern Community Cohort Study, 2002–2009.

Characteristic	Received mammogram		Did not receive mammogram		OR[b]	95% CI [c]
	n	%	*n*	%		
White						
Self-reported diabetes						
No	3886	80.9	7814	79.3	1.0	Referent
Yes	919	19.1	2041	20.7	0.95	0.85–1.06
Missing	2		3			
Times since diabetes diagnosis (years)[a]						
<1	83	9.2	155	7.7	1.0	Referent
1–4	298	33.0	672	33.3	0.69	0.50–0.96
5–9	200	22.1	449	22.3	0.70	0.50–1.00
10–14	123	13.6	301	14.9	0.69	0.48–1.01
15–19	70	7.7	159	7.9	0.80	0.52–1.23
⩾20	130	14.4	281	13.9	0.78	0.53–1.14
Missing	15		24			
Diabetes medications[a]						
No	209	22.8	410	20.1	1.0	Referent
Yes	709	77.2	1630	79.9	0.83	0.67–1.04
Missing	1		1			
Black						
Self-reported diabetes						
No	6704	73.3	16,547	76.3	1.0	Referent
Yes	2441	26.7	5144	23.7	1.00	0.93–1.07
Missing	0		10			
Times since diabetes diagnosis (years)[a]						
<1	186	7.8	384	7.6	1.0	Referent
1–4	709	29.8	1529	30.4	0.87	0.70–1.08
5–9	525	22.1	1029	20.5	0.92	0.74–1.15
10–14	360	15.1	796	15.9	0.80	0.63–1.01
15–19	210	8.8	462	9.2	0.78	0.60–1.02
⩾20	390	16.4	823	16.4	0.83	0.65–1.05
Missing	61		121			
Diabetes medications[a]						
No	321	13.2	677	13.2	1.0	Referent
Yes	2118	86.8	4463	86.8	0.91	0.77–1.07
Missing	2		4			

[a] Among women with diabetes.
[b] Odds ratio adjusted for age, total annual household income, educational level, marital status, health insurance coverage, recruitment source, maximum BMI, hypertension, cholesterol medications, alcohol intake, menopausal status, hormone replacement therapy and leisure-time moderate and vigorous physical activity during their 30s.
[c] Confidence interval.

for all of the variables. Among white women, 33.2% of those without diabetes had received a mammogram, compared with 31.0% of those with diabetes. Overall, there was no association between self-reported diabetes and mammography in white women (OR 0.95, 95% CI 0.85—1.06) which did not differ by menopausal status (premenopausal OR 0.88, 95% CI 0.66—1.15; postmenopausal OR 0.96, 95% CI 0.86—1.09; *p*-value for interaction = 0.65) (not shown). However, among women with diabetes, mammography use was significantly less by approximately 30% for 1—14 years relative to the first year after the diabetes diagnosis. Instead of restricting the time since diabetes diagnosis analysis to diabetic patients, if those without diabetes are used as the reference category, a non-significant higher odds of mammography use within one year of diabetes diagnosis is evident (OR 1.29, 95% CI 0.95—1.74) (not shown). There was little effect of the use of diabetes medications on recent mammography among white women (OR 0.83, 95% CI 0.67—1.04).

Among black women, 28.8% of those without diabetes and 32.2% of those with diabetes had received a mammogram. As was seen in white women, there was no association between diabetes and mammography use among black women (OR 1.00, 95% CI 0.93—1.07), but there was also no significant association between mammography use and time since diabetes diagnosis or use of diabetes medications. However, similar to whites, a non-significant higher odds ratio of mammography use was observed within a year of diabetes diagnosis when compared against black women without diabetes (OR 1.18, 95% CI 0.97—1.43) (not shown). The diabetes and mammography use association did not differ by menopausal status among black women (premenopausal OR 1.01, 95% CI 0.88—1.16; post-menopausal OR 0.99, 95% CI 0.92—1.07; *p*-value for interaction = 0.24) (not shown).

4. Discussion

Although previous studies among whites have reported lower mammography use among women with diabetes compared with women without diabetes [9—12], this study found no difference in recent mammography use by diabetes status overall. These findings among blacks were similar to those of McBean and Yu [11] in that women with and without diabetes received recent mammography with similar prevalence overall. It was not possible to categorize time-since-diabetes-diagnosis any more finely than 1 year, but the higher mammography use within a year of diabetes diagnosis followed thereafter by lower use (with 30% and 12% reductions in mammography use among whites and blacks, respectively) is consistent with the findings of Bowker et al. [6] who reported an elevated postmenopausal breast cancer risk within 3 months of diabetes diagnosis that disappeared with time following the diagnosis.

To further explore the racial difference in timing of mammography relative to diabetes diagnosis, a sensitivity analysis was performed restricted to women who had been diagnosed with diabetes, hypertension or high cholesterol and who received a mammogram to determine whether the distributions were similar for the three chronic conditions (not shown). Time between diagnosis and mammography was categorized as less than one year vs. one year or greater. The percentage of women with hypertension (whites 7.9%, blacks 6.9%, *p*-value = 0.014) and women with high cholesterol (whites 13.0%, blacks 17.5%, *p*-value <0.0001) who received a mammogram within one year of diagnosis differed significantly by race, but the direction of association with race differed for hypertension and high cholesterol, while the percentage of women with diabetes who received a mammogram within one year of diagnosis did not differ significantly by race (whites 10.1%, blacks 9.4%, *p*-value = 0.298). The absence of a consistent, systematic racial pattern for mammography use following diagnosis of various chronic diseases lends support to the validity of these findings. Thus, higher mammography use in the short-term following a diabetes diagnosis may account in part for the slightly elevated breast cancer risk associated with diabetes among white women, but not among black women.

A limitation of this study was the self-reporting of mammography use and diabetes; however, a validation sub-study of the SCCS found that over 95% of self-reported diabetes could be confirmed through a medical chart review [14]. Approximately one fourth of diabetes is undiagnosed, so there may have been a misclassification of self-reported diabetes status among those not reporting diabetes [17]. Mammography histories were not collected in this study and therefore the indication for the mammogram was unknown, so there may have been women receiving diagnostic rather than screening mammograms. In addition, self-reported dates of diabetes diagnosis or whether diabetes was diagnosed within the year prior to entry into the cohort preceding the recent mammography was not validated. However, the correct temporal sequence of diabetes preceding the mammography is assured for the great majority of diabetes pa-

tients with greater than one year duration of diabetes.

Study strengths included the large size of the study and assessment of effect modification and confounding. The numbers of women were sufficient to investigate the associations between diabetes and mammography use in white and black women separately. Menopausal status, age, maximum BMI and health insurance were assessed as effect modifiers in an attempt to disentangle their contribution to the diabetes and mammography use association. These and other confounders were adjusted to isolate the effect of diabetes on mammography apart from its effect on access to care.

5. Conclusions

In conclusion, although there was some evidence of higher mammography use within one year of diabetes diagnosis, these results suggest that mammography use is not related to diabetes. Possible direct effects of diabetes on increased breast cancer growth through causal pathways should continue to be explored.

Conflict of interest

None of the authors has a conflict of interest.

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References

[1] Wolf I, Sadetzki S, Catane R, Karasik A, Kaufman B. Diabetes mellitus and breast cancer. Lancet Oncol 2005;6:103—11.
[2] Larsson SC, Mantzoros CS, Wolk A. Diabetes mellitus and risk of breast cancer: a meta-analysis. Int J Cancer 2007;121:856—62.
[3] Xue F, Michels K. Diabetes, metabolic syndrome, and breast cancer: a review of the current evidence. Am J Clin Nutr 2006;86(Suppl.):832S—5S.
[4] Liao S, Li J, Wei W, Wang L, Zhang Y, Li J, et al. Association between diabetes mellitus and breast cancer risk: a meta-analysis of the literature. Asian Pac J Cancer Prev 2011;12:1061—5.
[5] Lambe M, Wigertz A, Garmo H, Walldius G, Jungner I, Hammar N. Impaired glucose metabolism and diabetes and the risk of breast, endometrial, and ovarian cancer. Cancer Causes Control 2011;22:1163—71.
[6] Bowker SL, Marra CA, Richardson K, Johnson JA. Risk of breast cancer after onset of type 2 diabetes. Diabetes Care 2011;34:2542—4.
[7] La Vecchia C, Giordano SH, Hortobagyi GN, Chabner B. Overweight, obesity, diabetes, and risk of breast cancer: interlocking pieces of the puzzle. The Oncologist 2011;16:726—9.
[8] Johnson JA, Bowker SL, Richardson K, Marra CA. Time-varying incidence of cancer after the onset of type 2 diabetes: evidence of potential detection bias. Diabetologia 2011;54:2263—71.
[9] Fontana SA, Baumann LC, Helberg C, Love RR. The delivery of preventive services in primary care practices according to chronic disease status. Am J Public Health 1997;87:1190—6.
[10] Beckman TJ, Cuddihy RM, Scheitel SM, Naessens JM, Killian JM, Pankratz VS. Screening mammogram utilization in women with diabetes. Diabetes Care 2001;24:2049—53.
[11] McBean AM, Yu X. The underuse of screening services among elderly women with diabetes. Diabetes Care 2007;30:1466—72.
[12] Lipscombe LL, Hux JE, Booth GL. Reduced screening mammography among women with diabetes. Arch Intern Med 2005;165:2090—5.
[13] Cohen SS, Signorello LB, Gammon MD, Blot WJ. Obesity and recent mammography use among black and white women in the Southern Community Cohort Study (United States). Cancer Causes Control 2007;18:765—73.
[14] Signorello LB, Hargreaves MK, Blot WJ. The Southern Community Cohort Study: investigating health disparities. J Health Care Poor Underserved 2010;21:26—37.
[15] Brookhart MA, Patrick AR, Dormuth C, Avorn J, Shrank W, Caderette SM, et al. Adherence to lipid-lowering therapy and the use of preventive health services: an investigation of the healthy user effect. Am J Epidemiol 2007;166:348—54.
[16] Bjorge T, Lukanova A, Jonsson H, Tretli S, Ulmer H, Manjer J, et al. Metabolic syndrome and breast cancer in the Me-Can (Metabolic Syndrome and Cancer) project. Cancer Epidemiol Biomarkers Prev 2010;19:1737—45.
[17] Cowie CC, Rust KF, Byrd-Holt DD, Gregg EW, Ford ES, Geiss LS, et al. Prevalence of diabetes and high risk for diabetes using A1C criteria in the U.S. population in 1988—2006. Diabetes Care 2010;33:562—8.

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