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## Association between Medical Home Enrollment and Health Care Utilization and Costs among Breast Cancer Patients in a State Medicaid Program

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### Abstract

**Background**—The patient centered medical home (PCMH) is increasingly being implemented in an effort to improve and coordinate primary care, but its effect on health care utilization among breast cancer patients remains unclear. The objective of this study was to examine health care utilization and expenditures as a function of PCMH enrollment among breast cancer patients in North Carolina's Medicaid program.

**Methods**—North Carolina Medicaid claims linked to North Carolina Central Cancer Registry records (2003-2007) were used to examine monthly patterns of health care use and expenditures. Fixed effects regression models analyzed associations between PCMH enrollment and utilization of outpatient, inpatient, and emergency department (ED) services and Medicaid expenditures during the 15-months after breast cancer diagnosis, controlling for selection bias on time-invariant characteristics.

**Results**—Among 758 breast cancer patients, 381 (50%) were enrolled in a PCMH at some time in the 15 months post-diagnosis. After controlling for individual fixed effects, PCMH enrollment was significantly associated with greater outpatient service use, but there was no difference in the probability of inpatient hospitalizations or ED visits. Enrollment in a PCMH was associated with increased average expenditures of \$429 per month during the first 15 months.

**Conclusions**—Greater outpatient care utilization and increased average expenditures among breast cancer patients enrolled in a PCMH may suggest that these women have improved access to primary and specialty care. Expanding PCMHs may change patterns of service utilization for Medicaid breast cancer patients, but may not be associated with lower costs.

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## Keywords

medical home; Medicaid costs; health care utilization; breast cancer

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## Introduction

The patient centered medical home (PCMH) model emphasizes patient-centered care by coordinating comprehensive, high quality, and community-based health care across providers<sup>1</sup>. This team-based health care delivery model has been increasingly noted as a potential solution to increase efficiency, improve patient health, and control costs<sup>1-4</sup>. Although evidence on the effectiveness of PCMHs in achieving these aims has been mixed, in North Carolina (NC) and other states, access to a PCMH has been associated with increased use of preventive health services, better clinical guideline adherence, and increased care coordination<sup>5-7</sup>. In some patient populations, PCMHs have been associated with shorter length of hospital stays, increased access to needed services, and reduced risks of delayed/forgone care<sup>8-11</sup>; findings are mixed regarding hospital admissions and emergency department visits<sup>12,13</sup>. However, previous research around PCMHs has focused on chronic diseases like asthma, heart disease, diabetes and mental illness, and few have examined the potential to improve care among cancer patients and survivors<sup>14,15</sup>.

Follow-up care for cancer patients aligns well with the principles of the PCMH to improve disease management<sup>15</sup>. Cancer treatment and follow-up often entail coordinating multiple providers, procedures, and medications, and over time, continued follow-up and surveillance requires additional coordination across providers. Additionally, cancer patients often suffer from multiple comorbid conditions, requiring additional complex care<sup>16,17</sup>. Coordinated care through a PCMH may help address challenges cancer patients face in staying connected to primary care, especially as they transition from active treatment to survivorship care<sup>18</sup>. Moreover, cancer patients are known to generate high health care costs, and their service use poses a significant expense to Medicaid and other payers as cancer care costs continue to outgrow other health services sectors<sup>19-22</sup>.

Although other studies have described how enrollment in a PCMH may lead to improved cancer care quality,<sup>7,23</sup> few studies have described how the PCMH affects health care utilization and expenditures among cancer patients. Many state Medicaid programs have been developing and implementing medical homes for over a decade and the Affordable Care Act contains provisions for medical or health homes<sup>24</sup>. Therefore, describing utilization patterns and expenditures among cancer survivors will inform policy makers and administrators as they move toward expanding access to medical homes. Using data from NC Medicaid beneficiaries with cancer, we examined whether enrollment in a PCMH was associated with additional health care utilization and overall Medicaid expenditures. Because adult Medicaid beneficiaries are more often female and breast cancer is one of the most common cancers among women, this study focuses on low-income, Medicaid-enrolled breast cancer patients, but the principles of the PCMH model likely extend to other types of cancer patients as well.

## Methods

### Setting

In the early 1990s, Community Care of North Carolina (CCNC) implemented a medical home model to improve primary care in vulnerable populations insured by Medicaid, and to control costs<sup>9</sup>. Uptake of and engagement in medical homes has increased over time and networks currently cover all 100 NC counties<sup>5,25</sup>. National Committee for Quality Assurance (NCQA) recognition of medical homes came later, in 2008, through its PCMH recognition program. CCNC practices are not required to be NCQA recognized, but NC has one of the higher recognition rates among states<sup>26</sup>. CCNC manages and coordinates care for high-risk patients, with more than 5,500 physicians caring for approximately 1.4 million of NC Medicaid's beneficiaries in a PCMH setting<sup>27</sup>.

### Data

We used NC Medicaid claims and enrollment data matched to NC Central Cancer Registry records for persons diagnosed with early breast cancer (stages 0-2, or unstaged disease) from 2003-2007. This represents a time period when the PCMH model was expanding throughout the NC Medicaid population and may be more generalizable to other states' PCMH experience currently.

Following a previously published approach, we required that women were enrolled in Medicaid for at least one month prior to their index breast cancer diagnosis and 80% of the 15-, 24, and 36-month follow-up periods after the first breast cancer diagnosis<sup>7,23</sup>. The dataset was restricted to women aged 18-64 years and only included person-months when women were not dually eligible for Medicare to ensure that complete health care service use was captured in Medicaid claims data. Although women who enroll in Medicaid through the Breast and Cervical Cancer Program receive full Medicaid coverage, they are ineligible for participation in CCNC. We therefore excluded person-months in which women were enrolled in Medicaid through the Breast and Cervical Cancer Program because they were ineligible at that time for the CCNC medical home program.

### Measures

Our goal was to characterize how enrollment in a PCMH was associated with health service utilization in the first 15 months post-diagnosis and total expenditures among breast cancer patients in the first 15, 24, and 36 months post diagnosis. Three outcomes reflecting utilization patterns were examined at the patient-month level: outpatient visits, inpatient hospitalizations, and emergency department (ED) use. We used a combination of physician-specific procedure codes and provider specialty codes to categorize types of outpatient visits (supporting information table). We omitted visits specifically related to receipt of breast cancer treatment (i.e., radiation, chemotherapy, surgery, or laboratory services) in the general outpatient visit measure. We also measured frequency of visits for oncology provider consultations, primary care providers (PCPs), and non-oncology specialists based on specialty codes in the claims data. We calculated total Medicaid expenditures at the person-month level, starting at the month of diagnosis. Because enrollment in a PCMH may be

more valuable over time, we measured all direct medical expenditures occurring anytime during the 15-, 24-, and 36-month follow-up periods.

The key independent variable of interest, PCMH enrollment, was constructed by identifying monthly PCMH payments to medical home providers and to the affiliated CCNC network which helped practices coordinate care and implement disease management programs. The dichotomous PCMH enrollment variable captures monthly enrollment, allowing variation in PCMH enrollment status from one month to the next and includes switching in and out of the program, which may occur when a patient changes providers or a provider becomes a CCNC practice.

Clinical characteristics as well as relevant socio-demographic factors that may affect the individual's health care utilization are described in Table 1. Tumor stage at diagnosis was derived from the American Joint Committee on Cancer grouping or Surveillance, Epidemiology and End Results summary stage. Staging data was missing or unknown in the registry data for almost 10% of the sample, but this is not an uncommon proportion of cases with no stage indication, thus they were also included. Comorbid conditions at diagnosis were determined using National Cancer Institute combined index with some modification, following previously published work <sup>7,23,28</sup>.

### Analytic Approach

We first conducted bivariate analyses to compare values of health care service utilization by PCMH enrollment as well as other sample characteristics. Monthly patterns of health care utilization and expenditures change over time, so the dataset was constructed at the person-month level (i.e., one observation per person for each month after a patient's initial diagnosis). Multivariate fixed effects models analyzed outcomes per woman to account for individual heterogeneity; therefore, person-specific, time-invariant factors such as race are effectively controlled. We conducted both linear and logistic regressions to estimate average marginal effects (MEs) of PCMH enrollment on monthly utilization of health services. MEs represent the marginal change in the probability of having any visit, the number of visits or total costs induced by PCMH enrollment. We also evaluated count-based regressions with fixed effects, but ultimately, because the results were qualitatively similar across the linear, logistic, and count-based regressions, we report results of the linear regressions with fixed effects because the interpretation of marginal effects is more straightforward. We used the unlogged form of expenditures as our dependent variable after the Wooldridge test indicated that it was a better fit for the expenditures model <sup>29</sup>.

We controlled for time-varying factors, including blind/disabled classification according to Social Security eligibility and breast cancer treatments, including receipt of surgical treatment, chemotherapy, and radiation therapy. We also included time fixed effects to control for time trends. We used cluster robust standard errors to adjust for heteroskedasticity in all models.

All analyses were conducted using STATA (Stata 12; StataCorp, College Station, TX).

## Results

The sample included 758 unique women with breast cancer, and a total of 9,407 person-month observations. Table 1 presents the summary statistics of the person-month observations, including time-invariant and time-varying socio-demographic characteristics and utilization. Overall, 50% of the sample was enrolled in a PCMH for at least one month, and we identified PCMH enrollment in 41% of the person-month observations. Among those who were ever enrolled, the mean enrollment in the program was 10.6 months (standard deviation (SD): 4.3). Women in a PCMH were more likely to have stage 1 breast cancer, hormone receptor positive tumors, and higher comorbidities. Those enrolled in the PCMH program were more often black and were also more likely to receive chemotherapy, radiation, or be classified as blind/disabled. In bivariate analyses, women in a PCMH had more outpatient visits than did women not in a PCMH (2.7 vs. 2.1,  $p<0.001$ ).

Sixty-nine percent of the observations had at least 1 outpatient visit in the first 15 months post diagnosis, not including visits where surgery, chemotherapy, and/or radiation therapy were received, and the unadjusted mean number of monthly outpatient visits was 2.4. Women with any outpatient use were more likely to be black, live in an urban county, or have stage 1 disease. Those with hormone receptor positive tumors were less likely to have an outpatient visit. Inpatient hospitalizations and ED visits occurred less frequently, with only 4.5% and 8.2% of person-months including hospitalizations and ED use, respectively; 255 (34%) women were hospitalized and 319 (42%) used emergency services at least once.

The unadjusted monthly Medicaid expenditures were higher among women in a PCMH (\$2,506 compared to \$1,933 among women not in a PCMH) in the first 15 months following breast cancer diagnosis ( $p<0.001$ ). The NC Medicaid program paid on average a total of \$33,161 per breast cancer patient for health care use in the first 15 months after diagnosis. Per-person monthly expenditures were highest in the month immediately following diagnosis (\$3,118) and gradually declined over time.

### Types of provider visits

We examined types of outpatient use including visits to PCPs, oncologists, and other non-oncology specialists as displayed in Table 2. In terms of PCP visits, when women were in a PCMH they were more likely to see a PCP (38% vs. 27%,  $p<0.001$ ); the unadjusted mean number of visits was also higher for months in a PCMH ( $p<0.001$ ). The monthly number of visits to an oncologist ranged from 0-13 visits; there were no differences by PCMH status. During months when women were enrolled in a PCMH, they were more likely to see non-oncology specialists (33% vs. 26%,  $p<0.001$ ).

### Medical home enrollment and health care utilization

The results of the fixed effect regression models for utilization are presented in Table 3. PCMH enrollment was associated with significantly more monthly outpatient service utilization; on average, during months when women were enrolled in a PCMH, they had 0.52 more visits ( $p<0.001$ ). Being classified as blind/disabled, and receiving breast cancer treatment were also associated with significantly more outpatient service visits. However,

being in a PCMH did not have a statistically significant effect on the probability of ever being hospitalized or using the ED. Blind/disabled classification and having received surgery, however, were significant predictors of having any inpatient hospitalization. Blind/disabled classification and having received radiation therapy were significant predictors of ever using the ED.

### Role of medical home on Medicaid expenditures

After controlling for individual and time fixed effects, PCMH enrollment corresponded to a significant increase in the average monthly expenditures for breast cancer patients (Table 4). On average, being in a PCMH was associated with greater Medicaid costs of \$429 (95% CI: \$115-\$744) per month in the first 15 months. However, the effect on expenditures was not statistically significant when we analyzed costs up to 24 and 36 months post-diagnosis; the magnitude of the difference in monthly expenditures trended downward over time. In the months when women were classified as blind/disabled and received any breast cancer treatment (surgery, radiation, or chemotherapy), we observed significant associations with increased monthly expenditures throughout all examined time periods.

### Discussion

This study examined the association between enrollment in a medical home and health care utilization and expenditures among a low-income breast cancer population insured by Medicaid. We characterized utilization patterns of outpatient, inpatient, and ED services. We addressed selection bias of medical home enrollment by estimating fixed effects models, thus estimating the effect of changes of PCMH enrollment *within* person over time. The results indicate that the medical home model may improve access to outpatient care among vulnerable populations like low-income breast cancer patients, but with some additional expenditures.

Our findings suggest that the PCMH program may enhance access to primary care for cancer patients and better connect them with outpatient providers, including non-oncology specialists, such as psychiatrists and physical therapists. We found that while women were enrolled in a PCMH they had significantly more PCP and specialist visits. This finding may not be surprising, given that the coordination program encourages enrollees to visit their PCPs regularly, and access to this personal physician ensures that breast cancer follow-up care as well as other non-cancer related services are more likely to be received by PCMH enrollees.

Although we did not find statistically significant reductions in hospitalizations or ED visits, these findings are consistent with other studies which reported no significant change in hospitalizations or ED visits after implementing PCMH models in other states<sup>12,13</sup>. We may not see lower utilization of these services because PCMH providers may be better at detecting health conditions that warrant appropriate inpatient or ED service use. If this occurs, any reductions in inappropriate inpatient or ED service use may not be apparent using generic measures of utilization. Explorations of the appropriateness of inpatient and ED service use was beyond the scope of the current study and would require a larger sample to better understand this relationship. However, in a separate analysis, we examined health

care utilization from chemotherapy-related adverse events and found that over 70% of breast cancer patients had at least 1 visit due to a chemotherapy-related adverse event and that MH enrollment was associated with significantly fewer inpatient admissions<sup>23</sup>. A recent systematic review on the PCMH reported results from five trials of PCMH interventions and showed no effect on inpatient utilization; additionally, three trials showed no effect on ED utilization<sup>6</sup>. However, other observational studies have had mixed results about utilization and costs among elderly, adult, and child populations<sup>6,8,12</sup>, which may indicate that the PCMH model may have different effects among different populations with varying diseases.

Among breast cancer patients, being in a PCMH was associated with increased monthly Medicaid expenditures in the first 15 months post diagnosis. This is likely a result of greater access to care and other services through the PCMH. Although expenditures were significantly higher for those months when patients were enrolled in a PCMH (on the order of approximately \$429 per month), increased expenditures may suggest that CCNC is able to provide better access to address unmet health needs of this vulnerable population.

Although we found evidence of greater Medicaid expenditures for breast cancer patients enrolled in a PCMH, even after using fixed effects estimation, we observed a trend of decreasing differences in expenditures for PCMH over time. Generally high health care service utilization and expenditures during the first year of cancer treatment are driven by primary treatment, including surgery, radiation therapy, and chemotherapy, which typically occur shortly after diagnosis<sup>30</sup>. As breast cancer patients transition from active therapy to survivorship care, they still use services related to ongoing treatment and surveillance, but we expect these health care visits and related costs to be less than those for initial cancer treatment. After the intensive treatment in the initial months, the monthly Medicaid expenditures decreased at least on a per-beneficiary basis. This is consistent with multiple studies of long term cancer costs having a cost-curve that corresponds to high costs during intense treatment shortly after being diagnosed and tapering off until end of life care<sup>20</sup>. Importantly, because our study was focused on early stage breast cancer patients during the first 1-3 years post-diagnosis (largely before recurrences occur), end of life care costs were immaterial.

This study provides valuable insight into health care utilization and expenditures associated with the PCMH model in a vulnerable, low-income population of breast cancer patients. Using these cancer registry-linked-claims data presented several opportunities as well as some limitations. Medicaid claims cannot capture the motivation of patients to participate in PCMHs or seek care; however, using fixed effects, we controlled for unobserved individual heterogeneity that doesn't change over time. Because part of the goal of implementing PCMHs was to improve access to and quality of care, simultaneity of PCMH enrollment and our outcomes may be of concern. For example, people who have a higher propensity to seek out and enroll in a PCMH may also have a higher propensity to use health care. We would argue that the fixed effects technique captures much of the unobserved selection associated with enrolling in a PCMH and controls for individual person effects, such as stage of disease, race, and age. However, unobserved time-varying characteristics, such as personal health risk perception may change with cancer diagnosis and treatment over time and may affect enrollment into PCMH and subsequently affect the use of services. Although we may

expect to see more long-term effects of PCMH enrollment, extending our time period beyond the first 36-months following diagnosis would decrease our sample size due to transient Medicaid enrollment, therefore limiting our ability to make meaningful inferences. Nonetheless, this study adds to the nascent but growing literature evaluating the effects of the PCMH model on utilization and costs among cancer patients.

Given the increasing number of cancer survivors and opportunities for Medicaid expansion, states may see more Medicaid beneficiaries with cancer in the future. In addition, with the increased emphasis on implementation of core elements of medical homes in the ACA, we may see more states and payers implementing medical home programs like CCNC<sup>24,31</sup>. Additional studies examining the effects of the PCMH on other aspects of cancer care, such as prevention and screening services, are needed. Care models that provide treatment assistance and target high-risk, low-income cancer patients may require significant initial financial investment, but enrolling vulnerable populations such as low-income women with breast cancer in a PCMH may be an effective strategy to provide access to care and to enhance quality and outcomes for cancer patients as they transition to survivorship.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1**  
**Characteristics of person-month sample of Medicaid breast cancer patients**

	Person month observations with the characteristic N = 9,407	Percentage / Mean (sd)
<i>Time varying characteristics</i>		
Medical home	3,872	41.1
Blind/disabled	3,753	39.9
Breast cancer therapy		
Surgery	571	6.07
Radiation	1,464	15.6
Chemotherapy	829	8.81
<i>Time invariant patient characteristics</i>		
Age at diagnosis		49.1 (9.6)
Race		
White	4,032	43.1
Black	4,373	46.7
Other	957	10.2
Urban residence	5,809	62.0
National Cancer Institute comorbidity index		0.28 (0.49)
Tumor stage		
Stage 0 ( <i>in situ</i> )	2,145	22.9
Stage 1	3,652	39.0
Stage 2	2,608	27.9
Stage unknown	957	10.2
Hormone receptor positive	3,707	39.6
Year of diagnosis		
2003	2,093	22.4
2004	1,544	16.5
2005	1,879	20.1
2006	1,895	20.2
2007	1,951	20.8
<i>Utilization Measures</i>		
Outpatient care visits		2.39 (2.92)
Inpatient hospitalizations		0.05 (0.24)
Emergency department visits		0.11 (0.42)
Medicaid expenditures		\$2,168 (3,699)

Notes: sd, standard deviation

**Table 2**  
**Unadjusted comparisons of monthly types of provider visits among sample by medical home status**

	Months enrolled in a medical home (N=3,872)	Months not enrolled in medical home (N=5,535)	Total (N=9,407)
Any PCP visit in the month, % ( <i>observations</i> )	38.1% (1,475)	26.8% (1,482)	31.4% (2,957) ***
Unconditional mean of PCP visits, <i>mean (sd)</i>	0.56 (0.87)	0.40 (0.78)	0.46 (0.82) ***
Mean of primary care provider visits among PCP users	1.48 (0.81)	1.48 (0.82)	1.48 (0.81)
Any oncologist visit in the month	8.1% (312)	7.3% (402)	7.6% (714)
Unconditional mean of oncologist visits	0.11 (0.42)	0.10 (0.45)	0.11 (0.44)
Conditional mean of oncologist visits among oncologist users	1.35 (0.70)	1.43 (0.96)	1.40 (0.86)
Any other specialist visit in the month	32.7% (1,268)	25.9% (1,433)	28.7% (2,701) ***
Unconditional mean of other specialist visits	0.49 (0.87)	0.41 (0.85)	0.44 (0.86) ***
Conditional mean of other specialist visits among specialist users	1.50 (0.89)	1.58 (0.98)	1.54 (0.94) *

Notes:

\*\*\*  
p<0.001;

\*\*  
p<0.01;

\*  
p<0.05

Monthly conditional means only account for those ever using the service in the month

During months when women were enrolled in a PCMH, they were more likely to have a PCP visit (p<0.001), and also had more PCP visits (p<0.001). There were no differences by medical home status in ever having an oncologist visit or the number of visits to an oncologist. During months in a PCMH, women were more likely to see a specialist (p<0.001) and also had greater visits to other specialists.

**Table 3**  
**Fixed effects regression estimation results – average marginal effect of medical home enrollment on utilization**

	Outpatient Use	Inpatient Use (LPM)	Emergency Department Use (LPM)
Medical Home (never enrolled reference category)	0.5252 *** (0.1111)	-0.0006 (0.0089)	0.0123 (0.0104)
Blind/Disabled	1.4088 *** (0.1590)	0.0580 *** (0.0130)	0.0683 *** (0.0138)
Breast Cancer Therapy			
Surgery	1.3137 *** (0.1149)	0.1846 *** (0.0178)	0.0172 (0.0145)
Radiation	2.1733 *** (0.1237)	0.0137 (0.0104)	0.0681 *** (0.0131)
Chemotherapy	0.2628 * (0.1228)	-0.0061 (0.0082)	-0.0116 (0.0094)
N observations	9,407	9,407	9,407
n breast cancer survivors	758	758	758

Notes:

\*\*\*  
p<0.001;

\*\*  
p<0.01;

\*  
p<0.05

LPM, linear probability model;

All models control for individual and time fixed effects (not shown) and excluded observation months in which the person was classified as partially or fully dual eligible for Medicare or enrolled through the breast and cervical cancer control program;

Cluster-robust standard errors in parentheses

**Table 4**  
**Fixed effects regression estimation results – average marginal effect of medical home enrollment on monthly Medicaid expenditures**

	Months after breast cancer diagnosis <sup>†</sup>		
	15 months	24 months	36 months
Medical Home	\$429 <sup>**</sup> (160)	\$254 (139)	\$154 (107)
Observations	9,407	11,386	13,883
Number of Individuals	758	560	485

Notes:

<sup>†</sup> Required continuous enrollment for 80% of each time period;

<sup>\*\*\*</sup> p<0.001;

<sup>\*\*</sup> p<0.01;

<sup>\*</sup> p<0.05;

All models control for individual and time fixed effects, blind/disabled classification, and breast cancer treatment (surgery, radiation, and chemotherapy). Models excluded observation months in which the person was classified as partially or fully dual eligible for Medicare or enrolled through the breast and cervical cancer control program

Cluster robust standard errors in parentheses