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Evaluating the potential for primary care to serve as a mental health home for people with schizophrenia

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Abstract

Objective—Primary care-based medical homes could improve the coordination of mental health care for individuals with schizophrenia and comorbid chronic conditions. The objective of this paper is to examine whether persons with schizophrenia and comorbid chronic conditions engage in primary care regularly, such that primary care settings have the potential to serve as a mental health home.

Method—We examined the annual primary care and specialty mental health service utilization of adult North Carolina Medicaid enrollees with schizophrenia and at least one comorbid chronic condition who were in a medical home during 2007–2010. Using a fixed-effects regression approach, we also assessed the effect of medical home enrollment on utilization of primary care and specialty mental health care and medication adherence.

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Results—A substantial majority (78.5%) of person-years had at least one primary care visit, and 17.9% had at least one primary care visit but no specialty mental health services use. Medical home enrollment was associated with increased use of primary care and specialty mental health care, as well as increased medication adherence.

Conclusions—Medical home enrollees with schizophrenia and comorbid chronic conditions exhibited significant engagement in primary care, suggesting that primary-care-based medical homes could serve a care coordination function for persons with schizophrenia.

Keywords

Medical homes; Primary care; Schizophrenia; Comorbid conditions

1. Introduction

Individuals with schizophrenia, in addition to requiring a great deal of specialty mental health care, have extensive and complex primary care needs [1–4]. Among these is the need for screening and management of chronic physical conditions such as cardiovascular disease and diabetes [5]. These conditions have been linked to treatment with certain types of antipsychotics and are highly prevalent among individuals with schizophrenia [6,7]. Because people with schizophrenia may use specialty-sector care at least as much as primary care, they have a critical need for effective coordination between providers to ensure consistency of treatment and medication prescribing. This need applies especially to antipsychotics, because having antipsychotic prescriptions from multiple providers has been associated with decreased medication adherence [8]. Coordinating care among providers presents a difficult challenge and is not adequately rewarded under most payment schemes [9].

Compounding the challenges associated with meeting these complex needs, individuals with serious mental illness (SMI) face barriers to accessing high-quality primary care [10]. Low rates of primary care utilization among this population are due to a variety of factors including not receiving timely appointments, financial barriers, and lack of transportation [11]. In addition to these patient-reported access barriers, qualitative research indicates that primary care providers may be reluctant to treat patients with SMI because they perceive that such patients require more clinical resources [12]. For individuals with schizophrenia, lack of access to primary care can result in late detection of chronic illnesses and poorer outcomes, as well as increased use of emergency services [11].

Quality of and access to primary care for individuals with schizophrenia may be improved through innovative organization of primary care service delivery, as in the medical home model developed in the early 1960s [13]. In this model, the medical home provider is reimbursed a modest amount on a per-member-per-month basis for leading the team of healthcare professionals who deliver a patient's medical treatment and coordinating care across providers [14]. The medical home model addresses the specific challenges faced by people with schizophrenia. Evidence suggests that individuals with a medical home tend to have greater access to primary care due to factors like open scheduling [15]. Studies have consistently demonstrated that individuals with a medical home benefit from improved quality of care in the treatment of chronic diseases, including diabetes and asthma [9,16–18].

Further, medical homes improve outcomes for individuals who receive treatment for specialty-intensive conditions, including SMI [19–21].

Although the medical home appears to hold promise for persons with schizophrenia, the literature gives little indication of whether the medical home for this population should be based in primary care or specialty mental health settings. The Substance Abuse and Mental Health Services and Health Resources and Services Administrations propose the development of behavioral health homes, focusing on both care for substance use and mental health, in which behavioral health agencies manage patients' treatment and ensure access to primary care through use of in-house or co-located primary care providers, or facilitated referrals to offsite primary care providers [22]. However, the increasing awareness of chronic diseases and their high prevalence in this population may increase the demand for primary-care-based services, making primary care providers potentially better equipped to oversee the care of individuals with comorbid mental and physical health conditions. Primary care providers may connect medical home enrollees to specialty mental health services and play a lead role in coordinating enrollees' mental health care while ensuring that their physical health needs are met. As policymakers seek to implement these health home models in practice, it is critical to understand how populations targeted by these models – including those with SMI and comorbid chronic conditions – engage with primary care and specialty mental health services.

Using data on North Carolina's Medicaid medical home program, this paper examines the primary care and specialty mental health utilization patterns of individuals with schizophrenia and one or more chronic medical conditions who are enrolled in a primary-care-based medical home. Beginning in 1998, North Carolina's Medicaid program offered its beneficiaries the opportunity to take part in a medical home program being rolled out across the state [21,23–25]. The program initially consisted of primary care providers across the state who received a per-member, per-month (PMPM) fee of \$2.50 to act as a medical home for the state's Medicaid beneficiaries. In addition to payments to practices, voluntarily formed regional networks of primary care providers also received a \$2.50 PMPM to improve care coordination and implement quality improvement initiatives. Though all Medicaid beneficiaries were eligible for participation in the program regardless of their diagnoses, the program focused on individuals with chronic conditions, and participating providers received training through their networks on management of chronic conditions, including diabetes and asthma.

Our examination of utilization patterns focuses on the extent to which medical home enrollees with schizophrenia and one or more chronic condition seek out primary care services. Since patient engagement in primary care is needed for a primary care provider to coordinate the mental health treatment of this population, we use primary care utilization as a marker of the potential for primary care to serve as a mental health home that coordinates mental health care for those with schizophrenia and comorbid chronic conditions. We use the term “mental health home” instead of “behavioral health home” to reflect that fact that our study sample does not focus on individuals with substance use disorders. To better understand the locus of services received inside a medical home, we also examine how

enrollees combine primary care and specialty mental health services. Our data do not allow us to capture visit content or to observe actual care coordination.

In addition to investigating the patterns of care for Medicaid-enrolled adults with schizophrenia who are enrolled in a medical home, we also examine the extent to which these patterns of care vary based on the number of comorbid conditions. Finally, we assess the effects of medical home enrollment on utilization of primary care and specialty mental health services and medication adherence to determine whether having a medical home changes the mix of services and medications among this comorbid population. We expect our findings to inform future research and policy discussions about the potential role of primary care providers in managing care for those with SMI and comorbid chronic conditions.

2. Study data and methods

We investigated the care utilization patterns of Medicaid enrollees with schizophrenia and at least one additional chronic health condition, using data from the North Carolina Integrated Data for Researchers (NCIDR) data set. This data set represents a longitudinal retrospective cohort of people with multiple chronic conditions receiving care from one or more public programs or settings in North Carolina. NCIDR integrates data from four care systems through which persons with schizophrenia in North Carolina are likely to receive services coverage: (1) Medicaid claims and enrollment, (2) state psychiatric hospitals, (3) claims from a regional behavioral health carve-out, and (4) the state agency responsible for reimbursing services provided to medically indigent individuals. Through the use of NCIDR, we constructed a more complete view of health care utilization for our study participants than any single source could provide.

We restricted our study sample to North Carolina Medicaid enrollees who were over the age of 18 and had administrative diagnoses of schizophrenia and at least one of seven selected chronic conditions: hypertension, hyperlipidemia, seizure disorder, chronic obstructive pulmonary disease, diabetes, asthma, or major depression [24]. The study period was from July 1, 2007 to June 30, 2010, allowing individuals to contribute up to three years of data. We excluded individuals with only a single outpatient diagnosis of schizophrenia in order to avoid rule-out diagnoses. We also excluded dual Medicare–Medicaid beneficiaries because prescription drug use is not observed in NCIDR for Medicare enrollees. Because the medical home program examined here was available only to Medicaid enrollees, all months in which an individual was not enrolled in Medicaid were excluded from the study sample.

In order to examine the annual patterns of service use among participants enrolled in a medical home, the analysis was restricted to the subsample of individuals who met all previously described study criteria, were enrolled in Medicaid for at least 80% (or 10 months) of a fiscal year, and had an administrative code for medical home enrollment during at least some of the year. This analysis was conducted at the person-year level and resulted in a sample of 8345 individuals contributing 18,250 person-years of data. We also examined the difference between medical home enrollees and non-enrollees through subsequent analyses that incorporated data on comparison individuals who met all other inclusion

criteria but were never enrolled in a medical home during the study period. With a combined sample of 12,662 individuals, contributing a total of 340,546 person-months of data, we compared the two groups with regard to primary care visits, specialty mental health visits, and antipsychotic medication adherence (see Appendix A for a flowchart showing patient inclusion and exclusion criteria).

2.1. Measures

A primary care provider was defined as any provider with a reported provider specialty or type of internal medicine, general or family practice, OB/GYNs, nurse practitioner, or pediatrics, or with a practice coded as a health department, rural health clinic, or federally qualified health clinic. A specialty mental health provider was defined as a psychiatrist, psychologist, licensed clinical social worker, licensed counselor, psychiatric nurse, assertive community treatment team, or mental health facility. Medical home enrollment was determined from monthly payments to providers and their networks, independent of the number of visits. We counted the total number of chronic conditions coded in the administrative data on an annual basis using the Chronic Illness and Disability Payment System (CDPS) [26,27]. This measure includes the six chronic physical study conditions, plus 12 additional conditions, for a maximum of 18 possible chronic conditions. Because inclusion in our sample required a diagnosis of schizophrenia, we excluded psychiatric conditions from the count of chronic conditions to avoid inflating the count by one for all sample members.

2.2. Statistical analysis

We conducted two distinct sets of analyses. First, in order to determine whether medical home enrollees have the potential to use primary care as their mental health home, we examined the distribution of visits to primary and specialty mental health care providers among those enrolled in medical homes. We defined individuals as having the *potential* to use primary care as their mental health home if they had one or more visits with a primary care provider during each study year. For those who used both specialty mental health and primary care, we were unable to determine which site they would consider as a mental health home. However, we identified the modal treatment setting for each participant in order to assess which setting offered more face-to-face contact.

To examine patterns of service use among individuals enrolled in a medical home, we generated descriptive statistics, including percentiles of the numbers of primary care and mental health visits. We created a stacked bar graph to show the joint distribution of annual use of primary care and specialty mental health services among medical home enrollees. To examine heterogeneity in utilization, we described patterns of service use (including mean number of annual visits in each category, percentage with no visits, percentage with 11 or more visits, and modal visit setting) stratified by quartile of the number of comorbid chronic conditions.

Second, in order to examine the influence the medical home may have had on this population, we incorporated the comparison group of Medicaid-enrolled adults who otherwise met all study inclusion/exclusion criteria, but were not enrolled in a medical home

during the month. We used the longitudinal monthly data to examine three outcomes: primary care utilization, specialty mental health utilization, and adherence to antipsychotic medications using the proportion of days covered, a continuous measure of adherence that reflects the percent of days in the month that each enrollee had one or more dispensed antipsychotic medications [28–30]. These outcomes were modeled using a fixed-effects regression model, with the person-month as the level of analysis and with the fixed effects at the person level. This approach controls for all measured and unmeasured time-invariant characteristics among the study participants, such as demographics, history of treatment, education completed at baseline, and long-term severity of illness.

3. Results

Medicaid enrollees with schizophrenia and at least one other chronic condition who were ever enrolled in a medical home were predominantly black (55.2%) and male (44.9%) and had an average age of 38.9 years (Table 1). Based on the CDPS measures, the most prevalent types of comorbid chronic conditions among medical home enrollees were pulmonary (65.3%), skin-related (61.8%), cardiovascular (60.0%), metabolic (56.8%), and skeletal (55.7%). On average, medical home enrollees had dispensed antipsychotic medication to cover 53.2% of days on Medicaid. With respect to utilization, those enrolled in a medical home had a mean of 9.5 primary care visits and 20.1 specialty mental health visits during the three-year study period.

In the distributions of annual visits, 21.5% of medical home enrollee person-years had no primary care visits and 24.5% had no specialty mental health visits, separately, reflecting a slightly higher probability of contact with the primary care sector than the specialty mental health sector in this population. Nearly one-fourth (24.2%) had one to two primary care visits in the year, and 13.6% had one to two specialty mental health visits in the year. More than half (54.1%) had three or more primary care visits during the year. The median number of annual primary care visits was three, and the median for specialty mental health services was four (not shown). Over one-third (35.4%) of the sample had more PCP than specialty mental health visits and 46.4% had at least as many PCP as specialty mental health visits (which includes ties).

In order to determine whether patterns of service use differed by the amount of time participants were enrolled in a medical home, we compared the utilization patterns of those continuously enrolled in medical homes with those of otherwise similar individuals who were continuously enrolled in Medicaid but only enrolled in medical homes for part of the year. We found that the rate of use of specialty mental health services was very similar between the two groups, but that those continuously enrolled in medical homes had a higher probability of using three or more PCP visits during the year and a lower probability of using two or fewer PCP visits during the year (results not reported).

Fig. 1 shows the bivariate distribution representing both primary care and specialty mental health utilization among medical home enrollees. Over one-third (35.4%) of sample person-years had more PCP than specialty mental health visits and 46.4% had at least as many PCP as specialty mental health visits (which includes ties). The remaining 53.6% had more

specialty mental health visits than primary care visits. Nearly one-fifth (17.9%) of medical home enrollee person-years had at least one primary care visit but no specialty mental health visits. A lower proportion (14.9%) had at least one specialty mental health visit but no primary care visits. For 6.7% person-years, no primary care or specialty mental health care visits were observed.

Stratification of annual utilization measures by quartile of number of comorbid chronic conditions showed that medical home enrollees with more comorbid chronic conditions in a given year were more likely to use both primary care and specialty mental health services and did so with greater frequency. The mean annual number of primary care visits ranged from 1.3 among those in the first quartile (two or fewer conditions) to 7.4 among those in the fourth quartile (eight or more conditions). The proportion of individuals with no primary care visits decreased substantially as number of conditions increased, from 48.2% of those in the first quartile to 7.6% of those in the fourth quartile. Similarly, the proportion with 11 or more primary care visits increased from 0.7% in the first quartile to 25.4% in the fourth quartile (Table 2). Similar patterns were observed with respect to specialty mental health utilization. Those with two or fewer conditions had a mean annual number of 6.4 specialty mental health visits, compared to 10.1 visits among those with eight or more conditions. The proportion with no specialty mental health visits decreased from 31.0% in the first quartile to 19.5% in the fourth quartile, while the proportion with 11 or more specialty mental health visits increased from 18.8% to 31.2% (Table 2).

In terms of the comparison between medical home enrollees and non-enrollees, we see in the unadjusted data that those non-enrollees were less likely to be black (50.1%) and more likely to be male (54.1%) and had a higher average age (41.9 years) (Table 1). A similar proportion were Latino (1.7%). The most prevalent types of comorbid chronic conditions among those never enrolled in a medical home were cardiovascular (47.5%), pulmonary (46.8%), skin-related (45.0%), metabolic (42.1%), and CNS (37.4%). Non-enrollees' adherence to antipsychotic medication was 38.6% of days covered, on average, and they had a mean of 4.3 primary care visits and 13.4 specialty mental health visits during the study period.

Table 3 shows the results of the fixed-effects regression analyses comparing services use by medical home enrollees versus non-enrollees. Medical home enrollment was associated with greater use of both service types, as well as increased antipsychotic medication adherence, compared to similar Medicaid-enrolled controls (Table 3). Controlling for time-invariant individual characteristics, medical home enrollment was associated with an increase of 0.08 monthly primary care visits ($p < 0.001$) and 0.13 monthly specialty mental health visits ($p < 0.001$). This translates to almost one more primary care and 1.5 more specialty mental health visits per year. With respect to adherence to antipsychotic medications, medical home enrollment is associated with an increase of 11 percentage points ($p < 0.001$). Evaluated at the mean proportion of days covered for non-medical home enrollees (38.6%), this effect size represents a 28.5% relative increase in medication adherence.

4. Discussion and conclusions

This study provides evidence of substantial contact with primary care providers and use of primary care services among North Carolina Medicaid beneficiaries with schizophrenia and at least one comorbid chronic condition who are enrolled in primary-care based medical homes. We observed generally high rates of engagement in primary care in this population, with 78.5% of the sample having had at least one annual primary care visit. This rate is consistent with previously reported primary care engagement rates for persons with schizophrenia, which is somewhat surprising given the greater prevalence of comorbid conditions in our sample [31–34]. Nonetheless, a non-trivial proportion of the sample (6.7%) exhibited no engagement with either primary care or specialty mental health care. However, we were unable to determine whether these patients had any provider contacts not funded by Medicaid. In answer to our key research question, we found that primary care could serve a care coordination function for 78.5% of the sample that had contact with the primary care sector and is the only choice for the 17.9% of the sample with no specialty mental health use and one or more primary care visits. If, instead, the modal treatment setting were a better indicator of the potential locus for a mental health home, primary care could serve an effective care coordination role for just under half (46.4%) of the sample, since just over half (53.6%) used more specialty mental health care than primary care.

Medical home enrollees included in the study sample were also found to use specialty mental health services at high rates regardless of their contact with primary care, suggesting that the setting of the mental health home may be less important than ensuring care coordination across settings for individuals with schizophrenia. Specifically, those with a higher number of comorbid chronic conditions tended to use both primary care and specialty mental health services at greater rates and more frequently than those with fewer comorbid conditions. Greater use of primary care among those with more comorbid conditions is likely attributable to poorer physical health, but the explanation for their increased use of specialty mental services is less clear. Individuals with more chronic conditions may also have mental illness of greater severity, as evidence indicates that individuals with more severe mental illness are less likely to receive recommended preventive services, which could put them at greater risk for development of more severe physical conditions [35,36]. It may also be the case that those with more comorbid conditions have complicated medication management needs that require greater involvement of mental health specialists.

This study also suggests that enrollment in a primary care-based medical home is associated with modest increases in utilization of both primary care services and specialty mental health services. These findings are consistent with prior work examining the effect of medical home enrollment on utilization patterns and medication adherence among North Carolina Medicaid beneficiaries with SMI, including schizophrenia [21]. Interestingly, we found that medical home enrollment is associated with a greater increase in use of specialty mental health services than in the use of primary care services, and the individuals included in this study visited specialty mental health providers more frequently than primary care providers during medical home enrollment. One explanation for this finding is that improved primary care access for individuals with schizophrenia in a medical home may complement specialty mental health services without reducing the extent to which these services are used.

Primary care providers may serve to connect medical home enrollees with schizophrenia to needed specialty mental health services, resulting in greater utilization. Alternatively, this finding may suggest that medical home enrollees require more specialty mental health visits because of primary care providers' failure to effectively manage enrollees' mental health treatment, although this explanation seems contrary to medical homes' emphasis on whole-person care [13].

Also consistent with other findings in the literature, our current study shows that enrollment in a primary-care-based medical home is associated with a large increase in antipsychotic medication adherence. Medication adherence among medical home enrollees may increase because primary care providers take charge of antipsychotic prescribing and medication management, or because of potentially greater consultation with mental health specialists.

This study is subject to a number of limitations. Medical home enrollment was largely voluntary over the study period and therefore subject to selection bias. We control for time-invariant differences between enrollees and non-enrollees with fixed effects, but time-varying differences, such as changes in symptoms, barriers to care, or provider availability, may remain. The distribution of visits in the medical homes sample may be due to other unobserved characteristics of enrollees, such as seeking out high-quality primary care. We excluded individuals who were dually Medicare eligible, so our results are not generalizable to this population. Visit counts do not reflect the intensity or costs of the visits. We coded medical homes enrollment directly from the administrative files based on administrative payment codes, but primary care clinics may continue to serve as medical homes even during gaps in PMPM payments, introducing contamination into our control group. This makes our estimates more conservative than they would be if we had more accurate measures of the intent to serve as a medical home. Finally, our classification of primary care as a potential mental health home is based on observed visits to primary care providers. A more sophisticated measure would include a patient-centered measure of where care coordination actually occurs, as well as where patients seek advice on mental health symptoms or treatments.

In conclusion, we find considerable evidence of engagement in both primary care and specialty mental health services among medical home enrollees with schizophrenia and comorbid chronic conditions, which may mean that both settings have a high potential of serving as a mental health home. In this population, both primary care and specialty mental health utilization increased substantially with the number of comorbid conditions, which could indicate either greater diagnosing of chronic conditions in those who use more services, or greater service use by those with greater medical and mental health needs. Our finding that members of the study sample used both types of services at high rates underscores the importance of care coordination for this population. Future research should examine whether the intended improvements in quality of care that motivate implementation of the primary-care based medical home model are being realized for medical home enrollees with schizophrenia and comorbid chronic conditions.

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Dr. DuBard and Dr. Jackson are employees of Community Care of North Carolina, which operates the medical home program that is the subject of this analysis.

Appendix A. Patient inclusion/exclusion criteria

References

1. Alakeson V, Frank RG, Katz RE. Specialty care medical homes for people with severe, persistent mental disorders. *Health Aff.* 2010; 29:867–73.
2. Bao Y, Casalino LP, Pincus HA. Behavioral health and health care reform models: patient-centered medical home, health home, and accountable care organization. *J Behav Health Serv Res.* 2013; 40:121–32. [PubMed: 23188486]
3. Burns T, Kendrick T. The primary care of patients with schizophrenia: a search for good practice. *Br J Gen Pract.* 1997; 47:515–20. [PubMed: 9302795]
4. Phelan M, Stradins L, Morrison S. Physical health of people with severe mental illness. *BMJ.* 2001; 322:443–4. [PubMed: 11222406]

5. Goldman LS. Medical illness in patients with schizophrenia. *J Clin Psychiatry*. 1999; 60(Suppl. 21): 10–5.
6. Henderson DC, Cagliero E, Gray C, Nasrallah RA, Hayden DL, Schoenfeld DA, et al. Clozapine, diabetes mellitus, weight gain, and lipid abnormalities: a five-year naturalistic study. *Am J Psychiatry*. 2000; 157:975–81. [PubMed: 10831479]
7. Nasrallah HA, Meyer JM, Goff DC, McEvoy JP, Davis SM, Stroup TS, et al. Low rates of treatment for hypertension, dyslipidemia and diabetes in schizophrenia: data from the CATIE schizophrenia trial sample at baseline. *Schizophr Res*. 2006; 86:15–22. [PubMed: 16884895]
8. Farley JF, Wang CC, Hansen RA, Voils CI, Maciejewski ML. Continuity of antipsychotic medication management for Medicaid patients with schizophrenia. *Psychiatr Serv*. 2011; 62:747–52. [PubMed: 21724787]
9. Page TF, Amofah SA, McCann S, Rivo J, Varghese A, James T, et al. Care management medical home center model: preliminary results of a patient-centered approach to improving care quality for Diabetic Patients. *Health Promot Pract*. 2015; 16:609–16. [PubMed: 25564454]
10. Bradford DW, Kim MM, Braxton LE, Marx CE, Butterfield M, Elbogen EB. Access to medical care among persons with psychotic and major affective disorders. *Psychiatr Serv*. 2008; 59:847–52. [PubMed: 18678680]
11. Mojtabai R, Cullen B, Everett A, Nugent KL, Sawa A, Sharifi V, et al. Reasons for not seeking general medical care among individuals with serious mental illness. *Psychiatr Serv*. 2014; 65:818–21. [PubMed: 24733659]
12. Kaufman EA, McDonell MG, Cristofalo MA, Ries RK. Exploring barriers to primary care for patients with severe mental illness: frontline patient and provider accounts. *Issues Ment Health Nurs*. 2012; 33:172–80. [PubMed: 22364429]
13. Sia C, Tonniges TF, Osterhus E, Taba S. History of the medical home concept. *Pediatrics*. 2004; 113:1473–8. [PubMed: 15121914]
14. Bitton A, Martin C, Landon BE. A nationwide survey of patient centered medical home demonstration projects. *J Gen Intern Med*. 2010; 25:584–92. [PubMed: 20467907]
15. Rosenthal TC. The medical home: growing evidence to support a new approach to primary care. *J Am Board Fam Med*. 2008; 21:427–40. [PubMed: 18772297]
16. Rosenthal MB, Alidina S, Friedberg MW, Singer SJ, Eastman D, Li Z, et al. Impact of the Cincinnati Aligning Forces for Quality Multi-Payer Patient Centered Medical Home pilot on health care quality, utilization, and costs. *Med Care Res Rev*. 2016; 73:532–45. [PubMed: 26612180]
17. Shi L, Lee DC, Chung M, Liang H, Lock D, Sripipatana A. Patient-centered medical home recognition and clinical performance in U.S. community health centers. *Health Serv Res*. 2016
18. Bojadzievski T, Gabbay RA. Patient-centered medical home and diabetes. *Diabetes Care*. 2011; 34:1047–53. [PubMed: 21447667]
19. Goyal RK, Wheeler SB, Kohler RE, Lich KH, Lin CC, Reeder-Hayes K, et al. Health care utilization from chemotherapy-related adverse events among low-income breast cancer patients: effect of enrollment in a medical home program. *N C Med J*. 2014; 75:231–8. [PubMed: 25046085]
20. Wheeler SB, Kohler RE, Goyal RK, Lich KH, Lin CC, Moore A, et al. Is medical home enrollment associated with receipt of guideline-concordant follow-up care among low-income breast cancer survivors? *Med Care*. 2013; 51:494–502. [PubMed: 23673393]
21. Domino ME, Wells R, Morrissey JP. Serving persons with severe mental illness in primary care-based medical homes. *Psychiatr Serv*. 2015; 66:477–83. [PubMed: 25686809]
22. Alexander, L., Druss, BG. Behavioral health homes for people with mental health & substance use conditions: the core clinical features. Washington, DC: SAMHSA-HRSA Center for Integrated Health Solutions; 2012.
23. DuBard CA, Cockerham J. Community Care of North Carolina and the medical home approach to chronic kidney disease. *N C Med J*. 2008; 69:229–32. [PubMed: 18751361]
24. Lichstein JC, Domino ME, Beadles CA, Ellis AR, Farley JF, Morrissey JP, et al. Use of medical homes by patients with comorbid physical and severe mental illness. *Med Care*. 2014; 52(Suppl. 3):S85–91. [PubMed: 24561764]

25. Fillmore H, DuBard CA, Ritter GA, Jackson CT. Health care savings with the patient-centered medical home: Community Care of North Carolina's experience. *Popul Health Manag.* 2014; 17:141–8. [PubMed: 24053757]
26. cdps.ucsd.edu. [Internet]. San Diego: Chronic Illness and Disability Payment System; 2016. c[cited 2016 Sep 21], Available from: <http://www.cdps.ucsd.edu/>.
27. Kronick R, Gilmer T, Lee L. Improving health-based payment for Medicaid beneficiaries: CDPS. *Health Care Financ Rev.* 2000; 21:29–64. [PubMed: 11481767]
28. Benner JS, Glynn RJ, Mogun H, Neumann PJ, Weinstein MC, Avorn J. Long-term persistence in use of statin therapy in elderly patients. *JAMA.* 2002; 288:455–61. [PubMed: 12132975]
29. Peterson AM, Nau DP, Cramer JA, Benner J, Gwadry-Sridhar F, Nichol M. A checklist for medication compliance and persistence studies using retrospective databases. *Value Health.* 2007; 10:3–12. [PubMed: 17261111]
30. Martin BC, Wiley-Exley EK, Richards S, Domino ME, Carey TS, Sleath BL. Contrasting measures of adherence with simple drug use, medication switching, and therapeutic duplication. *Ann Pharmacother.* 2009; 43:36–44. [PubMed: 19126828]
31. Salsberry PJ, Chipps E, Kennedy C. Use of general Medical services among Medicaid patients with severe and persistent mental illness. *Psychiatr Serv.* 2005; 56:458–62. [PubMed: 15812097]
32. Chwastiak LA, Rosenheck RA, Kazis LE. Utilization of primary care by veterans with psychiatric illness in the National Department of Veterans Affairs health care system. *J Gen Intern Med.* 2008; 23:1835–40. [PubMed: 18795371]
33. Dickerson FB, McNary SW, Brown CH, Kreyenbuhl J, Goldberg RW, Dixon LB. Somatic healthcare utilization among adults with serious mental illness who are receiving community psychiatric services. *Med Care.* 2003; 41:560–70. [PubMed: 12665719]
34. Lutterman, T., Ganju, V., Schact, L., Shaw, R., Monihan, K., Huddle, M. Sixteen state study on mental health performance measures. Rockville (MD): Center for Mental Health Services, Substance Abuse and Mental Health Services Administration; 2003. [DHHS Publication No.: (SMA) 03-3835]
35. Carney CP, Jones LE. The influence of type and severity of mental illness on receipt of screening mammography. *J Gen Intern Med.* 2006; 21:1097–104. [PubMed: 16970559]
36. Domino ME, Beadles CA, Lichstein JC, Farley JF, Morrissey JP, Ellis AR, et al. Heterogeneity in the quality of care for patients with multiple chronic conditions by psychiatric comorbidity. *Med Care.* 2014; 52(Suppl. 3):S101–9. [PubMed: 24561748]

Fig. 1.
Stacked bar graph displaying utilization/year for medical home enrollees.

Table 1

Characteristics of study population by medical home enrollment status.

Characteristic ^a	By medical home enrollment status	
	Ever in a medical home (N = 9243)	Never in a medical home (N = 3419)
Black *	5098 (55.2%)	1712 (50.1%)
Latino	182 (2.0%)	59 (1.7%)
Male sex *	4152 (44.9%)	1851 (54.1%)
Age *	38.9 (S.D. = 12.6)	41.9 (S.D. = 13.2)
Comorbid chronic conditions ^b		
Pulmonary condition *	6032 (65.3%)	1601 (46.8%)
Skin condition *	5714 (61.8%)	1539 (45.0%)
Cardiovascular condition *	5548 (60.0%)	1623 (47.5%)
Metabolic condition *	5252 (56.8%)	1440 (42.1%)
Skeletal condition *	5146 (55.7%)	—
CNS conditions *	—	1279 (37.4%)
Proportion of days covered for antipsychotic medications (adherence score) *	53.2 (S.D. = 34.1)	38.6 (S.D. = 39.5)
Number of primary care visits *	9.5 (S.D. = 9.9)	4.3 (S.D. = 7.5)
Number of specialty mental health visits *	20.1 (S.D. = 28.7)	13.4 (S.D. = 22.3)

S.D. = standard deviation.

^aN = 12,662.

^bOnly the five most common categories of comorbid chronic conditions for each medical home category are displayed.

* $p < 0.01$ for test in differences in means or proportions between medical homes enrollees and controls.

Table 2

Patterns of annual primary care visits and specialty mental health visits among medical home enrollees by quartile of number of comorbid chronic conditions ($N = 18,250$ person-years).

	Quartile 1 (0–2 conditions) ($N = 4483$)	Quartile 2 (3–4 conditions) ($N = 4889$)	Quartile 3 (5–7 conditions) ($N = 5707$)	Quartile 4 (8 or more conditions) ($N = 3171$)
Annual number of primary care visits	1.3 (S.D. = 2.1)	3.1 (S.D. = 3.1)	5.0 (S.D. = 4.0)	7.4 (S.D. = 5.2)
Proportion with no PCP visits	48.2%	18.0%	11.4%	7.6%
Proportion with 11 or more PCP visits	0.7%	2.9%	9.2%	25.4%
Annual number of specialty mental health visits	6.4 (S.D. = 11.1)	8.0 (S.D. = 12.8)	9.0 (S.D. = 13.4)	10.1 (S.D. = 15.6)
Proportion with no specialty mental health visits	31.0%	25.5%	21.4%	19.5%
Proportion with 11 or more specialty mental health visits	18.8%	24.3%	27.4%	31.2%

Table 3

Fixed effects regression analysis of medical home enrollment and number of primary care visits and specialty mental health visits at the person-month level.

	<u>Primary care visits</u>	<u>Specialty mental health visits</u>	<u>PDC</u>
	<i>B</i> (95% CI)	<i>B</i> (95% CI)	<i>B</i> (95% CI)
Medical home enrollment	0.077 [*] (0.071 to 0.083)	0.13 [*] (0.12 to 0.14)	0.11 [*] (0.11 to 0.12)

This analysis uses 340,546 person-month observations from 12,662 unique individuals.

^{*} $p < 0.001$.