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Complexity of ambulatory care visits of patients with diabetes as reflected by diagnoses per visit

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ABSTRACT

Aims: As the proportion of people with multiple chronic conditions grows, so does the complexity of patient care. Although office-based visits to subspecialists are expected to be intense, due to the focused nature of the visit, the complexity of office-based visits to primary care physicians has yet to be explored in depth. To explore complexity, we looked at diabetes as a case study to determine whether and how the complexity of office-based visits varies by physician specialty type, as measured by the number of diagnoses reported per visits.

Methods: The Medical Expenditure Panel Survey data is used to create a nationally-representative sample of adults who self-report a diabetes diagnosis, the specialty of the treating physician for their care, and the number of diagnoses for each visit. Using cross tabulations, the distribution of office-based visits are analyzed based on a categorization of patients by number of visit diagnoses, number of conditions reported, and type of physician seen.

Results: Almost 80 percent of visits made by adults with diabetes to subspecialist involved care for that single diagnosis; while 55 percent of visits to primary care involved care for at least one additional diagnosis. Almost 70 percent of visits in which only one diagnosis was reported were to subspecialist physicians. Almost 90 percent of visits in which four diagnoses were reported were to primary care physicians.

Conclusions: Office-based visits to primary care physicians are made increasingly complex by growing population morbidity. Adults with diabetes report more conditions being cared for per visit with primary care physicians than with subspecialty physicians. Future studies into where our results hold for other chronic conditions would be beneficial. As recent United States legislation moves health care payment toward paying for value and population health, encounter complexity should be accommodated.

Abbreviations: MEPS, Medical Expenditure Panel Survey; ICD-9, International Classification of Diseases, Ninth Revision.

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1. Introduction

A relatively large and growing number of Americans have multiple chronic conditions. In 2010, 21 percent of adults between 45 and 64 years old and 45 percent of those over 65 had multimorbidity, two or more chronic conditions [1]. From 2000 to 2010 the prevalence of multimorbidity increased by 22 percent and 25 percent in these two age groups, respectively. With 29.1 million (9.3%) Americans diagnosed with diabetes in 2012, diabetes is one of the most prevalent chronic condition in the United States [2]. Diabetes provides an ideal case study to examine issues surrounding the treatment of multimorbidity in the United States' healthcare system.

The recent increase in patient multimorbidity presents the potential for an increase in the number of issues addressed during a patient's ambulatory care visit to a physician. The complexity of a visit to a subspecialist physician is well understood, even presumed, due to the additional focal training of the clinician. In contrast, there is a limited understanding or appreciation of complexity in the primary care encounter. The latter results from a combination of factors, addressing uncertainty and the whole patient among them.

Although little has been written about the difference in volume of conditions managed between the subspecialist and the primary care encounter, there is evidence that primary care is linked to better health outcomes and lower costs. Specifically, research has shown that areas with a higher supply of primary care physicians have lower rates of mortality and a more effective delivery of preventive care [3–5]. Additionally, as the move toward value based payment has accelerated, the scope of practice for primary care clinicians has decreased [6], in part due to pressure to maximize efficiency. Payment changes have also resulted in a decrease in the income earned by primary care clinicians [7].

Understanding the complexity physicians face in treating their patients is an important aspect of care for policy makers to consider when weighing how to implement the recently enacted Medicare Access and CHIP Reauthorization Act of 2015 (MACRA) legislation. MACRA moves Medicare's quality reporting programs into a new single "Merit-Based Incentive Payment System" (MIPS) program to streamline payments to physicians who provide high-quality, high-value health care. Additionally, MACRA provides incentives and benefits for physicians participating in Alternative Payment Models that that pay for value based on the quality measures in the MIPS.

As policymakers scope how MACRA will be implemented and determines which measures will included in the MIPS, it is important to consider the differences in visit outcomes, quality of service, severity, or demand for service by clinician specialty. Understanding the different ways that complexity of a visit can be measured offers valuable insights into avenues to address the inadequacies of the current payment system. Therefore, it is important to characterize the care that various practitioners are providing in the outpatient setting.

Using individual self reported data from the 2008 to 2010 Medical Expenditure Panel Surveys – Household Component (MEPS-HC), we chraracterized office visits for adults aged 18 and older who reported receiving care for diabetes in the year of the survey. Overall, we hypothesize that primary care physicians were more likely to address multiple diagnoses during a single office visit. Although subspecialists are expected to treat patients with multiple chronic conditions, we hypothesize that the patient will only report one diagnosis for their visits to subspecialists. Current efforts that attempt to pay for health care based on the encounter complexity take into account the complexity of the patient, and not the complexity of the encounter itself. To the extent that the number of diagnoses addressed during a visit is a proxy for complexity, there may be grounds to argue that primary care physicians, by virtue of the breadth of their training, are uniquely capable of providing complex care for patients with multimorbidity.

2. Methods

We examine the distribution of office visits for adults aged 18 and over across physician type for those adults with at least one visit to address their diabetes using a pooled cross-sectional sample of adults in the 2008–2010 Medical Expenditure Panel Surveys – Household Component (MEPS-HC) surveys [8]. MEPS-HC is a nationally representative household survey of the civilian, non-institutionalized United States population that is conducted annually. Using overlapping panel design techniques, MEPS-HC respondents were interviewed five times over a 2½ year period. Thus when pooling years of data each observation is considered a person-year record, with most respondents appearing in the data twice.

Each respondent is asked to give information on all of their medical visits in the past year. Information recorded about visits to office-based providers includes the type of provider seen, the specialty of the provider, and the reason for the visit. The MEPS-HC only records up to four reasons for each visit. As the focus of our question is on chronic conditions, versus acute, for each respondent the number of distinct chronic conditions reported in a year is calculated using the ICD-9 diagnosis information available for each office visit. Based on the work of Goodman and colleagues [9], the following 19 conditions were classified as chronic: asthma, chronic kidney disease, dementia (including Alzheimer's and other senile dementias), cancer (all except non-melanoma skin cancer), hypertension, congestive heart failure, hyperlipidemia, arthritis, chronic obstructive pulmonary disease, depression, osteoporosis, schizophrenia, diabetes (non-gestational), autism, coronary heart disease, stroke, hepatitis, HIV, and substance abuse disorders.

Adults who were treated for diabetes at any visit in the reference year were flagged as a patient with diabetes. No distinction was made between type 1 and type 2 diabetes as patients were not expected to distinguish between the types when reporting their reason for the visit. The analysis was restricted to adults as parents are more likely to report that their child visited a pediatrician than a family physician, potentially affecting the results. Additionally, children are less likely to have a diabetes diagnosis or multiple chronic conditions. Patients with diabetes are categorized into multimorbidity categories of (1) diabetes diagnosis with no additional chronic conditions, (2) with 1 additional condition, (3) with 2–4 additional condition, or (4) with 5 additional conditions. Using the diagnoses for each office visits, each visit

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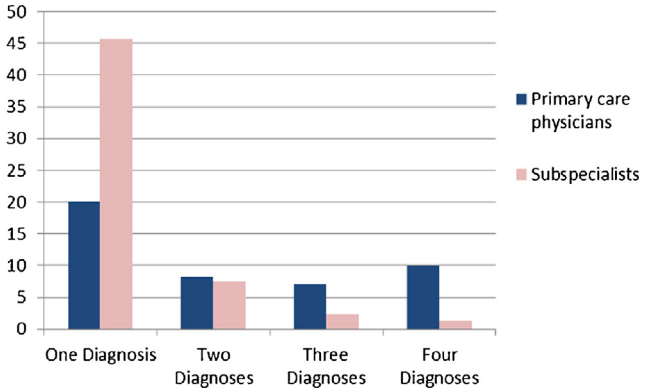

Fig. 1 – Number of ambulatory outpatient visits of patients with diabetes for primary care and subspecialty physicians, by number of diagnosis per visit, millions of visits in an average year from 2008 to 2010. *Note*: Primary care physicians includes family medicine, general medicine, internal medicine and geriatricians. Numbers are weighted to represent all US patients with diabetes.
***Source*: Analysis of 2008–2010 Medical Expenditure Panel Survey.**

is categorized by the number of visit diagnoses. Therefore a patient may be categorized as having multiple conditions, i.e. multimorbid, while each of their visits might be coded as have one or more diagnoses.

To investigate the relationship between multimorbidity and physician specialty, physicians are first categorized by type: family physicians/general practitioners, other primary care physicians (internal medicine and geriatricians), and subspecialist physicians. Internal medicine physicians and geriatricians are separated from family physicians/general practitioners because research has shown that these subspecialists do not always exhibit the same scope of practice [10]. Physician specialty is based on the report of respondents. Using cross tabulations the distribution of the patient's office visits by type of physician are analyzed, first based on the multimorbity categorization (Table 2) and second based on the categorization of number of diagnoses per visit (Fig. 1). Focusing on primary care physicians only, cross tabulations are presented between the diagnoses per visit and the patients sex and age (Table 3).

Cross tabulations are performed on the pooled 2008–2010 MEPS-HC sample of respondents with at least one office-based visit in which the providing physician is identified. The MEPS-HC data includes survey weights and survey design variables that allow for correction of estimates that take into account the complex survey design. These weights were used in all of the statistical analysis presented below. Demographic information is presented at the individual person-year level while information characterizing visits is presented at the visit level.

3. Results

The pooled 2008–2010 sample includes 44,005 person-year observations of adults with at least one office-based visit. Approximately 4500 observations were identified as being

Table 1 – Demographic characteristics of people with and without diabetes from 2008 to 2010.

	Diabetes (%) (N = 4510)	No diabetes (%) (N = 39,495)
Age	61.2*	49.0
Female	51.4*	58.5
Male	48.6*	41.5
Less than High School	23.0*	14.3
High School Diploma	32.4*	28.4
Some College	23.7	24.7
College Degree	20.5*	32.1
Married	58.6	57.0
Single	41.4	43.0
White	78.1*	84.0
Black	14.7*	10.0
Other Race	7.2*	6.0
Employed	42.3*	63.6
Unemployed	57.7*	36.5
Poor	13.2	10.3
Near Poor	5.8*	3.8
Low Income	15.7*	12.1
Middle Income	31.2*	29.2
High Income	34*	44.6
Private Insurance	34.1*	18.5
Public Insurance	59.6*	73.8
Uninsured	6.3*	7.7
No Chronic Condition	0.0*	63.9
Only One Chronic Condition	27.8*	22.5
Two Chronic Conditions	24.1*	8.4
Three to Five Chronic Conditions	46.7*	5.0
Six or More Chronic Conditions	1.4*	0.1

Source: Analysis of 2008–2010 Medical Expenditure Panel Survey.

* Variable is statistically different by diabetes status at $p < 0.05$.

patients with diabetes, almost 10 percent of the weighted analysis sample. The average age of these patients was 61 years compared to 49 years for patients who did not report treatment for diabetes (Table 1). Adults with a diabetes diagnosis have significantly fewer years of schooling and lower incomes (Table 1). Additionally, they are disproportionately non-white and unemployed. Adults with diabetes are slightly more likely to have private insurance than those without diabetes (Table 1).

The 4510 patients with a diagnosis of diabetes had a total of 35,827 office visits, of which 13,419 were to family physicians or general practitioners, 3591 were to other primary care physicians (general internists and geriatricians) and 18,817 were to specialists (Table 2). When looking at the distribution of visits of patients with a diabetes diagnosis by the number of conditions of the patient seen, about 20 percent of all visits were for patients with the single condition of diabetes, 20 percent of the visits were for patients who had one additional condition, 56 percent of the visits were for patients who had 2–4 additional conditions and 4 percent of the visits were for patients who had 5 or more conditions. Approximately 39 percent of all visits for patients who reported having diabetes and no other comorbid condition were to family physicians or general practitioners, almost 9 percent were to other primary care physicians, and 52 percent were to subspecialist physicians (weighted results). As the number of reported comorbid

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Table 2 – Percentage of ambulatory outpatient visits of patients with diabetes to primary care and subspecialty physicians, by number of chronic conditions in an average year from 2008 to 2010.

	Total office based visits	Diabetes only	Diabetes and one comorbid condition	Diabetes and 2–4 comorbid conditions	Diabetes and 5 or more comorbid conditions
Family Physicians/General Practitioners	4,00,30,683	39.3	33.4	33.2	30.2
Other Primary Care Physicians[a]	1,22,33,320	8.5	11.4	11	8.8
Subspecialists	6,41,85,494	52.2	55.2	55.8	61.0

Source: Analysis of 2008–2010 Medical Expenditure Panel Survey.

[a] Includes internal medicine and geriatricians.
Notes: There were 4510 patients with a diabetes diagnosis and a total of 35,827 unweighted visits.

conditions the individual reports increases to five or more, the percentage of visits to a family physician/general practitioner decreases to 30 percent and the percentage to specialist increases to 61 percent.

The percentage of visits varies little between family physicians/general practitioners and other primary care physicians (Fig. 1). Overall, almost 45 percent of the visits of adults with a diabetes diagnosis to family physicians or general practitioners were reported to address one diagnosis. In contrast, slightly more than 80 percent of visits for adults with a diabetes diagnosis to specialist were reported to address one diagnosis. Additionally, 23 percent of the visits to family physician/general practitioners were reported to address four diagnoses, compared to only 2 percent for subspecialist physicians.

Another way to characterize office visits for adults with a diabetes diagnosis is to look at the percentage of visits to various types of physicians given the number of diagnoses reported for the visit. Approximately 70 percent of visits for adults with a diabetes diagnosis in which only one diagnosis was reported were to subspecialist physicians and 30 percent were to primary care physicians or general practitioners. In contrast, almost 90 percent of visits in which four diagnoses were reported were to a primary care physician or general practitioner.

Although of small magnitude, the odds that a diabetes patient saw a primary care physician were almost 1 percent higher for each additional year of age of the patient (1.008 $p < 0.01$). Patients with a lower education were more likely to see a primary care physician for their ambulatory care visit. Compared with patients who never finished high school, patients who obtained their high school diploma had 19 percent lower odds of seeing a primary care physician at their visit (0.809 $p < 0.05$) and patients who had obtained at least a bachelor degree had almost 38 percent lower odds of seeing a primary care physician at their visit (0.623 $p < 0.01$). Additionally the percentages of visits to any primary care physician for each of the diagnoses categories did not vary significantly by gender or age (Table 3).

4. Discussion

Overall our results show that when individuals describe their visits to subspecialist, they consider these physicians to have only addressed a single diagnosis. This research suggests that patients will continue to rely on primary care physicians to care for their chronic conditions. As the discussion over health care payment continues, it is important to consider the patient's perspective.

The current fee-for-service system of reimbursement offers greater rewards for a higher volume of patient seen and larger number of procedures performed than for care that addresses the multiple dimensions of cognitive abilities needed to provide whole-person care. Although subspecialist physicians are expected to see more complex patients, there is an important distinction between the complexity of the patient and whether the complexity of the patient is addressed during their office visit. U.S. patients with a diabetes diagnosis had more visits to subspecialist physicians than to primary care; however, their visits to subspecialists were more likely to address a single diagnosis. In contrast, multiple diagnoses were more common in visits to primary care physicians.

Overall, complexity of the office visit, as reflected by the number of visit diagnoses reported, is found to be higher for primary care physicians than for subspecialist physicians. These findings are consistent with the work of Katerndahl and colleagues who measure the complexity of ambulatory care visits based on such metrics as quantity of information and events, diversity, and variability [11]. Additional research has shown duration of visit to be inversely correlated with the complexity of the medical problems seen [12]. Thus, the shorter the duration-of-visit, the higher the burden placed on physicians as the encounter seems more complex. Extending this work, Temte and colleagues suggested that the number of clinical problems addressed per hour, the "encounter problem density," would be an appropriate measure of complexity [13].

Our results show an inverse relationship between the proportion of visits in a year to a primary care physician and the complexity of the patient. Similar to Starfield and colleagues, our findings show that as the number of conditions reported increases for adults who report a diabetes diagnosis in a given year, a larger proportion of their visits are to subspecialist physicians [14]. This results is mainly driven by the increase in overall visits as the number of conditions diagnosed increases.

One limitation of this study is that we are only analyzing office visits to physicians; thus, we are unable to generalize the results to the entire population. Specifically adults who have

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Table 3 – Percentage of ambulatory outpatient visits of patients with diabetes to primary care physicians, by number of diagnosis per visit in an average year from 2008 to 2010.

	One diagnosis	Two diagnoses	Three diagnoses	Four diagnoses
Male	64	15	11	10
Female	65	15	8	12
18–34	71	21	5	3
35–55	62	17	11	10
56+	64	15	9	12

Source: Analysis of 2008–2010 Medical Expenditure Panel Survey.

Notes: There were 4510 patients with a diabetes diagnosis and a total of 35,827 unweighted visits. Includes all family physicians, general pediatricians, internal medicine and geriatricians.

untreated diabetes, or who receive their treatment in an emergency room or hospital setting, are not represented in the data. Additionally office-based visits to a non-physician provider are also not included. Therefore patients seeing a physician assistant or nurse practitioner for their diabetes would also not be included.

A second limitation is the use of the number of diagnoses per visit as a measure of complexity. Patients might not report diabetes or other conditions they may have as a reason for their visit to their subspecialist, even though the subspecialist knew about and considered those conditions. Perhaps the patient thinks that their diabetes specialist only treats diabetes and so they do not report their other conditions as a reason for visit. As there is no way to determine everything each physician considered during a visit outside of the reason for visit given, we believe our measure a reasonable, but necessarily imperfect, method to reflect complexity.

The results in this paper represent one of the first looks into the variation in conditions treated during an office based visit to provide a novel way to understand differences in care provided by different physician specialties. Looking at the complexity of office based visits helps to shape thinking about time inputs into healthcare delivery as stakeholders estimate the value of care and the time required to delivery care to patients to patients with comorbidities. Although both primary care physicians and subspecialty physicians see patients with multiple chronic conditions, when estimating the complexity of the visit the complexity faced by the treating physician is as important as the overall complexity of the patient.

To encourage more comprehensive care for patients, longer, more intense visits for complex patients needs to be supported. Encouraging primary care physicians to spend more time with their complex patients in order to better address the multiple diagnoses these patients present with will lead to better health outcomes overall. As recent legislation moves health care payment toward paying for value and population health, encounter complexity should be accommodated.

Conflicts of interest

The authors state that they have no conflict of interest.

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REFERENCES

[1] V.M. Fried, A.B. Bernstein, M.A. Bush, Multiple Chronic Conditions Among Adults Aged 45 and Over: Trends Over the Past 10 Years. NCHS Data Brief No. 100, 2012, http://www.cdc.gov/nchs/data/databriefs/db100.pdf (assessed 22.06.14).
[2] Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, National Diabetes Statistics Report, 2014, http://www.cdc.gov/diabetes/pubs/statsreport14/national-diabetes-report-web.pdf (Accessed 29.09.15).
[3] B. Starfield, L. Shi, J. Macinko, Contribution of primary care to health systems and health, Milbank Q. 83 (3) (2005) 457–502.
[4] M. Chernew, L. Sabik, A. Chandra, J.P. Newhouse, Would having more primary care doctors cut health spending growth? Health Aff. (Millwood) 28 (5) (2009) 1327–1335.
[5] J. Macinko, B. Starfield, L. Shi, Quantifying the health benefits of primary care physicians supply in the US, Int. J. Health Serv. Res. 37 (1) (2007) 111–126.
[6] L.E. Peterson, B. Blackburn, M. Peabody, T.R. O'Neill, Family physicians' scope of practice and American Board of Family Medicine recertification examination performance, J. Am. Board Fam. Med. 28 (2) (2015) 265–270.
[7] H.T. Tu, P.B. Ginsburg, Losing Ground: Physician Income, 1995–2003. Center for Studying Health System Change Tracking Report No. 15, 2006.
[8] Agency for Healthcare Research and Quality. Medical Expenditure Panel Survey (MEPS).
[9] R.A. Goodman, F.P. Samuel, E.S. Huang, et al., Defining and measuring chronic conditions: imperatives for research, policy, program, and practice, Prev. Chronic Dis. 10 (2013) 120239.

Please cite this article in press as: M. Moore, et al., Complexity of ambulatory care visits of patients with diabetes as reflected by diagnoses per visit, Prim. Care Diab. (2015), http://dx.doi.org/10.1016/j.pcd.2015.11.006

[10] A. Bazemore, et al., What services do family physicians provide in a time of primary care transition, JABFM 24 (2011) 635–636.
[11] D. Katerndahl, R. Wood, C.R. Jaén, Family medicine outpatient encounters are more complex than those of cardiology and psychiatry, JABFM 24 (2011) 6–15.
[12] H.P. Greenwald, M.L. Peterson, L.P. Garrison, et al., Interspecialty variation in office-based care, Med. Care 22 (1984) 14–29.
[13] J. Temte, M. Grasmick, J. Barr, et al., Encounter problem density in primary care: a better measure of complexity? in: Presented at the Annual Meeting of the North American Primary Care Research Group, Vancouver, British Columbia (October 20–23, 2007), 2007.
[14] B. Starfield, K.W. Lemke, R. Herbert, et al., Cormorbidity and the use of primary care and specialist care in the elderly Ann. Fam. Med. 3 (2005) 215–222.

Please cite this article in press as: M. Moore, et al., Complexity of ambulatory care visits of patients with diabetes as reflected by diagnoses per visit, Prim. Care Diab. (2015), http://dx.doi.org/10.1016/j.pcd.2015.11.006