



## Primary care-public health linkages: Older primary care patients with prediabetes & type 2 diabetes encouraged to attend community-based senior centers

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### ABSTRACT

The Institute of Medicine (IOM) suggests that primary care-public health integration can improve health outcomes for vulnerable patients, but the extent to which formal linkages may enhance patients' use of community resources, or the factors that may influence providers to encourage their patients to use these resources, remain unclear. We conducted baseline assessments in 2014–2015 with 149 older adults with prediabetes or diabetes who had recently joined three senior centers linked to a network of primary care clinics in San Antonio, Texas. In addition to collecting sociodemographic and clinical characteristics, we asked members to identify their source of primary care and whether a health care provider had encouraged them to go to the senior center. We also asked members why they had joined the senior centers and which programs interested them the most. Members' source of primary care was not associated with being encouraged to attend the senior centers by a health care professional. Multivariable analysis indicated that participants with total annual household incomes of \$20,000 or less [OR = 2.78; 95% CI = (1.05, 7.14)] and those reporting 12 years of education or less [OR = 3.57; 95% CI = (1.11, 11.11)] were significantly more likely to report being encouraged to attend the senior center by a health care provider. Providers who are aware of community-based resources to support patient self-management may be just as likely to encourage their socioeconomically vulnerable patients with prediabetes or diabetes to use them as providers who have a more formal partnership with the senior centers.

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### 1. Introduction

Prediabetes and type 2 diabetes (T2D) dramatically increase with age and are major contributors to adverse health outcomes associated with aging, including functional limitations and disability (Centers of Disease Control and Prevention, 2014; Cowie et al., 2009; Blaum et al., 2003; Halter et al., 2014; Gregg et al., 2000; Espinoza et al., 2012). Lifestyle change strategies are important for preventing and controlling diabetes and reducing modifiable risk factors for cardiovascular disease (The Diabetes Prevention Program Research Group, 2005; The Look AHEAD Research Group, 2010; Avery et al., 2012; Sigal et al., 2006). Although self-management support has been identified as one of the

essential elements in the provision of high-quality care for individuals with chronic illnesses such as diabetes (Wagner and Groves, 2002; Wagner et al., 2001), health care providers have struggled to identify approaches to support self-management activities that are sustainable and cost-effective, especially within the constraints of the traditional primary care clinic. (Bodenheimer et al., 2002). The Chronic Care Model suggests that linkages to self-management support resources in the community are important for patients with chronic illnesses. (Wagner and Groves, 2002; Wagner et al., 2001). Comprehensive, community-based senior centers may play an important role in helping to preserve the health of aging primary care patients. Studies indicate that senior center participation in general is associated with positive health outcomes (Aday, 2003; Aday et al., 2006), and that preventive screenings and health promotion programs can be efficaciously delivered in senior centers (Baker et al., 2007; Sarkisian et al., 2007; Hendrix et al., 2008; Li et al., 2008; Layne et al., 2008; Speer et al., 2008; Frosch et al., 2010; Clark et al., 2011; West et al., 2011). As noted by the Institute of Medicine (IOM), there is great potential to leverage the infrastructure of community resources to implement and

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sustain effective interventions to improve health outcomes in lower income and minority individuals (Institute of Medicine, 2012).

Although there are recent attempts to implement evidence-based self-management programs in community organizations such as senior centers (Administration on Aging, 2012), a 2012 systematic review and “environmental scan” found that few examples of clinical practice-community organization partnerships exist. (Porterfield et al., 2012). The IOM suggests that the integration of primary care and public health can occur on a continuum, ranging from working in isolation in separate silos to a complete merger (Institute of Medicine, 2012). IOM implies that varying degrees of integration (i.e., mutual awareness, cooperation, collaboration, partnerships) can be used to achieve better health results (Institute of Medicine, 2012), but the extent to which formal primary care-public linkages may enhance patients' use of community resources, or the factors that may influence providers to encourage their patients to use community-based resources, remain unclear.

In this paper, we present an exploratory study describing the characteristics of Medicare-eligible adults with prediabetes and T2D who are new members of community-based multi-purpose senior centers. The senior centers, which are supported through a unique partnership between an innovative network of primary care clinics and a city municipality, serve vulnerable, older adults from lower income, predominantly Hispanic neighborhoods. Because of the IOM's suggestion that primary care's linkage to community resources can help to improve health outcomes in vulnerable patients, our objectives were to determine whether members' source of primary care was associated with their report of being encouraged to attend the senior center by a health care provider, and which patient-level characteristics prompted these referrals. Our assessment incorporated an exploration of members' reasons for joining the senior centers and the programs that interested them the most.

## 2. Methods

### 2.1. Study design and setting

We used baseline data from a longitudinal observational study focusing on new members of three multi-purpose senior centers in San Antonio, Texas that are supported by a non-profit 501(c)3 organization, the WellMed Charitable Foundation (WCF). WCF is the philanthropic partner of WellMed Medical Management Inc. (WMMI), a network of primary care clinics and the largest provider of senior health care in South Texas. The WCF jointly funds operating expenses for two of the centers through a unique partnership with the City of San Antonio, which also provides free lunches to members through the Senior Nutrition Program (SNP) funded by the City and the State of Texas. The WCF provides 100% of the operating expenses for the third center, with the City contributing SNP lunches. A WMMI clinic is co-located at each of the three centers, which have a combined membership of over 18,000.

Although WMMI is formally linked to the senior centers, membership is free and open to all adults 60 years and older, and all center services are provided at no cost, regardless of members' health plan. Approximately 30% of the senior center members are WMMI patients, while the remaining senior center members receive their primary care from non-WMMI providers or clinics. Members are required to be independent in their activities of daily living (ADLs), or to be accompanied by a caregiver if not ADL independent. Transportation barriers are minimized because the centers are on major bus routes, and each center provides free transportation to those within a 5 mile radius, if needed.

The senior centers provide a variety of programming to promote the physical, social, and emotional well-being of their members. Because of the high prevalence of obesity and diabetes in South Texas, the centers offer a variety of options to support physical activity, including a menu of exercise classes that vary in intensity and include the four categories of exercises recommended for older adults (Nelson et al., 2007). Each center has a large number of exercise and weight machines, and free weight stations. A personal trainer is available to assess members'

body mass index (BMI) and current level of physical activity, develop a personalized exercise program, and orient them to the exercise equipment. The centers also offer classes on nutrition, healthy eating, and cooking demonstrations, and also serve as distribution centers for the local food bank. The SNP lunches are nutritionally balanced and meet diabetes guidelines. A variety of evidence-based health education classes, such as the Stanford Diabetes Self-Management Program (Lorig et al., 2009), information sessions (e.g., advance directives), and support groups are available. WMMI nurses provide health screenings and immunizations, while social workers provide assistance with, or referrals to, City social services (e.g., elder abuse/fraud, emergency utility assistance). Other amenities include a lending library, cyber café and computer classes, and art classes (e.g., painting, creative writing), as well as various recreational and socialization opportunities, including games, weekly movies, and monthly parties with music and dancing.

### 2.2. Study participants

We recruited adults 65 years or older who were new senior center members using flyers and presentations at member orientation sessions. Individuals who reported being diagnosed with prediabetes or T2D were eligible, including both WMMI and non-WMMI patients. Although senior center membership is open to all adults 60 years and older, we restricted study participation to those 65 years of age and older, since WMMI serves only Medicare-eligible patients. We excluded individuals who reported being enrolled in any clinical trials, having a serious mental illness or drinking >14 alcoholic beverages a week, or having a life expectancy of less than one year. We also excluded individuals who were planning to relocate to another city or travel for more than one month in the next year. A modest incentive (\$15 gift card) was provided for participating. All participants signed a consent form that explained their rights as research subjects, and all procedures were approved by the Institutional Review Board of the University of Texas Health Science Center at San Antonio.

### 2.3. Data collection

Baseline assessments were completed in person at the centers and included an interview conducted by a bi-lingual research associate in accordance with participants' stated language preference. Participants' responses were recorded and optically scanned into an electronic database. In addition, laboratory personnel at the co-located WMMI clinic assessed participants' height and weight and collected blood samples to assess glycemic control. During the interview, we collected information on participants' sociodemographic characteristics (i.e., age, gender, race/ethnicity, education, household income, work status, marital status). Because distance may act as a barrier, members' home address was collected to estimate their travel distance to the center defined as the shortest path along a transportation network (i.e., road). Participants were also asked to identify their source of primary care.

We assessed physical and mental functional status with the Medical Outcomes Study Short Form-12 Version 2® (MOS SF-12v2®); (Ware et al., 1996; Ware et al., 2002) difficulties in Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs); (Katz et al., 1970; Lawton and Brody, 1969) physical activity with the Rapid Assessment of Physical Activity (RAPA); (Topolski et al., 2006) chronic disease count and perceived disease burden with Bayliss' Disease Burden Checklist; (Bayliss et al., 2005) depression severity with the 15-item Yesavage Geriatric Depression Scale (GDS); (Yesavage et al., 1983) and patient activation with the 13-item Patient Activation Measure (PAM 13™). (Hibbard et al., 2004). The interview included an open-ended question asking participants why they joined the senior center. Participants were asked whether a doctor, nurse, or other health professional had recommended that they go to the center. Finally, participants were asked to indicate which activities or programs at the center interested them the most.

## 2.4. Statistical analysis

Descriptive statistics were used to summarize participants' sociodemographic and clinical characteristics and their interview responses. All sociodemographic variables and some clinical variables [e.g., diabetes status (diabetes vs. pre-diabetes)] and questionnaire-derived variables were dichotomized. Bayliss Disease Count and Disease Burden ratings, SF-12v2® Component Scores, HbA1c, and distance from participants' home to the senior centers were used as continuous variables. Overall rates of missing values were <1%. Scale and subscale scores for respondents with missing values were included only if they responded to a majority of items. The missing values for items in a scale or subscale were treated as missing at random, and the mean score of a scale or subscale was calculated as the mean of non-missing items.

Differences between senior center members who reported that they were and were not encouraged to go to the center by a health care professional were compared using Student t-tests or Wilcoxon rank-sum tests for continuous or ordinal variables and chi-square tests for categorical variables. Multivariable logistic regression was used to assess the association between patient-level characteristics and the likelihood of members' reporting that a health care professional had encouraged them to attend the center, conditioned on WMMI patient status. Predictors in the regression model included source of primary care (WMMI vs. non-WMMI), Hispanic ethnicity, age ( $\geq 70$  years old vs. <70 years), and variables that were at least modestly correlated (2-sided  $p \leq 0.15$ ) with the dependent variable in the bivariate analyses. Analyses were conducted using Stata Version 10 (StataCorp, 2007).

Responses to the open-ended question were recorded during the interview and independently reviewed by two members of the investigative team, including a qualitative expert, who summarized salient themes, which were then tabulated by topic. Discrepancies were resolved by consensus. The larger investigative team reviewed the themes, combining comparable ones into meta-themes.

## 3. Results

### 3.1. Descriptive characteristics

Approximately 535 new members were invited to participate in the study at the 3 centers over a 14-month period, and a total of 160 were consented into the study. Of those who did not participate, most were younger than 65 years of age or did not have prediabetes or T2D. Of the 160 individuals consented into the study, nine were determined to be ineligible because they were enrolled in an unrelated clinical trial ( $n = 5$ ), were planning to relocate or travel for one or more months during the coming year ( $n = 3$ ), or clarified during the interview that they did not actually have prediabetes or diabetes ( $n = 1$ ). Two additional individuals were later determined to have never actually joined the centers and were withdrawn by the PI.

As shown in Table 1, the majority of the 149 participants were female (67.1%) and 70 years of age or older (55%) with a mean (sd) age of 71.2 (5.6). More than two-thirds were Hispanic, but <10% indicated a Spanish language preference. Approximately 50% reported 12 years of education or less. Almost half reported a total household income of \$20,000 or less per year. Almost three-quarters reported having diabetes. Study participants also had significant comorbidity, averaging of 7.7 (3.0) chronic illnesses. Fifty (33.6%) of the participants indicated they were WMMI patients, while 97 (65.1%) indicated they received primary care from one of >25 non-WMMI providers or medical groups. Two other members indicated that they did not currently have a primary care provider.

### 3.2. Reasons for joining

Participants' responses to the open-ended question as to why they joined the centers were varied. Many participants reported multifaceted reasons, as illustrated by this quote: "I retired recently, wanted

**Table 1**

Descriptive characteristics from a sample of senior center members ( $n = 149$ ) in San Antonio, Texas assessed in 2014–2015 and bivariate analyses of those who were and were not encouraged to attend senior centers by a health care professional.

Variables	Total	Not encouraged 116 (77.9%)	Encouraged 33 (22.1%)	p
Female N (%)	100 (67.1%)	67.2%	66.7%	0.951
$\geq 70$ years N (%)	82 (55%)	52.6%	63.6%	0.260
Hispanic N (%)	107 (71.8%)	72.4%	69.7%	0.760
Married N (%)	79 (53%)	53.4%	51.5%	0.844
Lives alone N (%)	41 (27.5%)	28.4%	24.2%	0.633
12 years of education or less N (%)	77 (51.7%)	44.8%	75.8%	0.002
Retired or not working N (%)	136 (91.3%)	106 (91.4%)	30(90.9%)	0.933
Total household income <\$20,000 N (%)	72 (48.3%)	41.4%	72.7%	0.002
Diabetes N (%)	109 (73.2%)	72.4%	75.8%	0.702
HbA1c mean (sd)	7.2 (1.4)	7.3 (1.4)	7.1 (1.6)	0.697
Overweight N (%)	133 (89.3%)	91.4%	81.8%	0.118
Obese N (%)	87 (58.4%)	56.9%	63.6%	0.488
Bayliss disease count mean (sd)	7.7 (3.0)	7.5 (3.0)	8.3 (3.2)	0.223
Bayliss disease burden ratings mean (sd)	14.4 (11)	13.7 (10.2)	16.9 (13.2)	0.139
No difficulty in ADLs N (%)	112 (75.2%)	76.7%	69.7%	0.410
No difficulty in IADLs N (%)	103 (69.1%)	72.4%	57.6%	0.104
SF-12v2® physical component score mean (sd)	44.7 (8.8)	45.3 (8.9)	42.5 (8.3)	0.113
SF-12v2® mental component score mean (sd)	54.0 (9.8)	54.8 (8.7)	51.2 (12.8)	0.068
Mild or moderate depression (GDS score of 5 or higher)	26 (17.4%)	15.5%	24.2%	0.244
Lack of confidence in managing health (PAM score level 3 or less) N (%)	26 (17.4%)	15.5%	24.2%	0.244
Sedentary or underactive (RAPA score <6) N (%)	120 (80.5%)	78.4%	87.9%	0.227
Knows someone at senior center N (%)	99 (66.4%)	67.2%	63.6%	0.425
Interested in health-related activity N (%)	143 (96%)	96.6%	93.9%	0.501
Travel distance from home to center mean (sd)	5.6 (4.4)	5.8 (4.6)	4.9 (3.4)	0.275
Source of primary care (WMMI patient) N (%)	50 (33.6%)	31.9%	39.4%	0.421

The Bayliss Disease Burden Checklist provides a disease count ranging from 0 to 21 common chronic conditions; for each disease checked, respondents are asked to rate the extent to which it interferes in their daily lives with a scale ranging from 1 (not at all) to 5 (a lot). The Modified Katz Scale and the Modified Lawton Brody Scale were used to assess difficulty in IDLs and IADLs, respectively. Activities are rated by difficulty on a 4-point scale ranging from "no difficulty at all" to "a lot of difficulty." SF-12v2® Component Scores are normed with a mean of 50 and an sd of 10 with higher scores indicating better functioning. The 15-item GDS scores range from 0 to 15; scores of 0–4 are considered normal, while scores of 5 or more indicate varying levels of depression. The PAM 13™ has a theoretical range of 0 to 100, which can be segmented into one of four progressively higher levels of activation. The first 7 items of the RAPA assess activity level; any score <6 is considered suboptimal.

to stay active, not lose touch with friends. I wanted to exercise, they have great equipment, I used to have to pay." Table 2 lists common meta-themes and subthemes with exemplar quotes. The most common reasons were to be engaged socially or in general activities ( $n = 66$ ) and to exercise or be physically active ( $n = 62$ ). Although 36 participants mentioned a health-related concern or goal, only 10 specifically mentioned a diabetes-related concern. Substantially more participants spontaneously reported being encouraged to attend the center by a family member or friend than by a health care provider. When specifically queried, however, approximately 20% reported being encouraged to go to the center by a health care professional, and almost all reported interest in one or more health-related activities such as an exercise program.

Bivariate analyses indicated that participants who were encouraged to join the center by a health care professional were significantly more likely to have lower levels of educational attainment and lower household income than those not encouraged to join the center by a health care professional. Source of primary care was not significantly associated with encouragement to join the center by a health care professional [WMMI (26%) vs. non-WMMI (20.2%),  $p = 0.421$ ].

The multivariable logistic regression analysis indicated that participants with total annual household incomes less than \$20,000, compared to those with higher incomes [OR = 2.78; 95% CI = (1.05, 7.14)], and those with reporting 12 years of education or less compared to those with one or more years of college [OR = 3.57; 95% CI = (1.11, 11.11)] were significantly more likely to report that a health care professional had encouraged them to attend the center. Age, Hispanic ethnicity,

Spanish language preference, WellMed status, difficulty in IADLs, health status, perceived disease burden, and weight status were not significant (Table 3).

#### 4. Discussion

Our findings suggest that lower levels of income and educational status among older adults with prediabetes and diabetes, as opposed to indicators of poorer health such as level of glycemic control, BMI, or self-reported health status, were associated with a significantly greater likelihood of being encouraged to attend the three multi-purpose, community-based senior centers by a health care provider. Indicators of low socioeconomic status (SES) such as low income and low educational attainment are increasingly recognized as being associated with poor health outcomes and are common among ethnic minorities such as Mexican-Americans (Braveman et al., 2011). There are a variety of mechanisms by which low SES might predispose individuals to poor diabetes control (Agardh et al., 2011; Saydah and Lochner, 2010; Hill et al., 2013). Low SES is associated with poor health literacy, which is a barrier to effective self-management (Schillinger et al., 2002). Individuals living in impoverished neighborhoods tend to be less physically active due to higher crime rates, limited public open spaces, and reduced walkability (Berke et al., 2007). They also have reduced access to, and consumption of, fruit and vegetables, as well as higher rates of food insecurity (Seligman et al., 2012; Berkowitz et al., 2013). Therefore, older individuals from lower SES neighborhoods may need more assistance with self-management support to address these modifiable risk factors than individuals from higher SES neighborhoods. Given how infrequently these social determinants of health are documented in electronic health records (IOM, 2014), we believe it is unlikely that providers are making these referrals in response to a formal assessment of income and education. Primary care providers may instead be detecting and responding to the self-management struggles of these vulnerable older adults. It is also possible that patients with higher SES may simply be more likely to start using community-based resources like the senior centers on their own before being referred by their primary care providers.

Participants' source of primary care (WMMI vs. non-WMMI) was not associated with being encouraged to attend the senior centers by a health care professional. Although WMMI supports the three senior centers through its charitable foundation, and its patients comprise a significant proportion of senior center membership, WMMI does not formally document or track referrals to the senior centers in its electronic health record at this time. Based upon anecdotal reports, however, we know that WMMI providers do informally refer their patients to the senior centers, as corroborated by 26% of the study participants who were WMMI patients. We found, however, that approximately 20% of the study participants who were not WMMI patients also

**Table 2**

Reasons for joining senior center and exemplar quotes from a sample of new senior center members ( $N = 149$ ) in San Antonio, Texas assessed in 2014–2015.

Meta- & subthemes <sup>a</sup>	Examples
To be socially engaged or engaged in activities ( $n = 66$ )	
• To be involved in activities or because of boredom ( $n = 38$ )	I was getting bored at home.
• To socialize or because of loneliness ( $n = 28$ )	Because I was alone at home. Want to meet other people.
• To get out of the house ( $n = 13$ )	To get away from home.
• Retirement or death of spouse ( $n = 10$ )	Because I retired from work and want to keep active.
To be physically active or to exercise ( $n = 62$ )	I was just sitting around and I need to exercise. To exercise inside when it's too hot or too cold outside.
Health-related concern or goal ( $n = 36$ )	
• General health ( $n = 12$ )	Because I want to be healthy.
• Diabetes-specific ( $n = 10$ )	I need help with diabetes real bad. I need to control my diabetes and lose weight. To lose weight.
• Lifestyle or weight/nutrition-related ( $n = 10$ )	
• Other disease-specific ( $n = 6$ )	Because I'm recovering from hip surgery. Therapy was over so I want to continue my exercises.
• Psychological related ( $n = 4$ )	I need to start getting more active. With my husband's death I was getting depressed.
Recommendation ( $n = 27$ )	
• Recommendation by family member or friend ( $n = 24$ )	My neighbors recommended the center.
• Recommendation by health care provider ( $n = 3$ )	My doctor told me to go to Center for my diabetes.
To participate in non-exercise activities/learn a new skill ( $n = 6$ )	I want to get into computers - learn to use them.
Other general benefit ( $n = 6$ )	I enjoy the environment.
Miscellaneous ( $n = 9$ )	
• Convenience due to cost or proximity ( $n = 4$ )	Because the YMCA charges and the Senior Center is free. Because it's right next door to the Wellmed clinic.
• Other support ( $n = 2$ )	The meals. To get help with electricity.
• Curiosity/general interest ( $n = 3$ )	Because of curiosity so I came.

<sup>a</sup> Totals exceed 149 because many participants reported more than one reason.

**Table 3**

Results of multivariable logistic regression of baseline factors associated with likelihood of new members ( $n = 149$ ) being encouraged to attend senior centers in San Antonio, Texas in 2014–2015 by a health care professional.

Baseline variable	OR (95% CI) <sup>a</sup>	p
70 years of age or older (vs. <70 years)	1.14 (0.46, 2.85)	0.78
Hispanic (vs. non-Hispanic)	0.36 (0.11, 1.14)	0.08
Spanish language preference (vs. English)	1.07 (0.26, 4.32)	0.93
Income <\$20,000 per year (vs. ≥\$20,000)	2.78 (1.05, 7.14)	0.04
≤12 years of education (vs >12 years)	3.57 (1.11, 11.11)	0.03
No difficulty in IADLs (vs. any difficulty)	0.86 (0.28, 2.66)	0.80
SF-12v2 mental component score	0.99 (0.94, 1.04)	0.64
SF-12v2 physical component score	0.98 (0.92, 1.04)	0.43
Perceived burden of chronic illness	1.00 (0.96, 1.06)	0.73
Overweight or obese (vs. normal weight)	0.55 (0.16, 1.90)	0.35
Source of primary care (WMMI vs. non-WMMI)	1.13 (0.45, 2.81)	0.80

<sup>a</sup> Subgroup sample sizes & percentages for each variable included in the model are available in Table 1.

reported being encouraged to attend the senior center by a health care professional. The three senior centers have received significant amounts of coverage in the local media, so it is perhaps not unexpected that other health care providers should be aware of and take advantage of these community-based resources for their patients.

The majority of WMMI's patients are enrolled in capitated Medicare Advantage plans, providing WellMed a strong financial motivation to keep its patients healthy (Phillips et al., 2011). Given Centers for Medicare & Medicaid Services and the Accountable Care Act's new emphasis on value-based purchasing, reimbursing for quality and outcomes instead of volume of services (Anon, 2014; Burwell, 2015), healthcare organizations are increasingly looking for new models of care to improve patient outcomes. WMMI's support of senior centers programs is analogous to Kaiser-Permanente's initiative to support school-based obesity programs in California through its charitable foundation, which it undertook after realizing that 20% of its patients were school-aged children (Baxter and Kaiser Permanente, 2015). Furthermore, the National Institute of Senior Centers, a program of the National Council on Aging that accredits senior centers, has also begun to actively promote strategies to help senior centers build partnerships with health care organizations (e.g., providing fee-based services for purchase by Accountable Care Organizations), so such partnerships are likely to increase.

This study is limited by the relatively small sample size and our reliance on participants' self-report of their providers' encouragement to attend the senior centers. Although WMMI provides operational support to the senior centers in partnership with the City of San Antonio, they currently do not have a formal method of capturing referrals to the senior centers. It is possible that these referrals are documented in text notes, but given that the senior center participants included both WMMI and non-WMMI patients, it would have been logistically challenging to obtain this or other relevant information (e.g., prescribed medications) from the medical records of the various primary care providers and clinics. It is important to note, however, that referrals constitute a complex care process in the outpatient setting that may range from informal verbal encouragement to those facilitated by electronic health records (EHR) (Hysong et al., 2011). Even when referrals are documented in EHRs, lapses in follow-up may occur if not properly communicated to the patient. Another limitation is the geographic restriction to a narrow region of the United States. Examples of primary care – public health integration, however, are rare in the scientific literature. This preliminary exploration of an innovative primary care network formally linked to a community-based resource provides a real world example of a primary care-public health partnership that is sustainable and scalable. In addition to the three senior centers in San Antonio, WMMI currently supports 6 additional senior centers in 5 other communities in Texas.

Participation in physical activity or exercise was one of the most frequently stated reasons for joining the senior centers. Physical exercise, which has long been recognized as an important aspect of lifestyle interventions for individuals with diabetes and prediabetes, confers several benefits for individual with or at risk for T2D (American College of Sports Medicine and the American Diabetes Association, 2010; Knowler et al., 2002). Recent initiatives to link primary care patients to exercise programs at the YMCA are currently in progress (Ackermann et al., 2014), but older primary care patients with T2D may also benefit from self-management support programs delivered within the context of senior centers. In addition to providing social support, senior centers offering exercise programs provide opportunities for “social” learning in which older adults are more likely to observe individuals similar to themselves in age and cultural background engaging in and benefiting from physical activity, thereby increasing self-efficacy for behavior change (Rosenstock et al., 1988). There are over 11,000 senior centers in the United States; many of these offer comprehensive services promoting physical, social, and emotional well-being that are tailored to older adults and that can address socioeconomic barriers that derail

self-management efforts in vulnerable populations (Pardasani and Thompson, 2012).

## 5. Conclusions

Our results indicate that older adults with prediabetes and diabetes and other significant comorbidity recognize the value of multipurpose senior centers for their well-being and that health care providers encourage their socioeconomically vulnerable patients to use these resources when they are available in the community. Our findings also suggest that providers who are aware of these resources may be just as likely to encourage their patients to use them as providers who have a more formal partnership with the senior centers. The extent to which primary care-public linkages may enhance patients' frequency of use, or their ability to benefit from, community-based resources, however, remains unclear. We will be following these older adults to determine the frequency with which they actually use senior center resources over a 9 month period and whether their diabetes-related outcomes improve as a result. Future explorations of the proportion of older patients who are referred by their primary care providers to comprehensive, multi-purpose senior centers, as well as the extent to which referred patients do or do not take advantage of health-related services will also be important.

## Conflict of interest statement

Dr. Noël reports grants from the National Institute on Aging and the WellMed Charitable Foundation during the conduct of the study. Dr. Hazuda reports grants from NIH during the conduct of the study. The other authors declare that there are no conflicts of interest.

## Transparency document

The Transparency document associated with this article can be found, in online version.

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All authors made a substantial contribution to the conception and design of the study, to data acquisition, or to data analysis and interpretation. The first author wrote the article and all of the other authors revised the article for important intellectual content. All of the authors read and approved the final version of the submitted manuscript.

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