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## Annual wellness visits are associated with increased use of preventive services in patients with diabetes living in the Diabetes Belt

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### Abstract

**Objective:** To examine whether Annual Wellness Visits (AWVs) were associated with increased use of preventive services in Medicare patients with diabetes living in the Diabetes Belt.

**Methods:** We used a case-control design where outcomes were utilization of preventive services recommended for patients with diabetes (foot exam, eye exam, A1c test, and microalbuminuria test) and the exposure was AWVs using data for Medicare patients with diabetes in 2014 – 2015 residing in the Diabetes Belt (N = 412,009).

**Results:** Only 13.4% of patients in 2014 and 17.4% in 2015 used AWVs. Eye exams (61% vs 53%), foot exams (93% vs 79%), A1c tests (81% vs 71%), and microalbuminuria tests (45% vs 28%) were more common among patients who had an AWV in the preceding year compared with those who did not. These differences remained significant after adjusting for patient demographics, comorbidities, county level medical resources, and geographic factors.

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Author Contributions

T.M and M.S analyzed the data, and wrote the manuscript. All authors critically reviewed the manuscript and approved it. M.S. is the guarantor of this work and, as such, had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Duality of Interest

No potential conflicts of interest relevant to this article were reported.

Conflict of Interest

The authors have no conflicts of interest to report.

Supplementary materials

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**Conclusions:** AWWs were significantly associated with increased preventive care use among patients with diabetes living in the Diabetes Belt. Low AWW utilization by patients with diabetes in and around the Diabetes Belt is concerning.

### Keywords

Diabetes; Preventive care utilization; Diabetes Belt; Case-control study

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## Introduction

The Affordable Care Act created Annual Wellness Visits (AWVs) for Medicare beneficiaries to have one yearly visit with primary care physicians to discuss preventive care for the upcoming year. Since 2011, the Affordable Care Act has allowed Medicare patients to receive a free AWW each year. During an AWW, providers are required to complete an individualized risk assessment including personal and family history, create a patient-specific plan for preventive care by determining which preventive care is appropriate, and help patients identify sources of needed care [1]. AWWs are an important tool to engage patients by increasing knowledge about recommended preventive care and by linking them to sources of care.

AWVs have been shown in several studies to be associated with increased use of vaccinations and preventive screening [2–4]. Nonetheless, adoption has been slow, with rates of AWWs increasing from 7.5% in 2011 to 15.6% in 2014 [5], with slower rates of adoption in practices caring for underserved patients [6].

In this study, we examine the association between AWWs and diabetes preventive care use for Medicare patients living with diabetes in the Diabetes Belt. The Diabetes Belt consists of 644 counties in the southeastern and Appalachian United States that had diabetes prevalence of at least 11% in 2008, compared to about 8.5% in the rest of the country [7]; these areas continue to have high rates of diabetes [8]. We focus on four diabetes preventive services: foot exams, eye exams, A1c tests, and microalbuminuria (MA) tests. Our hypothesis is that AWWs are significantly associated with increased use of these preventive services for patients with diabetes in this region.

## Methods

### Research design and study sample

This is a case-control study in which outcomes were the utilization of annual preventive care services recommended by the American Diabetes Association (ADA) for patients with diabetes and the exposures were the utilization of AWWs in the preceding year.

This study uses claims data from the most recent two years (2014–2015) of a longitudinal sample of Medicare patients with diabetes living in the Diabetes Belt between 2006 and 2015. County-level data on the availability of services and socioeconomic status were extracted from the Area Health Resources File (AHRF) [9].

The sample was designed and weighted to provide valid inference for cross-sectional analyses in each of the 10 years, and to provide for the ability to track patients longitudinally. Once sampled, patients were retained in subsequent years' samples for as long as they remained alive, lived in their original county, and enrolled in Medicare Fee-for-Service (FFS). Patients who died, moved out of county, or switched to Medicare Advantage plans were replaced each year with a fill-in sample drawn from patients who were newly eligible or moved into an eligible county. In addition, minority populations were oversampled to provide increased precision in these subgroups. The sample design and comparisons to the reference population are fully described elsewhere [10].

This study specifically focuses on the sub-population of these patients living in the Diabetes Belt and, to ensure that all claims data were available, enrolled in FFS in 2014 and 2015, the two most recent years of data. Two years of data were required to allow for identification of AWVs in the 12 months preceding the receipt of preventive service. Patients enrolled in Medicare HMOs were excluded because their claims data are not available.

### **Identification of preventive care utilization**

Our outcomes were the utilization of four recommended preventive services: foot exam, eye exam, A1c tests, and MA tests. The ADA Standards of Medical Care in Diabetes recommends annual foot exams and MA tests, A1c tests 2 or more times per year, and eye exams every two years patients with no sign of degeneration. Eye exams were recommended annually until 2013 [11].

We identified utilization of these services using the ICD-9 and ICD-10 codes along with Health Care Common Procedure Coding System (HCPCS) codes in the Medicare Outpatient and Carrier (Physician/Supplier) claims files for 2015. These codes are summarized in Appendix Table A1. For the foot exam, because the CMS considers it to be part of the Evaluation and Management (E&M) visits to a primary care physician and its reimbursement is bundled into the E&M visit for the patients with diabetes [12], it is not frequently coded as part of the claims. We thus identified a foot exam as happened during all E&M visits and visits to a diabetes specialist. Likewise, we identified an eye exam as happened when a patient visited an optometrist or an ophthalmologist.

### **Identification of annual wellness visits**

Our exposure is Annual Wellness Visits (AWVs). AWVs in this study are defined as primary care visits whose primary purposes is to identify the needs for and plan for preventive care in the coming year. They were identified using HCPCS codes G0438 and G0439 in the Medicare Outpatient and Carrier claims files for any service provided during a one-year period before the date of preventive service as explained below. AWVs cannot be reimbursed as such if any actual care is performed during the visit. HCPCS code G0402 ("Initial preventive physical examination; face-to-face visit, services limited to new beneficiary during the first 12 months of Medicare enrollment") is sometimes regarded as AWVs [13] but was not included in this study because it is used to code preventive services provided as part of a care-delivering physical exam.

## Covariates

We identified covariates that may potentially affect the exposure and outcomes. They included patient demographics (age, sex, and race); all Elixhauser comorbidities except diabetes and diabetic complications [14]; an indicator for end stage renal disease; insurance status; the patient's home state; county level per capita health care providers (physicians, podiatrists, optometrists, ophthalmologists, nurses, physicians' assistants, federally qualified health centers, short term general hospitals), median income and high school graduation rate in county; urban/rural residence; and geographic access to primary care doctors based on the number of providers within 15-minute drive of the patient's zip code centroid (low access: 0–5 providers, moderate access: 6–15 providers, good access: 16–50 providers, and best access: 51 or more providers).

## Statistical analysis

The primary research question was whether AWVs were associated with the increased use of eye exams, foot exams, A1c tests and MA tests. For each service we constructed a separate analytic sample using a case-control design, searched the claims files for the whole year in 2015, and defined cases to be those patients who received the service and the controls to be those who did not. For the cases, we defined the event date as the first date in 2015 on which the patient received a preventive care service. For the controls, the event date was assigned to be the last day of the study period (December 31, 2015).

Exposure was defined as the receipt of an AWV during the 12 months preceding the event date for each service.

To mitigate confounding and selection bias, we used the propensity score stratification [15,16] for each outcome model. The propensity scores were estimated using a logistic regression as the conditional probability of receiving an AWV in the year prior to the event given all covariates. Sampling weights were used as an additional covariate in the propensity score model as recommended in DuGoff et al. [17] and Austin et al. [18] Once propensity scores were calculated, we estimated weighted logistic regressions using SAS surveylogistic procedure to account for the sampling design for each event outcome stratified by quintiles of propensity score; these outcome models accounted for all covariates included in the propensity models. For a sensitivity analysis, we analyzed the data using weighted logistic regressions without stratification. To correct for multiple comparisons using the Bonferroni method [19], a p-value < 0.0125 is considered statistically significant in this study.

All other statistical analyses were performed using SAS (v9.4 SAS Institute, Cary, NC) and R (v4.0.3 R Foundation for Statistical Computing, Vienna, Austria). All analyses accounted for sampling design and weights. Elixhauser comorbidities were calculated using the Elixhauser Comorbidity Variables Creation Software v3.7 (HCUP, 2015). This study was approved by the University of Virginia Institutional Review Board.

## Results

A total of 412,009 patients lived in the Diabetes Belt, were enrolled in Medicare FFS in 2014 and 2015, and were alive at the end of 2015; the sample flow diagram in Fig.1 shows

all exclusions and how we reached the final sample size. The retained patients represented a survey weighted estimated total population of 899,239.

In 2014, 13.4% of patients received an AWV; in 2015, this proportion increased to 17.4%. In 2015, 54.6% of patients had an eye exam, 81.4% a foot exam, 72.6% at least one A1c test, and 30.8% an MA test. Additional univariate descriptive statistics, including comorbidities with frequency greater than 1%, are shown in Table 1.

Utilization rates and 95% confidence intervals split by whether patients had an AWV in the preceding year are shown in Table 2. For all four procedures, utilization rates were higher among patients who had an AWV in the preceding 12 months compared with those who had not. Eye exams showed the smallest difference, from 53.4% among patients who did not have an AWV to 60.8% among patients who did. The other three preventive services each showed at least absolute 10% higher utilization rates among patients who had an AWV compared to those who had not.

Table 3 contains adjusted odds ratios for preventive service utilization associated with the receipt of an AWV. After adjusting for demographics, comorbidities, and regional access to care, AWVs were associated with significantly higher odds of utilizing all preventive services. Odds ratios ranged from 1.22 for eye exams (95% CI: 1.20, 1.25) to 2.38 for foot exams (95% CI: 2.30, 2.46). Results from the sensitivity analysis (logistic regressions without propensity score stratification) were almost identical. Complete regression results showing ORs for all included covariates are given in Appendix Table A2.

## Discussion

Our data show that AWVs in Medicare patients living with diabetes in the Diabetes Belt were strongly associated with higher utilization of all four preventive services: annual foot exams, eye exams, A1c tests, and MA tests. Absolute improvements in use of preventive services ranged between 7.4% (eye exam) and 16.9% (MA test), after adjusting for age, sex, race/ethnicity, and other access to care factors and health service availability indicators. These improvements represented a relative difference of 14% and 60% between AWV users and non-users. These differences remained after controlling for a wide range of demographics, comorbidities, and geographic information in a stratified propensity score analysis with odds ratios ranging from 1.22 (eye exam) to 2.38 (foot exam). Almost identical results were obtained in a sensitivity analysis using weighted logistic regression without propensity score stratification. Our results suggest that AWVs helped improve preventive care use in this population.

Appropriate preventive care is an important component of improving health outcomes in patients with diabetes. Because many diabetic complications cannot be reversed after onset, the ADA recommends preventive care to reduce their risks and delay onset. Although there was a guideline change in 2014 to decrease the eye exam frequency to once every two years, evidence links routine eye exams to reductions in diabetic retinopathy and associated vision loss [20–22]. Several studies have showed that MA screening is cost effective for managing and reducing chronic kidney disease [23,24]. There is evidence linking foot exams

to reductions in lower extremity amputations [25] and consistent A1c testing to better cardiovascular outcomes [26].

When used, AWVs appear to result in large improvements in diabetes preventive care utilization. However, at the population level, the overall realized gains were small because only 13.4% of Medicare patients in the Diabetes Belt received an AWV in 2014 and 17.4% received an AWV in 2015. AWVs are a relatively straight-forward intervention that can be delivered at no cost and no risk to the patient and, when delivered consistently, can potentially improve uptake of recommended preventive care for diabetic patients. Our results are encouraging in that these beneficial effects may also be realized in medically underserved areas such as the Diabetes Belt.

The scientific literature on whether AWVs have resulted in net benefit to patients is mixed, depending upon condition or service examined and modeling approach. Ganguli and colleagues examined AWV effects in national Medicare data for the period 2008 (pre-AWV) through 2015 [27]. Using difference-in-difference models of practices (versus beneficiary level), they found that modest differential increases in screening and declines in emergency department visits associated with AWV became non-significant when pre-intervention trends were accounted for. In the Ganguli study, uptake of AWV was approximately 30% in 2015, much higher than observed in the Diabetes Belt (17.4%), and suggest caution about possible selection bias whereby patients seen by practices that adopted AWVs in the Diabetes Belt could have received a more proactive stance toward diabetes care, overall, regardless of AWV effects.

On the other hand, Chung et al. [28] studied patients aged 65 – 75 years within a healthcare system across insurance types and found a significant increase in preventive care visits over the previous period for Medicare insured patients, which resulted in an increased use of advance directives and screening for abdominal aortic aneurysm. The nearly doubling in the overall rate of preventive care visits in Medicare insured patients in the Chung et al. study suggests that increased preventive care utilization occurred as a result of AWVs.

The Diabetes Belt is known for its higher diabetes prevalence rates and higher rates of chronic conditions compared to the rest of the country. As we demonstrated in this study, AWVs can potentially be used to increase the ADA recommended preventive care for patients with diabetes in this region and thereby reduce disparities in diabetic complications that the Diabetes Belt residents may experience compared to those outside the Belt. A policy to target patients with diabetes to increase AWV utilization may be needed in this mostly rural and medically underserved region. A further policy recommendation could be towards promoting the expansion of AWVs to other populations such as those patients covered by Medicaid and private insurance, as AWVs may similarly be an effective tool towards improving diabetes management in these populations.

Measured by both absolute effect and odds ratios, AWVs were associated with the smallest increase in the utilization of eye exams. Eye exams were the second least frequently used preventive service, which is in line with the recommendation for biennial screening. Additionally, some patients could potentially receive all of a foot exam, MA test, and A1c

test in a single office visit, while eye exams would typically require seeing an optometrist or ophthalmologist. Because remote retinal exams are not currently covered by Medicare, an eye exam would almost always necessitate making and keeping a second appointment. Further research will be needed to understand why AWVs appear to have had heterogeneous effects across the four screenings.

The primary limitation of our study is that it is retrospective analysis of administrative data. Although we used propensity score matching at the patient level to address selection and confounding bias in using AWVs, there may be important factors associated with uptake of AWVs that are unaccounted for in our models. Both practice-level variation and psychosocial characteristics of patients are unmeasured and could affect the likelihood of patients receiving both AWVs and screening. Further, variables measuring income and geographic access to care are measured at the regional rather than the individual level. Nonetheless, the large sample size based on high quality patient and region level data enabled careful attempts to control for confounding and to account for patients having different propensities to seek out AWVs. We therefore believe that AWVs encourage and facilitate patients to get recommended routine screenings.

These results suggest that diabetes preventive service use could be significantly increased through increased adoption of AWVs in the Diabetes Belt. More aggressive promotion of AWVs through local health departments and community organizations may be a key to improved preventive care utilization for patients with diabetes in the Diabetes Belt.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## Abbreviations:

<b>ADA</b>	American Diabetes Association
<b>AHRF</b>	Area Health Resources Files
<b>AWV</b>	Annual Wellness Visit
<b>CHF</b>	congestive heart failure
<b>CMS</b>	Centers for Medicare and Medicaid Services
<b>E&amp;M</b>	evaluation and management

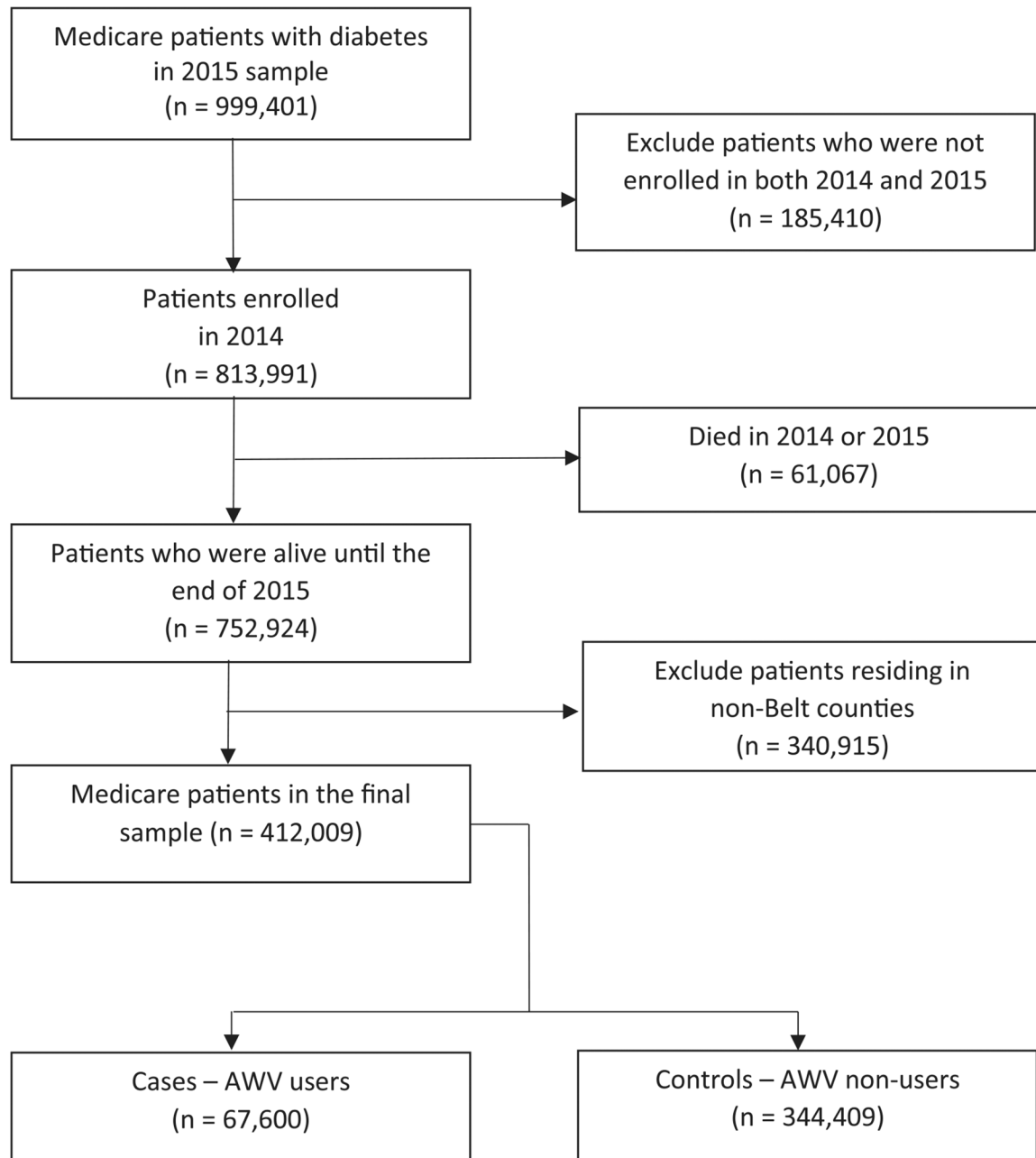
<b>FFS</b>	Fee for Service
<b>HCPCS</b>	Healthcare Common Procedure Coding System
<b>HMO</b>	health maintenance organization
<b>ICD</b>	International Classification of Diseases
<b>IQR</b>	interquartile range
<b>MA</b>	microalbuminuria

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**Fig.1.**  
Sample flow diagram.

**Table 1**

Population demographics and comorbidities overall and split by whether a patient had an annual wellness visit in 2015\* .

	<b>Overall</b>	<b>Without AWV</b>	<b>With AWV</b>	<b>p-value</b>
n (Weighted %)	412009 (100%)	344409 (82.6%)	67600 (17.4%)	
Age, median (IQR)	75 (70, 81)	75 (70, 81)	75 (70, 80)	< 0.001
Male	44.1%	44.1%	43.8%	0.218
Race/Ethnicity				
White	75.6%	74.9%	78.8%	< 0.001
Black	22.2%	22.9%	19.1%	
Hispanic	0.7%	0.7%	0.6%	
Other	1.5%	1.5%	1.5%	
Rural/Urban Residence				
Rural	6.4%	6.8%	4.6%	< 0.001
Metropolitan	40.1%	41.5%	33.1%	
Metropolitan	53.5%	51.7%	62.3%	
Elixhauser Comorbidities				
CHF	15.9%	16.5%	13.1%	< 0.001
Valvular Disease	14.4%	14.4%	14.6%	0.263
Pulmonary Circulatory	4.2%	4.3%	3.9%	< 0.001
Peripheral Vascular	18.5%	18.5%	18.1%	0.022
Hypertension, Comp.	90.0%	89.6%	92.0%	< 0.001
Paralysis	2.6%	2.8%	1.5%	< 0.001
Neurologic Disorders	14.5%	15.1%	11.3%	< 0.001
Chronic Pulmonary	24.5%	24.7%	23.6%	< 0.001
Hypothyroidism	79.0%	78.4%	81.8%	< 0.001
Renal Failure	27.5%	27.2%	29.0%	< 0.001
Liver Disease	23.2%	22.8%	24.9%	< 0.001
Lymphoma	18.0%	18.2%	17.2%	< 0.001
Metastatic Cancer	3.1%	3.1%	3.5%	< 0.001
Tumor	1.0%	1.0%	1.0%	0.897
Rheumatoid Arthritis	1.2%	1.2%	1.1%	0.243

	Overall	Without AWV	With AWV	p-value
Coagulopathy	11.4%	11.2%	12.5%	< 0.001
Obesity	5.9%	5.8%	6.6%	< 0.001
Weight Loss	3.4%	3.4%	3.3%	0.254
Fluid/Electrolytes	15.1%	14.8%	16.9%	< 0.001
Blood Loss Anemia	4.8%	5.0%	3.9%	< 0.001
Deficiency Anemia	15.5%	15.9%	13.6%	< 0.001
Drug Abuse	1.5%	1.5%	1.6%	0.254
Psychoses	26.6%	26.8%	25.7%	< 0.001
Depression	1.5%	1.5%	1.3%	< 0.001

\* AWV = Annual Wellness Visit; CHF = congestive heart failure; IQR = interquartile range. All percentages were weighted.

**Table 2**

Overall utilization rates in 2015 and 95% confidence intervals, split by whether patients had an Annual Wellness Visit in the preceding year\*.

Preventive Care	Without AWV	With AWV
Eye Exam	53.4% (53.3%, 53.6%)	60.8% (60.4%, 61.2%)
Foot Exam	79.2% (79.1%, 79.4%)	93.0% (92.7%, 93.2%)
A1cTest	71.0% (70.8%, 71.2%)	81.4% (81.1%, 81.7%)
MA Test	28.1% (28.0%, 28.3%)	45.0% (44.6%, 45.4%)

\* AWV = Annual Wellness Visit; MA = microalbuminuria.

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**Table 3**

Adjusted odds ratios for using each preventive care for AWW users compared to non-users from the propensity score stratified models.

Outcomes	OR (95% CI)	p-value
Eye Exam	1.22 (1.20, 1.25)	< 0.001
Foot Exam	2.38 (2.30, 2.46)	< 0.001
A1cTest	1.42 (1.39, 1.46)	< 0.001
MA Test	1.69 (1.66, 1.73)	< 0.001

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